

Landowner & Cattle Producer Values Towards Grasslands and Avian Species at Risk in Southwestern Manitoba



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Cow and calf pairs in a pasture near Melita, Manitoba

By Lynnea Parker

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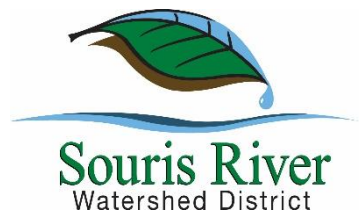
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Project Funders



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1.0 Introduction

In the spring of 2019, the 12th Prairie Conservation and Endangered Species Conference was hosted in Winnipeg, Manitoba. This conference brought together representatives from the agricultural sector, conservation organizations, academia, and government to discuss native prairie conservation in “working landscapes” across Canada. The theme “working landscapes” was chosen in recognition that prairie management represents a multi-faceted, complex set of issues that can be addressed through collaborative engagements. The theme couldn’t have been timelier as Manitoba has experienced a significant loss of its mixed-grass prairie ecosystem primarily through cultivation, conversion to tame forage, and other forms of land development (Hamel & Neufeld, 2018). Conservation program delivery in Manitoba has not been able to keep pace with the loss of native prairie that started in the 19th century and is still ongoing today (Gage, Olimb, & Nelson, 2016; World Wildlife Fund, 2018).

Much of Manitoba’s remaining native grasslands are located in the southwestern region of the province on private property and function as hay land and pasture for livestock (Hamel & Neufeld, 2018). However, there are a number of socio-economic factors at play that have led to competing land use interests and strong market demands for remaining grassland properties (Statistics Canada, 2017). Beyond their importance for livelihood, privately-owned grasslands provide critical habitat for many of Manitoba’s species at risk. Species at risk are species designated as a conservation concern (e.g., endangered, threatened, special concern) under provincial (SM 1989-90, c. 39) or federal (S.C. 2002, c. 29) law. For these reasons it is imperative that we find appropriate mechanisms to support landowners who conserve native prairie and employ land management practices that are beneficial for species at risk. Actively engaging local landowners and land users in southwestern Manitoba is an important piece of the puzzle for achieving positive conservation outcomes.

In order to strike a balance between the wellbeing of landowners, cattle producers, and conservationists, this project was undertaken to better understand the perspectives and values of the landowners and beef producers who steward grasslands in southwestern Manitoba. Through electronic surveys and in-person interviews, this project sought a better understanding of participant views towards species at risk, grassland conservation, and conservation program preferences. From these results, an attempt was made to identify opportunities for developing lasting partnerships. Through this project, I also sought to identify the obstacles and barriers that landowners and beef producers encounter when trying to engage in conservation activities. It is hoped that outcomes of this project will be used to inform future conservation programming and engagement priorities in southwestern Manitoba and lead to key grassland areas being secured and stewarded to protect species at risk in ways that are considered viable to local communities.

2.0 Methods

2.1 Overview

This project incorporated two research components. The first component pertained to the development and implementation of an online survey that was primarily focused on understanding the environmental values and perspectives of landowners and cattle producers in southwestern Manitoba. The designated survey area is described in Section 2.2. The questionnaire that was developed for the online survey contained four parts: demographics, conservation land use values, conservation and species at risk, and grassland conservation programs. Each component of the questionnaire is detailed in Section 2.3. Participation for the online survey was solicited through non-probability sampling methods and the inclusion of an optional free-entry contest, which are both described in Section 2.4. The post-survey participation rate is stated in Section 2.5 along with the results of the contest and represented coverage of the survey area. The second component of this project involved recruiting a small subset of cattle producers, who were also landowners, for in-person meetings. These meetings were incorporated to expand upon the results of the online survey and further explain issues related to grassland conservation, programming, and economic concerns. Information related to the structure of the in-person meetings and anticipated outcomes is presented in Section 2.6. The final section (Section 2.7) explains the methods for the statistical tests that were performed.

2.2 Survey Area

In Manitoba, the majority of grassland obligate avian species at risk are located in the southwestern portion of the province where blocks of native mixed-grass prairie still remain (Fedy, Devries, Howerter, & Row, 2018; Hamel & Neufeld, 2018). In order to better understand how the values and priorities of landowners and cattle producers affect grassland conservation efforts, the southwestern region was the focal area of this study. The study area was broken down into two segments: 1) primary target area and 2) generalized target area (Figure 1). The primary target area included 13 municipalities that coincided with areas of significant conservation priority for land securement and species at risk recovery efforts. These municipalities included: Ellice-Archie, Prairie View, Wallace-Woodworth, Riverdale, Pipestone, Sifton, Whitehead, Souris-Glenwood, Two Borders, Grassland, Brenda-Waskada, Deloraine-Winchester, and Boissevain-Morton. An additional 14 municipalities were included in the generalized target area: Russell-Binscarth, Riding Mountain West, Rossburn, Yellowhead, Hamiota, Harrison Park, Oakview, Clanwilliam-Erickson, Minto-Odanah, Elton, Cornwallis, Oakland-Wawanesa, Prairie Lakes, and Killarney-Turtle Mountain.

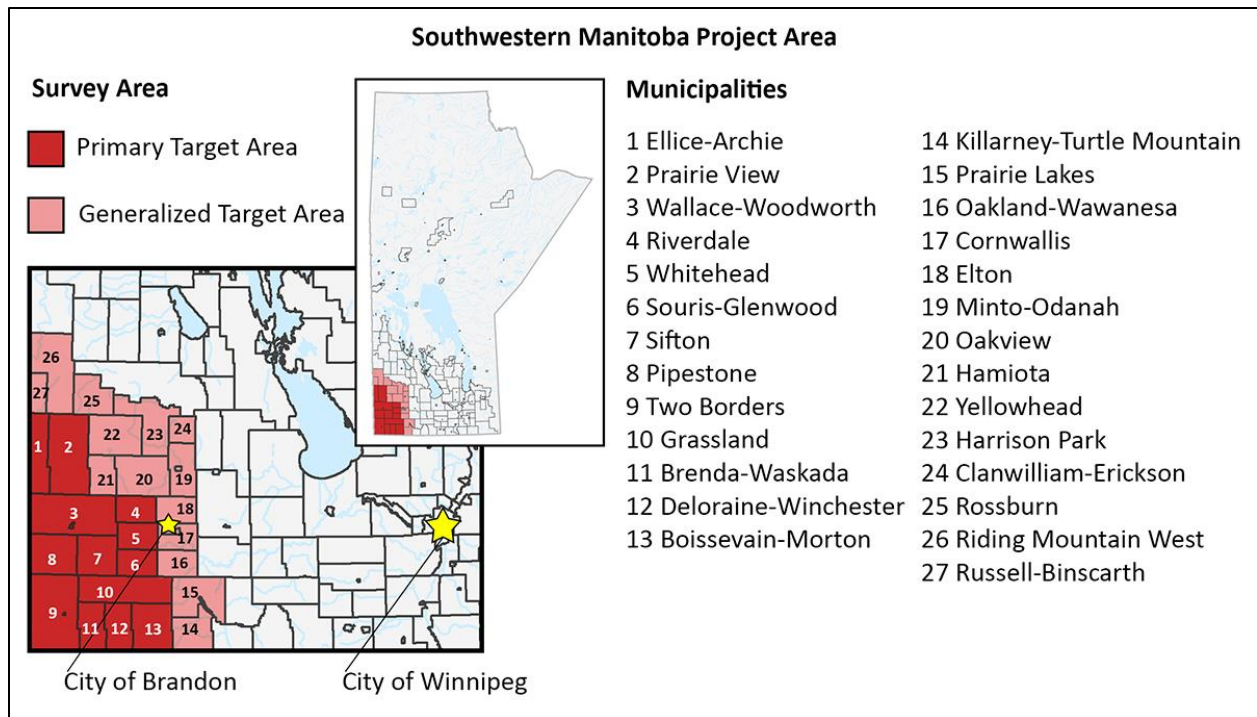


Figure 1: Map of Manitoba featuring the study area and municipalities. Base map with municipal boundaries obtained from Manitoba Land Initiative (Government of Manitoba) with modifications by Lynnea Parker.

2.3 Online Survey & Questionnaire Development

LimeSurvey was used to host the online questionnaire. LimeSurvey was chosen because it was a cost-effective platform that was capable of incorporating the question formats that were required. The online survey contained a cover page with contact information for the project coordinator, affiliations, a description of the project, information on what kinds of questions participants could expect to see, information on the free-entry contest, and information on how participant data would be used. All online responses were anonymous; however, participants could choose to enter the free-entry contest by providing their first name and phone number. Contest entries were stored separately from participant responses and were destroyed/deleted after the contest was completed. The province of Manitoba does not require licensing for free-entry contests. More information on the contest can be found in Section 2.4.

The questionnaire was designed to take between 15 and 20 minutes to complete and contained four parts: 1) demographics, 2) conservation land use values, 3) conservation and species at risk in Manitoba, and 4) grassland conservation programs. The survey incorporated questions and methods previously developed by Dr. Lily A. Sweikert and Dr. Larry M. Gigliotti of South Dakota State University. Parts 1, 3, and 4 contained replicated and/or adapted questionnaire items and scales from Dr. Sweikert’s study of South Dakota landowners (2017) in addition to new questions that were designed by the author to specifically meet the needs of this project. The questions in Part 2 were a replication of the Land Use Value (LUV) scale developed by Sweikert & Gigliotti (2018, 2019). Each part of the questionnaire will be described in more detail below.

Questionnaire - Part 1: Demographics

The first part of the questionnaire was designed to ensure that participants were among the target demographic (landowners and/or cattle producers) that owned, managed, and/or leased grassland properties in southwestern Manitoba. To determine if participants fit the project criteria, the questions asked were:

- Whether or not the participant owned, managed, and/or leased grassland property.
- If the participant was a cattle producer.
- If the participant was able to influence or make land use decisions.
- If the participant grew commodity crops.
- Where the participant's land was located.
- How much grassland property the participant owned, managed, and/or leased.
- How long the participant has been involved in farming/ranching.

Questionnaire - Part 2: Conservation Land Use Values

For the second part of the questionnaire, the Land Use Value (LUV) scale developed by Sweikert & Gigliotti (2018, 2019) was incorporated to gain a better understanding of how participants perceived their relationship with nature. A significant objective of this project was to define landowner and cattle producers' values towards grassland conservation and species at risk. This could, in part, be accomplished by examining the broader environmental beliefs held by participants. The LUV scale was developed as a tool to measure the basic views and beliefs of agricultural producers in relation to land use and the environment (Sweikert & Gigliotti, 2019) and therefore its inclusion in this study was appropriate. The LUV scale is comprised of 7 questions representing a nature-centered dimension, and 6 questions representing a human-centered dimension (Sweikert & Gigliotti, 2019). Using these two dimensions, participants can theoretically be placed into one of four LUV type categories: nature first, interconnected, disconnected, and human first (Sweikert & Gigliotti, 2019). Following methods outlined by Sweikert & Gigliotti (2019), questions were randomly ordered, and responses were indicated using a 7-point Likert scale from strongly disagree to strongly agree. Background information on how the LUV scale was developed can be found in publications by Sweikert & Gigliotti (2018, 2019).

Questionnaire - Part 3: Conservation & Species at Risk in Manitoba

While Part 2 examined the broader environmental views of participants, the third part of the questionnaire was designed to specifically examine participants' knowledge, values, and level of engagement with species at risk, wildlife in general, and grassland conservation. Questions gauged:

- The level of awareness participants had with what avian species were designated as species at risk in southwestern Manitoba.
- How confident participants were with determining if avian species at risk were present on properties they owned, managed, and/or leased.
- How likely participants were to report the known presence of any species at risk on properties they personally owned, managed or leased to a conservation entity.
- How likely participants were to report the known presence of any species at risk on properties they did not own, manage or lease to a conservation entity.
- If participants had considered the needs of wildlife in their land management decisions within the past 5 years.

- How important it was for participants that their land was able to support species at risk.
- If participants believed that the possible presence of species at risk could negatively affect their ability to use their own land.
- If participants had engaged in activities that had resulted in the loss of native prairie within the last 10 years.
- How important it was for participants to protect the native prairie they owned, managed, or leased.

Questionnaire - Part 4: Grassland Conservation Programs

Within Manitoba there are agencies and organizations that engage landowners and cattle producers in different types of programs and activities in support of conservation priorities. The fourth part of the questionnaire was designed to gain a better understanding of what types of programs would be most supported by landowners and cattle producers. 12 different types of programs were identified by prominent individuals engaged in conservation programming in Manitoba. Each of the 12 conservation programs were presented in a table and accompanied by a brief description (Table 1). Of the 12 options that were presented, most are currently being offered or have been offered in the past to eligible landowners and cattle producers in Manitoba. Some options that were presented have not been implemented in Manitoba before, these options include: annual payment for a habitat outcome, bird-friendly beef certification label, and voluntary carbon offset program. Participants were able to provide their responses by indicating how likely they were to consider participating. A 7-point Likert scale from very unlikely to very likely was used to measure responses with the addition of a not applicable option.

Table 1: 12 different types of land conservation programs that could be implemented by conservation organizations or governments in southwestern Manitoba.

Conservation Program	Description
Easements in perpetuity with one-time payment	A permanent easement that places specific restrictions on the use of land and is applicable to current and future owners.
Easements in perpetuity with an annual payment for a prescribed period	A permanent easement that places certain restrictions on the use of land and is applicable to current and future owners.
Term agreements (10, 20, or more years) with one-time payment	An agreement that places specific conditions on how land can be used for a specified period of years.
Operational costs assistance program with a grazing plan	A conservation group provides financial assistance to landowners/producers to complete projects (e.g., installation of watering systems, upgraded fencing) with the creation of a grazing plan.
Annual payment program for a habitat outcome	A conservation organization will set a framework for ideal habitat/conservation outcomes. Landowners/producers who achieve outcomes would be eligible for annual compensation payments.
Minimal grazing leases on lands owned by a conservation group	Availability of low-cost (minimal) grazing leases on lands owned by a conservation group.
Land purchased by conservation group with a minimal grazing lease	Landowner receives first right of refusal for a minimal grazing lease (low-cost lease) on any lands previously owned and sold to the conservation group.
Land purchased by conservation group with a “grass-banking” approach	Landowner sells land to a conservation group and receives grazing rights in return for commitments to accommodate conservation priorities (e.g., practicing specific grazing regimes to meet conservation needs).
Mortgage assistance program	Financial assistance meant to enable livestock producers to purchase and retain grassland properties.

Conservation Program	Description
Grazing co-op approach	A conservation organization assists with the purchase of land in combination with other landowners/producers.
Bird-friendly beef certification label	A label that would allow consumers to identify products that come from operations that adopt approved conservation practices, as defined by a conservation organization or consortium.
Voluntary carbon offset program	An opportunity for grassland property owners meeting specific carbon criteria to access carbon credit markets.

To provide context to a landowner’s past involvement in conservation programming participants were asked if they had previously enrolled any land voluntarily in a conservation program. They were also asked if they currently had any land enrolled in a conservation program; response options were: yes, no, or not applicable. Participants were not asked to identify what programs they may have been previously or currently enrolled.

To gain a better understanding of some of the variables that may motivate landowners and cattle producers to engage in conservation activities, a range of potential factors was presented. Participants could indicate how important each factor was when making decisions about past, present, or future participation in a conservation program. The list of factors and the response scale was adapted from Sweikert’s (2017) study of South Dakota landowners. The response scale had five options to choose from: not applicable, not a reason, slightly important, moderately important, and very important. The factors were:

- protecting species at risk,
- improving habitat for game species,
- improving habitat for non-game species,
- conserving native prairie,
- improving grazing regimes for conservation,
- cattle operation assistance projects,
- financial incentives/compensation,
- legacy planning,
- wetland restoration projects,
- grassland restoration projects,
- invasive species control,
- access to grazing rights.

Participants were also provided with an optional comment section to expand upon any additional factors.

In addition to motivational factors, variables that may prevent or discourage a landowner or cattle producer from participating in conservation programs are equally important to recognize. As with the previous set of questions, the factors and the response scales were adapted from Sweikert’s (2017) study of South Dakota landowners. The factors were:

- Do not want to sign a contract with a conservation organization.
- Do not want to sign a contract with government.
- Conservation programs limit the activities that can be conducted on a property.
- Do not want to work with a conservation organization or district.

- Enrolling in a program takes too much time and effort.
- Financial incentives are not high enough.
- I have no land that qualifies for conservation projects.
- Conservation programs are too complicated.
- The length (in years) of terms agreements or easements is too long.
- There are not enough enrollment opportunities.
- I am not aware of what conservation programs exist.
- Property may have a reduced resale value.

Participants were also provided with an optional comment section to expand upon any additional factors.

The last set of questions pertained to program features. Five questions were asked about how important different factors were to participants when considering land conservation options. As with the previous two sets of questions, the factors and the response scales were adapted from Sweikert's (2017) study of South Dakota landowners. The program factors were:

- maintaining private ownership,
- ability to reside on your land,
- ability to negotiate the terms,
- being able to maintain current uses of the land, and
- an arrangement that will follow the sale of the land.

The factor "an arrangement that will follow the sale of the land" was included as a reference to long-term programs that place caveats on a land title (e.g., conservation easements).

Lastly, there were two optional long-answer opportunities for participants to provide additional feedback.

2.4 Sample Size and Sampling Method

As per funding agreements, the minimum sample size for the online survey was 15 landowners from the primary target area. The target sample size was to be between 20 and 30 landowners as it was expected that gaining landowner and cattle producer participation in the online survey would be challenging. Gaining participation was expected to be difficult because the target demographic was located in rural areas of southwestern Manitoba with low population densities and there were limitations on how the survey could be advertised to the public. Originally, the sampling method was to include public advertising in local newspapers in addition to a Watershed Districts and organizations promoting the survey to landowner and cattle producer contacts. When this project was conceptualized, it was unknown that another researcher would also be conducting a similar study targeting the same demographic across all of central and southern Manitoba. Because that study had utilized broad scale public advertising methods (e.g., radio and newspaper advertisements) in July and August of 2019, advertising the online survey in newspaper and radio ads was not pursued to avoid potential confusion with the public.

The online survey was active from October 4, 2019 to November 10, 2019. To help encourage participation, a free-entry contest was also held. The prize was a \$100 pre-paid VISA card and participants who wanted to enter

could provide their first name and phone number at the end of the survey. The winner was drawn on November 25, 2019.

This project solicited survey participation using selective sampling, convenience sampling, and snowball sampling methods to target landowners and cattle producers who owned, operated, and/or leased grassland properties. The online survey was predominantly advertised through online blog posts (e.g., [Manitoba IBA blog post](#)), private Facebook networks, 1 Watershed District, 4 conservation oriented non-governmental organizations, private email lists, and the direct solicitation of individuals.

Because non-probability sampling methods were used to solicit participation, results are likely to be biased towards the views and beliefs of landowners and cattle producers who have a history of involvement with conservation activities. While efforts were made to encourage participation from those who were not predisposed to supporting or engaging in conservation-oriented activities, efforts were not thought to have been as successful. The limitation imposed on public advertising in newspapers is thought to have contributed to this potential bias, as individuals who were not already associated with a Watershed District or conservation organization would have had fewer opportunities to become aware of the project. It is also noted that attempts to engage individuals in an online survey can be problematic in general if interest and motivation in the subject matter may be weak or absent. The goal of this study was to attract motivated participants who were, and were not, conservation-oriented in order to reduce the risk of “random responding”. Incidences of random responding can undermine the meaningfulness of results and often occurs when individuals lack interest or motivation in the subject matter (Osborne & Blanchard, 2011).

2.5 Post-Survey Participation Rate

Despite the survey being advertised on platforms such as Facebook (pages and groups) and a website blog, the success of this project was solely dependant upon the goodwill of colleagues, project partners, project supporters, and private individuals sharing the survey link with relevant contacts. Advertising the survey on online platforms alone would not have been sufficient for achieving the minimum sample size of 15 participants from the primary target area.

The survey was active for 38 days and 48 completed surveys were obtained, exceeding overall expectations for project participation. Of the 48 participants, 33 either owned, managed, and/or leased grassland properties within the generalized target area of southwestern Manitoba ($n = 21$ within the primary target area). An additional 13 participants owned, managed, and/or leased grassland within Manitoba that was outside of the target area but within the Prairie Potholes ecoregion of southwestern Manitoba. Two participants were from outside of Manitoba and were excluded from the summary results and discussion; these two participants included one individual from Orkney, Saskatchewan and one individual from Eldorado, Illinois.

The participants who did not fall within the designated survey area in Manitoba were not excluded from the summary results and discussion. As there was no significant difference in environmental values between those who were located within the survey area (group 1, $n = 33$) and those located outside of the survey area (group 2, $n = 13$), the decision was made to retain them in the sample. Retaining these samples both increased sample size and provided additional insights into landowner and cattle producer motivations. The environmental values of participants were assessed using the LUV scale by adding together the scores for the nature-centered

dimension and the human-centered dimension. Each dimension was tested separately using a non-parametric Kruskal Wallis H test. This test was chosen because it did not require equal sample sizes and normally distributed scores (Laerd Statistics, 2015). The distribution in scores between the two groups were similar on both dimensions, as assessed by examining histograms and box plots. Results showed that there was no difference in median scores between those in group 1 (*Mdn* = 47) and group 2 (*Mdn* = 46) on the nature-centered dimension, $H(1) = 3.699, p = .054$. Similarly, there was no difference in median scores between those in group 1 (*Mdn* = 24) and group 2 (*Mdn* = 22) on the human-centered dimension, $H(1) = 1.053, p = .305$. Asymptotic significance is determined at $p \leq 0.05$.

The free-entry contest that was included in the survey was thought to have been beneficial as 75% of participants chose to enter. The average time to complete the survey was 24 minutes; the fastest completion time was 8 minutes and the longest completion time was 1 hour and 5 minutes.

In total, participants ($N = 46$) indicated that they owned, managed, and/or leased grassland properties across 30 municipalities in Manitoba (Table 2). The survey area was well-represented, with participants associating with 19 of the 27 municipalities located within the survey area. Participant demographics are further reported in Section 3.2.

Table 2: The number of participants (#) that indicated they owned, managed, and/or leased lands that were grassland in each municipality. Participants could be associated with more than one municipality ($N = 46$).

Primary Target Area		Generalized Target Area		Outside Survey Area	
Municipality	#	Municipality	#	Municipality	#
Boissevain-Morton	5	Clanwilliam-Erickson	3	Cartwright-Roblin	6
Brenda-Waskada	3	Harrison Park	5	Dauphin	2
Deloraine-Winchester	3	Killarney-Turtle Mountain	1	Dufferin	2
Ellice-Archie	1	Minto-Odanah	2	Glenboro-South Cypress	1
Grassland	3	Oakview	1	Grandview	1
Pipestone	4	Prairie Lakes	4	Lorne	1
Prairie View	3	Riding Mountain West	2	Louise	1
Riverdale	1	Yellowhead	4	North Cypress-Langford	2
Sifton	5			North Norfolk	1
Two borders	5			Riverside	1
Wallace-Woodworth	5			Rosedale	1

2.6 Landowner Meetings

On November 7th and 8th, 2019, in-person interviews were conducted with five cattle producers at their residences in southwestern Manitoba. These meetings were incorporated into the project to gain additional insights that may not have been captured by the online survey component. The meetings ranged in length from one hour to two and a half hours. The meetings/interviews were loosely-structured to allow for an organic conversation to take place. The objective was to engage cattle producers in a discussion about the beef sector in Manitoba and how the state of their operations impacted their own ability to incorporate aspects of conservation into their land management practices. Notes were taken during the meetings to help identify key themes in cattle producers' concerns for their industry, the future of their land, and their ability to incorporate

conservation priorities into their current operations. The meetings were not audio recorded due to privacy reasons.

The cattle producers who were interviewed for this project were located in the areas of Oak Lake, Pipestone, and Melita, MB. Individuals were referred to this project by the West Souris River Conservation District (now part of the Souris River Watershed District), Manitoba Habitat and Heritage Corporation, and Monarch Homestead. Three of the five cattle producers interviewed were actively involved in conservation programming. The two cattle producers who were not enrolled in a specific program were actively engaged in relevant conservation-related activities.

Outcomes related to the landowner meetings are presented in Section 3.7.

2.7 Survey Results

Summary results for each part of the questionnaire have been reported as either percentages rounded to the nearest whole number, or as frequencies. Whole numbers were reported for ease of interpretation. Microsoft Excel and SPSS Version 25 were used to manage and analyze data. Under each heading below is a description of the methods for any statistical procedures that were conducted in association with the results reported in Section 3.0.

Land Use Values

Based on methods developed by Sweikert & Gigliotti (2019), the value orientation of each participant was identified by adding together the scores for the nature-centered dimension and human-centered dimension respectively. Scores were then converted back to the original scale for easier interpretation by dividing by the number of questions in each construct. The LUV scale was first introduced and explained in Section 2.3. In Sweikert & Gigliotti (2019) the average score of each dimension was used as a midpoint to gauge participants' placement as either nature first, interconnected, disconnected, or human first. This approach may have been suitable for their study because their sample was representative of the population they were studying. However, using the average score as a midpoint can cause skewed results when sample sizes are small and distributions for each dimension are not normal. When the distribution of scores for each dimension were examined in this study, histograms showed that the nature-centered dimension was heavily skewed toward the right ($M = 6.40$, $SD = 0.824$), indicating a strong positive alignment. The human-centered dimension resembled a normal distribution ($M = 3.76$, $SD = 1.381$). While no method for establishing a standardized "midpoint" to reference participant scores has been established in the literature, I attempted to address this issue by using the midpoint of the original measurement scale (a value of 4 on a scale of 1 to 7). Based on Sweikert & Gigliotti (2019), the following chart (Table 3) was used to determine the LUV type of each participant:

Table 3: Each LUV type and placement criteria developed by Sweikert & Gigliotti (2019).

Land Use Value (LUV) Type	Nature Dimension	Human Dimension
Nature First	Above Midpoint Score	Below Midpoint Score
Interconnected	Above Midpoint Score	Above Midpoint Score
Disconnected	Below Midpoint Score	Below Midpoint Score

Land Use Value (LUV) Type	Nature Dimension	Human Dimension
Human First	Below Midpoint Score	Above Midpoint Score

To address the issue that arises when average values are the same as the midpoint, the LUV type interconnected was considered to be at or above the midpoint; disconnected was considered to be at or below the midpoint. Nature first and human first were both required to have above and below average scores. There were no instances of participants having midpoint scores on both dimensions.

Mann-Whitney U tests

Mann-Whitney U tests were conducted for most group comparisons. The non-parametric test was chosen because dependant variables were considered to be ordinal data and the independent variable was categorical. For all Mann-Whitney U tests the mean rank values were interpreted and reported. Asymptotic significance is determined at $p \leq 0.05$. Relative effect sizes (r) can be interpreted as 0.1 (small), 0.3 (medium), and 0.5 (large).

Multiple Linear Regression

A multiple linear regression model was conducted to determine how much variation in participants’ willingness to consider participating in conservation programs could be explained by motivating and inhibiting factors. The dependant variable was a construct comprising the 12 program option variables ($\alpha = 0.748$). There were two predictor variables, each containing 12 items. The first predictor was coined “motivating reasons” and including questions that gauged how important different reasons were for encouraging participants to consider participating in conservation programs ($\alpha = 0.883$). The second predictor was coined “inhibiting reasons” and included questions that gauged how important different factors were for discouraging or preventing participants from considering their participation in conservation programs ($\alpha = 0.807$). This test was chosen because all three constructs were continuous, and all of the main assumptions of multiple linear regression were met.

3.0 Results

3.1 Overview

The results section reports on the findings of the four sections of the online survey, participant feedback, and main outcomes of the landowner meetings. Section 3.2 presents the results for participant demographics. While demographics related to the survey area were shown in the methods (Section 2.5), Section 3.2 provides background information on the participants included in the analyses. As one of the main objectives of this project was to describe the environmental values of landowners and cattle producers, Section 3.3 presents summary results for each of the LUV scale items and categorizes participants by their Land Use Value orientations using methods described in Section 2.7. Landowner views towards species at risk, grassland conservation, and wildlife in general are reported in Section 3.4. Views described in Section 3.4 are specific to southwestern Manitoba, whereas views expressed in Section 3.3 are broader generalizations of environmental values. Section 3.5 states the findings of participants’ willingness to consider participation in a range of different program types. Different factors that may influence participants’ preference in programs are also

reported. Section 3.6 is a summary of the written feedback that was received from participants at the end of the survey. Section 3.7 summarizes of the main outcomes of the landowner meetings.

3.2 Demographics

There were no participants who identified as only leasing lands that were native grassland, hay land, tame pasture, or other forms of grassland. All participants, with the exception of one, either owned their own land ($n = 27$) or owned and leased lands ($n = 18$) that were considered to be grassland (Figure 2). The one participant who did not own or lease land indicated that they were able to make or influence land use decisions that affected grassland habitats.

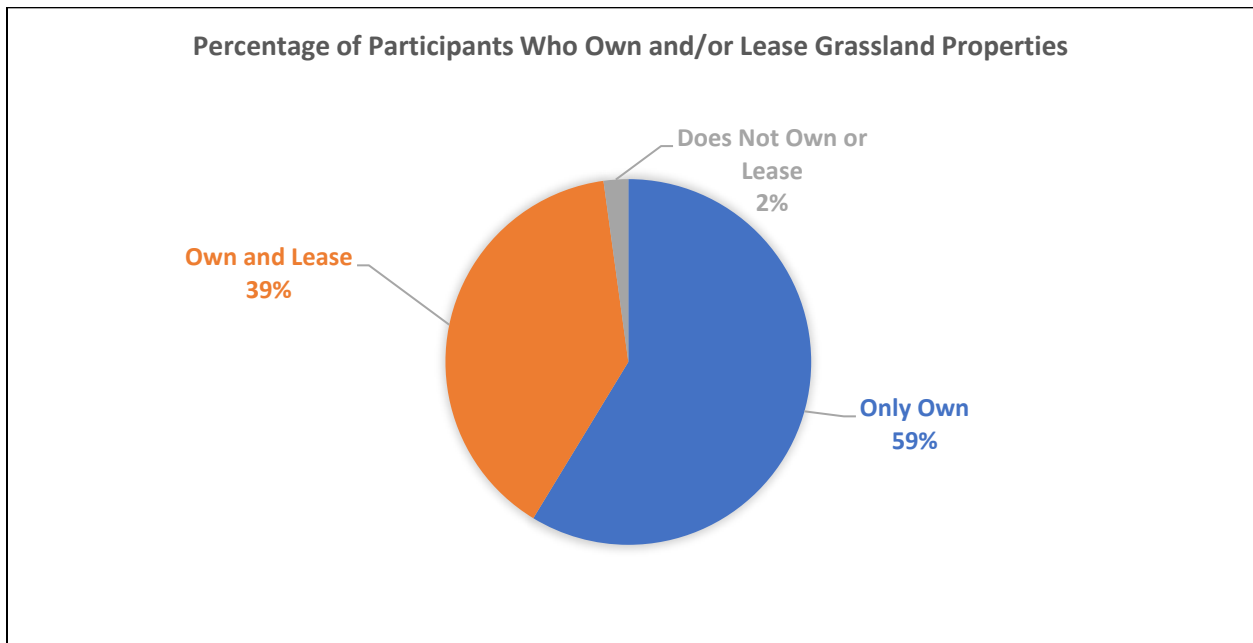


Figure 2: The percentage of participants ($N = 46$) who indicated that they either owned and/or leased grassland properties. There were no participants who only leased grassland property.

The term “manage” for the purpose of this report refers to any participant who was responsible for making or influencing land use decisions that could affect grassland habitat. 100% of participants in this study managed grassland properties in some way. When participants were asked how much land they managed ($N = 46$), 50% of participants ($n = 23$) oversaw at least 1 full section (640 acres) of grassland property (Figure 3).

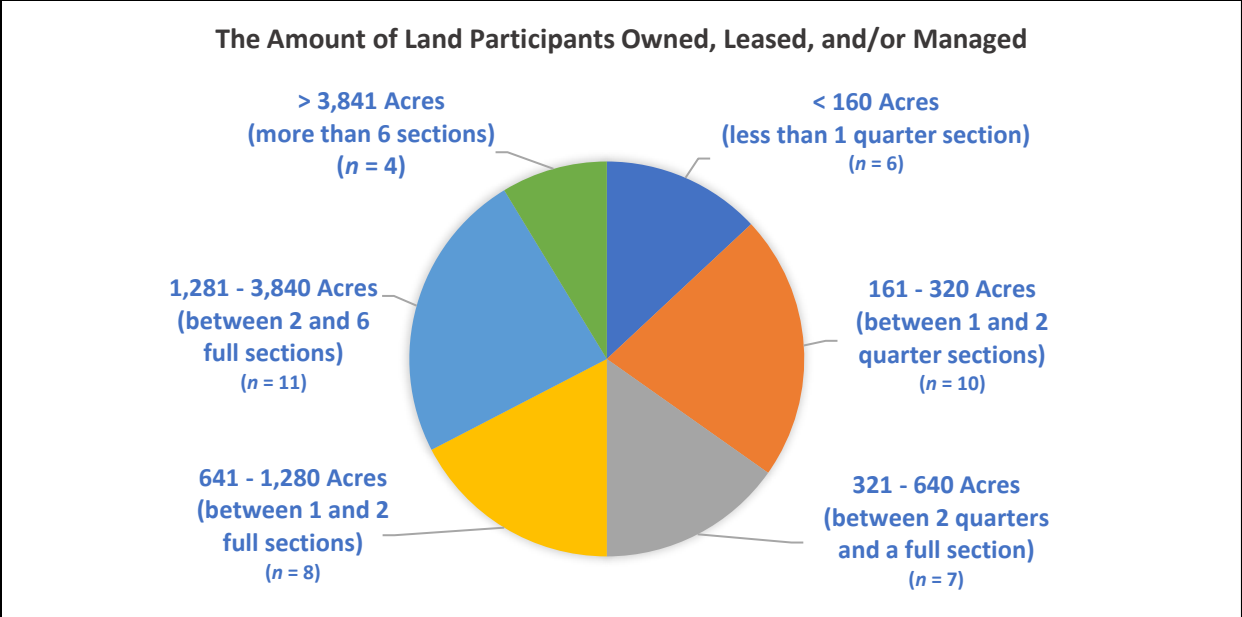


Figure 3: The amount of land that participants (N = 46) owned, leased, and/or managed.

85% (n = 39) of participants identified as being a cattle producer, of which 72% (n = 28) did mixed farming (raised cattle and grew commodity crops). Of the 7 landowners who were not cattle producers, only 1 grew commodity crops. When cattle producers were asked how much of their annual household income was derived from farming or ranching related to grasslands, 8 participants said 1% – 25%, 9 said 26% – 50%, 6 said 51% – 75%, and 16 said 76% – 100%. Of those who were not cattle producers, farming and ranching related to grasslands made up less than 50% of their annual household income (n = 7). Of those who are, or previously had been, involved in farming or ranching (n = 45), 62% (n = 28) have over 20 years of experience (Figure 4).

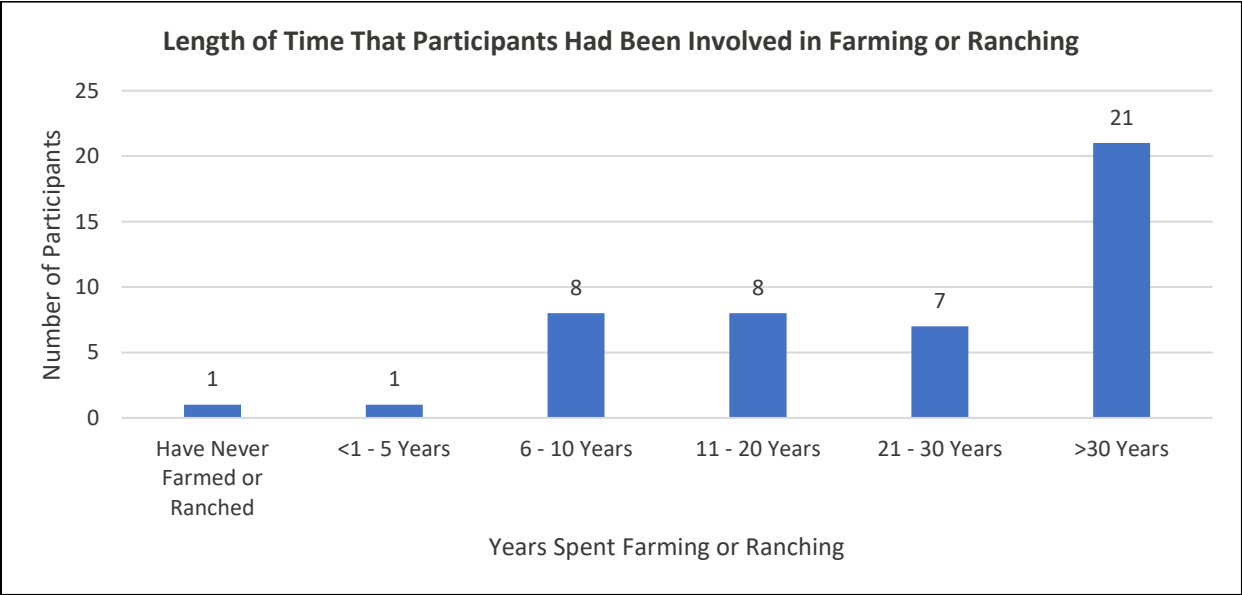


Figure 4: Length of time that participants (N = 46) had been involved in farming or ranching activities

62% (n = 28) of participants had a history of enrolling land in a conservation program while 38% (n = 17) did not. 44% (n = 20) of participants had land currently enrolled in a conservation program and 54% did not (n = 25). Of those who did not currently have land enrolled, 32% (n = 8) had previously enrolled land in a conservation program in the past and 68% (17) had no history of enrollment at all.

3.3 Land Use Values

Participants were categorized based on their LUV type using methods outlined in Section 2.3. Results showed that most participants could either be identified as having a nature first (n = 23) or an interconnected (n = 21) value orientation. The LUV types disconnected and human first each had one participant. Due to the small sample sizes for the disconnected and human first types, only nature first and interconnected types were examined in future results. The mean responses for each question included in the LUV model is located in Table 4. Cronbach’s alpha for the nature-centered dimension was 0.859 and the human-centered dimension was 0.827. The reliability results are considered to be good (Vaske, 2008) and are consistent with findings reported by Sweikert & Gigliotti (2019).

Table 4: Mean results for LUV scale items developed by Sweikert & Gigliotti (2019). The mean scores are based on a Likert scale from 1 (strongly disagree) to 7 (strongly agree).

Nature-Centered Dimension	M	SE
Restored lands maximize both productivity and ecosystem function.	6.00	0.213
Farmers and ranchers have an obligation to protect the soil, water, plants, habitat, and fish and wildlife on their land.	6.22	0.220
The quality of the land is positively influenced by the diversity of native plants and animals that live on and around it.	6.24	0.179
Farmers and ranchers are only temporary trustees of the land and it is their responsibility to take good care of it for future generations.	6.74	0.100
The diversity of plants and wildlife in an area is a sign of the quality of the natural environment.	6.46	0.148
If you take care of the land, it will take care of you.	6.43	0.115
All parts of the ecosystem, down to the microorganisms in the soil, are important for proper functioning.	6.74	0.141
Human-Centered Dimension	M	SE
Farmers and ranchers are masters of the land.	5.26	0.312
Farmers and ranchers have the right to use the soil, water, plants, and animals on their land in any way they see fit.	4.07	0.342
The needs of farmers and ranchers should take priority over the conservation of land.	3.63	0.264
Farmers and ranchers should focus on maximizing production on their land regardless of environmental costs.	1.91	0.191
The best use of land should be determined by the amount of profit that can be earned annually.	2.98	0.253
Because farmers’ and ranchers’ livelihoods depend on the land, they are the best stewards of the land.	4.74	0.281

Mann-Whitney U Tests were conducted to determine if participants' values for each dimension differed based on whether or not they had a history of enrolling land in a conservation program. Results showed that there was no statistically significant difference between groups on the nature-centered dimension, $U = 222.50$, $z = -0.367$, $p = .714$, $r = .055$, or the human-centered dimension, $U = 309.50$, $z = 1.676$, $p = .094$, $r = .250$. Tests were also conducted to determine if participants' values for each dimension differed based on the amount of time they had spent farming or ranching. Results showed that there was no statistically significant difference between those with more than 20 years of experience and those with less than 20 years of experience on the nature-centered dimension, $U = 285.50$, $z = 1.123$, $p = .261$, $r = 0.167$, or the human-centered dimension, $U = 235.50$, $z = -0.059$, $p = .953$, $r = 0.009$.

3.4 Values Towards Species at Risk, Wildlife, & Grassland Conservation

Results suggest that general awareness of avian species at risk in southwestern Manitoba is low. Of the 46 participants, only 17% ($n = 8$) indicated that they were very aware of what bird species were considered to be at risk. 59% ($n = 27$) of participants felt that they were somewhat aware, while 24% ($n = 11$) felt that they were unaware. When asked if they had had any bird species at risk on grassland properties they may have owned, managed, and/or leased, 39% ($n = 18$) indicated that they didn't know, 22% ($n = 10$) said they had never detected any, and 30% ($n = 14$) said yes they had detected them. 9% ($n = 4$) of participants reported that results of an official bird survey had confirmed the presence of bird species at risk, however none of those participants had detected any themselves.

When participants were asked if they would report the presence of any species at risk they detected on property they personally owned ($N = 43$), 47% were either uncertain or not likely to do so ($n = 20$) (Figure 5). Results of a Mann-Whitney U test showed that those with a nature first LUV type (Mean Rank = 25.67, $n = 21$) were significantly more likely to report species at risk found on their own properties than those with an interconnected LUV type (Mean Rank = 16.10, $n = 20$), $U = 112$, $z = -2.606$, $p = .009$, $r = .407$.

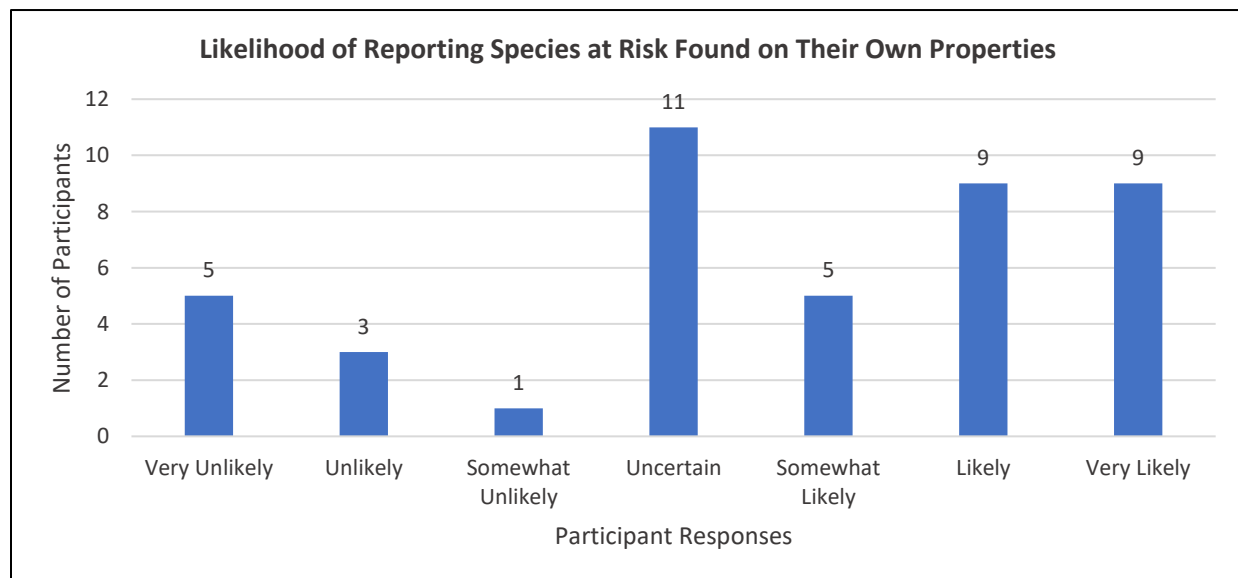


Figure 5: Likelihood of participants ($N = 43$) self-reporting species at risk found on their own properties.

When participants were asked if they would report any species at risk detected on a property that they did not personally own ($N = 45$), 67% said they were uncertain or not likely to do so ($n = 30$) (Figure 6). Results of a Mann-Whitney U test showed that those with a nature first LUV type (Mean Rank = 25.67, $n = 23$) were significantly more inclined to report species at risk detected on properties they didn't own than those with an interconnected LUV type (Mean Rank = 17.77, $n = 20$), $U = 145.5$, $z = -2.109$, $p = .035$, $r = .322$.

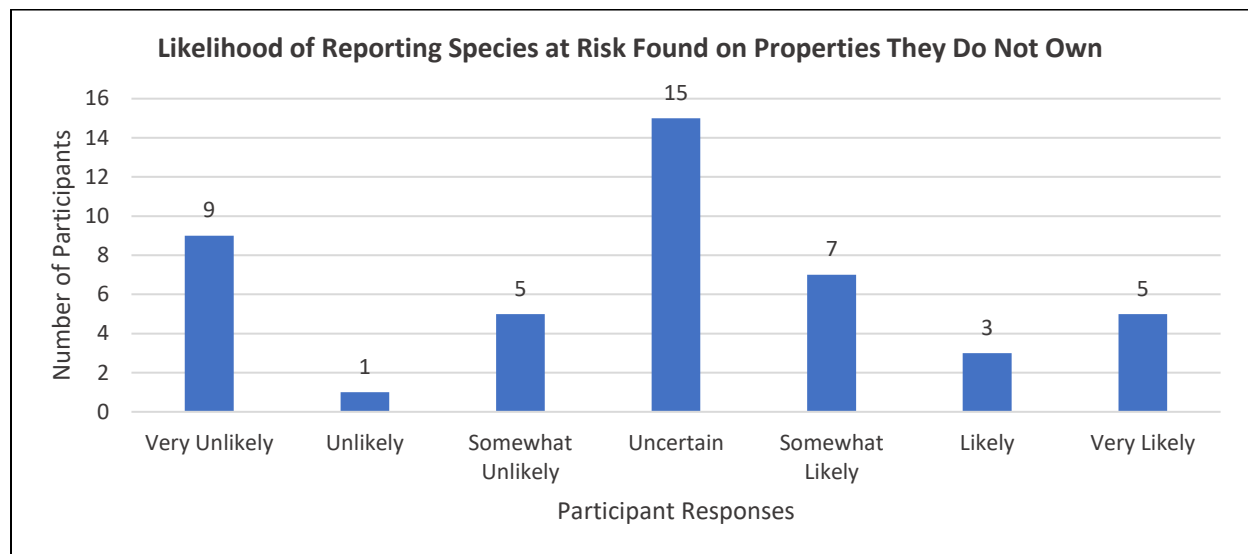


Figure 6: Likelihood of participants ($N = 45$) self-reporting species at risk found on properties they do not personally own.

When participants were asked how important it was that their land could support species at risk, 41% ($n = 19$) felt that it was very important to them, 37% ($n = 17$) said moderately important, 20% ($n = 9$) said slightly important, and only 2% ($n = 1$) said it was not important. Similarly, when asked how important it was that native grasslands they owned, managed, and/or leased remained intact and unbroken now and into the future, 63% ($n = 29$) said it was very important to them, 28% ($n = 13$) said it was moderately important, 4% ($n = 2$) said it was slightly important, and 4% ($n = 2$) said it was not important. Over the last 10 years, 6.5% ($n = 3$) of participants reported that they had converted or cultivated native grassland to other land uses ($N = 46$). For those who had indicated that protecting native grassland was only slightly important or not important at all, there were no apparent demographic variables that could be used to predict their response. This was also true for those who felt that having their land support species at risk was only slightly important, or not important at all. These participants ranged widely in their location, amount of land they owned, income percentage, years of experience with farming or ranching, and LUV types.

To gauge landowner and cattle producers' perceptions of protected species, participants were asked if they believed the presence of species at risk on lands they owned, managed, and/or leased could, or already had, negatively impact their ability to use the land ($N = 36$). While most participants (58%, $n = 21$) did not believe the presence of protected species would negatively impact their ability to use land, 8% ($n = 3$) did believe land use would be negatively affected and 33% ($n = 12$) were unsure. 11 Participants expressed their support for, or concerns about, the presence of species at risk on properties they owned, managed, and/or leased in an optional short-answer response section; each response is shown in Table 5.

Table 5: Participant comments with associated survey responses for the question: Do you believe the presence of species at risk on grasslands you own/manage/lease could, or already has, negatively impacted your ability to use the land?

Survey Response	Comments Provided*
Yes	Limitations on stock density.
Unsure	I worry that the land will be taken away from us and we need the land we have to graze our cattle and to hay for them for winter. We do not have extra land. We would have to downsize our herd and that would put our family into a financial crisis.
Unsure	I feel all grasslands need to be grazed to be optimally functional ecosystems. If the presence of at risk species would lead to the prevention of grazing[,] I feel that would be a huge issue. This would be the main reason why landowners wouldn't report at risk species
Unsure	I did not know that we should be reporting species at risk. I am currently unaware as to any land use changes/requirements that would be implemented should we see any species at risk on our properties.
Unsure	I don't want non-agricultural people telling me how to farm or ranch[.] If I have species at risk on my property that means that I am doing a good job of stewardship.
<i>Response Not Provided</i>	Conservation [g]roups do not always consider the livelihood of the farmer.
No	Outside entities trying to dictate land management practices to protect the habitat for species at risk[.]
No	I feel the presence of species at risk has assisted me with funding to provide additional habitat for birds.
No	We are seeing Bobolinks[,] [w]hich we have never seen before[.] [We are] [t]rying [to manage] for high grass prairie[.] [There are] [m]any pairs on our property[.]
No	To me, the presence of species at risk would be an indicator of good pasture management. An environment that is good enough to support species at risk would allow me to lower my cost of production for my cattle herd.
No	[We need] [t]he knowledge of which species are at risk ... [and] where to report the sighting of the at risk species. As farmers the information about at risk species is not highly visible[,] nor is who we [are supposed to] report sighting through.

**Comments, where necessary, have been edited for clarity. Edits indicated with square brackets. This includes typographical and grammatical errors from written responses.*

3.5 Conservation Programs

Each participants was able to rate (7-point Likert scale) how likely they were to consider participating in 12 different conservation program options (programs were described in Table 1). Participant willingness to consider participation in each program type (Figure 7 and Table 6) was generated by re-grouping responses into four categories: would not consider (unlikely scores 1, 2, and 3), would consider (likely scores 5, 6, and 7), undecided (4), and not applicable.

Results showed that more participants were willing to consider participation in conservation programs that provided financial returns for their livestock operations and would not impact their autonomy over the land. Despite financial compensation, fewer participants were willing to consider participation in programs that placed restrictions on private lands (e.g., easements and term agreements). Even fewer participants were willing to consider programs that resulted in the direct sale of land to a conservation organization, even if livestock operators could continue to use the land for grazing purposes.

The top six ranking programs that participants were willing to consider participating in were:

1. Annual payment program for a habitat outcome
2. Voluntary carbon offset program
3. Operational costs assistance program with a grazing plan
4. Bird-friendly beef certification label
5. Term agreements (10, 20, or more years) with one-time payment
6. Easements in perpetuity with an annual payment for a prescribed period

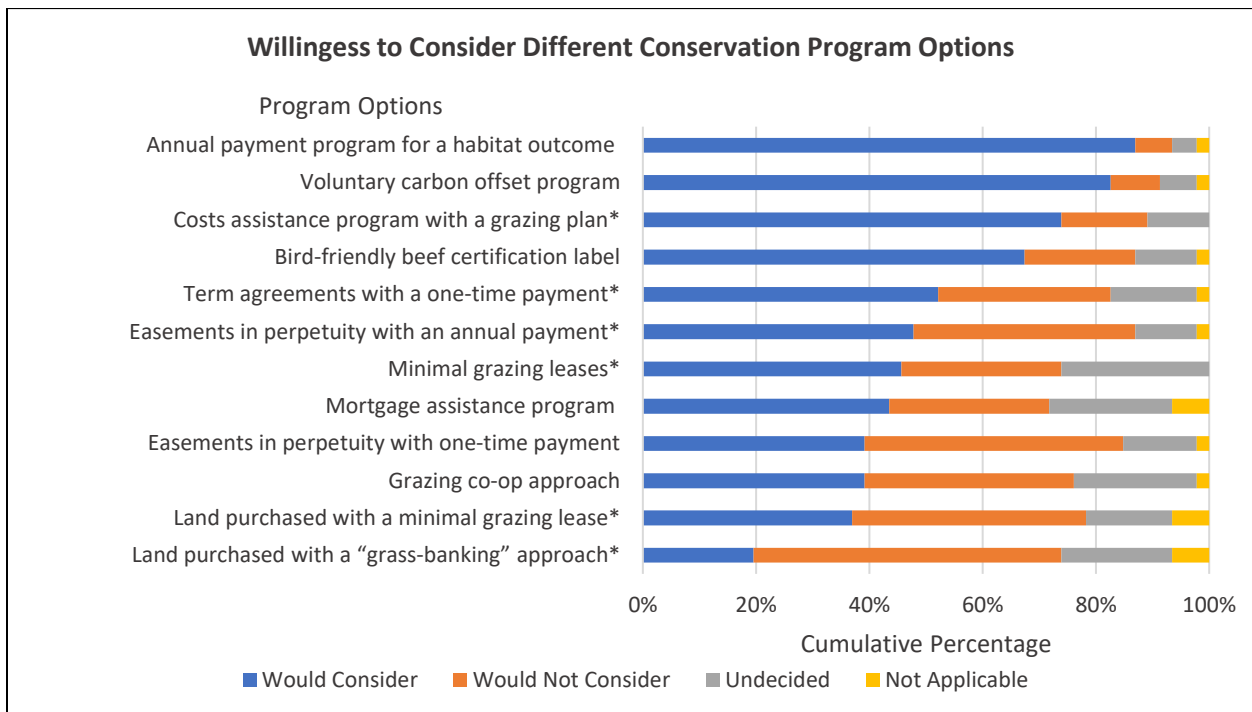


Figure 7: Percentage of participants willing to consider participating in 12 different conservation program options (N = 46). Program options are listed from most willing to least willing. Asterisks (*) denotes that the program name has been shortened for display purposes. The four categories were created by grouping responses based on how likely participants were to consider participating in each program type: would not consider (unlikely scores 1, 2, and 3), would consider (likely scores 5, 6, 7), undecided (score of 4).

As participants could indicate how likely they were, or were not, willing to consider participating in 12 different conservation programs, the level of interest in each program type was also assessed (Figure 8). The top 6 programs with the highest levels of participant interest were:

1. Voluntary carbon offset program
2. Annual payment program for a habitat outcome
3. Mortgage assistance program
4. Bird-friendly beef certification label
5. Land purchased by conservation group with a minimal grazing lease
6. Minimal grazing leases on lands owned by a conservation group

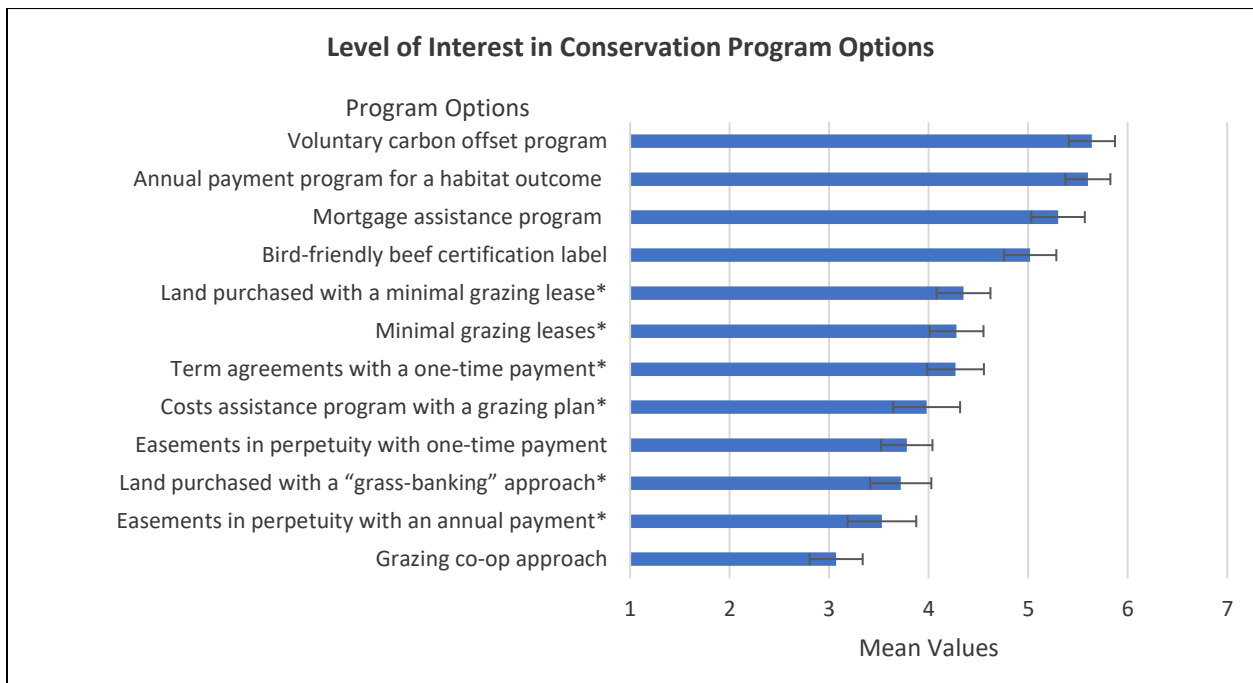


Figure 8: Participants' level of interest in participating in 12 different conservation program options. Mean results with standard error bars are based on a Likert response scale from 1 (very unlikely) to 7 (very likely). Asterisks (*) denotes that the program name has been shortened for display purposes.

The programs “annual payment for a habitat outcome”, “voluntary carbon offset program”, and “bird-friendly beef certification label” were among the top-ranking programs for both willingness to consider and overall level of interest. Results showed that while more participants were willing to consider participating in programs such as “operational costs assistance program with a grazing plan”, “term agreements (10, 20, or more years) with one-time payment”, and “easements in perpetuity with an annual payment for a prescribed period”, the overall level of interest was lower than for other program options. While fewer landowners/producers were willing to consider participating in the programs “mortgage assistance”, “land purchased by conservation group with a minimal grazing lease”, and “minimal grazing leases on lands owned by a conservation group”, those who were willing expressed a high level of interest.

Results of a Mann-Whitney U test showed that those with a nature first LUV type (Mean Rank = 25.95, $n = 22$) were significantly more inclined to participate in the program “term agreements (10, 20, or more years) with

one-time payment” than those with an interconnected LUV type (Mean Rank = 17.86, $n = 21$), $U = 144.000$, $z = -2.150$, $p = .032$, $r = .328$. Those with a nature-first LUV type (Mean Rank = 27.07, $n = 22$) were also found to be more inclined to participate in the program “easements in perpetuity with one-time payment” than those with an interconnected LUV type (Mean Rank = 16.69, $n = 21$), $U = 119.500$, $z = -2.783$, $p = .005$, $r = .424$. There were no statistically significant differences between the two LUV types for the other 10 program options.

When examined by the length of time participants had spent farming/ranching, those with 20 years of experience or less (Mean Rank = 27.21, $n = 17$) were more inclined to participate in “term agreements with a one-time payment” than those who had more than 20 years of experience (Mean Rank = 19.54, $n = 27$), $U = 149.500$, $z = -1.960$, $p = .05$, $r = .295$. Those with 20 years or less experience farming/ranching (Mean Rank = 28.16, $n = 17$) were also more inclined to participate in the “mortgage assistance program” than those with more than 20 years of experience (Mean Rank = 16.96, $n = 25$), $U = 99.000$, $z = -2.951$, $p = .003$, $r = .455$. There were no statistically significant differences between the two experience categories for the other 10 program options.

When examined by the amount of land that participants managed, those who oversaw one full section or less of land (Mean Rank = 25.75, $n = 22$) were more inclined to participate in the program “land purchased by conservation group with a “grass-banking” approach than those who owned more than one section of land (Mean Rank = 18.07, $n = 21$), $U = 148.500$, $z = -2.042$, $p = .041$, $r = .311$. Those who owned one full section or less of land (Mean Rank = 29.50, $n = 22$) were also significantly more inclined to consider participating in the program “grazing co-op approach” than those who owned more than one section of land (Mean Rank = 16.78, $n = 23$), $U = 110.000$, $z = -3.307$, $p = .001$, $r = .493$. There were no statistically significant differences based on the amount of land managed for the other 10 program options.

When examined by participants’ history of involvement in a conservation program, those who had experience enrolling land in a program (Mean Rank = 26.52, $n = 27$) were significantly more inclined to participate in the program “easements in perpetuity with a one-time payment” than those with no experience (Mean Rank = 16.12, $n = 17$), $U = 121.000$, $z = -2.695$, $p = .007$, $r = .406$. Similarly, those who have enrolled land in a conservation program (Mean Rank = 25.83, $n = 27$) were significantly more inclined to participate in the program “easements in perpetuity with an annual payment” than those who have never enrolled their land in a program before (Mean Rank = 17.21, $n = 17$), $U = 139.500$, $z = -2.212$, $p = .027$, $r = .333$. Those with a history of involvement (Mean Rank = 26.00, $n = 27$) were also significantly more inclined to participate in the program “bird-friendly beef certification label” than those with no history of involvement (Mean Rank = 16.94, $n = 17$), $U = 135.000$, $z = -2.322$, $p = .020$, $r = .350$. There were no statistically significant differences based on past experience with enrolling land in a conservation program for the other 9 program options. 65% of those who had a history of involvement in a conservation program had a nature-first LUV type.

Table 6: Participants ranked how likely they were to consider participating in 12 different conservation program types on a 7-point Likert scale. The mean (*M*) and standard error (*SE*) are reported for each program type under “level of interest”. For “willingness to consider participation” frequencies reported are based on scale items being grouped into 1 of 4 categories: would not consider (unlikely scores 1, 2, and 3), would consider (likely scores 5, 6, and 7), undecided (score of 4), and not applicable.

Program Option	Willingness to Consider Participation				Level of Interest	
	Would Not Consider	Would Consider	Undecided	N/A	<i>M</i>	<i>SE</i>
Voluntary carbon offset program	4	38	3	1	5.64	0.232
Annual payment program for a habitat outcome	3	40	2	1	5.60	0.226
Operational costs assistance program with a grazing plan	7	34	5	0	5.30	0.269
Bird-friendly beef certification label	9	31	5	1	5.02	0.263
Minimal grazing leases on lands owned by a conservation group	13	21	12	0	4.35	0.271
Mortgage assistance program	13	20	10	3	4.28	0.271
Term agreements (10, 20, or more years) with one-time payment	14	24	7	1	4.27	0.285
Easements in perpetuity with an annual payment for a prescribed period	18	22	5	1	3.98	0.336
Grazing co-op approach	17	18	10	1	3.78	0.258
Land purchased by conservation group with a minimal grazing lease	19	17	7	3	3.72	0.307
Easements in perpetuity with one-time payment	21	18	6	1	3.53	0.345
Land purchased by conservation group with a “grass-banking” approach	25	9	9	3	3.07	0.267

24 Factors that could potentially explain why landowners may choose to voluntarily enroll in a conservation program were examined. Of the 12 factors that measured positive motivations for enrollment, the four highest ranking items were (Figure 9, Table 8):

1. Financial incentives/compensation,
2. Cattle operation assistance projects,
3. Conserving native prairie,
4. Grassland restoration projects.

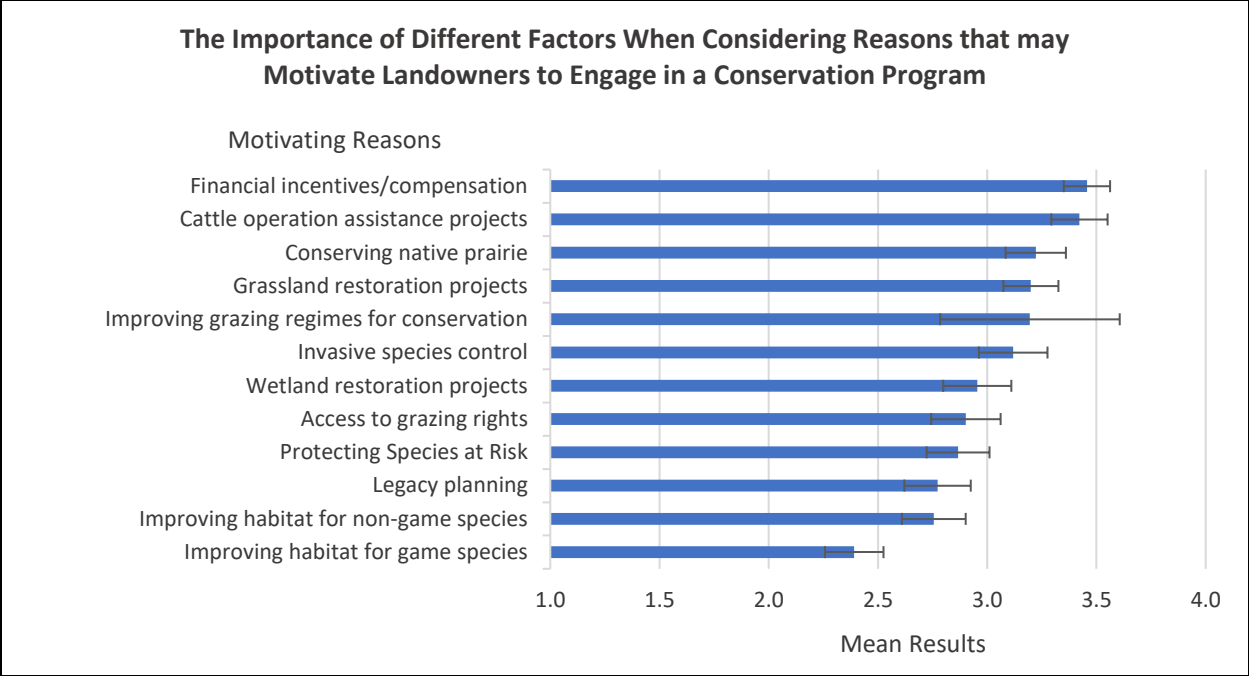


Figure 9: 12 Different reasons that may motivate landowners and livestock producers to engage in conservation programs. Mean results and standard error bars are based on a Likert scale from 1 (not important) to 4 (very important).

When motivating factors were examined by LUV type, results of a Mann-Whitney U test showed that those with a nature-first LUV type reported that protecting species at risk, improving habitat for non-game species, conserving native prairie, improving grazing regimes for conservation, and conducting grassland restoration projects were more important motivations than for those who had an interconnected LUV type (Table 7). There were no significant differences found between those with a nature-first and interconnected LUV type on the other 7 factors. When motivating factors were examined by the amount of time participants had spent farming/ranching and the how much land was managed, no significant differences were detected.

Table 7: Mann-Whitney U test results comparing LUV types based on factors that may motivate landowners/cattle producers to participate in a conservation program.

Motivating Factors	LUV Type	Mean Rank	n	U	z	p	r*
Protecting species at risk	Interconnected	17.07	21	127.500	-2.660	.008	.406
	Nature First	26.70	22				
Improving habitat for non-game species	Interconnected	16.50	20	120.000	-2.795	.005	.426
	Nature First	26.78	23				
Conserving Native Prairie	Interconnected	16.14	21	108.000	-3.279	.001	.500
	Nature First	27.59	22				
Improving grazing regimes for conservation	Interconnected	15.31	21	90.500	-3.883	< .001	.585
	Nature First	29.07	23				
Grassland restoration projects	Interconnected	17.98	21	146.500	-2.223	.026	.339
	Nature First	25.84	22				

*Relative effect sizes are 0.1 (small), 0.3 (medium), 0.5 (large).

When motivating factors were examined by participants' history with enrolling land in a conservation program, those who have enrolled land (Mean Rank = 24.21, $n = 24$) were significantly more motivated by the incentive "invasive species control" than those who have never enrolled land (Mean Rank = 16.47, $n = 17$), $U = 127.000$, $z = -2.196$, $p = .028$, $r = .343$. Those who have previously enrolled land in a conservation program (Mean Rank = 26.33, $n = 27$) were also significantly more motivated by the incentive "cattle operation assistance projects" than those who have never enrolled land (Mean Rank = 16.41, $n = 17$), $U = 126.000$, $z = -2.869$, $p = .004$, $r = .433$. There was no significant difference between groups for the other 10 motivating factors.

There were 12 factors that explained potential reasons why landowners would not engage in a conservation program. The four highest ranking factors were (Figure 10, Table 8):

1. Financial incentives are not high enough,
2. Property may have a reduced resale value,
3. Conservation programs limit the activities that can be conducted on a property,
4. The length of term agreements or easements is too long.

Mean results suggest that the highest-ranking inhibiting factors were regarded as being slightly to moderately important to landowners. No single factor stood out as being highly influential for preventing or discouraging voluntary participation in a conservation program. Mann-Whitney U tests were conducted to determine if inhibiting factors differed based on participant's history of enrolling land in a conservation program. No significant differences between groups were detected for each of the 12 factors.

Results of a multiple linear regression analysis suggest that motivating factors could be more important determinants of participant willingness to engage voluntarily in a conservation program than inhibiting factors, $F(2, 43) = 8.606$, $p = 0.001$, $\text{Adj. } R^2 = 0.253$. Motivating and inhibiting factors explained 25.3% of the variation in participants willingness to consider participation in conservation programs, a medium effect size (Cohen, 1992). Motivating factors ($\beta = 0.745$) contributed more explained variation in the model than did inhibiting factors ($\beta = -0.272$).

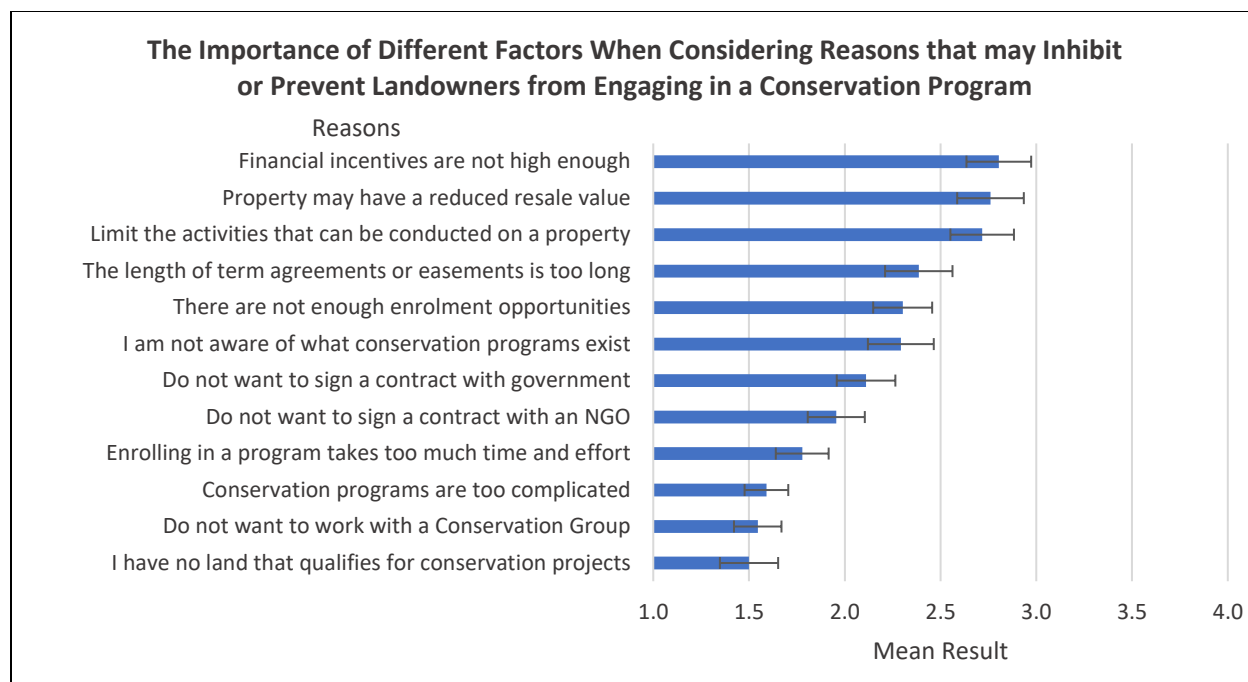


Figure 10: 12 Different reasons that may prevent or inhibit landowners from voluntarily engaging in conservation programs. Mean results with standard error bars are based on a Likert scale from 1 (not important) to 4 (very important).

Table 8: Sample sizes (*N*) are reported for each motivating and inhibiting reason that landowners may consider when deciding to participate in a conservation program. Mean (*M*) and standard error (*SE*) results are reported for the overall importance of each reason. Results are based on a Likert scale from 1 (not important) to 4 (very important).

Motivating Reasons	<i>N</i>	<i>M</i>	<i>SE</i>	Inhibiting Reasons	<i>N</i>	<i>M</i>	<i>SE</i>
Financial incentives/compensation	46	3.457	0.106	Financial incentives are not high enough	46	2.804	0.169
Cattle operation assistance projects	45	3.422	0.129	Property may have a reduced resale value	46	2.761	0.174
Conserving native prairie	45	3.222	0.138	Limit the activities that can be conducted on a property ¹	46	2.717	0.166
Grassland restoration projects	45	3.200	0.126	The length of term agreements or easements is too long	44	2.386	0.176
Improving grazing regimes for conservation	46	3.196	0.411	There are not enough enrolment opportunities	43	2.302	0.154
Invasive species control	42	3.119	0.157	I am not aware of what conservation programs exist	41	2.293	0.172
Wetland restoration projects	44	2.955	0.156	Do not want to sign a contract with government	45	2.111	0.153
Access to grazing rights	41	2.902	0.159	Do not want to sign a contract with an NGO ²	45	1.956	0.149
Protecting species at risk	45	2.867	0.144	Enrolling in a program takes too much time and effort	45	1.778	0.138

Motivating Reasons	N	M	SE	Inhibiting Reasons	N	M	SE
Legacy planning	44	2.773	0.152	Conservation programs are too complicated	44	1.591	0.114
Improving habitat for non-game species	45	2.756	0.146	Do not want to work with a Conservation Group ³	44	1.546	0.124
Improving habitat for game species	46	2.391	0.134	I have no land that qualifies for conservation projects	36	1.500	0.152

¹ Originally “conservation programs limit the activities that can be conducted on a property”. ² Originally “Do not want to sign a contract with a conservation organization”. ³ Originally “do not want to work with a conservation organization or district”. Statements were shortened for graphical presentation.

Participants were asked to indicate how important five different features were when considering participation in a conservation program (Figure 11, Table 9). Mean results show that all five features were considered to be important.

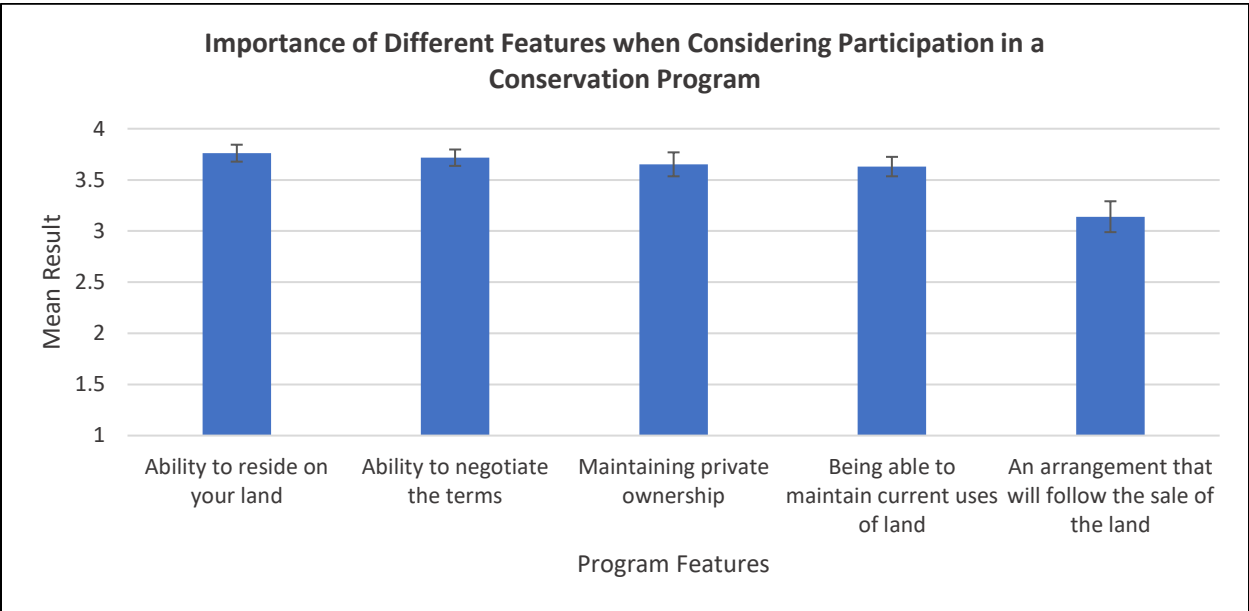


Figure 11: Five different program features that are important to landowners/producers when considering enrolment in a conservation program. Mean results with standard error bars are based on a Likert scale from 1 (not important) to 4 (very important).

Table 9: Mean (M) importance of five different program features with sample size (N) and standard error (SE) reported.

Program Feature	N	M	SE
Ability to reside on your land	46	3.761	0.083
Ability to negotiate the terms	46	3.717	0.08
Maintaining private ownership	46	3.652	0.117
Being able to maintain current uses of land	46	3.63	0.095
An arrangement that will follow the sale of the land	43	3.14	0.151

3.6 Summary of Survey Feedback

Of 48 participants, 21 provided written feedback at the end of the online survey; 19 participants from within the survey area and both of the excluded participants. The one participant from Eldorado, Illinois stated that their reason for participating was because, as a landowner, they were concerned about the effect their land-use decisions could have on migratory birds: “Although not from Manitoba[,] I am interested ... [in this study] because of the affect that I may have[,] in southern Illinois[,] for the migratory species”. The one participant from Orkney, Saskatchewan did not state a reason for participating, but did provide advice on how conservation organizations could work better with landowners:

Producers want to know that they will not have changes sprung on them a few years into the [conservation] agreement. Work with ... [landowners,] do not force rules on them[,] and you [can] have a good relationship. Most producers want to conserve their land [and] they just need the right tools to do it.

Participant feedback could be identified as fitting under one or more themes by grouping commonalities across written statements. *Understanding* was identified as the first theme and it encapsulated landowner and livestock producers’ understanding of pertinent conservation issues, the value of ecological goods and services, and general appreciation for the environment. Respondents wrote comments that suggested they understood the role they, and/or their operation, played in environmental conservation:

Ruminants are a vital part of a healthy ecosystem across the prairies and beef cows are filling the void left by the disappearance of the bison. A healthy ecosystem will provide a higher quality and quantity of forage, cleaner water bodies and increased plant and animal diversity. This benefits our livestock, wildlife and their entire habitat.

The second theme was *education* and included identifying the need for landowners and livestock producers to be made aware of current environmental issues and to be educated on best practices related to land management. This theme also includes the importance of educating the general public on the positive environmental aspects of the beef sector. One cattle producer requested that conservation organizations “[provide] [e]ducation on the benefits of planned grazing and how better management will help ... [producers] bottom line as well as protect species at risk. More workshops in more communities.”

Other participants remarked:

Beef producers need to see more information about what a well managed grazing system looks like and why we would want to do this. The descriptions we get are too general. Farmers need specifics. Rotational schedules suitable for various months, grass height when cows need to be moved, watering tips....

And:

Possible exposure to others. I learned a lot from exposure to ranches in southwestern Saskatchewan. I believe that I see better management of grassland there (rest/rotation/stocking rates etc.). How can we develop a similar ethic in [southwestern Manitoba]? It seems that in [southwestern Manitoba] more producers are mixed farms that cannot or do not focus as much time and energy on grass or cattle management,

and more goes to the cropping enterprise. A conservation or grassland ethic improved through education and exposure may benefit both grasslands and species-at-risk.

One landowner highlighted the lack of awareness of conservation programs available in Manitoba:

We currently are involved with ALUS to enhance portions of our grassland pastures with 10-year commitments to protect selected areas. We are interested in further land easements but don't have much information on who or what organizations might be interested in protecting the entire farm into the future.

Landowners and beef producers also emphasised the need for broader public education on the positive environmental benefits of cattle:

We must be diligent and promote conservation and beef producers as good stewards of the land and environment, as of lately we have been scrutinized as an industry as having a negative impact on the environment. Beef production is one of the only agriculture commodities that can produce a high quality, healthy food that was produced as part of the natural ecosystem.

The third theme was *communication* and focused on the need for increased unity between landowners/producers and conservation organizations. Among participants, it was clear that producers and landowners recognized the need for more open communication and agreement on land-use topics: "We need to open up the lines of communication between beef producers and conservation organizations. ... The needs of the beef producers and conservationists are very similar we need to start to ... [be] in the same room when these conversations [about conservation] are happening." In regard to protecting species at risk, one participant remarked: "I think better communication is needed, unless we are actively looking for information we are not aware of species that are at risk."

The fourth theme was *partnerships* and it focused on the perceived need for conservation organizations to develop trust-based, mutually beneficial relationships with livestock producers:

The idea that not eating grazing animals is good for our environment is prevalent in society but is wrong (based on the science) and the consequences of such an idea would be the loss of grasslands and would be catastrophic for flood control, erosion control, biodiversity, carbon sequestration, etc. Conservation groups need to engage with grassland owners to counter the vegan/vegetarian message by advertising (TV, radio, print) the ecological goods and services that grasslands provide. This type of advertising is lacking and is critical to prevent the loss of more grassland to large grain/oilseed producers.

Further, another participant wrote: "Develop relationships/trust. Assist [producers] ... to promote their products [and] support them. Be seen as an ally. This is being done already, but ... [could] always improve." One participant did comment on the perceived shortfalls of conservation organizations trying to partner with cattle producers:

Currently the efforts of conservation organizations seem to be siloed with specific objectives focused on particular ecosystem functions or species at risk. As ranchers we are working with many variables and complex systems. While we can ultimately work to create habitat through good grazing management[,] the relationship between ranchers and conservation has been strained as there is often a lack of understanding related to what may be viewed as differing objectives.

Distrust was identified as the fifth topic and included current negative perceptions of conservation organizations and their associated programs. Of the 19 participants who provided written feedback, only one expressed outright distrust in a specific conservation organization:

Very disappointed to see that [name omitted] land in Saskatchewan has been sold off to private producers who are literally destroying the land. I feel those families sold or gave the land to [name omitted] in good faith that the land would be looked after and kept for the wildlife.

The last topic was *programs* and included recommendations to enhance or alter aspects of current programs, and/or requests for new programs that could better support the needs of livestock producers and landowners. For many producers, the economic viability of their operation was a key factor that needed to be addressed in any potential programming options:

It will generally come down to dollars and cents. In my personal situation, I need to consider that I do not jeopardize my competitiveness (profitability). Programs designed to make a beef (or sheep etc...) producer competitive with grain producers would be beneficial when it comes to purchasing new land or converting cropland to a forage scenario. Consider programs that also promote tame forage (grazing or hay) or even extensive grazing of cropland. This will help support the same people that manage native grassland.

And:

Help producers engage in regenerative ag[riculture programs] that will improve the soil, habitat, water cycle, profitability, etc. Small farms were typically more environmentally conscious in the past, but as profitability of these small farms has declined, so has the attention to the environment. Many of today's cash strapped farmers and corporate farms do not have the time or money to focus on the environment.

And:

I feel [D]ucks [U]nlimited - how ever unpopular - may have the most effective approach to slowing the loss of natural habitat. That being the purchasing of land on the open market, enrolling these lands in permanent easement and then reselling back into the public market. The conservation effort will never keep pace with the increase in land prices - at \$1000-\$1500 /acre ... [no] farmer is willing to leave wetlands, trees or anything else that stands in ... [their] way of maximizing returns on ... [their] investment.

I have seen 100's of acres of native prairie, wetlands and blank road allowance converted to mono culture crops within a 5-mile radius of our farm over the past decade, and this trend will only continue.

Comments further included: "Provide incentives to improve grazing management (infrastructure) and provide incentives to producers that show superior forage cover" and "[h]elp me be competitive to purchase or lease crop land to convert to temporary habitat".

There was also a focus on ecosystem services and the need for landowners/producers to be compensated for providing and maintaining wildlife habitat:

I spoke with one organization this spring about restoring some wetlands but there was no mention of compensation for the wetlands already in existence. No wonder guys are draining wetlands - we are providing a service for society with no compensation! If it's not going to be through higher food/grain prices, then it should be for the wetlands, grasslands, bush that we own and manage. Also - many organizations seem to focus on one segment rather than the big picture and any programs offered have to fit their criteria. How about working with landowners/producers to find solutions that benefit all?

In addition: "Fairly compensate landowners for the additional costs they incur to provide enhanced habitat to conserve native prairie and species at risk"; "[provide an] [a]nnual payment to landowners to maintain wetlands and bushlands"; and "a missing benefit is carbon sequestration on managed grassland or maintaining the carbon storage already present in native grassland. This benefit is most important to our great grandchildren".

3.7 Summary of Landowner Meetings

Environmental Values and Land Management

Each of the cattle producers who were met for in-person meetings were asked questions to gauge their environmental values and assess some of their current land management practices and involvement in conservation programming. While all five producers indicated that they cared for wildlife and habitat conservation, the degree to which that care translated to their own land management considerations and practices varied considerably. Each producer could be placed into one of two categories: those who recognized the conservation value of their own land and those who did not. Those who seemed to have a good understanding of their land's conservation value were found to be actively engaged in learning and employing best practices to promote healthy grasslands and support biodiversity. These landowners were identified as being self-motivated in regard to actively acquiring knowledge that would allow them to increase the sustainability of their cattle operations on the landscape. These landowners participated and/or supported local conservation programming and sometimes undertook conservation initiatives at their own financial expense. Those who did not seem to recognize the conservation value of their own land were found to be less engaged in stewardship, less aware of their environmental impact, and were less self-motivated to learn about sustainable ranching practices. For the producers who did not seem aware that their land held conservation value, motivations for engaging in a conservation program or initiative appeared to be directly related to the

programs level of convenience and/or financial incentive; there was an apparent disconnect between the purpose of the conservation program (to provide an environmental benefit and instill an appreciation for stewardship) and the reason for participation (operational assistance).

While landowners who did not seem to recognize the conservation value of their land may lack self-motivation for learning and incorporating sustainable practices, it did not mean that they were necessarily resistant to new ideas and knowledge when it was presented to them. These producers showed a genuine interest when they were told how their own land management practices *specifically affected* different species that occurred, or could occur, on their own land. For example, talking about the importance of specific habitat characteristics for different avian species at risk, within the context of their own land, appeared to elicit more interest in learning about better grazing practices than did a generalized discussion about the need for grassland conservation.

All of the producers that were met in-person owned and managed grassland with the confirmed presence of species at risk. The following nine avian species at risk were represented across the properties owned by the five producers: Baird's Sparrow (Provincially Endangered), Burrowing Owl (Endangered), Chestnut-collared Longspur (Endangered), Red-headed Woodpecker (Endangered), Barn Swallow (Threatened), Bobolink (Threatened), Ferruginous Hawk (Threatened), Loggerhead Shrike (Threatened), and Sprague's Pipit (Threatened).

For producers who did not recognize the conservation value of their land and had not incorporated sustainable practices into their operations (e.g., delayed haying, grassland restoration, grazing plans), their main reasons for not doing so was 1) a lack of awareness for both the practice and how to implement it, and 2) they did not know that their current practice could have a negative affect on wildlife. They stated that if they knew the specifics required (e.g., preferred haying dates, rotational grazing schedules, ideal grass heights), they would be inclined to make considerations for incorporating it into their management practices if opportunities arose. Further, if certain practices could be shown to benefit cattle production and increase yields, they would not be opposed to changing practice altogether. One landowner remarked that knowing what species were at-risk and where they were located on his land would help him to plan around them.

Some participants identified barriers that they were thought were preventing sustainable land management practices from becoming more widely used within the ranching community:

1. The cattle ranching community in southwestern Manitoba is not as well-connected as it once was in the past, making it more difficult for ranchers to stay connected with each other and disseminate knowledge about more sustainable and profitable land management practices.
2. There are not enough good examples of profitable ranchers who are using conservation-oriented agriculture practices being showcased within ranching communities.
3. A perceived generational rift has formed between younger producers who are interested in trying different ranching techniques and older generation producers who have established ways of running their operations.
 - a. Older generation farmers may not be supportive of newer/younger ranchers who are perceived as being inexperienced and want to incorporate practices that are not traditional. Many ranchers use practices that were passed down through family and the incorporation of different management practices may be seen as foolish.

4. Conservation oriented techniques (e.g., regenerative agriculture) are often under-represented at conventional farming conferences.

Economics and Grassland Conservation

“Without a viable beef industry there will be no more grassland left.”
- *Cattle Producer from southwestern Manitoba*

All of the producers interviewed, regardless of their environmental beliefs and land management practices, believed that the retention of grassland in southwestern Manitoba was ultimately dependant upon the economic health of the beef sector. Discussions on how to conserve grassland often centered on how the economic viability of the beef sector in Manitoba could be strengthened and individual producers supported. Producers thought that the following factors were negatively impacting the viability of cattle operations in Manitoba, thereby directly or indirectly impacting grassland conservation:

1. Rising cost of land.

Perception: While the rising cost of land will benefit producers who are set to retire and sell off their assets, the purchase of land has become cost prohibitive for those who do not already have large cattle operations. Farmers who grow commodity crops are perceived to be more financially competitive when it comes to purchasing land at higher values. The continued conversion of productive grasslands by commodity crop farmers is also increasing the scarcity of good grazing lands, further contributing to rising pastureland values. Some interviewees also observed that commodity crop farmers have also been buying less productive grasslands for cultivation, which often results in the eventual conversion to tame pasture when yields are poor.

2. Lack of support for new producers entering the industry.

Perception: Due to economic uncertainty, lack of affordable and available land, and very low profit margins for individual producers, only large operations can make a profit; it is becoming less economically feasible for new producers to start out small and grow their operations.

3. Lack of succession planning among ranchers who are set to retire within the next 10 to 15 years.

Perception: A significant proportion of cattle producers with large operations and land holdings are set to retire in the near future (within 10 to 15 years). Most of these producers have no succession plan in place and no one in the family to step up and take over their business. Little thought has gone into the future of their operations and their assets, and when the time comes they will “sell out and be done”. Two of the five producers interviewed admitted to having no succession plan in place despite their own intention to retire in the near future.

4. Rising popularity of anti-beef movement.

Perception: Misconceptions about the beef sector in Canada have contributed to the rising popularity of anti-beef movement online and in the media. Producers expressed their disappointment at the lack of media push-back and absence of positive messaging to counter agendas led by animal rights groups and some environmental organizations. Producers wished to see their industry representatives and local conservation

organizations become more visible in educating the public on the positive environmental aspects of cattle production in Canada.

5. Persisting, widespread financial impacts of the bovine spongiform encephalopathy (BSE) crisis in Canada that began in 2003, “country of origin” labeling that was introduced in the United States in 2004, and other economic factors.

Perception: The cattle industry in Manitoba has yet to recover from the severe economic setbacks of the BSE crisis and further suppression of the market caused by the introduction of the “country of origin” labelling in the USA. In addition to these two factors, years of drought, rising land prices, and inadequate insurance structures have made it increasingly difficult for producers to make a profit and recover from bad production years (e.g., drought, flooding, winter feed shortages). Those who do mixed-farming or only farm annual crops are seen as being more profitable and competitive; the availability of robust insurance schemes and AgriStability programs help to “prop up” crop farmers, thereby making them more competitive against cattle producers who cannot afford to take on as much risk.

6. Poor industry representation.

Perception: Those interviewed did not believe that the national and provincial organizations representing their sector were doing enough to improve economic outlooks and address systemic issues facing producers today (e.g., rising cost of land, lack of support for new producers, lack of resources available to provide help in succession planning, lack of response to the anti-beef movement, and insufficient incorporation and promotion of new research and land management approaches).

Programs and Outreach

Through speaking with producers, it was repeatedly expressed that ranching is a “relationship-based business”. Three of the five interviewees stated that the connection they had with their program representative (the person they dealt with directly) was ultimately more important than the organization delivering the program. This was exemplified when, unsolicited, three interviewees recounted similar experiences and feelings about their relationship with one particular individual who had previously worked for the Critical Wildlife Habitat Program. This program representative was characterised as someone who was respected for their personal experience in the cattle industry, knowledge of rangeland health and conservation, and dependability when they needed assistance. The loss of this individual, due to his departure from the program, was deeply felt among these landowners who reported that he would be greatly missed. This program representative had held the position of Mixed-grass Prairie Management Technician and had been responsible for assisting and negotiating Twice-over Grazing Agreements with landowners who owned native prairie in southwestern Manitoba (C. Graham, personal communication, December 13, 2019). Through the program, landowners were able to enter into multi-year agreements with cash incentives to install fencing as required for a twice over grazing strategy. Over the years of the agreement the prairie was assessed, and the cows were weighed to measure productivity for the habitat and the producer (C. Graham, personal communication, December 13, 2019).

When asked how conservation groups could better connect with cattle producers to deliver programs, it was commonly reported that attempting to do so would be a difficult task. Some interviewees provided reasons as to why they held this belief:

1. Older generation cattle producers/landowners tend to be absent or less active on online forums, such as chat groups (e.g., WhatsApp), Facebook groups, and email lists where education is being offered and discussions about sustainable ranching and farming are taking place.
2. When regenerative agriculture workshops and presentations are held in communities, it tends to be the same ranchers and farmers showing up. It is hard to attract new folks.
3. Mail-out media communications are not perceived to be an effective option because “the mail sometimes doesn’t even end up leaving the post office”.
4. Many organizations want to start engaging with landowners in the spring and summer to carry out their programming. For landowners/producers, this is the least convenient time to start entering into discussions. Most farmers and landowners want to have meetings and develop plans over the fall and winter.
5. “Cattle farmers might be wary of literature and science. People who provide new info[rmation] are often scientists and not farmers. Farmers may be intimidated/sceptical in taking advice from a scientist verses a [third] generation farmer, for example”.
 - a. Ranchers and farmers who have a low level of formal education (may not have finished secondary school and have no post-secondary education) may not understand the methods behind scientific research or the scientific reasons behind new practices.

While communication and relationship barriers were quickly identified, producer-generated solutions to these problems were limited. Recommendations included pairing scientists with farmers in the delivery of programs to better establish rapport among potential participants, delivering more seminars in more communities to disseminate knowledge of programs and opportunities, and interacting in online chat groups where other producers and farmers are discussing farming techniques.

Each of the five producers had different ideas as to what types of programs could benefit grassland conservation efforts:

Conservation-based program ideas

- A program that will subsidize the restoration of degraded farmland back to native habitats.
- A program that will be flexible in its eligibility criteria and allow landowners with varying habitat types and quality to participate.
- Carbon credit programs that can compensate landowners for maintaining native habitats (e.g., voluntary carbon markets or Federal carbon tax revenues).
- Workshops for farmers and land managers that explain the habitat characteristics and needs of different species.

Industry-based programs and investment ideas

- The creation of a farmland investment company that would purchase and secure pasture lands as a conservation-driven, long-term investment.
- Mortgage assistance programs to help new producers purchase land for their operations.
- Programs that can partner older and younger producers together in succession planning.
- Programs that can help producers develop legacy plans and provide financial planning assistance.

Producers also identified important characteristics that they thought would make programs more successful:

- Programs should be results-driven.
- Program representatives should be easy to get a hold of.
- Programs should not be complicated and not involve tedious amounts of paperwork.
- Programs should be able to work around the landowner's availability (e.g., conduct meetings in the late fall and winter).

When producers were asked what types of programs would not work for them, conservation easements were identified as being the top issue. It was a commonly held belief amongst interviewees that easements would decrease the resale value of their land. One producer also believed that the compensation provided for the placement of an easement would not be sufficient enough to mitigate the loss in property value. Another producer acknowledged that conservation easements held importance, but the lack of flexibility over time and impact on land values made it impractical for them to consider. Another producer, who had bought land with an existing conservation easement, stated that the lack of follow-up over the lifetime of the easement by the easement holder was concerning. While this producer knew that an easement existed on their land, they were unaware of its definitive boundaries, the limitations it placed upon the land, and who the easement holder was.

4.0 Discussion

All of the participants in this study were found to manage grassland properties in some way, with the majority being cattle producers. All but one participant had experience farming/ranching, with the most having over 20 years of experience. With fewer people entering the agricultural field and taking over businesses (Beaulieu, 2015), it was not unexpected that those with less farming/ranching experience would be under-represented. In 2011, 68.5% of farms in Manitoba were operated by people 50 years of age or older (Beaulieu, 2015). The industry bias towards older farmers at or near retirement age and declining recruitment has begun to change the composition of the beef industry in Canada (Jelinski, Kennedy, & Campbell, 2015). A report titled *Demographics of the Canadian cow-calf industry for the period 1991 to 2011* concluded that “[u]nless the younger producers dramatically expand their herd sizes, Canada will have a much smaller industry in terms of beef cow numbers” (Jelinski, Kennedy, & Campbell, 2015). Forecasted declines for the cow-calf sector is anticipated to have serious implications for the future of grassland conservation in the province. As producers set to retire within the next 10 to 15 years divest their land holdings, many conservationists fear that some of the last contiguous patches of native prairie in southwestern Manitoba could be lost to the plough (C. Artuso, personal communication, January 15, 2019). Although many remnant native prairie pastures are now confined to areas historically considered to be undesirable for crop production, a report by Statistics Canada (2017) has shown that farmers are increasingly converting marginal areas to productive cropland. Those interviewed believed that grasslands today were being sold to crop farmers partly due to declining intergenerational business transfers, fewer new cattle producers entering the industry, and weak financial competitiveness for those cattle producers wanting to buy land.

In Manitoba, efforts to conserve grasslands have largely fallen into one of two categories: land securement and landowner engagement. Land securement has been achieved primarily through fee simple land purchases, donations, or the establishment of conservation easements. Prominent conservation agencies such as the Nature Conservancy of Canada and Manitoba Habitat and Heritage Corporation and others play an essential role in protecting and managing endangered prairie ecosystems on private lands in Manitoba. The role of non-profits, corporations, and private citizens in land conservation has become increasingly important as mixed-grass prairie is not legally recognized as an endangered ecosystem and does not receive any formal protections on private land under federal or provincial environmental law. In 1990 the government of Manitoba introduced *The Endangered Species and Ecosystems Act* (SM 1989-90, c. 39) (amended in 2013 to include endangered ecosystems). Under this act, the minister may designate ecosystems, develop recovery strategies, secure land, designate preservation zones, and prohibit or restrict activities within preservation zones (SM 2018, c. 8, s. 22). Ecosystems currently designated under the *Endangered and Threatened Ecosystems Regulation* are tall grass prairie and alvar (MB Reg 70/2015). As of 2020 neither tall grass prairie nor alvar have received designated preservation zones awarding them specific protections. While mixed-grass prairie is not listed under the *Endangered Species and Ecosystems Act*, federal and provincial laws for species at risk that occur in mixed-grass prairie have the potential to offer some indirect protections.

Under both federal and provincial legislation, it is a punishable offence to kill, injure, possess, disturb, or interfere with a species listed as at-risk (endangered, threatened, or extirpated) (S.C. 2002, c. 29; SM 1989-90, c. 39). These protections also extend to the habitat of a listed species. While current legislation has the potential to be a powerful tool for conservation, under federal law critical habitat has not been legally defined for grassland obligate avian species at risk in Manitoba; provincial law does not require the identification of

critical habitat. In the absence of defined critical habitat (federal) and a lack of federal and provincial resources to notify landowners, inventory and monitor habitat, and investigate infractions, enforcement has been exceedingly difficult and therefore rare. There are currently no known cases of a landowner being brought to court for the destruction or disturbance (e.g., cultivation) of species at risk habitat corresponding to mixed-grass prairie either federally or provincially in Manitoba.

Imposing protections for species at risk on private lands is a controversial (Geary, 2019), albeit increasingly sought-after conservation measure. The very first prosecution under Manitoba's *The Endangered Species and Ecosystems Act* was made in 2019 in connection to the disturbance of habitat of the endangered Western-prairie Fringed Orchid in southeastern Manitoba's tall grass prairie (Hoye, 2019). Proceedings for this unprecedented case took place during the data collection phase of this project and it was therefore predicted that ongoing media coverage would influence landowner perceptions of species at risk. Results suggest that the media coverage was not as influential as expected, as only 8% of respondents believed that the presence of species at risk could, or already had, negatively impacted their land use; most participants were either uncertain or did not believe their land use could be impacted. If media coverage of the Western-prairie Fringed Orchid case had had a larger effect, it is speculated that results would have shown a much higher percentage of those who believed that they could be negatively impacted. A lack of awareness of legislation is thought to be the main reason why so few participants believed that the presence of species at risk could impact their land use and is reflected by 33% of the respondents being unaware. For the 58% who believed their land use would not be negatively impacted, it is unknown to what extent they understood the law. Respondents' perceptions could be explained by the fact that grasslands used for cattle grazing are often compatible with supporting species at risk (e.g., Parks Canada Agency, 2016) and as such, participants may believe that their current land use practices would not be impacted. In addition, landowners with a nature-first LUV type may not perceive some land use restrictions as a negative implication since they are more likely to make concessions to help meet the conservation needs of species at risk. Landowner support for species at risk protections has also been identified in a study by Olive and McCune (2017). Olive and McCune found that 76% of the southern Ontario landowners they interviewed believed that "...it would be appropriate for the government to place some limitations on ... [their] private property rights for the sake of conservation" (2017, p. 5).

Results from the LUV test showed that 50% of participants had a nature-first value-orientation while 46% had an interconnected value-orientation. Only 4% were determined to have a disconnected or human-first value-orientation. These results reveal that survey participation was evenly split between those who held strong pro-environmental views and those with balanced views on environmental and social needs. For many items in the questionnaire, results were compared between nature-first and interconnected LUV types to better understand participant views. Those with a nature-first LUV type consistently scored statistically significantly higher ($p < 0.05$) on items that would benefit species at risk and grassland conservation in cases where doing so was likely to impact them personally either socially and/or financially.

Low levels of awareness for species at risk laws also extended to the species themselves. Results showed that the majority of participants either had no awareness of which birds were designated as at-risk or were only somewhat aware. Further, when asked if they had species at risk on their own properties, 39% did not know and 22% had never detected any. Because knowledge testing was not incorporated into this study, it cannot be determined if those who had never detected any did in fact know what species they should be looking for and if they would be capable of detecting them. It is suspected that many species at risk on private lands go undetected as 4 of the 10 participants who indicated that they had never detected any did in fact have some

on their property. While charismatic species such as the Bobolink, Burrowing Owl, and Loggerhead Shrike are easier to identify, many grassland birds can be nondescript and are more likely to go unnoticed. Examples of nondescript species include the Baird's Sparrow and Sprague's Pipit.

Despite low levels of awareness for what species are at-risk in Manitoba and the uncertainties some landowners have in regard to laws, all but one participant felt it was important to them, to some extent, that their land could support species at risk; 41% stated that it was very important, 37% stated it was moderately important, and 20% stated it was slightly important. Feedback provided by landowners has shown that many of those who do have species at risk on their properties take pride in knowing that their management has been able to support them. However, even with this positivity about species at risk, participants may still be leery of conservation programs. For example, programs seeking to encourage landowners to report species at risk occurrences for citizen science projects may struggle with program uptake. When participants were asked how likely they were to report species at risk seen on their own properties to a conservation entity, 26% were uncertain and 21% were unlikely to report. Likelihood of reporting species at risk was even lower when participants were asked if they would report sightings from properties they did not personally own. Reasons are thought to be related to uncertainty surrounding species at risk laws, lack of awareness of who to report sighting to, concerns regarding privacy, and concerns about interference with other landowners. Respondents with a nature-first LUV type were more inclined to report species at risk both on their own properties and others, suggesting that they are more motivated and are potentially more willing to take risks to help conservation efforts.

Olive and McCune's study of southern Ontario landowners reported similar findings about landowner views towards species at risk (2017). The authors interviewed 21 landowners to understand their attitudes towards, level of knowledge of, and level of engagement with, endangered species and conservation. In short, they found that landowners were largely ignorant of species at risk protection laws and had very little awareness and knowledge of what species were protected despite holding highly positive views towards them. While landowners were willing to accept some restriction on their property to support species at risk, they also held many reservations. A few participants from southwestern Manitoba who participated in the survey also expressed reservations towards species at risk; they believed species at risk protections could lead to the prevention/limitation of grazing, that their land would be taken away, or that outside entities would be able to dictate their land management practices. Many of these apprehensions could be relieved through public education and outreach. In response to the controversial conviction of a landowner in southeastern Manitoba for cultivating the habitat of a provincially endangered species (Hoye, 2019), the rural municipality has now partnered with the Federal government to hire a species at risk liaison (RM of Stuartburn, 2020). Progressive partnerships such as this should become a proactive initiative, and not just a reactive measure, for providing public education in the future.

In terms of grassland conservation, 91% of participants believed that it was moderately important to very important that the grasslands they owned, managed, and/or leased remained intact and unbroken now and into the future. With such strong positive values towards land conservation, it may seem contradictory that programs affording long term protections were deemed to be less desirable (e.g., conservation easements). Participants instead showed a preference for programs that would provide a financial benefit and not infringe upon their control over the land. Other studies examining western society views towards conservation measures have found similar landowner resistance towards formal protections being placed on private lands (e.g., Cocklin & Doorman, 1994; Brook, Zint, & De Young, 2003; Miller, Bastian, McLeod, Keske, & Hoag, 2010;

Henderson, Reed, & Davis, 2014; Olive & McCune, 2017). A study of landowners in New Zealand found that they "... acknowledge a need for conservation on private landholdings, but do not necessarily equate conservation with legal protection" (Cocklin & Doorman, 1994, p. 16). Reasons for this are thought to be rooted in cultural views surrounding land ownership in western societies; It is a prevalent belief that government regulation of private property is unconstitutional because "[p]rivate property represents the sum of the goods that the individual gets to keep outside of the control of the state" (Epstein, 1985, p. 13 as cited in Haddad, 2003). Going back to Olive and McCune's study, they found that while resistance to regulation was present, they surmised that "better communication with landowners about the scarcity and importance of remaining habitat - including habitat on their own property - could make the enforcement of land use restrictions more palatable to landowners, or at least be perceived as more legitimate" (2017, p. 8). In regard to participants views of land ownership in southwestern Manitoba, some of the landowners interviewed expressed resistance towards restrictive programs (e.g., easements) more in terms of fear for financial hardship and impact to livelihood rather than an outright attack on their personal property rights.

Focusing in on participants' preferences for conservation programs, most were willing to consider participation in "annual payment for a habitat outcome", "voluntary carbon offset program", "cost assistance program with a grazing plan", and "bird-friendly beef certification label". One thing that these programs all have in common is that they are voluntary, do not infringe upon personal property rights, are results driven, and have the potential to provide ongoing financial returns to landowners and beef producers. It was stated by more than one participant that beef producers in particular needed assistance with staying competitive so that they could continue supporting conservation objectives. This was also reflected by the fact that the two most important factors motivating participation in a conservation program was 1) financial compensation and 2) cattle operation assistance projects.

There were some differences between willingness to consider participating in conservation programs and level of interest in said programs. For example, the "mortgage assistance program" placed eight out of 12 for willingness to consider but was ranked third for overall participant level of interest. This demonstrates that while fewer participants would consider enrolling in this type of program, those that would consider enrolling were very interested. For the "mortgage assistance program" this difference can be explained by demographics. Those who were most interested in this type of program were those with less than 20 years of farming/ranching experience. Because those with less experience were under-represented in the sample, it makes sense that fewer participants would be willing to consider participation. This result is important because it highlights how the needs of newer cattle producers entering the industry may be missed by conservation programs, industry representatives, and governments.

Program options that would see conservation entities owning land and sharing access to grazing rights through a "grass-banking" or "grazing co-op" approach were more popular among participants who owned one full section of land or less. While neither of these programs ranked highly on either scale, they still warrant consideration. It is speculated that interest in these programs could increase in coming years as those interviewed identified a growing number of challenges that newer cattle producers are facing today. These challenges included economic uncertainty, very low profit margins, and a lack of affordable and available land. Conservation groups that are able to provide grazing access through land holdings could potentially offer solutions to some of these problems (Gripne, 2005).

When program preferences were examined by LUV type, it was not an unexpected finding that those with a nature-first value orientation would be more inclined to participate in the programs that would place restrictions on land use (term agreements and conservation easements with a onetime payment). This result further provides support for the idea that there are a portion of landowners who do not view the placement of some restrictions on private lands for conservation purposes negatively. It was also found that those with a nature-first LUV type were more inclined to engage in conservation programs based on intrinsic motivations than those with an interconnected LUV type. Intrinsic motivations included protecting species at risk, improving habitat for non-game species, conserving native prairie, improving grazing regimens for conservation, and conducting grassland restoration projects.

Insights gained from survey comments and interviews with beef producers included a strong desire for increased education for both landowners, beef producers, and the general public. Landowners and beef producers wanted to know what land management tools were beneficial for species at risk and which one were not. They also said that they needed to know specifics. For example, simply stating that “delayed haying” was beneficial was not good enough. They needed to know why it was beneficial and what dates would be appropriate. Educational resources with this kind of information do currently exist but are not highly visible and easily accessible for landowners and cattle producers. One such example would be the Manitoba Important Bird Areas Program’s *Landowners’ Guide to Grassland Bird Conservation in Manitoba* (N.d.). This kind of information would likely be more impactful if landowners and cattle producers also knew what species at risk they had (if any) and where they have occurred on their properties.

5.0 Conclusions & Recommendations

5.1 Conclusion

With most of the remaining grassland in Manitoba being privately owned, conservationists and law makers tasked with protecting remnant native prairie and species at risk have been searching for constructive ways to partner with landowners and cattle producers. Understanding the environmental perspectives of those who own, lease, or otherwise influence the management of grassland properties is an essential first step in being able to identify opportunities for collaboration. Findings of this research indicate that landowners and cattle producers are an underutilized resource for conservationists to partner with for species at risk recovery and grassland conservation in Manitoba. While landowner and cattle producers' views towards conservation and protection may be complex, the majority of participants were seen as wanting to help, they just need the right knowledge and supports to do so. The value of public outreach and education both to target audiences (landowners and beef producers) and non-target audiences (general public) should not be overlooked; There was a very strong desire among participants to see more visible education and awareness regarding species at risk and beneficial land management practices. Programs currently employed by large conservation organizations have tended to focus on targeted outreach, giving selected landowners one-on-one assistance through incentive-based projects in high priority areas. While this research has confirmed that these types of programs are desired, what seems to be lacking is the general outreach campaigns needed to engage landowners and beef producers on a much larger scale. Although this research was not conducted at a scale large enough to reflect the opinions of all landowners and cattle producers in southwestern Manitoba, results do suggest that there could be a large number of landowners and beef producers who would like to see conservation organizations have a stronger presence in the public sphere.

The lack of awareness for what species are designated as at-risk in Manitoba and associated laws meant to protect them should be a cause for concern. With landowners and beef producers playing a significant role in the fate of these imperiled species, they cannot be expected to conserve what that they are unaware of. Governments in particular have a duty to inform the public of species at risk laws and also enforce them. This research has shown very high levels of positive support for species at risk conservation among participants and this support should be fostered and utilized in ways that will benefit species at risk on the landscape.

"In the end we will conserve only what we love,
we will love only what we understand,
and we will understand only what we are taught."

– Baba Dioum

5.2 Key Findings

1. 96% of participants were found to have personal value orientations that aligned with conservation principles.
2. There was a low level of awareness among participants regarding which grassland birds are designated as species at risk, what the habitat needs of species at risk are, how the presence of species at risk can affect land use, and where observations of species at risk can be reported.
3. 78% of participants said that it was very important to moderately important that their land could support species at risk, however, 47% would be unlikely to report occurrences of species at risk to a conservation entity.
4. It should not be assumed that landowners and cattle producers who have pro-environmental values and beliefs possess the required awareness and knowledge to include species at risk conservation as a consideration in their land management activities.
5. Landowners who did not seem to recognize the conservation value of their own land were found to be less engaged in stewardship, less aware of their environmental impact, and were less self-motivated to learn about sustainable ranching practices.
6. The most supported conservation programs were those that provided a financial incentive and would not impact a landowner's autonomy over their land.
7. Landowners/cattle producers would like to see more outreach and education about better grazing systems and species at risk habitat requirements.
8. Those with 20 years or less of farming and ranching experience were more inclined to participate in the programs "term agreements with a one-time payment" and "mortgage assistance program".
9. Those with a history of involvement with a conservation program were more inclined to participate in the programs "easements in perpetuity with a one-time payment", "easements in perpetuity with an annual payment", and "bird-friendly beef certification label".
10. Motivating factors were a more important determinant of participant willingness to engage in a conservation program than inhibiting factors.
11. 65% of those who had a history of involvement in a conservation program had a nature-first LUV type.

5.3 List of Recommendations

For Conservation Organizations

Public Engagement

- Results from this study have shown that there is a desire for increased education and engagement with landowners and the general public. Conservation organizations should consider increasing their use of advertising (e.g., television commercials, radio messaging, newspaper articles, social media ads, attendance at community events) to increase the visibility of:
 - a. The large number of grassland species that are at-risk;
 - b. species at risk habitat requirements;
 - c. laws protecting species at risk;
 - d. grassland conservation issues;
 - e. what good grazing systems should look like in different contexts;

- f. good examples of farmers in Manitoba who support species at risk;
 - g. and the role grasslands play in active carbon sequestration and storage.
- When asking landowners to report species at risk, addressing the uncertainties and/or negative assumptions about land use impacts could improve participation rates.
- Some of the cattle producers who were interviewed wanted to be contacted about program opportunities during the off-season (fall and winter) as opposed to the spring and summer.

Programming Methods

- Invest in the employment of staff and/or the recruitment of volunteers who have a background in land ownership and/or cattle ranching and can assist with bridging the social gaps that exist between agriculture and conservation in program delivery.
- Invest in the retention of staff and/or volunteers who have demonstrated an aptitude for developing valuable working relationships with landowners and cattle producers in program delivery.

Program Concepts

- The development of a consultation program or service for landowners who would like to have their land assessed for its current conservation value (e.g., ability to support biodiversity) and be subsequently provided with the knowledge of how to achieve improved conservation outcomes.
- Development of a marketing initiative that is aimed at raising the visibility of local cattle producers who own profitable businesses and have successfully integrated conservation priorities into their land management activities.
- Consider making landowner engagement opportunities available for those who want to become involved and have previously been turned away/discouraged because they either have land located outside priority zones or the land is deemed to currently have less conservation value.

For Agricultural Organizations

- There was a strong desire among survey participants and those interviewed to see the beef sector partner with conservation groups to:
 - a. Highlight the positive environmental aspects of cattle ranching;
 - b. Promote more sustainable land management practices;
- Cattle producers who were interviewed indicated that they would like to see programs designed to help with:
 - a. financial planning;
 - b. finding new/aspiring farmers to mentor and gradually transition ownership of their operations;
 - c. enabling young producers to enter the industry and be competitive;

For Governments

- Governments should seek to raise the visibility of species at risk and legal protections through public education efforts.

- Governments should be proactive in partnering with rural municipalities to address concerns regarding species at risk recovery and legal protections.
- Landowners should be notified if species at risk are known to occur on their properties and be informed of their legal requirements.
- Critical habitat should be defined for species at risk in Manitoba's mixed-grass prairie region to facilitate enforcement of species at risk laws.

5.4 Opportunities for Future Research

- Further research should examine landowner and cattle producer's understanding of species at risk laws in Manitoba
- Further research should be conducted to better understand the discrepancies that exist between a landowner's personal environmental values and their actual land management practices.
- Research should be conducted to assess the potential social and environmental ramifications of disqualifying interested landowners and cattle producers from participation in a conservation program.
- Follow-up research should be conducted with landowners/cattle producers to determine if conservation practices continue to be integrated into land management planning after enrollment in a conservation program has ended.
- Research assessing landowner/cattle producer's risk perceptions about pertinent conservation issues should be examined to determine if a low level of perceived risk contributes to inaction on incorporating more sustainable land management practices.
- Further research should examine what social norms are present among ranching communities and the degree to which these norms may facilitate or hinder the adoption of new land management practices and participation in conservation programs.

6.0 Literature Cited

- Beaulieu, M. S. (2015, November 30). *Demographic changes in Canadian agriculture*. Retrieved from <https://www150.statcan.gc.ca/n1/pub/96-325-x/2014001/article/11905-eng.htm>.
- Brook, A., Zint, M., & De Young, R. (2003). Landowners' response to an Endangered Species Act listing and implications for encouraging conservation. *Conservation Biology*, 17(6): 1638-1649.
- Cocklin, C., & Doorman, P. (1994). Ecosystem protection and management in New Zealand: A private land perspective. *Applied Geography*, 14, 264-281.
- Cohen, J. (1992). A power primer. *Psychological bulletin*, 112(1): 155.
- Epstein, R., 1985. Takings: Private property and the power of eminent domain. *Harvard University Press*, Cambridge, MA, p. 362.
- Fedy, B., Devries, J. H., Howerter, D. W., & Row, J. R. (2018). Distribution of priority grassland bird habitats in the Prairie Pothole Region of Canada. *Avian Conservation and Ecology*, 13(1): 4.
- Gage, A. M., Olimb, S. K., & Nelson, J. (2016). Plowprint: Tracking cumulative cropland expansion to target grassland conservation. *Great Plains Research*, 1(2): 107-116.
- Geary, A. (2019, August 10). Manitoba municipality calling for change after endangered orchid interrupts farming. *CBC News*. <https://www.cbc.ca/news/canada/manitoba/stuartburn-farmers-rare-orchid-1.5241887>
- Grippe, S. L. (2005). Grassbanks: Bartering for conservation. *Rangelands*, 27(1): 24-28.
- Haddad, B. M. (2003). Property rights, ecosystem management, and John Locke's labor theory of ownership. *Ecological Economics*, 46: 19-31.
- Hamel, C., & Neufeld, R. (2018). Decline of native prairie in core grassland conservation areas in southwestern Manitoba 2010-2015. *Blue Jay*, 76.4: 30-33.
- Henderson, A. E., Reed, M., & Davis, S. K. (2014). Voluntary stewardship and the Canadian Species at Risk Act: Exploring rancher willingness to support species at risk in the Canadian prairies. *Human Dimensions of Wildlife*, 19(1): 17-32.
- Hoye, B. (2019, December 23). Manitoba judge fines farmer for disturbing rare Prairie orchid. *CBC News*. <https://www.cbc.ca/news/canada/manitoba/manitoba-orchids-farmer-fined-1.5407282>
- Jelinski, M. D., Kennedy, R., & Campbell, J. R. (2015). Demographics of the Canadian cow-calf industry for the period 1991 to 2011. *The Canadian Veterinary Journal*, 56(2): 163-168.
- Manitoba Important Bird Areas Program. (N.d.). *Landowners' guide to grassland bird conservation in Manitoba*. <https://mbimportantbirdareas.files.wordpress.com/2015/08/grassland-bird-conservation-guide-high-res.pdf>

- Miller, A. D., Bastian, C. T., McLeod, D. M., Keske, C. M., & Hoag, D. L. (2010). Factors impacting agricultural landowners' willingness to enter into conservation easements: A case study. *Society and Natural Resources*, 24(1): 65-74.
- Olive, A., & McCune, J.L. (2017). Wonder, ignorance, and resistance: Landowners and the stewardship of endangered species. *Journal of Rural Studies*, 49: 13-22.
- Osborne, J. W., & Blanchard, M. R. (2011). Random responding from participants is a threat to the validity of social science research results. *Frontiers in Psychology*, 1. Doi: 10.3389/fpsyg.2010.00220
- Parks Canada Agency. (2016). *Multi-species action plan for Grasslands National Park of Canada*. Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa, 57.
- Rural Municipality of Stuartburn (RM of Stuartburn). (2020, March 25). Community liaison for species at risk (SAR). Retrieved March 30, 2020 from <http://www.rmofstuartburn.com/>
- Statistics Canada. (2017, May 10). 2016 Census of Agriculture (catalogue no. 11-001-X). *The Daily*. <https://www150.statcan.gc.ca/n1/en/daily-quotidien/170510/dq170510a-eng.pdf?st=7Fb-4cpE>
- Sweikert, L. A. (2017). *Human dimensions of habitat loss in the plains and prairie potholes ecoregion* (Doctoral dissertation). Retrieved from Electronic Theses and Dissertations. (1692)
- Sweikert, L. A., & Gigliotti, L. M. (2018). Understanding conservation decisions of agricultural producers. *The Journal of Wildlife Management*, 86(4): 993-1004.
- Sweikert, L. A., & Gigliotti, L. M. (2019). A values-based private landowner typology to improve grassland conservation initiatives. *Society & Natural Resources*, 32(2): 167-183.
- Vaske, J. J. (2008). *Survey research and analysis: Applications in parks, recreation, and human dimensions*. State Collage, PA: Venture Publishing Inc.
- World Wildlife Fund. (2018). The Plowprint report: 2018. Retrieved from: www.worldwildlife.org/projects/plowprint-report