Summative Evaluation of Delayed Hay Cut Initiative on Prince Edward Island

Final Report

CBCL

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March 31, 2021

Molly Tomlik
Conservation Biologist
Environment and Climate Change Canada
17 Waterfowl Lane, 1st Floor
Sackville, NB E4L 4N1

Dear Molly:

RE: Final Report – Summative Evaluation of the Delayed Hay Cut Initiative in Prince Edward Island (PEI)

CBCL Limited (CBCL) is pleased to provide you with the evaluation of the delayed hay cut initiative on Prince Edward Island (PEI).

Should you have any questions or require clarification of any matter raised in this submission, please contact the undersigned at your convenience. We appreciate the opportunity to work with ECCC-CWS on this project.

Yours very truly,

CBCL Limited

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Attachments

Project No: 212605.00

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Abbreviations and Acronyms

AC CDC	Atlantic Canada Conservation Data Center
ALUS	Alternative Land Use Services Program
BMP	Best Management Practice
CBCL	CBCL Limited
CCA	Canonical Correspondence Analysis
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
ECCC	Environment and Climate Change Canada
INT	Island Nature Trust
MNRS	Maritime Nest Record Scheme
OSCIA	Ontario Soil and Crop Improvement Association
PEI	Prince Edward Island
PEI-A&L	PEI Agriculture and Land
PEI-EECA	PEI Environment, Energy and Climate Action
PID	Parcel Identification Number
SAR	Species at Risk
SARA	Species at Risk Act
SARPAL	Species at Risk Partnerships on Agriculture Lands
SD	Standard Deviation

Executive Summary

Environment and Climate Change Canada (ECCC) retained CBCL Limited (CBCL) to evaluate a joint-partner grassland bird conservation initiative in Prince Edward Island (PEI). To conserve Bobolink and other grassland species in PEI, Island Nature Trust (INT) introduced an initiative to reduce unintentional destruction of grassland bird nests in hayfields by promoting the practice of delayed hay cut. This initiative later expanded to include the option of a financial incentive for producers to adopt the practice through PEI ALUS. The objective of this evaluation is to identify the overall performance, relevance, and impact of the intervention and provide recommendations on improvements and next steps.

Data and previously prepared reports on the initiative were provided by project partners. Using this data, CBCL assessed the impact of the intervention, focussing on producer engagement and measurable biological outcomes. Producer engagement data was calculated each year to evaluate the number of landowners and the total acreage of hay in which cutting was delayed. Graphical methods were used to portray these results and assess for trends. Biological outcomes (e.g., abundance and productivity) were assessed using summary statistics to measure efficacy of the intervention, and to assess for changes overtime and between intervention types (ALUS vs. non-ALUS). A literature review compared results to similar studies, particularly when a control was missing. Similar incentive programs, alternative metrics to assess reproductive success for grassland birds, and surveying techniques were also reviewed and summarized.

Measured indicators provide evidence that the intervention (incentivized delay hay cut) is successful in achieving the intended outcomes. Producer engagement indicates there is a willingness on the part of the farmer to participate in the delayed hay cut initiative and the number of participants increased each year. However, with the information available, it is not clear how much the financial incentive contributed to the increase in the number of participants. In 2020, there was an increase in non-compliance, which is most likely related to the climatic conditions and the need to secure quality hay for livestock.

There are opportunities to continue to enhance Bobolink monitoring through different field surveying techniques and to further refine or confirm fledging date. An increase in biological outcomes of the program may increase by refining the eligibility criteria to enroll in the incentivized program.

There are options to further develop the program to benefit Bobolink and grassland wildlife by introducing alternative intervention practices (e.g., rotational and deferred grazing). An understanding on how relevant climate change projections may impact farm management and grassland birds could help guide program development in the future.

Chapter 1 Introduction

Environment and Climate Change Canada (ECCC) retained CBCL Limited (CBCL) to evaluate a grassland bird conservation initiative in Prince Edward Island (PEI). The initiative, known as the Farmland Bird Program, has been carried out over the past seven years through Island Nature Trust (INT). Through ECCC's *Species at Risk Partnerships on Agricultural Lands* (SARPAL) a unique partnership was formed with INT and PEI Alternative Land Use Services (ALUS) to examine and promote grassland bird conservation across PEI. ECCC's Canadian Wildlife Service (CWS) has been a funding partner of the initiative and has an interest in the effectiveness of the initiative's main intervention—an incentivized delayed hay cut—and recommendations on improvements and next steps.

The objective of this evaluation is to identify the overall performance, relevance, and impact of the intervention, as defined below:

- Performance–degree to which the intervention achieved the intended results.
- Relevance–extent to which the initiative responded to demonstrable need.
- Impact–intended and unintended outcomes of the intervention.

1.1 Background

Native grasslands are one of the most human-altered and endangered ecosystems in North America, and grassland birds, dependent upon grassland ecosystems for habitat, have experienced widespread population declines across the continent (Vickery et al. 1999, Samson and Knopf 1994, Brennan and Kuvlesky 2005). Historically, as immigrants settled in North America, they altered or destroyed native grasslands by converting them into agricultural land (Askins 1993). Simultaneously, forests were cleared in the east for development and conversion into agricultural fields, providing surrogate habitat and thus enabling grassland bird species to expand or relocate their distributions from the western grasslands eastward (Peterjohn and Rice 1991, Martin and Gavin 1995, Askins 1999).

In the last half-century, the availability of surrogate habitat for grassland birds in eastern North America began to decline due to changes in farm management. On the breeding grounds, farm abandonment has increased with subsequent afforestation (Askins 1993), agricultural practices have shifted to earlier and more frequent hay cuts (Bollinger and

Gavin 1992, Tews et al. 2013), hayfields and pastures have been converted to row crops (e.g., corn, wheat, soybean) (McCracken et al. 2013), and there has been an increased use of pesticides on existing farms (Freemark and Kirk 2001). These factors are contributing to the widespread decline of grassland bird populations across North America. One species that is particularly sensitive, is the Bobolink (*Dolichonyx oryzivorus*), which in 2017 was listed under the *Species at Risk Act* (SARA) as threatened.

The Bobolink is an obligate grassland species, relying throughout its range on agricultural lands for breeding habitat. As a neotropical migrant, the Bobolink winters in central South America (Martin and Gavin 1995) where they are treated as pests and exposed to toxic pesticides (Renfrew and Saavedra 2007). The Bobolink returns to North America in the spring to breed and raise their young. Bobolinks typically begin to arrive on their breeding grounds starting in May to early June. Because of their long migrations, Bobolink have a short breeding period, producing one brood per year (McCracken et al. 2013). In PEI, Bobolinks nest in hayfields from early May to late July (Stewart et al. 2015).

In Canada, long-term Breeding Bird Survey (BBS) data shows a significant (88%) population decline between 1968 and 2008. Incidental mortality from agricultural practices (e.g., earlier and more frequent hay cutting) has been identified as a main cause of this decline (COSEWIC 2010). When Bobolink arrive on their breeding grounds in the spring they are attracted to undisturbed agricultural fields (e.g., hayfields and pasture). However, disturbance of these fields due to agricultural practices (e.g., hay cutting and grazing cattle) during the Bobolink nesting period can result in both direct (e.g., mortality as a result of hay cutting and trampling) and indirect nest failure (e.g., loss of nest cover increases detection by predators) (Perlut and Strong 2011; COSEWIC 2010).

To conserve Bobolink and other grassland species in PEI, the INT introduced a delayed hay cut initiative to reduce unintentional destruction of grassland bird nests in hayfields by promoting the practice of delayed hay cut (or harvest). This initiative expanded to include the option of a financial incentive for producers to adopt the practice through partnership with PEI ALUS. To demonstrate the linkages and goals of this intervention, ECCC developed a theory of change model, illustrated in Figure 1.1.

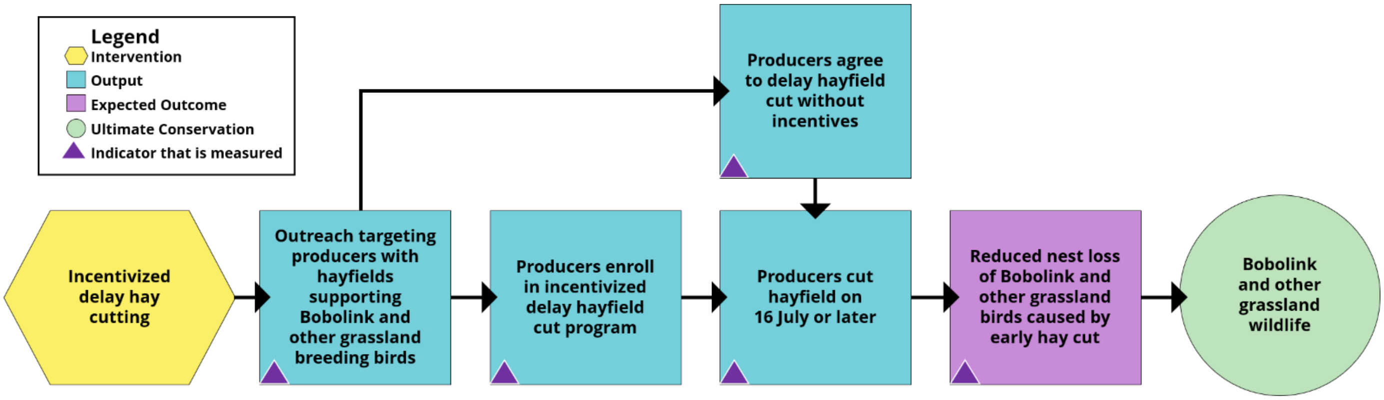

Figure 1.1: Theory of change for delay hayfield cut intervention with indicators (Source: ECCC).

1.2 Delayed Hay Cut Intervention and Incentive

1.2.1 Voluntary Hay Cut Initiative

Since 2014, INT has been engaging with farmers and rural landowners in PEI through their Farmland Bird Program. Initially, the objective of the program was focused on raising awareness about two species at risk (SAR) that use agricultural land for breeding, the Bobolink and the Barn Swallow (*Hirundo rustica*). This evaluation will focus on efforts related to Bobolink and other grassland bird species.

Through the Farmland Bird Program, INT communicated with landowners to raise awareness about SAR and the threats they face. INT visited properties of interested landowners to identify the presence of these species and to educate the landowners on how they could help protect SAR. In 2016, a citizen science portion was added to the Farmland Bird Program that provided landowners and other volunteers an additional way to participate. Through this, volunteers observe and record key dates related to the Bobolink and Barn Swallow breeding season. This information contributes to phenological (timing of reoccurring biological events) data of these species breeding in PEI.

In 2017 and 2018, INT's Farmland Birds program expanded its focus on the Bobolink through a partnership with the provincial and federal governments to conduct productivity monitoring and to learn more about what types of habitat features at the field and landscape-scale may be selected by nesting Bobolink in PEI. The objective with this component of the study was to compile five years of data for trend analysis.

1.2.2 Incentivized Hay Cut

In 2018, INT partnered with the PEI ALUS program, which added a new conservation incentive for delayed hay cut to conserve grassland birds. The support was available for a three-year pilot, with $90,000 in funding from ALUS Canada and the Weston Foundation. The financial incentive was available to eligible agricultural landowners who owned or leased long-term hay fields and agreed to delay their first hay-cut until July 16 or later. July 16 is the date identified in PEI by INT that would allow successful nesting of Bobolinks and potentially other grassland bird species. Early-season hay cuts have greater nutritional benefits to livestock than cuts later in the season (Nocera et al. 2005). A delayed hay cut may represent a loss in hay nutritional quality (e.g., feed protein) for livestock and have downstream impacts on livestock health and quality of meat and dairy products, thus justifying the incentive. Eligible participants are supported with an annual payment of $25/acre ($62/hectare).

For fields to be eligible for the delayed hay cutting initiative through ALUS, all fields enrolled needed to be long-term grasslands not in an annual crop rotation, and not in a state of renewal (first year being re-seeded). Projects were further prioritized if Bobolink were previously observed in the field. INT was responsible for monitoring for Bobolink presence and delayed hay compliance at all locations registered in the program.

By incentivizing delayed hay cutting, the ALUS program aims to improve the nesting success of grassland birds in PEI and contribute to the recovery of Bobolink on agricultural lands in PEI. It is believed that the incentive will also raise awareness among agricultural landowners and the general public.

ECCC-CWS provided funding to the delayed hay cut program through the SARPAL program from 2017 to 2020. This funding supported key project activities including the identification of potential sites, bird monitoring, and data analysis. ECCC's funding afforded a unique opportunity for INT to partner with PEI ALUS to examine and promote grassland bird conservation across PEI. Evaluations of grassland habitat, the presence and absence of Bobolink, and their nesting phenology is being assessed. In-field compliance monitoring has been completed on most projects, and incidents of non-compliance have been recorded and addressed.

Chapter 2 Evaluation Methodology

2.1 Data Collection and Compilation

Data and summary reports were provided by three main partners: INT, PEI Agriculture and Land (PEI-A&L), and PEI Environment, Energy and Climate Action (PEI-EEAC).

Producer engagement data was collected and provided by INT and PEI-A&L. The number of producers involved in the delayed hay cut program between 2014 and 2020 was provided by INT. PEI-A&L provided participant data and information associated with the incentive program. Monitoring was completed by INT to determine the level of compliance with the incentivized program and PEI-A&L provided information related to events of non-compliance.

INT collected information related to biological outcomes (e.g., Bobolink abundance and productivity) and this data was provided for evaluation. Bobolink productivity monitoring was initiated in 2017 and collected each consecutive year on a subset of fields with nesting Bobolink. Productivity data includes the number of males, females, and fledglings observed from roadside surveys and estimated fledging dates. Observations of other grassland birds were incidentally recorded in 2019 and 2020.

Bobolink distribution and site selection in PEI was assess by INT through field and desktop studies. Landscape variables were measured using PEI Land Online. Canonical Correspondence Analysis (CCA) was used to explore the relationships between Bobolink abundance and environmental variables. PEI Fish and Wildlife acquired all known sources of Bobolink observations and completed a kernel density analysis to assess Bobolink distribution in PEI. The results of these analyses were provided in a report format.

A number of reports were provided and reviewed as part of the evaluation. The following reports were provided by INT:

1. Engagement Indicators n.d.
2. Farmland Birds Update 2017.
3. Farmland Birds Program 2018-Bobolink report to Province.
4. Field and Landscape-Scale Habitat Drivers of Bobolink Abundance on Prince Edward Island 2018.

5 Prince Edward Island Species at Risk Partnerships on Agricultural Lands (SARPAL): Bobolink (*Dolichonyx oryzivorus*) 2018-03-29.
6 ALUS Delayed Hay: Monitoring Bobolink presence and productivity 2019.
7 Monitoring Bobolink (*Dolichonyx oryzivorus*) presence and productivity in Prince Edward Island 2020.

PEI-EEAC provided:

1 Species at Risk Partnerships on Agricultural Lands: Bobolink (*Dolichonyx oryzivorus*). Prince Edward Island. Forests, Fish, and Wildlife Division and Island Nature Trust. 2019.
2 A Status Report of Delayed Hay Cutting Projects for Grassland Bird Conservation through PEI's Alternative Land Use Services (ALUS) Program 2020.

2.2 Data Analysis and Literature Review

Using data provided by initiative partners, CBCL assessed the impact the intervention had on intended outcomes, focussing on producer engagement and measurable biological outcomes. Producer engagement data was calculated each year to evaluate the number of landowners and the total acreage of hay delayed. Graphical methods were used to portray these results and assess for trends.

Measurable biological outcomes (e.g., abundance and productivity) were assessed using summary statistics (e.g., mean) to measure efficacy of the intervention, and to assess for changes overtime and between site types (ALUS vs. non-ALUS). INT incidentally recorded other grassland species present on hayfields in 2019 and 2020 but data to assess biological outcomes for these species was not available. The Nesting Calendar Query Tool provided by Project NestWatch was used to develop nesting calendars for the additional bird species that may be nesting in hayfields. Overlap between nesting periods were assessed to determine potential co-benefits these species may receive as a result of delayed hay cuts.

A literature review was completed to compare results with other studies, particularly in the absence of controls. The literature review also identified similar incentive programs aimed at benefiting grassland species. Alternative metrics to assess reproductive success for grassland birds and surveying techniques were also reviewed and summarized.

Chapter 3 Results and Discussions

3.1 Producer Engagement

3.1.1 Enrollment

INT has been engaging with farmers and rural landowners in PEI as part of a Farmland Birds Program since 2014 with data available for each year of the initiative up to 2020. Since the introduction of delayed hay cuts, the number of participants (Figure 3.1) and the total acreage of hay cut after July 16 (Figure 3.2) have increased each consecutive year.

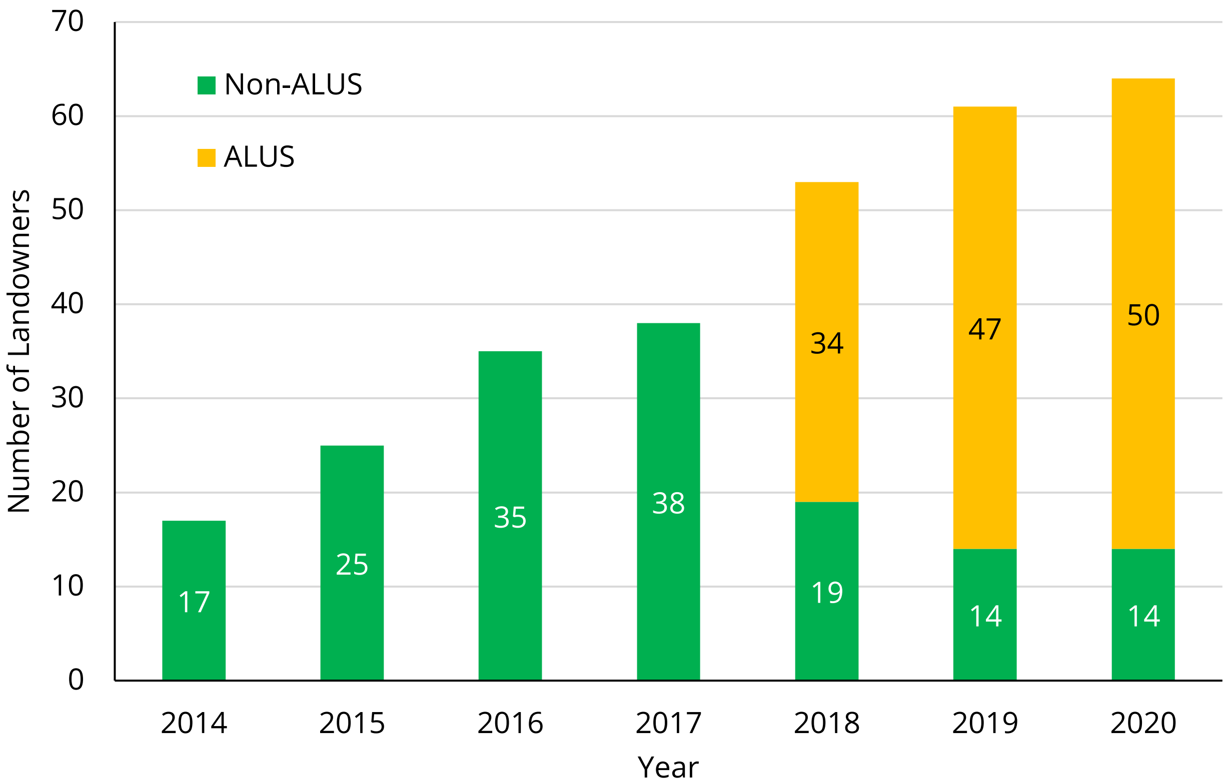

Figure 3.1: Number of landowners delaying hay cut in PEI through INT's Farmland Bird Program (green) and ALUS Program (yellow) from 2014 to 2020. The number of landowners enrolled in each program each year are indicated on each corresponding bar.

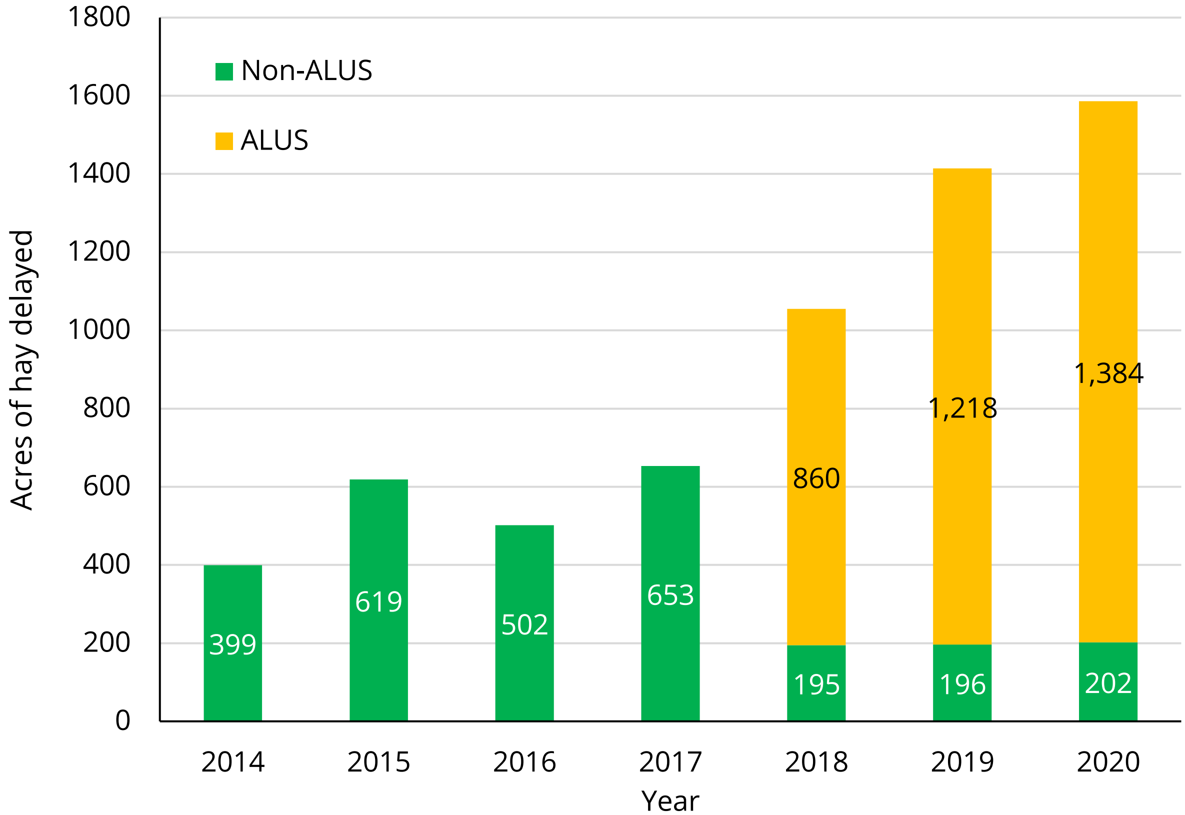

Figure 3.2: Total acres of hay with delayed hay cut in PEI through INT's Farmland Bird Program (green) and ALUS Program (yellow) from 2014 to 2020. The number of acres enrolled in each program each year are indicated on each corresponding bar.

In 2014, 17 landowners were involved in INT's Farmland Bird Program, delaying a total of approximately 400 acres of hay. The number of landowners participating in the program grew to 38 in 2017, corresponding to approximately 650 acres with delayed hay cuts. In 2018, with the introduction of the incentivized delayed hay cutting program, the number of landowners' voluntarily delaying hay cut decreased because a number of participants voluntarily delaying hay cutting enrolled in the incentivized program.

Since 2014, the number of landowners delaying hay in PEI increased consistently each year, even with the introduction of the incentive program. During the first year of this ALUS program, 34 clients enrolled with some previously delaying hay cutting voluntarily through INT's Farmland Bird Program. The number of farmers enrolled in the ALUS program increased each year, with 50 participating in 2020 (Figure 3.1). Of the 50 ALUS program participants, 15 were previously involved in the voluntary Farmland Bird Program. Through the combined efforts from INT's Farmland Bird Program and PEI's ALUS incentive program, the total acreage of delayed hay cut grew from 400 acres in 2014 to 1384 acres of delayed hay cut in 2020.

With the introduction of the financial incentive, the trend of the number of participants enrolled continued to increase. However, it is not clear how much the financial incentive contributed to this increase. It is suspected that some farmers may adopt late hay cut practices only with a financial incentive. The total acreage delayed appears to have increased at a greater rate with the incentive compared to what could have been expected on a voluntary basis.

INT conducted a landowner survey in 2016 and all landowners (n=31) categorized themselves as enthusiastic to very enthusiastic toward birds and wildlife on their properties. While many were aware of the presence of at least one Bobolink on their property in the last three years, 16% (n=5) of respondents indicated that they learned of Bobolink only through INT's Farmland Bird Program. Landowners were also asked if they would consider delaying hay cutting or create late hay refuge to preserve Bobolink and 90% (n=18) of landowners stated that they would delay hay cut.

The results from the landowner surveys and the success of the Farmland Bird Program, particularly between 2014 and 2017, indicates there is an interest in PEI to manage hayfields in a manner than is beneficial to nesting Bobolink, even without a financial incentive.

Other notable engagement efforts have included PEI's Department of Transportation, Infrastructure and Energy and community pastures. In 2017, INT engaged the department regarding a highway expansion (Cornwall bypass project) project that would affect three known Bobolink nesting locations. That year, the department ensured that those fields would have delayed haying. The department has now made it standard practice to incorporate delayed haying until after July 15 on the provincial land that they manage.

Communication was initiated with the L.M. Montgomery Land Trust who own areas of hay land suitable for Bobolink, encouraging the negotiation of a delayed haying with the farmers who lease from them. With assistance from ALUS, contact was made with a community pasture in Evangeline to discuss the protection of Bobolink and permission was given by the landowner to monitor for any presence of Bobolink. The results of these efforts are unknown.

3.1.2 Compliance

Compliance monitoring was conducted between 2018 and 2020 to document how many of the agricultural landowners enrolled in the PEI ALUS Program were delaying hay cutting until July 16 (minimum). The number of hayfields each participant has enrolled in the ALUS program can vary. As such, a site is referred to the total area a participant has enrolled in the ALUS program. INT completed delayed hay cut compliance monitoring by driving by sites to visually observe if any hayfields were cut. Table 3.1 summarizes the results of delayed hay cut compliance monitoring completed by INT between 2018 and 2020.

Table 3.1: Delayed Hay Cut Compliance Monitoring completed by INT between 2018 and 2020

Year	Participants	Compliance Checks	Incidents of Non-Compliance (%)	Reasoning for Non-Compliance
2018	34	30	2 (6%)	Field cut July 14, human error, communicated with landowner
2019	47	43	1 (2%)	Small area (4.5 acres) cut early, communication error
2020	50	50	12 (24%)	Unknown at this time

In 2018, one of the 30 sites checked had all hayfields on the property cut and Bobolink had been previously been recorded onsite. One other site had one field cut and two fields left uncut. The cut fields had no Bobolink present and the uncut fields had Bobolink present. All other sites had all fields left uncut. In 2019, 43 sites were checked on July 15th for delayed hay cut compliance. One site had one hayfield cut and a small portion of another field appeared to be cut. Follow-up with non-compliant participants is the responsibility of the province.

INT completed compliance checks at all 50 sites on July 15, 2020. Twelve of the 50 hayfields were observed to have been cut before July 15. It is understood that given the hot, dry summer drought conditions (Fenech and Wang 2020), farmers needed to cut earlier than anticipated because forage quality is greatly affected by extended dry conditions.

Overall, delayed hay cut compliance by ALUS participants is high and based on compliance results from other ALUS conservation programs, compliance for this conservation program is anticipated to remain high (S. Hill, pers comm).

3.2 Measureable Biological Outcomes

3.2.1 Fledging Date

Bobolink breeding success at participating sites was monitored during the Bobolink breeding period. Each site was visited every seven to 10 days starting in June until the first week of July. Sites were visited more frequently (every one to two days) after the first week of July to try to determine fledging dates. Fledge date is defined by INT as the date when fledglings are first observed from the edge of the field. This date reflects when fledglings/young are capable of sustaining short flights and should not be interpreted as the date when nests are fledged. INT indicates that this fledge date is an approximate measure because it is when the observer first observes fledglings and may not reflect the true fledge date. However, it may be a reasonable estimate due to the increased frequency of site visits around the presumed time of fledging.

Fledge dates in PEI ranged from July 7 to July 24 between 2016 and 2020, with a mean fledge date of July 13. INT indicated the mean fledge date for each year are July 13 (2016), July 12 (2017), July 15 (2018), July 14 (2019), and July 12 (2020). Because Bobolink require approximately seven days post-fledging to be able to sustain flight (Martin and Gavin 1995), the mean date when Bobolink fledged nests corresponds to approximately July 6 (2016), July 5 (2017), July 8 (2018), July 7 (2019) and July 5 (2020). These dates are similar to a study conducted in Nova Scotia where the average peak nest fledging date was July 4 (Nocera et al. 2005). Similarly, the mean date that Bobolink fledged nests in Ontario and Quebec was June 23 and June 24 (Frei, 2009; MacDonald and Nol, 2017).

Because nests were not directly monitored, INT indicates that the fledge dates are an estimate and may not reflect the true fledge dates. However, INT's approach and results appear to be appropriate and align with other reported fledging dates. In addition, the Nesting Calendar Query Tool provided by Project NestWatch (refer to Section 3.2.4) estimates the Bobolink nesting period in PEI occurs between May 22 and July 21. For more accurate fledgling data, nest monitoring would be required. Alternatively, mining Bobolink nest data from the Maritime Nest Record Scheme (MNRS) to assess local nest phenology data would provide direct nest phenology data for assessment and comparison. Coordination with ECCC-CWS in Sackville, NB would be required.

3.2.2 Bobolink Productivity

3.2.2.1 Productivity Study

A subset of delayed hay cut fields were monitored as part of INT's productivity study. Bobolink were observed in the fields identified for the productivity study. The fields included in the productivity study and presented in this section represent a combination of ALUS and non-ALUS fields. Productivity data was recorded at 52 hayfields between 2016 and 2020 (Appendix A). These fields ranged in size from approximately three to 48 acres, with a mean field size of 14.2 acres.

Productivity was estimated for each hayfield where fledglings were recorded. Productivity for each productive site was determined by dividing the number of observed fledglings by the number of observed females in each field. This measurement provides an estimate of productivity as the number of fledglings per female.

Productivity ranged from 0.5 to 5.5 fledglings per female, with a mean productivity value of 3.1 fledglings per female. Mean productivity was lower in 2020 (2.25 fledglings per female) compared to previous years: 2019 (2.85), 2018 (3.17), and 2016 and 2017 combined (3.12).

Table 3.2: Summary Abundance and Productivity Data Recorded from 52 Hayfields Monitored between 2016 and 2020

	Male Bobolink Observed	Female Bobolink Observed	Bobolink Fledgling Observed	Productivity (Fledglings/Female)
Mean	4.6	3.3	9.5	3.1
Minimum	1	1	1	0.5
Maximum	12	9	37	5.5

These productivity estimates are similar to those reported in other studies, which ranged from 2.15 to 3.9 fledglings per nest. As summarized by Renfrew et al. (2019), Bobolinks in Vermont raised 2.15 fledged young/clutch (n = 881), and first clutches were more productive, with 3.9 fledged/clutch (n = 457; N. Perlut, unpubl. data). Annual reproductive success in New York was 2.55 young fledged per female (n = 379 females) and in heavy flooding years in Wisconsin, nests that were unaffected by flooding fledged 2.69 young per nest (215 young fledged by 80 females) (Martin 1971). In warm-season fields in southwestern Wisconsin, 35 of 48 nests were successful and fledged an average of 3.2 (SD = 1.5) fledglings (C. A. Ribic, unpubl. data).

Productivity estimates should be interpreted with recognition of the limitations. INT has indicated (and others concur (e.g. (Put et al, 2020)) that it is difficult to get an accurate count of fledglings/young, particularly from roadside surveys and in some instances their counts may be underestimated. In addition, female Bobolink are quite inconspicuous and do not sing, so it is common to also underestimate female abundance. However, Bobolinks disperse from hay fields and pastures after mowing and grazing during the breeding season (MacDonald 2014; Diemer and Nocera 2016). This could result in counting individuals (e.g., adults and fledglings) that were dispersed from an adjacent field resulting in an overestimate of the number of males and females breeding and the number of fledglings produced in a particular field.

For more accurate productivity estimates, nest monitoring would be required. However, as previously discussed, Bobolink nest data may be available through the MNRS.

3.2.2.2 Estimated Productivity on ALUS Sites

INT have monitored for the presence of Bobolink at most ALUS sites between 2018 and 2020. Bobolink have been recorded on approximately 40% to 56% of hayfields receiving an incentive for delaying hay cut between 2018 and 2020 (Table 3.3); with a mean Bobolink occupancy on 49% of ALUS sites. In 2018, there was a higher percentage of sites containing Bobolink and this is likely a reflection of the fact that many of the initial participants were already voluntarily delaying hay cutting through the Farmland Birds Program.

As previously outlined, productivity was monitored on a subset of fields containing Bobolink. Productivity estimates were based on fields enrolled in INT's Farmland Bird Program and the ALUS program. An estimated total number of fledglings (estimated total fledglings) produced from all ALUS sites was calculated for each year by multiplying the mean productivity value by the total number of females Bobolinks observed in ALUS fields. Based on these estimates, the ALUS incentive program is producing approximately 194 to 231 fledglings per year; with a mean of 208.3 fledgling per year.

Table 3.3: The Number of ALUS Sites with Bobolink Observed Each Year between 2018 and 2020

Year	Partici-pants	Sites Checked	Sites (%) with Bobolink	Total No. of Observed Male Bobolink	Total No. of Observed Female Bobolink	Mean Fledgling per Female*	Estimated Total Fledglings†
2018	34	26	19 (56%)	86	73	3.17	231
2019	47	42	19 (40%)	102	70	2.85	200
2020	50	50	26 (52%)	137	86	2.25	194

*Mean fledgling per female (productivity estimate) is calculated from data collected on ALUS and non-ALUS sites.

†Estimated fledglings produced was calculated by taking the mean productivity value per year and multiplying it by the total number of female Bobolink observed.

The number of sites with Bobolink could be higher and further contribute to the intended outcome of the intervention. Options to increase the biological outcome of the program is discussed in Chapter 4.

3.2.2.3 2018 Productivity Comparison

Data collected by INT in 2018 allowed for a preliminary evaluation between ALUS and non-ALUS sites. Bobolink were monitored at four ALUS sites and 13 non-ALUS sites (Appendix B). Sites that did not contain Bobolink were not monitored for productivity.

The mean Bobolink male, female, and fledgling abundance, and field size, for each site type was calculated (Table 3.4). This initial comparison between ALUS and non-ALUS sites suggest that Bobolink abundance and productivity is similar between sites types.

Table 3.4: Mean Number of Male, Female, and Fledging Bobolink Observed for Each Site Type (ALUS (n=4) and non-ALUS (n=13)) in 2018

Site Type	Male Bobolink	Female Bobolink	Fledgling	Productivity (Fledglings/ Female)	Mean Field Size (Acres)
ALUS	4.3	3.5	9.3	2.5	12.1
Non-ALUS	3.0	2.6	9.7	3.5	11.6

3.2.3 Potential Benefits for Co-occurring Species

Bobolink and Barn Swallows have been the focal species of INT's Farmland Bird Program. Observations of other grassland species have only been recorded incidentally when monitoring for the presence of Bobolink. Since 2019, INT have put more emphasis on recording other grassland species during field visits but no reproductive information was noted.

During the 2019 and 2020 fieldwork, INT recorded other species that may be using agricultural fields for nesting. These species include Savannah Sparrow (*Passerculus sandwichensis*), Nelson's Sparrow (*Ammodramus nelsoni*), Northern Harrier (*Circus hudsonius*), and Red-winged Blackbird (*Agelaius phoeniceus*). These species overlap spatially with Bobolink in terms of geographical range and habitat. Given these species may co-occur with Bobolink in fields experiencing delayed hay cut, these species would presumably benefit through conservation efforts undertaken for Bobolink if young are fledged before July 16.

The Nesting Calendar Query Tool provided by Project NestWatch was used to estimate the nesting period for the other grassland species observed (Figure 3.3). As stated by Birds Canada (2013), in this query tool, the nesting dates provided are estimations from predictive models that identify the main nesting period. Before and after these dates the probability of encountering an active nest is lower, but not zero (Rousseu and Drolet 2015).

The nesting chronology provided by the tool starts with the laying of the first egg and ends with the departure of the last young from the nest. Thus, the earliest nesting date does not take into account the nest building period and the latest nesting dates do not take into consideration the period of dependence of young outside the nest (Birds Canada 2013). The information provided by this query tool does not provide a guarantee of the presence or absence of active nests or that the activities will avoid disturbing or destroying the nest or the eggs of a bird (Birds Canada 2013).

The nesting calendars for each co-occurring bird species (Figure 3.3) were built using the province of PEI as the geographical boundaries. The color palette in Figure 3.3. indicates the percentage of the ecodistricts within which a species is predicted to be actively nesting.

The Bobolink nesting period overlaps with all other nesting periods queried. The delayed hay cut date of July 16 overlaps the nesting period of the Northern Harrier, Savannah Sparrow, and Nelson's Sparrow. The delay hay cut date would be adequate for Red-winged Blackbirds as it occurs after their nesting period is complete. While the delayed hay cut date may benefit early breeders or first broods, this date may not be conservative enough for individuals nesting during the latter part of the nesting period. For example, in Vermont, the earliest observed fledging date for Savannah Sparrow was June 5, and the latest was August 10 (Strong 2010). Nocera et al. (2005) defined peak fledging as the date with the greatest mean number of fledging observed per adults. The dates of peak fledglings for Bobolink, Savannah Sparrow, and Nelson's Sparrow monitored in Nova Scotia between 2000 and 2003 was July 4, July 2, and July 7 respectively. Savannah Sparrow is the only species (of these three species) that predictably double-brooded, with the second peak fledging date occurring in the first week of August (Nocera et al. 2005).

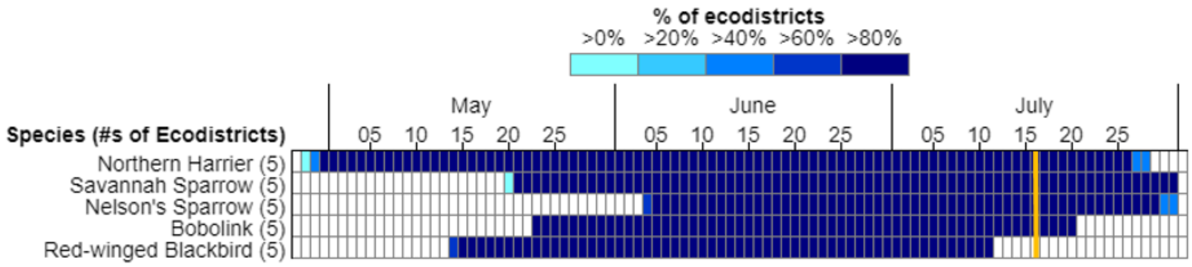

Figure 3.3: Nesting period for other grassland birds based on the Project NestWatch database for Prince Edward Island. The delay hay cut date (July 16) is highlighted in yellow.

The Bobolink has been identified as a focal species, however, research and conservation actions are expected to not only benefit Bobolinks, but also other grassland species. Different grassland bird species select finer-scale habitat characteristics (e.g., height and density of the grass, litter layer, proportion of forbs) and Bobolink are commonly characterized as a generalist and their breeding habitat tends to overlap other grassland species more than others.

3.2.4 Comparing to Early Cut Hayfields

Farmers enrolled for delayed cuts either voluntarily or incentivized through ALUS were for the most part, compliant (refer to Section 3.1.1). As a result, data to compare the success of Bobolink in fields delayed until July 16 or later to fields cut before July 16 in PEI is not available. However, many studies have indicated that grassland management was the strongest factor affecting nest success and daily nest survival rates (e.g. Perlut et al., 2006; MacDonald and Nol, 2017; Fromberger et al., 2020).

Incidental loss of nests as a result of early and/or frequent cutting of hayfields is regarded as one of the primary threats to Bobolink (McCracken et al. 2013). Overall, Bobolink nest mortality as a result of haying can be extremely high (90 to 100% failure) (Bollinger et al., 1990; MacDonald and Nol 2017; Perlut 2007). Because of exceptionally high rates of nest mortality, virtually all birds that nest in hayfields vacate the site immediately after a field is mowed.

Nest losses from haying occur directly through the physical destruction of nest contents during haying operations and indirectly through increased predation exposure following cutting. For example, in Vermont, haying machinery directly caused 78 percent of Bobolink nest failures and predation caused failure of the remaining 22 percent of nests. Predation was mostly by Ring-billed Gulls (*Larus delawarensis*), Common Ravens (*Corvus corax*), and American Crows (*Covus brachyrhynchos*) (Perlut 2007).

Hay cutting can have substantial effects on Bobolink populations. Models estimate the total annual mortality rates by mechanical farming operations (e.g., mowing, tilling, seeding, and harvesting) of young in Canada is approximately 667,000 individuals, with indirect mortality of another 321,000 individuals (Tews et al., 2013). This loss represents a significant number of birds, as the current national population estimate for Bobolink is 1.8 and 2.2 million breeding birds (COSEWIC 2010).

3.3 Landscape and Field Variables

Some fields have greater value to nesting grassland birds than others. Establishing criteria when developing and implementing incentive programs is critical for a biologically successful program. For example, fields registered for the incentive program should be suitable breeding habitat for Bobolink in order to help meet the intervention's intended outcomes. To learn more about the distribution of Bobolink in PEI and variables that may be influencing site selection, INT and PEI Fish and Wildlife completed several field and desktop analyses. This information can be used to develop biological criteria to evaluate and prioritize applications for the incentivized hay cut program. This approach may become more applicable as the program grows and funding is only available for a portion of the applicants.

PEI Fish and Wildlife acquired all known sources of Bobolink observations which included Atlantic Canada Conservation Data Center (AC CDC), the Maritimes Breeding Bird Atlas, eBird, INT, and PEI Nature Tracker to assess Bobolink land use in PEI. After reviewing this data, efforts were focused on surveying gap areas where no Bobolink were reported in attempt to determine if Bobolink were absent or whether Bobolink in these areas were simply undetected. From the 268 roadside point counts conducted in 2017, 12 Bobolink were observed at nine survey sites, with no Bobolink recorded at the other 259 sites. Of the nine new sites, five were hayfields and four were pasture sites.

All known sources of Bobolink observations for PEI collected after 2000, including those observed during INT's 2017 survey were combined into a single dataset to explore Bobolink densities across PEI. PEI Fish and Wildlife used ArcGIS to create a kernel density layer representing the magnitude-per-area of Bobolink in PEI, using the number of Bobolinks reported in each record to weight each observation. For records that did not report the number of Bobolinks observed, a value of one was assumed. The Mount Stewart region is a popular birding area in the province. Because of this, there was an unusually large number of Bobolinks reported and was masking subtle trends in other regions of the province. As such, a kernel density map was created excluding the records in Mount Stewart.

After excluding Mount Stewart recordings, it was reported that Dunedin – St. Catherines and Lower Malpeque – Lower Darnley were the regions with the greatest Bobolink density (0.262 – 0.326 individuals/km²), followed by Borden-Carleton, St. Peters – Cable Head East and Harrington (0.197-0.261 individuals/km²). The Cardigan region expanded to include Poplar Point and Roseneath, while new regions were observed extending from Pownal to Eldon (0.066-0.131 individuals/km²) and at Skinners Pond (0.066 individuals/km²) (Figure 3.4). The reported regions are provided on Figure 3.3 for reference.

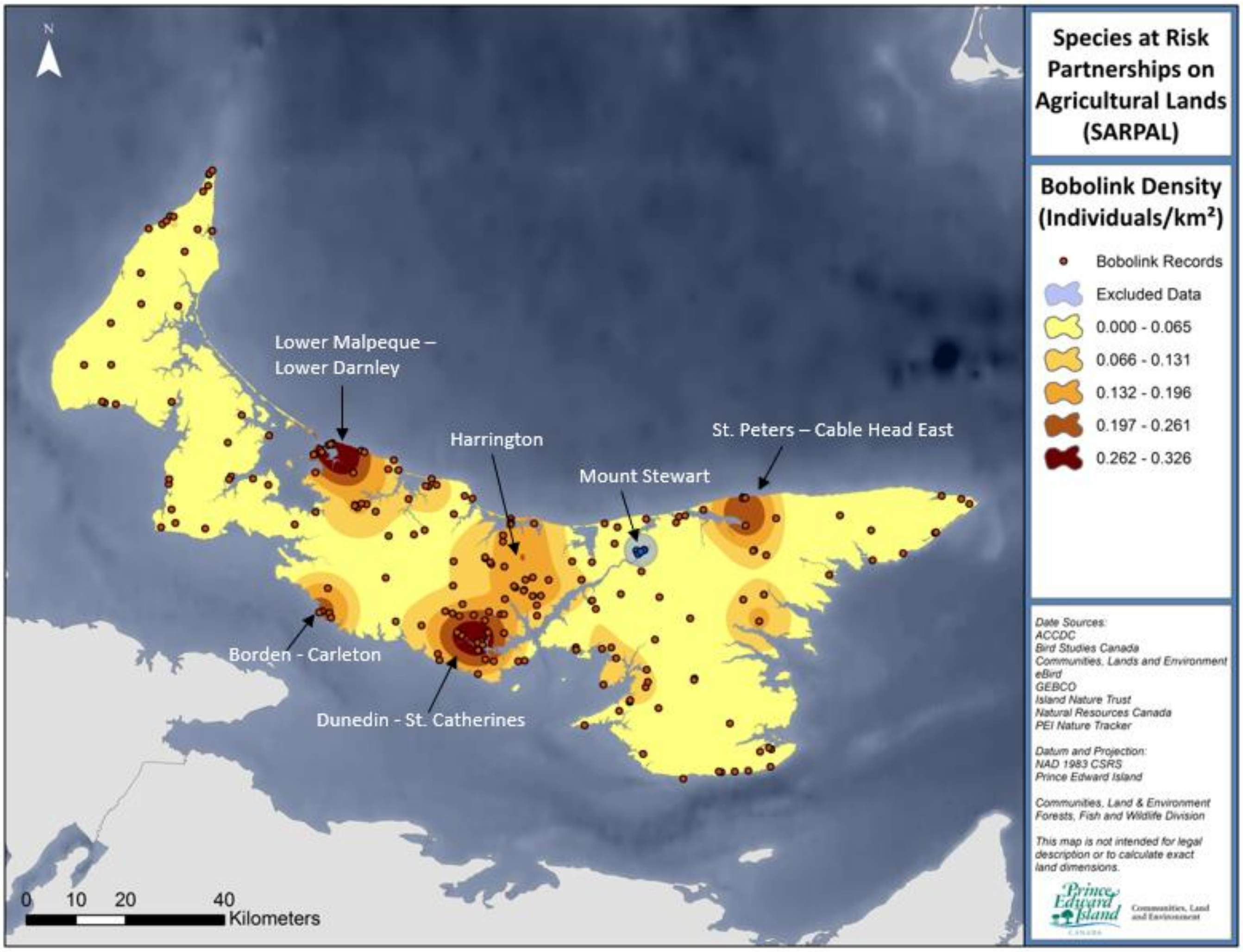

Figure 3.4: Kernel density of all available Bobolink observations on Prince Edward Island after 2000. Density is expressed as individuals per square kilometre. Observations around Mount Stewart were excluded (31 records, blue circle) (Source: PEI Fish and Wildlife and INT [adapted by CBCL]).

INT completed a Canonical Correspondence Analysis (CCA) to explore the relationships between Bobolink abundance and environmental variables. CCA is an exploratory method that can be used to provide an overview of data collected for multiple variables, with the plot producing a visualisation of any relationships among the variables. INT performed the analysis using XLSTAT-Ecology (Addinsoft 2020).

A land use inventory website available to PEI landowners (PEI Land Online) was used to measure most environmental variables (field size, slope greater than 9%, distance to water, and proportion of forest edge). Weediness was also included and is a ranking (one to five) identified by INT that has been used to estimate quality of the field. The ranking ranges from majority of the field dominated by weeds (one) to complete hay uniform (five). Ranking was assigned based on field photos and field notes. The species variables used in the analysis were number of Bobolink recorded (male, female, and fledglings). CCA was also performed using a productivity estimate (number of fledglings/number of females) as a species variable, instead of number of fledglings, to investigate potential relationships with fledgling success. CCA for fledglings and productivity were explored separately because of the inter-dependence of these two measures. Year was also included as a variable in the analysis.

The use of CCA has allowed INT to investigate some preliminary associations between Bobolink and landscape-scale variables. In some cases, the relationships among the variable shifted with year (e.g. open water) and may be interpreted with caution. INT has indicated some key findings from the analysis. For example, field size does not appear to have a large effect on Bobolink site selection and should not be a determining factor for sites that qualify for the delayed hay cut incentive. Instead, it seems more relevant to look at the surrounding landscape to prioritise hayfields for the program.

Other studies have found that the size of fields in which Bobolinks breed often depends on the context of the surrounding landscape, especially in more fragmented open lands (Ribic et al., 2009, Shustack et al,. 2010; Davis et al., 2013; Guttery et al., 2017) and Bobolink have been found to use smaller fields in more open landscapes (Renfrew and Ribic, 2008). Furthermore, a recent study has found that field size has not been found to be an important factor affecting Bobolink nest survival (Fromberger et al., 2020).

The size of the field owned by an individual is not an ecologically relevant factor; the more important factor from an ecological perspective for Bobolink, is the size and configuration of open grassland-type habitat. As a general rule of thumb, if the area surrounding a field is predominately forested or developed, the density of grassland birds will be diminished, relative to landscapes that are dominated by agriculture.

During compliance checks, INT also noted that habitat was not suitable in some fields receiving an incentive. In some cases, INT indicated that grass was far too short or composition not favorable for Bobolink. In addition, if in fields with very short vegetation, potential financial loss would be less and perhaps an incentive is not required to offset this loss. These fields may have to be reconsidered for renewal in the program as they would not be used by Bobolink or other grassland birds.

Grass height has been identified as probably the most critical habitat feature at the onset of Bobolink territory establishment (Nocera et al., 2007). Grass height will vary based on agricultural practices (e.g., date since last hay cut, grazing intensity) and will depend on the region (climate) and plant species composition. Generally, grass cover should be approximately 25 cm or more at the start of the breeding season (McCracken et al. 2014). There is potential to incorporate and record grass height measurements during field studies to get a better understanding of grass height in hay fields during Bobolink territory establishment and to identify if Bobolink are selecting for or avoiding hay fields of certain grass height. This measurement is also a practical measurement to ask landowners and farmers could estimate grass heights in the fields they are managing. If grass height proves to be important for Bobolink nesting in PEI, this could serve as an eligibility/criteria factor when assessing ALUS applications and help identify fields that may not be suitable as Bobolink nesting habitat early.

3.4 Similar Delay Haying Initatives

3.4.1 The Bobolink Project

The Bobolink Project is administered by Mass Audubon, Audubon Vermont, and New Hampshire Audubon. Originally a research study to investigate conservation-minded donor behavior, the Bobolink Project proved to be valuable to grassland bird conservation. Since 2013, the Bobolink Project administered donated funds to farmers delaying hay cut to allow Bobolink time to fledge young. This innovative approach connects people donating for conservation purposes with farmers who are willing to help.

In recent years, the project has been able to support delayed hay cut on approximately 20 farms, totalling 600 to 900 acres, and they receive twice as many applications from farmers interested in participating. Some participants have enrolled in most or all years, and others have been selected only once. The limiting factor is the amount of funds available through donations rather than interest among farmers.

The Bobolink Project ranks fields by selecting those most biologically suitable for nesting grassland birds. The biological criteria evaluated during the application process includes size, shape, and surroundings. Priority is given to fields ≥ 20 acres and is based on acres of actual grassland (acres in row crops are not included). Circle or oval field shapes are preferred over rectangles or complex shapes with lots of edge. Edge habitats can increase predators and Bobolink tend to avoid these areas. Lastly, fields located in landscapes with adjacent fields are preferred over fields surrounded by forest or suburban development. The Bobolink Project indicated they have not had any problems with farmer compliance to the contracted restrictions on harvest times.

3.4.2 Ontario Soil and Crop Improvement Association

The Ontario Soil and Crop Improvement Association (OSCIA), is a non-profit organization that supports farmers and delivered programs to producers in Ontario. Delivered by OSCIA and funded by ECCC, SARPAL provides cost-share support to agricultural producers to implement Best Management Practices (BMPs) that protect, maintain, and enhance SAR habitat while sustaining production and profitability on the farm. SAR that are included in SARPAL include Loggerhead Shrike, Henslow's Sparrow, Barn Swallow, Bobolink, Eastern Meadowlark, Grasshopper Sparrow, American Badger, Little Brown Bat, Eastern Foxsnake, Gypsy Cuckoo Bumble Bee, Rusty-patched Bumble Bee and Monarch. OSCIA receive and assess applications and also issue payments after projects have been completed.

Supported BMPs include:

- Tree and Shrub Planting.
- Establishment of In-field Perennial Grass Strip(s).
- Wetland Restoration.
- Grassland Restoration.
- Cross Fencing for Rotational Grazing.
- Fencing to Exclude Livestock from Woodland Areas.
- Forage Harvest Management (Delayed Haying).

Funding for Forage Harvest Management (Delayed Haying) BMP is determined based on size of the delayed haying field, and the demonstrated added benefits to grassland birds. Eligible projects must be at least 10 continuous acres in size. Delayed haying projects are supported based on the results from the "Rating for Grassland Birds" self-assessment in the application form. Priority is given to projects that demonstrate added benefits to grassland birds. Fields that are less than 10 acres in size, or that rate as having low field feature values for grassland birds are not eligible for funding as part of this BMP.

A Grassland Stewardship Program was a program previously delivered under the SARPAL umbrella and funded by ECCC. The program ran from 2016 to 2019 and focused on Bobolink (the target species). For a delayed haying project, Conservation Agreements were in place between the producer and ECCC for one year or three years. Between 2016 and 2019, 4,362 acres were delayed under Grassland Stewardship Program.

Chapter 4 Recommendations and Considerations

4.1 Program Considerations

4.1.1 Measuring Biological Outcomes

Assessing reproductive success for grassland birds is both time-consuming and labour intensive. Measuring the biological outcomes of the delayed hay cut initiative and incentive can be difficult to achieve given the time constraints (short breeding period) and large geographical area. Reproductive activity is commonly assessed using territory mapping or nest monitoring but territory mapping does not provide information related to reproductive success. Nest monitoring can be difficult, especially when studying cryptic-nesting grassland birds across large geographical areas.

The reproductive index introduced by Vickery et al. (1992) provides an alternative to measure reproductive success and can be applied at a landscape/field level. This index is based on the assumption that behaviours are indicative of different stages in the breeding period (Table 4.1) that are collected across multiple visits during the breeding season.

Table 4.1: Reproductive-index Rankings as Outlined by Vickery et al. (1992)

Rank	Definition
1	Territorial male present 4+ weeks.
2	Territorial male and female present 4+ weeks.
3	Pair found nest building, laying or incubating eggs or giving distraction display.
4	Adults carrying food to presumed nestlings.
5	Evidence of fledging success.

Two different studies looking at the reproductive status of Bobolink in Ontario have developed modified Vickery indices that provided an accurate assessment of Bobolink breeding status in a field (MacDonald and Nol 2017; Put et al. 2020). Put et al. (2020) tested the efficacy of various field survey types (roadside count, transect surveys, point counts) to identify when Bobolink finish breeding by comparing results to those obtained through more rigorous methods (spot mapping and nest monitoring). Put et al. (2020) indicated that evidence of nesting included an adult incubating a nest or carrying nest material or food. Evidence of fledging included an adult or pair deliver food to multiple locations after evidence of a nest was observed, flightless dependant fledglings, or adults carrying food for eleven days or more. Adults carrying food for more than 11 days to one location is evidence of fledgling as Bobolink remain in the nest for 10 to 11 days.

Put et al. (2020) found that transect surveys and point counts could be used to determine when Bobolink finished nesting. Researchers rarely detected evidence of Bobolink breeding on roadside counts compared to transect surveys and point counts. The modified Vickery Index provided reasonably accurate identification of Bobolink breeding status in a field using transect surveys and point counts (Put et al., 2020). The breeding status was identified during each field visit (e.g. if Bobolink were still nesting or not) rather than quantifying the number of nests or fledged young which would require more information.

Put et al. (2020) also indicated that two consecutive visits to a field that fail to detect evidence of breeding are needed in July to reasonably determine that Bobolink have finished breeding. This approach would leave a small probability (<0.01) that agricultural activities would impact breeding Bobolink, thus allowing agricultural land use while maximizing conservation benefits.

Transect surveys or point counts conducted in the field and recording behaviours to identify breeding periods and success would increase accuracy of estimates of abundance and reproductive activity at a field level. This approach could also be applied to all bird species to gain a better understanding of other species that may be co-benefiting from the incentive. However, if estimates of the number of nesting Bobolinks (male and females) and fledgling are of interest, then spot mapping and nest monitoring could be implemented at a representative subset of monitored fields (Campomizzi et al. 2020).

While roadside point counts provide access to numerous agricultural fields without the logistical constraints of obtaining permission from landowners, consideration should be given to adjust survey techniques on a subset or fields enrolled in the incentive program. Transect surveys or point counts conducted within the field and recording evidence of breeding will provide more valuable information to measure the intended outcome of the intervention.

4.1.2 Improving Biological Outcomes

The intervention is aimed at delaying hay cut to avoid inadvertently destroying nesting Bobolinks and efforts to incentivize fields delaying hay cuts should be on fields with suitable nesting habitat. The intervention (voluntary and incentivized) is achieving the intended impact, with an estimate of approximately 208 fledglings produced on ALUS sites each year. On average, Bobolink have been observed on 49% of sites enrolled in the ALUS program. There is a potential to improve the efficacy of this program and increase the intended biological outcome by increasing the proportion of ALUS sites that have nesting

Bobolink. An option to improve this is to develop a more robust field criteria and process of accepting applications into the ALUS program. This approach has been utilized by other similar incentive programs (refer to Section 3.4) and would allow fields with the greatest potential conservation benefit to be identified and funded.

Currently, fields enrolled in the ALUS program are long-term grasslands not in an annual crop rotation, and not in a state of renewal (first year being re-seeded). Fields were further prioritized if Bobolink were previously observed in the field.

Results from the preliminary investigations on Bobolink distribution and site selection could be incorporated into the application and selection process. Unlike other incentive programs, field size does not need to be an eligibility criterion for PEI as Bobolink have been productive in smaller fields (e.g. four acres in size). Openness and surrounding landscape (agriculture, forest, and development) should be included in the application process. This could be self-reported by asking the applicant to submit a farm map or by asking specific questions in the application or this could be assessed by the applicant reviewer by looking up the Parcel Identification Number (PID) using aerial imagery (e.g. Google Earth).

Consideration for the presence of Bobolink should remain as part of the enrollment process. If farmers are unaware of the presence of Bobolink on their property alternative methods could help to assess. The kernel density map developed (Figure 3.4) could be used to determine if the field falls within areas where Bobolink are known to occur or if the field occurs within the areas where Bobolink are absent. This can help to rank fields that are applying to the program without a direct understanding of Bobolink on their property.

Grass height could be incorporated as part of the assessment criteria. INT have observed fields enrolled in the program in 2020 were not suitable based on grass that was far too short or composition was not favourable. If applicants were required to report grass heights their fields may have been ranked lower priority.

Fields can also be visually assessed on an annual basis or opportunistically during other site visits. Fields that are enrolled and later identified as not suitable for Bobolink nesting habitat should not be renewed in the incentive program the following year. If field visits are going to occur, priority should be on new fields to assess for suitability.

4.2 Additional Program Considerations

A recent study analyzed the nest survival for 463 Bobolink nests monitored over six years across late-cut hayfields, pastures, restored grasslands, and fallow fields in southern and eastern Ontario. Daily survival rates did not vary across these field types, demonstrating that various field types have potential conservation value for Bobolink (Fromberger et al.

2020). However, the density of breeding birds, which is also important for focusing conservation efforts, may vary by field type and size.

4.2.1 Pasture Management

There are a number of different ways pasture is managed (e.g., continuous grazing, rotational grazing) that, with minor modifications, can benefit Bobolink and other grassland species.

Rotational grazing is a method of pasture management that divides a pasture into multiple paddocks. Cattle are rotated throughout a pasture, grazing one paddock at a time thereby allowing the remainder of the pasture to "rest" and regrow. Grazing management systems vary from simple to intensive based on the farmers' discretion. Pasture managed using a simple grazing management plan, consists of large paddocks grazed for long periods of time with cattle rotated through paddocks once over the grazing season. Intensive rotational grazing systems contain smaller paddocks that are grazed for short periods of time with cattle rotated frequently, resulting in each individual paddock grazed more than once during the grazing season (MacPhail and Kyle 2012).

Research illustrated that pasture paddocks on rotationally grazed beef cattle farms in Ontario that are ungrazed or lightly grazed during the Bobolink breeding season, provide breeding habitat that enable Bobolink to successfully fledge young (Campomizzi et al. 2019; MacDonald and Nol 2017).

Based on 2017 survey results, INT identified nine new sites that contained Bobolink and four were pasture sites. These results suggest Bobolink are using pasture as breeding habitat in PEI. INT, with assistance from ALUS, have also had efforts dedicated to pasture management, particularly with community pastures.

There is potential to expand the program to engage farmers to delay cattle grazing in a portion of their pasture until after July 16. If rotational grazing is currently being practiced, delaying grazing in a paddock(s) occupied by Bobolink until July 16 would provide an opportunity for Bobolink to fledge young.

For example, OSCIA have introduced pasture management in one of their funded Supported Best Management Practices. The Cross-Fencing for Rotational Grazing Best Management Practice provides funding to support new fencing and watering system infrastructure to strengthen rotational grazing systems in a way that would allow portions of pasture to remain ungrazed until Bobolink are able to fledge young (OSCIA 2018).

4.2.2 Education and Awareness

Efforts to engage farmers and landowners in the voluntary Farmland Bird Program and incentivized delayed hay cut program were successful in raising awareness and delaying hay cuts. The results of the 2016 Landowners Survey suggest farmers are enthusiastic about birds and wildlife and would be willing to delay hay cuts to benefit these species, and few were unwilling even without an incentive.

Continued efforts to increase awareness of grassland birds, particularly Bobolink, in PEI may help to contribute to the ultimate conservation of these species. An understanding of how farmers and landowners are managing their land is needed to identify where outreach efforts could be focused to receive the greatest conservation return. For example, some farmers time their hay cuts early for higher nutritional yields and would have potential financial loss with a delayed cut. On the other hand, some farmers cut later (e.g., in July) because it is their common practice, and therefore this cut date could be better timed to benefit Bobolink without consequences to farmers hay yields. In this circumstance, education without incentive may be more suitable. However, it is important to note that the incentive may also be serving as an engagement tool for some and by becoming a participant is holding farmers more accountable to delay hay cutting.

Further understanding of farming practices in PEI and how potential changes to these practices may positively and negatively impact famers and grassland birds and wildlife would help guide the expansion of this program and conservation of grassland species.

4.3 Environmental Considerations

Climate change is projected to impact not only grassland birds, but also their agricultural habitats and land management practices (Renfrew et al. 2019). In 2020, abnormally warm and dry conditions in PEI are thought to have created a risk of compromised hay quality. This may have been what led some farmers (24% of ALUS participants) to harvest prior to July 16, thus not complying with the delayed hay cutting incentive program. Beyond impacts to breeding habitat for grassland birds, the 2020 drought may also have decreased insect prey abundance and reduced foraging success, as has been demonstrated in other geographies (Renfrew et al. 2019).

Climate models project that warmer and drier summers, such as 2020, will become more common in PEI in the future (Tam et al. 2019). Other projected climate changes include increased total precipitation, higher precipitation intensity, more frequent heat waves, increased intensity of tropical storms, higher susceptibility to wildfires, changes to wind patterns, and longer growing seasons, among others (Bush and Lemmen 2019). The key to understanding climate change risk and vulnerability is to study the magnitude and timing of these changes on a regional scale, as it relates to agriculture, Bobolink, and other grassland wildlife.

Figure 4.1 provides examples of climate changes that may impact breeding grassland birds and their agricultural habitats in PEI. This figure illustrates how impacts to birds interact with land management and climate change adaptation practices. Further study of these interactions, based on relevant climate change projections for PEI, would inform future outcomes of the delayed hay cutting incentive program. For example, spatial variation of climate projections could be used to prioritize field eligibility. In addition, climate change adaptation practices that benefit grassland birds and wildlife could potentially be considered as incentivized options to support the delayed hay cutting initiative (see Section 4.2).

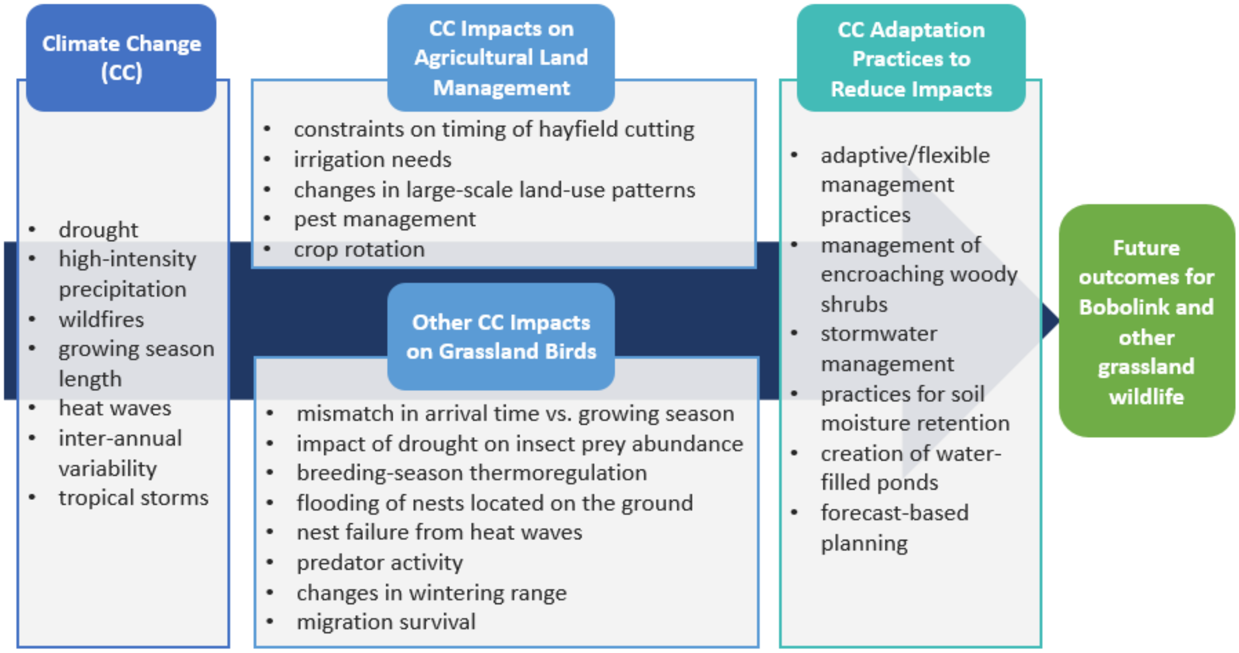

Figure 4.1: Examples of climate change impacts to grassland birds and climate change adaptation practices (includes information from Renfrew et al. 2019).

Chapter 5 Conclusions

Measured indicators (farmers reached and enrolled, % compliance, and number of Bobolink fledged) provide evidence that the intervention (incentivized delay hay cut) is successful at achieving the intended outcomes. Producer engagement indicates there is a willingness on the part of the farmer to participate in the delayed hay cut initiative, but this initiative requires engagement by all partners involved to help raise and maintain awareness.

The number of participants enrolled in the delayed hay cut programs (voluntarily and incentivised) increased each year. However, with the information available, it is not clear how much the financial incentive contributed to the increase in the number of participants, but it did appear to help with the intended outcome (i.e., greater acreage of hay delayed, allowing Bobolink to nest and fledge young).

There are opportunities to continue to enhance Bobolink monitoring through different field surveying techniques and monitor biological outcomes more closely (e.g. transects and reproductive indices). To further refine or confirm nest fledging dates and provide additional support of the delay hay cut date (July 16), local nesting records could be acquired through the MNRS. Alternatively, nests could be monitored during upcoming field seasons on a subset of fields.

By further refining the eligibility criteria to enroll in the incentivized program, greater biological outcomes may be achieved. As the program continues to grow and/or funding becomes limited, sites that would provide the greatest conservation benefit to Bobolink must be identified and prioritized. The application process may need to be adjusted and refined as the program develops and regional Bobolink information is identified. It is important to make sure the application does not become onerous and thus discourage landowners and farmers from enrolling in the program. Finding a balance between requesting information to assess and prioritize fields and burdening the applicant is important.

There are several options to continue to grow the program through both voluntary and incentivized approaches. Expanding potential intervention options (e.g., rotational and deferred grazing) could benefit Bobolink in PEI. Given the success of INT's Farmland Bird Program in the infancy stages (2014) coupled with the results of INT's surveys, efforts to educate landowners about SAR, may further benefit Bobolink in PEI. In 2018 and 2019, non-compliance issues were relatively low, but increased in 2020. The 2020 increase in non-compliance is most likely related to the climatic conditions and the need to secure quality hay for livestock. A further understanding on how relevant climate change projections may impact farm management and grassland birds could help guide program development. Perhaps an additional incentive could be provided to farmers during dry years to supplement additional losses. Climate change adaptation practices that benefit grassland birds could also potentially be considered as incentivized options.

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APPENDIX A

Productivity Data

Table 1 Data recorded by INT at 52 hayfields during the 2016 – 2020 breeding season (number of male, female and fledgling Bobolinks, a productivity estimate, fledge date, field size, and hay cut date) (source: INT).

Year	Male	Female	Fledgling	Productivity	Fledge Date	Field Size (Acres)
2020	5	4	22	5.50	July 12	17.89
2020	4	3	10	3.33	July 17	18.3
2020	2	2	5	2.50	July 14	4.85
2020	12	9	14	1.56	July 14	47.89
2020	10	8	19	2.38	July 14	12.67
2020	8	5	11	2.20	July 15	12.07
2020	4	3	7	2.33	July 7	19.1
2020	5	3	8	2.67	July 14	12.05
2020	9	2	8	4.00	July 13	6.3
2020	6	4	14	3.50	July 13	10.3
2020	5	2	8	4.00	July 12	16.5
2020	2	2	7	3.50	July 17	5.2
2020	6	3	9	3.00	July 11	4.2
2020	6	2	9	4.50	July 7	5.1
2019	7	4	6	1.50	July 12	17.89
2019	3	2	8	4.00	July 15	8.47
2019	8	7	37	5.29	July 10	28.99
2019	3	2	6	3.00	July 24	18.3
2019	2	1	4	4.00	July 12	4.85
2019	12	9	14	1.56	July 16	47.89
2019	3	2	4	2.00	July 12	16.41
2019	4	3	14	4.67	July 17	13.65
2019	10	8	8	1.00	July 15	13.8
2019	2	3	8	2.67	July 10	24.93
2019	3	2	3	1.50	July 15	12.78
2019	10	8	19	2.38	July 15	12.67
2019	2	1	3	3.00	July 11	5.26
2019	1	1	4	4.00	July 20	8.22
2019	8	5	11	2.20	July 11	12.07
2018	3	2	10	5.00	July 16	19.1
2018	5	6	11	1.83	July 13	12.07
2018	5	2	7	3.50	July 14	5.37
2018	5	4	17	4.25	July 17	12.05
2018	4	4	22	5.50	July 13	28.99
2018	2	2	4	2.00	July 17	5.26
2018	3	2	1	0.50	July 22	12.67

Year	Male	Female	Fledgling	Productivity	Fledge Date	Field Size (Acres)
2018	8	7	16	2.29	July 12	17.89
2018	2	2	6	3.00	July 14	4.85
2018	1	1	3	3.00	July 13	5.65
2018	4	2	8	4.00	July 16	18.3
2017	5	5	17	3.40	July 17	19.1
2017	5	3	14	4.67	July 11	19.46
2017	5	3	12	4.00	July 11	16.67
2017	1	1	2	2.00	July 14	9.12
2017	1	2	2	1.00	July 10	11.73
2017	4	4	13	3.25	July 11	28.99
2017	1	2	5	2.50	July 12	2.71
2017	5	3	5	1.67	July 11	5.26
2017	4	2	6	3.00	July 12	12.67
2016	2	1	4	4.00	July 14	13.63
2016	1	1	5	5.00	July 13	5.37
2016	1	1	3	3.00	July 14	14.1

APPENDIX B

2018 Productivity Data – ALUS and Non-ALUS

Table 2 Data recorded by INT in the 2018 breeding season (number of male, female and fledgling Bobolinks, a productivity estimate, fledge date, field size, and hay cut date) at four ALUS and 13 non-ALUS sites (source: INT).

Site Type	Male	Female	Fledgling	Productivity (Fledglings/Female)	Fledge Date	Field Size	Hay Cut Date
ALUS	5	4	17	4.25	17-Jul	12.05	after July 15
ALUS	3	2	1	0.5	22-Jul	12.67	after July 15
ALUS	8	7	16	2.29	12-Jul	17.89	after July 15
ALUS	1	1	3	3	13-Jul	5.65	after July 15
Non-ALUS	3	2	10	5	16-Jul	19.1	after July 20
Non-ALUS	3	3				16.67	12-Jul
Non-ALUS	3	2				21.21	after July 15
Non-ALUS	5	6	11	1.83	13-Jul	12.07	after July 15
Non-ALUS	5	2	7	3.5	14-Jul	6.57	after July 15
Non-ALUS	2	2				4.12	after July 15
Non-ALUS	3	4				2.61	after July 15
Non-ALUS	1	1				8.47	after July 15
Non-ALUS	4	4	22	5.5	13-Jul	28.99	not cut
Non-ALUS	2	2				2.71	after July 15
Non-ALUS	2	2	4	2	17-Jul	5.26	8-Aug
Non-ALUS	2	2	6	3	14-Jul	4.85	7-Aug
Non-ALUS	4	2	8	4	16-Jul	18.3	August


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