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Effects of Plant Cover Improvements for Nesting Ducks on Grassland Songbirds

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Several islands located along the St. Lawrence River in southern Quebec have been used as natural pastureland by cattle for decades. Recently, a rest-rotation grazing system and dense nesting cover were established on four islands near Varennes to improve duck nesting conditions. The effects of these two plant cover improvements on the abundance of grassland songbirds were assessed through four treatments: (1) idle fields with no vegetation improvement but exclusion of cattle (IDLE), (2) improved pastures with seeding of forage plants for cattle (IMPP), (3) dense seeded nesting cover fields improved for ducks and where cattle were excluded (DNC), and (4) natural or unimproved pastures grazed by cattle after the duck nesting season (UIPP). The overall abundance of birds was similar among treatments before cover improvements as well as two years after. The abundance of Bobolinks (*Dolichonyx oryzivorus*) was significantly greater in DNC and UIPP two years after treatments while Red-winged Blackbirds (*Agelaius phoeniceus*) were more abundant in DNC and IDLE. Plant cover improvements had little impact on Savannah Sparrow (*Passerculus sandwichensis*) abundance. Furthermore, few annual or treatment-related changes were observed for less abundant species. On the short-term, duck nesting cover improvements in natural pastures did not have any major effect on grassland songbirds on Varennes islands.

Key Words: ducks, nesting, plant cover, grassland, songbirds, Québec.

Since the early 1950s, intensive farming practices have radically transformed the agricultural landscape of North America, which resulted in many negative effects on ground-nesting grassland birds (Sugden and Beyersbergen 1984; Best et al. 1990; Askins 1993). Cattle grazing, for example, has greatly expanded in most regions, and improvements in forage crops and range management have allowed farmers to increase stocking rates (Barker et al. 1990). By modifying the quality of plant cover (Kantrud and Kologiski 1982; Fleischner 1994), cattle reduce both the diversity of birds and their breeding densities (Bowen and Kruse 1993; Bélanger and Picard 1999). Grazing also reduces the quantity of residual vegetation available for nest construction and as substratum for invertebrate prey species, which in turn, may affect bird breeding and/or foraging (Heitchmidt et al. 1982; Quinn and Walgenbach 1990). Nesting cover modified by trampling can also increase predation and parasitism (Jensen et al. 1990; Johnson and Temple 1990).

It has been shown that proper habitat management such as rotational grazing systems and the establishment of dense-seeded nesting cover can greatly improve nesting conditions for waterfowl (Gjersing 1975; Klett et al. 1988; Barker et al. 1990; Lokemoen et al. 1990; Lapointe et al. 2000). However, the effect of such techniques on other grassland ground-nesting bird species is poorly understood (Johnson et al. 1994).

In Québec, close to 40% of the 5000 ha of islands of the St. Lawrence River has been used for decades as natural pastureland (Bélanger and Lehoux 1995), thereby compromising the value of these islands as duck-nesting habitat (Bélanger and Picard 1999). Consequently, a project to improve waterfowl nesting and brood-rearing habitat, as well as to limit riverbank erosion and overgrazing problems, was initiated in 1992 on the Varennes islands by establishing a rest-rotation grazing system and plots of dense nesting cover. In a previous paper, Lapointe et al. (2000) reported the benefits of these plant cover improvements to island-

nesting ducks. The objective of this study was to assess the short-term effects of plant cover improvements on the abundance of ground-nesting grassland songbirds.

Study Area

The 115-ha Varennes archipelago (45° 40' N, 73° 27' W) is located 20 km northeast of Montreal (Canada) along the St. Lawrence River. It is composed of four islands ranging in size from 9.4 to 59.8 ha (Figure 1). Before cover improvements, the dominant plant species on these islands were Tufted Vetch (*Vicia cracca*), Redtop (*Agrostis alba*), Red Fescue (*Festuca rubra*) and Kentucky Bluegrass (*Poa pratensis*). On one island (Grande-île), however, tall grasses such as *Phalaris arundinacea* and *Calamagrostis canadensis* were dominant. As a result of continuous grazing pressure, trees and shrubs are absent. Emergent marsh vegetation consists primarily of cattails (*Typha angustifolia*) and scattered clumps of Giant Bur-reed (*Sparganium eurycarpum*) and arrowheads (*Sagittaria* spp.).

Communal pasture is a traditional agricultural practice on islands of the freshwater section of the St. Lawrence River in Québec (Bélanger and Picard 1999). Approximately 100 cows are present each year on the Varennes islands from late May-early June to mid-November. Before 1993, cows roamed freely over the four islands. In fall 1992, Ducks Unlimited Canada initiated a controlled grazing system; one 19-ha pasture was seeded with a mixture of Timothy (*Phleum pratense*), Yellow Sweet-Clover *(Melilotus officinalis*), Smooth Brome (*Bromus inermis*) and clovers (*Trifolium* spp.) to improve the quality of the forage (improved pasture – IMPP). A dense nesting cover (DNC93) was also established on a 5-ha plot by seeding Reed Canary Grass (*Phalaris arundinacea*). The remaining parts of the islands were left in their natural state with some being grazed by cattle after the duck-nesting season (27.4 ha of unimproved pastures – UIPP) or left undisturbed by excluding cattle (59.9 ha of idle fields – IDLE). All seeded fields were previously treated with herbicide and ploughed. In summer 1993, the rest-rotational grazing system limited cattle to approximately 50% of the islands, in rotation between IMPP and UIPP. In fall 1993, the treatments were completed with the seeding of two additional plots of dense nesting cover (15.0 ha of DNC – DNC94) with a mixture of Western Wheatgrass (*Agropyron smithii*) and Crested Wheatgrass (*A. cristatum*). Finally, a 17.6-ha portion of old pasture had been ploughed for future works (PLGH). More details may be found in Lapointe et al (2000).

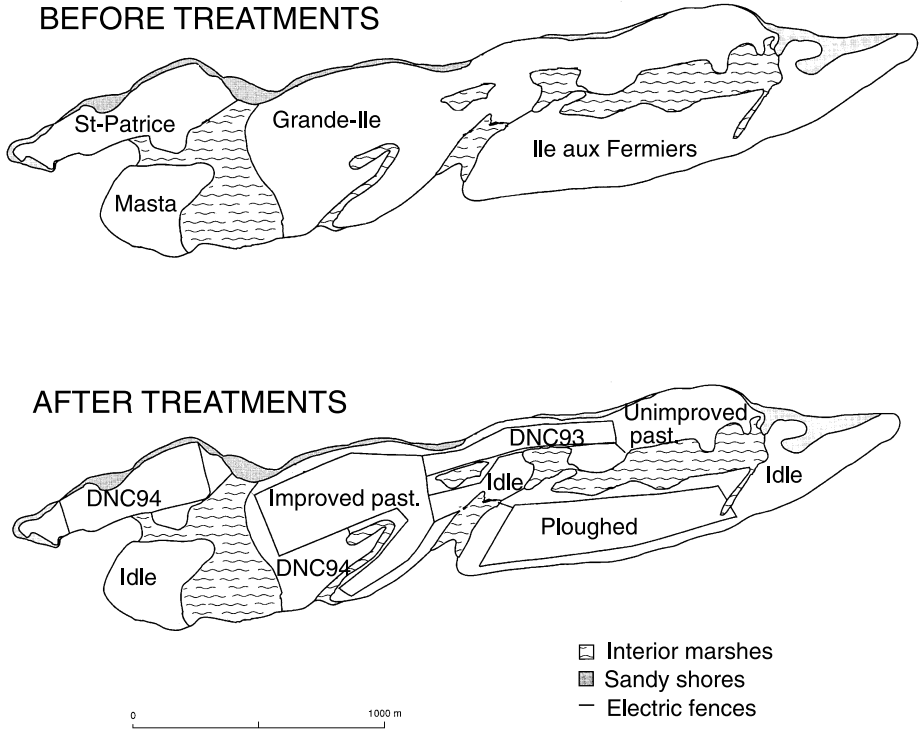

FIGURE 1. The four islands of Varennes archipelago along the St. Lawrence River (Quebec) before (1992) and after (1993-1994) plant cover improvements for nesting ducks.

Material and Methods

Experimental design and bird surveys

Because it was impossible to find other islands similar in size, plant cover types, spring flooding conditions, past and present grazing intensity, we did not attempt to set up a large scale spatially replicated experiment. Instead, we tried to circumvent the problem with a temporal control by taking comparative measures of plant cover use by birds within the same sampling plots before and after cover improvements (see Lapointe et al. 2000).

Birds were surveyed in 50 0.5 ha-plots (50 × 100 m) distributed randomly over the upland portions of the islands. The four corners of each plot were marked with posts and the same plots were surveyed from 1992 to 1994. However, treatments to which these plots belonged varied from year to year in relation to habitat modifications. An observer located in the centre of the plot recorded all the birds heard and seen during a 5-min period after a 2-min delay before the count began. Birds flying over the plots were not counted. Surveys were done during five consecutive days in early June, between 05:00 and 10:00, whenever weather conditions were adequate.

Data analyses

For each species, we totalled the number of males and females recorded in each plot for a given date. We first conducted a series of ANOVA for each year and species to compare the relative abundance of individuals among survey dates. For each species, we then used the day with the maximum number of birds recorded and compared their relative abundance among treatments and years with ANOVA. Maxima were used because detection probability of individuals is always <1 during such surveys. Logarithmic transformations were used because the data were not normally distributed and the variances were not homogeneous. Differences among treatments and years were determined using multiple comparison tests (LSD). Finally, the species composition (proportion of individuals of each species) was compared among years using χ^2 tests. Means are presented ± 1 SE throughout the text and tables.

Results

Species composition and bird abundance

Totals of 1638, 1738, and 1507 bird observations were recorded in 1992, 1993, and 1994, respectively. Each year, the mean number of birds/plot did not differ among the five survey dates for all species except two. The number of Savannah Sparrows (*Passerculus sandwichensis*) was always higher towards the end of the sampling period indicating that some birds arrived on the breeding grounds during the survey period (1992: $F_{4,244} = 15.4$, $P = 0.0001$; 1993: $F_{4,245} = 2.5$, $P = 0.04$; 1994: $F_{7,384} = 11.7$, $P = 0.0001$). On the other hand, the number of Song Sparrows (*Melospiza melodia*) was three times larger during the first day of the survey in 1992 than later indicating that migrating birds were still passing through the area ($F_{4,244} = 12.7$, $P = 0.0001$). This count was therefore discarded and we used the second highest count for the analyses.

Although 15 species were observed on the islands, Savannah Sparrows, Bobolinks (*Dolichonyx oryzivorus*) and Red-winged Blackbirds (*Agelaius phoeniceus*) represented 92% of the observations. The relative abundance of these species varied among years ($\chi^2 = 68.5$; df = 8; $P<0.001$). Savannah Sparrows were more abundant in 1993 than in 1992 and 1994, and the opposite was true for Red-winged Blackbirds. Bobolinks were less abundant in 1993 and 1994 than in 1992. Other species occurred at low densities and included Common Snipe (*Gallinago gallinago*), Swamp Sparrow, Wilson's Phalarope (*Phalaropus tricolor*), Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*), Marsh Wren (*Cistothorus palustris*), Chipping Sparrow (*Spizella passerina*), Eastern Kingbird (*Tyrannus tyrannus*), Horned Lark, Lincoln Sparrow (*Melospisa linconii*) and Eastern Meadowlark (*Sturnella magna*).

Effects of cover improvements

Before habitat improvements (1992), the mean number of birds was similar among future treatment areas ($F_{3,46} = 1.55$, $P = 0.22$; Table 1). After the rest-rotation grazing system had been implemented and dense cover sown (1993), the greatest number of birds was found in IDLE ($F_{3,46} = 6.06$, $P = 0.002$). In 1994, the mean number of birds was similar in all treatments except in PLGH where fewer individuals were recorded ($F_{3,48} = 4.29$, $P = 0.003$).

The mean number of birds in IDLE increased in 1993, but returned to an intermediate level in 1994 ($F_{2,56} = 3.33$, $P = 0.04$; Table 1). In IMPP, the number of birds decreased after controlling cattle movement ($F_{2,33} = 4.81$, $P = 0.01$). Bird abundance also decreased in UIPP after the first year but increased in 1994 ($F_{2,21} = 3.95$, $P = 0.03$). Bird numbers in DNC93 remained constant over years ($F_{2,12} = 0.88$, $P = 0.44$).

We further investigated the effect of habitat improvements by looking at the annual abundance of individual species. In 1992, the average number of Savannah Sparrows was similar in all future treatments ($F_{3,46} = 0.32$, $P = 0.81$; Table 2). In 1993, they were more common in IDLE and IMPP than in the newly seeded DNC93 ($F_{3,46} = 5.96$, $P = 0.002$) and less in 1994 ($F_{5,43} = 4.68$, $P = 0.002$). Bobolink numbers were similar in all treatments, both before and after the first year following cover improvements (1992: $F_{3,46} = 0.32$, $P = 0.18$; 1993: $F_{3,46} = 0.44$, $P = 0.73$; Table 2). Differences appeared in 1994 when a greater number of bobolinks was recorded in the two-year-old DNC93 and UIPP ($F_{5,43} = 3.48$, $P = 0.01$). Unlike the previous species, Red-winged Blackbirds showed significant differences in 1992 among future treatments. They were more abundant in UIPP than in the other treatments and

TABLE 1. Mean (±SE) number of birds/0.5-ha plot for all species of birds in six treatments on the Varennes islands in 1992 (pre-treatment year) and 1993-1994 (post-treatment years).

Treatment	n[1]	1992	1993	1994
IDLE	23, 23, 13	7.3±0.9 a,A[2]	10.0±0.6 a,B	8.5±1.0 ab,AB
IMPP	12, 12, 12	10.3±1.2 a,A	7.1±1.1 b,B	6.0±0.7 ab,B
UIPP	10, 10, 4	9.2±1.2 a,AB	5.8±0.7 b,B	11.3±3.0 a,A
DNC93[3]	5, 5, 5	9.2±1.2 a,A	8.2±0.9 ab,A	11.4±2.7 a,A
DNC94[4]	1, 1, 7	–	–	7.0±1.1 ab
PLGH	1, 1, 8	–	–	4.1±0.8 b

[1] Number of plots surveyed in 1992, 1993, and 1994, respectively.
[2] Lower case letters indicate significant differences among treatments for a given year while upper case letters indicate significant differences among years for a given treatment (LSD, $P<0.5$).
[3] DNC seeded in 1992 and first available in 1993.
[4] DNC seeded in 1993 and first available in 1994.

more abundant in IMPP than in DNC93 ($F_{3,46}$ = 12.02, P = 0.0001; Table 2). In 1993, Red-winged Blackbird numbers were similar in all treatments ($F_{3,46}$ = 0.81, P = 0.49) while they increased in IDLE, UIPP and the two-year-old DNC93 in 1994 ($F_{5,43}$ = 8.22, P = 0.0001).

Few annual or treatment-related changes were observed for the less abundant species. Song Sparrows were found in all treatments while Common Snipes were found in UIPP each year and in PLGH and IMPP in 1994. Wilson's Phalaropes were observed in UIPP during all years and in IDLE in 1992 and 1993. Swamp Sparrows were recorded in UIPP (1993 and 1994), IDLE, and DNC93. Uncommon species like the Nelson's Sharp-tailed Sparrow and Marsh Wren were seen in different treatments, but did not seem to favour one over the others during the three years of the study.

Discussion

Integrating traditional agricultural practices and wildlife needs has been a major component of the conservation plan proposed for the St. Lawrence River islands (see Bélanger and Lehoux 1995). Stocking rate >1 cow/ha/yr can reduce bird diversity and breeding densities by modifying cover quality (Bélanger and Picard 1999). Consequently, grazing management has been implemented to improve plant cover conditions, especially for nesting ducks (Lapointe et al. 2000). However, the effects of such techniques on other grassland birds have remained poorly understood (Johnson et al. 1994).

Before cover improvements, grazing had a significant impact on plant cover on the Varennes islands by reducing green vegetation biomass by more than 50% in a single season (Lapointe et al. 2000). All the islands were grazed uniformly resulting in a similar cover quality among treatments before the experimental work. The introduction of a rest-rotation grazing system helped to lessen the impact of cattle on the vegetation and allowed the establishment of a high-quality nesting cover for ducks (Lapointe et al. 2000). Two years after cover improvements, more litter was found in DNC and IDLE and greater levels of visual obstruction were noted in DNC. Our study shows that these changes had little effects on the overall abundance of grassland birds. All treatments were located in open habitats and the well-delimited plots were easily surveyed in all treatments. We therefore believe that no observability bias existed among treatments before or after the management works.

Community analysis may sometimes conceal different levels of tolerance among individual species (Bock et al. 1993). We therefore tested for changes in numbers for the three most abundant species. Cover improvements seemed to have little impact on Savannah Sparrow abundance. This species generally favours idle fields with tall vegetation (Owens and Myres 1973; Kantrud 1981) but was equally attracted to IDLE, DNC, IMPP, and UIPP on the Varennes islands. Numbers also remained unchanged in IMPP when the intensity of grazing increased. Savannah Sparrow generally does not tolerate intensive grazing (Bock et al. 1993). However, since this species begins nesting in mid-May in our area (Gauthier and Aubry 1996), it may be more tolerant to cattle grazing, which began in late May-early June at Varennes. Although no effects of cover improvements were observed for Bobolinks in the first year they subsequently were more abundant in DNC and UIPP. This could be related to their preference for nesting in tall vegetation with a dense litter (Kantrud 1981; Bollinger and Gavin 1992). The greater number of Red-winged Blackbirds in UIPP before cover improvements cannot be explained by differences in plant cover quality as it was similar among treatments (Lapointe et al. 2000). However, two years after, redwings preferred treatments with greater amounts of residual vegetation and better levels of visual obstruction (IDLE and DNC), which support observations by Searcy (1979).

It was more difficult to assess the impact of cover improvement on less common species because of their low abundance. We found several nests of Wilson's

TABLE 2. Mean number (± SE) of Savannah Sparrows, Bobolinks, and Red-winged Blackbirds/0.5-ha plot in six treatments on the Varennes islands in 1992 (pre-treatment year) and 1993-1994 (post-treatment years). Numbers of plots surveyed are given in Table 1.

Treatment	Savannah Sparrow			Bobolink			Red-winged Blackbird		
	1992	1993	1994	1992	1993	1994	1992	1993	1994
IDLE	3.9±0.6 a,B[1]	6.9±0.6 a,A	2.9±0.4 cd,B	1.7±0.3 a,A	1.3±0.3 a,A	1.2±0.4 bc,A	0.9±0.2 bc,B	1.6±0.5 a,B	3.6±0.5 a,A
IMPP	4.5±0.8 a,A	4.8±0.8 ab,A	4.3±0.4 abc,A	2.6±0.7 a,A	1.6±0.4 a,A	0.8±0.3 c,A	2.1±0.6 b,A	0.9±0.3 a,B	0.5±0.2 b,B
UIPP	3.4±0.7 a,A	4.2±0.7 bc,A	4.5±0.7 ab,A	2.0±0.4 a,A	1.0±0.3 a,A	2.5±0.9 a,A	3.9±0.5 a,A	0.9±0.2 a,B	4.5±0.7 a,A
DNC93[2]	4.2±0.6 a,AB	2.2±0.9 c,B	5.2±0.9 a,A	3.4±0.8 a,A	1.0±0.6 a,B	2.4±0.4 ab,AB	0.4±0.2 c,B	0.6±0.6 a,B	4.6±1.8 a,A
DNC94[3]	–	–	3.1±0.3 bcd	–	–	0.7±0.6 c	–	–	1.3±0.5 b
PLGH	–	–	2.5±0.3 d	–	–	0.1±0.1 c	–	–	1.0±0.4 b

[1] Lower case letters indicate significant differences among treatments for a given year while upper case letters indicate significant differences among years for a given treatment (LSD, $P<0.05$).
[2] DNC seeded in 1992 and first available in 1993.
[3] DNC seeded in 1993 and first available in 1994.

Phalarope, a species that has recently expanded into the east (Gauthier and Aubry 1996). Nelson's Sharp-tailed Sparrow, a rare species usually found in *Spartina* tidal marshes of the St. Lawrence estuary, was also recorded several times on the islands. The distribution of those species did not change significantly after cover improvements and it seems to be linked to other habitat features. Many of these species use wetlands and riparian areas of the archipelago, and this may be more important than the treatments *per se*.

In conclusion, our study showed that cover improvements for nesting ducks in natural pastures did not have any major effects on the abundance of other ground-nesting species. The nesting cover improvements carried out on the Varennes islands were relatively recent, and only their short-term effects (two years) have been evaluated. As time goes on, IDLE will revert to oldfields (presence of shrubs), and DNC will be better established (more litter). We think that the resulting enhanced habitat quality will be more tangible then, resulting in an increase in songbird abundance.

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