HABITAT MANAGEMENT PRACTICES FOR THE PROTECTION OF FARMLAND BIRDS

Recommendation Guide

Stéphane Lamoureux
Catherine Dion

2ND EDITION

REGROUPEMENT QuébecOiseaux

REGROUPEMENT QUÉBECOISEAUX

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Founded in 1981, Regroupement QuébecOiseaux (RQO) is a non-profit organization that brings together and represents individuals and organizations with an interest in the study, observation and protection of birds in Quebec. Its objectives are to encourage the development of birdwatching as a pastime, promote ornithological study and oversee the protection of birds and their habitats. Most notably, RQO promotes the acquisition and sharing of knowledge on bird distribution, ecology and conservation through (i) the establishment and maintenance of databases, (ii) a breeding site monitoring program of species at risk and (iii) the production of multiple publications, including the magazine QuébecOiseaux.

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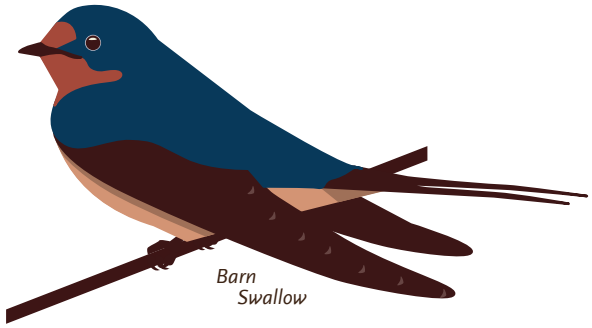
Foreword



Why this guide? Regroupement QuébecOiseaux is dedicated to the conservation and protection of birds that are in decline or at risk. One of the priorities of this organization is the decline of birds associated with agricultural habitats (farmland birds), which in recent years has become a major conservation issue in many parts of the world. In fact, farmland birds have been showing the most significant declines of any group of birds. In recent decades, changing agricultural practices have had an impact on farmland bird populations. The declines observed are notably attributable to the modification, degradation and loss of habitats in agricultural areas. In reality, however, this problem is not well recognized by the agricultural community (producers and other stakeholders alike), and this lack of understanding represents a major obstacle for implementing concrete actions aimed at reversing the situation.

This guide has thus been developed so that the parties that work directly with farmers can both better understand the issues related to farmland bird habitats, and so that they can be in a position to make recommendations to safeguard these habitats in accordance with each type of agricultural production. In this context, for each of the habitats that can be found in agricultural environments, the guide identifies the various problems faced by farmland birds and proposes solutions (habitat management or modification of practices) that allow for better co-existence.

Definition of farmland birds For the purposes of this guide, the term "farmland birds" is used to define species that use agricultural environments as nesting habitat almost exclusively. Open habitats such as cultivated fields, meadows and pastures allow farmland birds to feed, find shelter and reproduce. Additionally, the authors considered species that use more closed habitats, but are typically associated with agricultural environments such as abandoned farmland, tree crops, orchards, vineyards and berry patches.

SPECIES CONSIDERED AS FARMLAND BIRDS (NON-EXHAUSTIVE)

SPECIES	ASSOCIATED HABITATS	OTHER ELEMENTS
American Kestrel	PA, ME, AF, MH, AS, OVB	NB, Wocc
Barn Swallow*	PA, ME, MH, AS	NB
Blue-winged Teal	ME, AF, MH	G
Blue-winged Warbler	AF	S
Bobolink*	ME, AF	G
Brown Thrasher	AF, MH, OVB	
Brown-headed Cowbird	PA, AF, MH	W
Clay-coloured Sparrow	PA, TC, AF	G
Eastern Bluebird	PA, ME, AF, MH, AS	NB
Eastern Kingbird	MH	
Eastern Meadowlark*	PA, ME, AF, AS	G
Eastern Towhee	PA, AF, MH	G, Wocc
Field Sparrow	PA, TC, AF	G
Golden-winged Warbler*	AF	G
Grasshopper Sparrow*	PA, ME, AF, AS	G
Grey Partridge	AC, ME, AF	G, W
Horned Lark	AC, ME, PA	G, W
Killdeer	AC, PA, ME	G
Loggerhead Shrike*	PA, AF, MH, AS	
Nelson's Sparrow	ME	G
Northern Harrier	PA, ME, AF, AS	G, Wocc
Rough-winged Swallow	PA, ME, MH, AS	
Savannah Sparrow	PA, ME, AF	G
Sedge Wren	ME, AF	G
Short-eared Owl*	PA, ME, AF, MH, AS	G, Wocc
Tree Swallow	PA, ME, MH, AS	NB
Upland Sandpiper	PA, ME, AS	G
Vesper Sparrow	AC, PA, ME, TC, AS	G

HABITATS : Annual Crops **AC**, Meadows **ME**, Pastureland **PA**, Orchards, Vineyards and Berry Patches **OVB**, Tree Crops **TC**, Abandoned Farmland **AF**, Marginal Habitats **MH**, Anthropogenic Structures **AS** | **OTHER ELEMENTS** : Nest Box User **NB**, Ground Nester **G**, Winter **W**, Occasional in Winter **Wocc**, Species of Concern *

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“How much more habitable a few birds make the fields! At the end of the winter, when the fields are bare and there is nothing to relieve the monotony of the withered vegetation, our life seems reduced to its lowest terms. But let a bluebird warble over them, and what a change!”

Henry David Thoreau
March 1858

Short-eared Owl

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Killdeer

History of Agriculture and Birds in Quebec

Pre-1620 Prior to colonization, the habitats used by farmland birds in Quebec were likely limited to naturally present grasslands around wetlands and the floodplains of watercourses, particularly along the St. Lawrence River [(1)]. Other open spaces, created by clearing or slash-and-burn for hunting and agriculture (e.g. "Three Sisters" technique for growing corn, beans and squash), were also used by farmland birds [(2)].

1620 to 1950 With the arrival of European colonists, land clearing intensified, which substantially transformed the landscape and created new habitats. The first farmers settled the land based on availability and not how conducive it was for agriculture [(3)]. These croplands and pastures [(4)] attracted bird species that initially nested on natural grasslands such as Eastern Meadowlark and Bobolink [(1)]. During this period, agriculture remained a subsistence activity and did not play a significant economic role in the province [(5)]. The non-intensive nature of agriculture, absence of pesticides and limited agricultural machinery contributed to the persistence of a mosaic of cultivated land, woodlands and residual vegetation (isolated trees, bushes, hedgerows). Similarly to birds that frequent open areas, edge habitat species such as the Eastern Kingbird and Brown Thrasher benefited greatly from this landscape.

Savannah Sparrow

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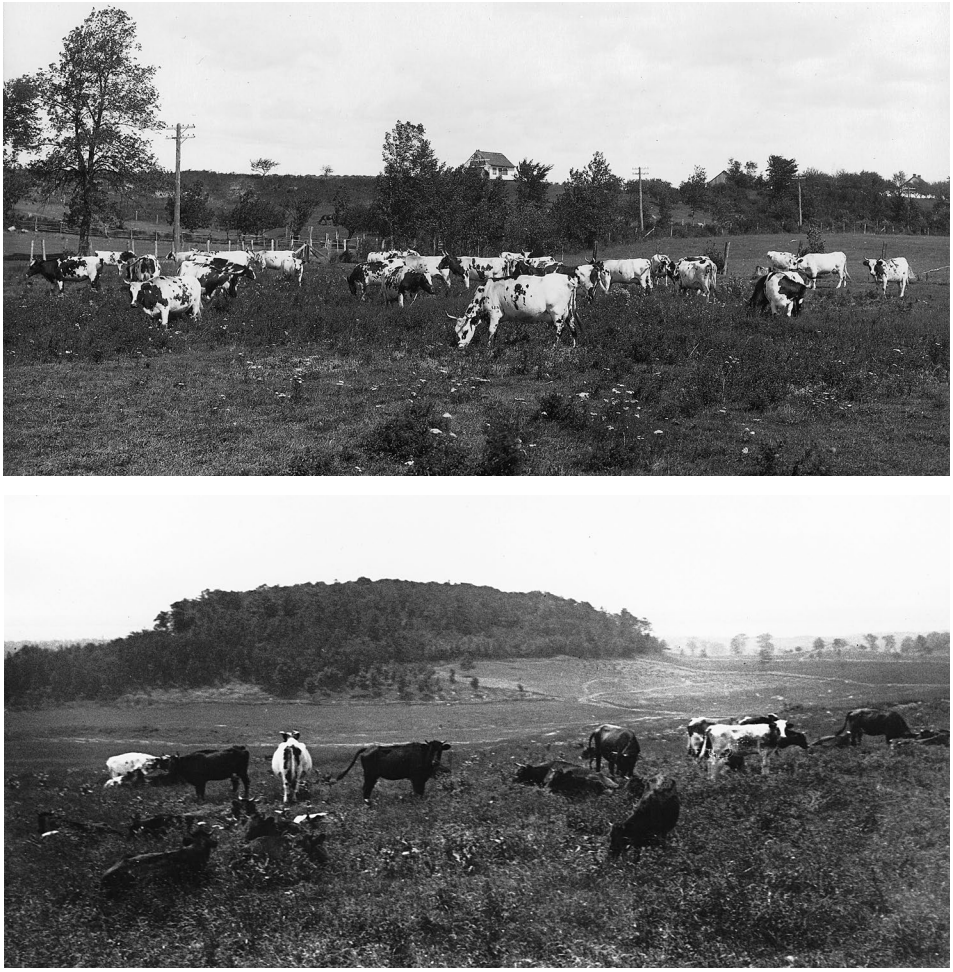
—

OPPOSITE

Extensive agricultural landscape in Lanaudière

© Martin Joly

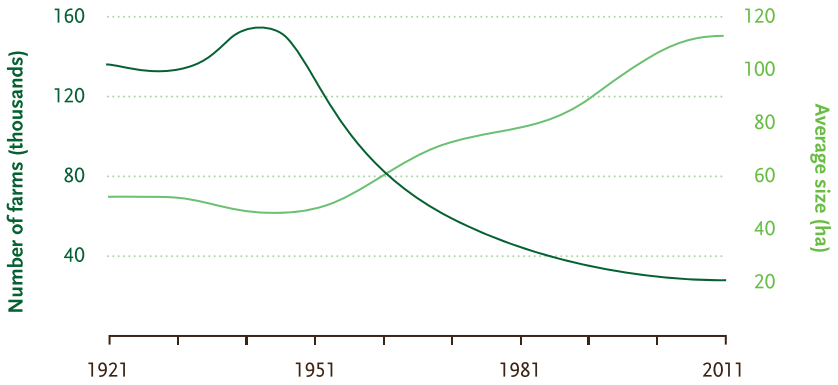
However, the Great Depression of the 1930s cast a shadow over rural areas and triggered new changes. Many parcels were abandoned, altering the agricultural landscape of the province. These areas eventually became overgrown with trees and bushes, particularly the less productive lands of the Canadian Shield and the Appalachians [4]. Certain species associated with abandoned farmland such as the Golden-winged Warbler and Eastern Towhee would benefit from this woody succession.



Historical agricultural landscapes (circa 1900) in Sainte-Anne-de-Bellevue and Oka

© McCord Museum

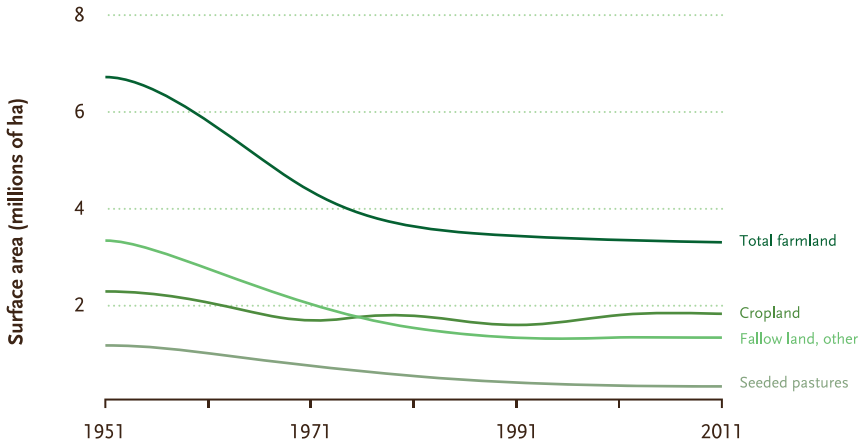
1950 to present Beginning in the 1950s, the appearance of new crop techniques, modernization of agricultural machinery, use of fertilizers and pesticides, installation of drainage and irrigation systems, larger herds and efforts to maximize crop acreage would allow the agricultural sector to play a key role in the national economy [5, 6] and better meet market needs and requirements [5, 7]. However, this period would be marked by a steep decline in the total area occupied by farms as well as their number [8]. From 1951 to 2001, the total area occupied by farmland fell from 6.8 million to 3.4 million hectares, while the number of farms declined from 134,000 to just over 32,000 (Figures 1 & 2). The average size of remaining farms doubled in size, however, increasing from an average of 51 ha to 106 ha over this same period [9]. Abandoned plots can be observed in nearly all regions that are not part of the St. Lawrence Lowlands [4].



SOURCE: RUIZ, J. AND G. DOMON (2005)

fig. 1

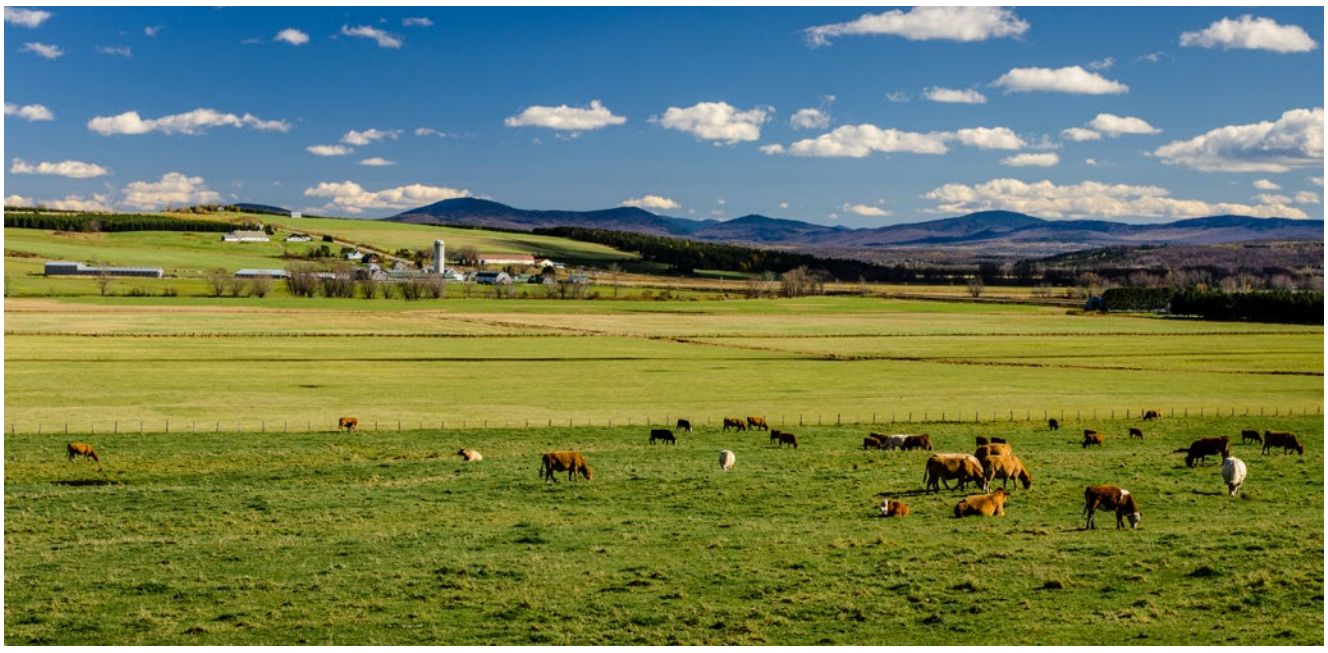
Increasingly fewer, increasingly larger: changes in the number and size of farms – 1921 to 2011



SOURCE: J. RUIZ AND G. DOMON (2005)

fig. 2

Evolution of farmland use – 1951 to 2011



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Eastern Meadowlark, one of the species disadvantaged by intensive farming

© Alain Daigle

Furthermore, between 1966 and 1986, annual milk production per head increased by more than 50%, while demand for dairy products peaked toward the end of the 1970s [10]. As a result, many farmers were prompted to switch to growing field crops [11]. Traditional farms combining crops and animal breeding thus disappeared in favour of fewer, larger farms specializing in a specific type of production [8]. Quebec agriculture was thus undergoing a shift from extensive farming (numerous pastures and hay fields) to more intensive techniques (major cereal crops), particularly in Montérégie.

At this time, population declines begin to be observed for the first time in certain farmland birds, notably the Savannah Sparrow, Bobolink, Barn Swallow and Eastern Meadowlark. Conversely, species of less interest to farmers benefited from intensive farming and grew in population (Ring-billed Gull, Rock Pigeon, Mourning Dove).

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Intensive monoculture landscape in Montérégie

© Stéphane Lamoureux

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Repercussions of New Agricultural Practices on Birds

CHANGING LANDSCAPES

The new agricultural era brought with it significant changes to the landscape that translated into a net loss of habitat as well as a decline in the productivity of residual habitats. In fact, just half of all farmland established historically remains today. The disappearance of this acreage once available for agriculture (3.4 million hectares) resulted in a loss of habitat for many farmland species. Most of these lands have either reverted to forest or have been developed. Whatever farmland that has remained has undergone heavy intensification. Declining crop diversity and maximization of the acreage dedicated to these crops give rise to an increasingly monotonous landscape that is not conducive to nesting and not able to support sizable bird populations (overly simplified habitat structure and composition).

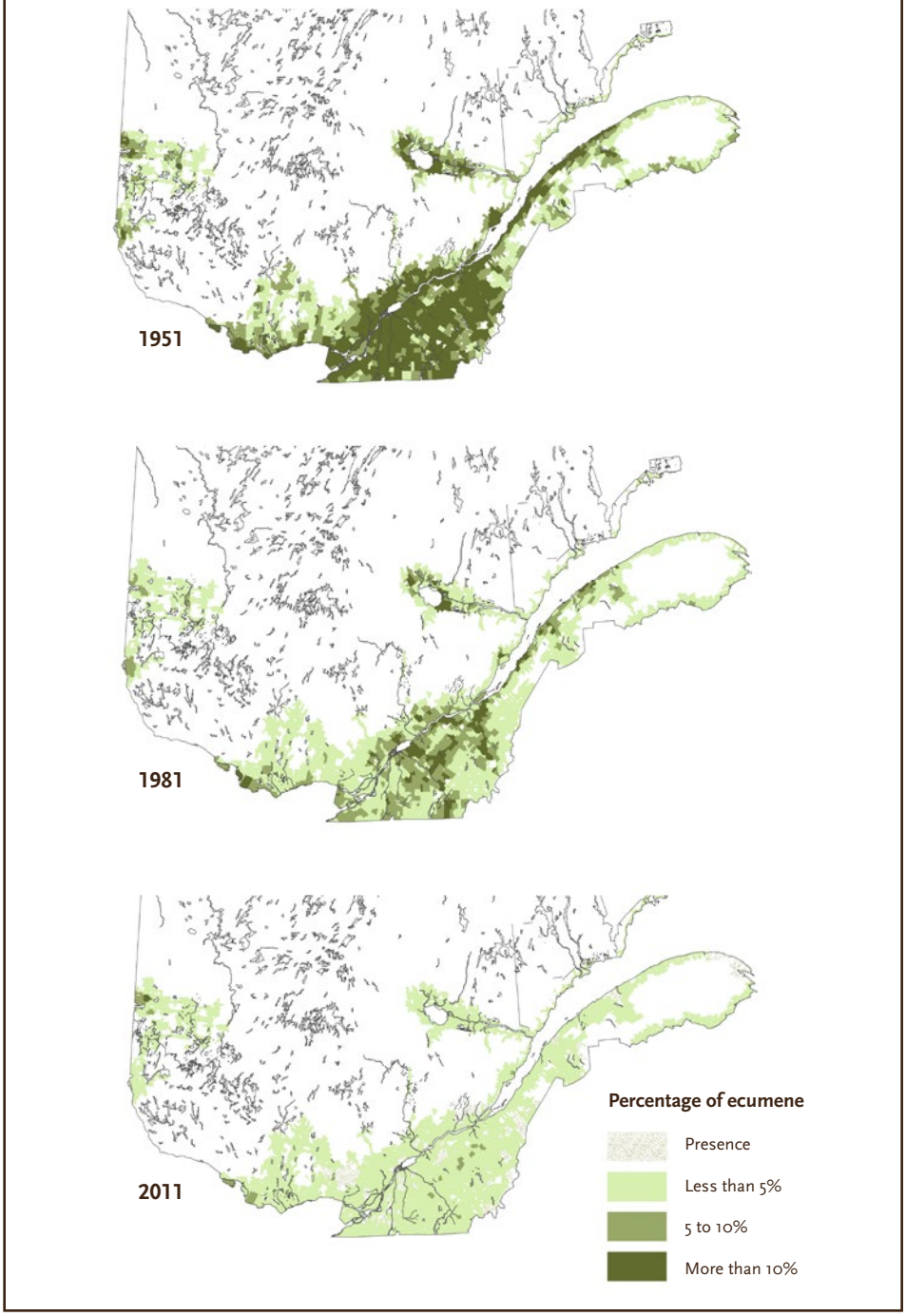
In the outskirts of Montréal, agricultural land is regularly targeted for real estate development. Intensive agriculture on the parcels that remain has led to the disappearance of numerous wildlife habitats.

© Alexandre Nicole

Dwindling crop diversity The homogenization of crops observed today stems from the fact that farms—heavily supported by agricultural policies and programs—have shifted toward a restricted number of types of production, the most extreme forms of which include factory farming and monoculture [8]. Likewise, pastures, which were an essential component of the traditional agricultural landscape, have contracted substantially over the past few decades [8]. Over 80% of pastureland disappeared following the conversion of dairy farms to grain farms and the introduction of factory farming (Figures 3 and 4). Simultaneously, a significant decline in the number of

fig. 3

Quebec Municipal Land Occupied by Seeded Pasture



SOURCE: J. RUIZ AND G. DOMON (2005)

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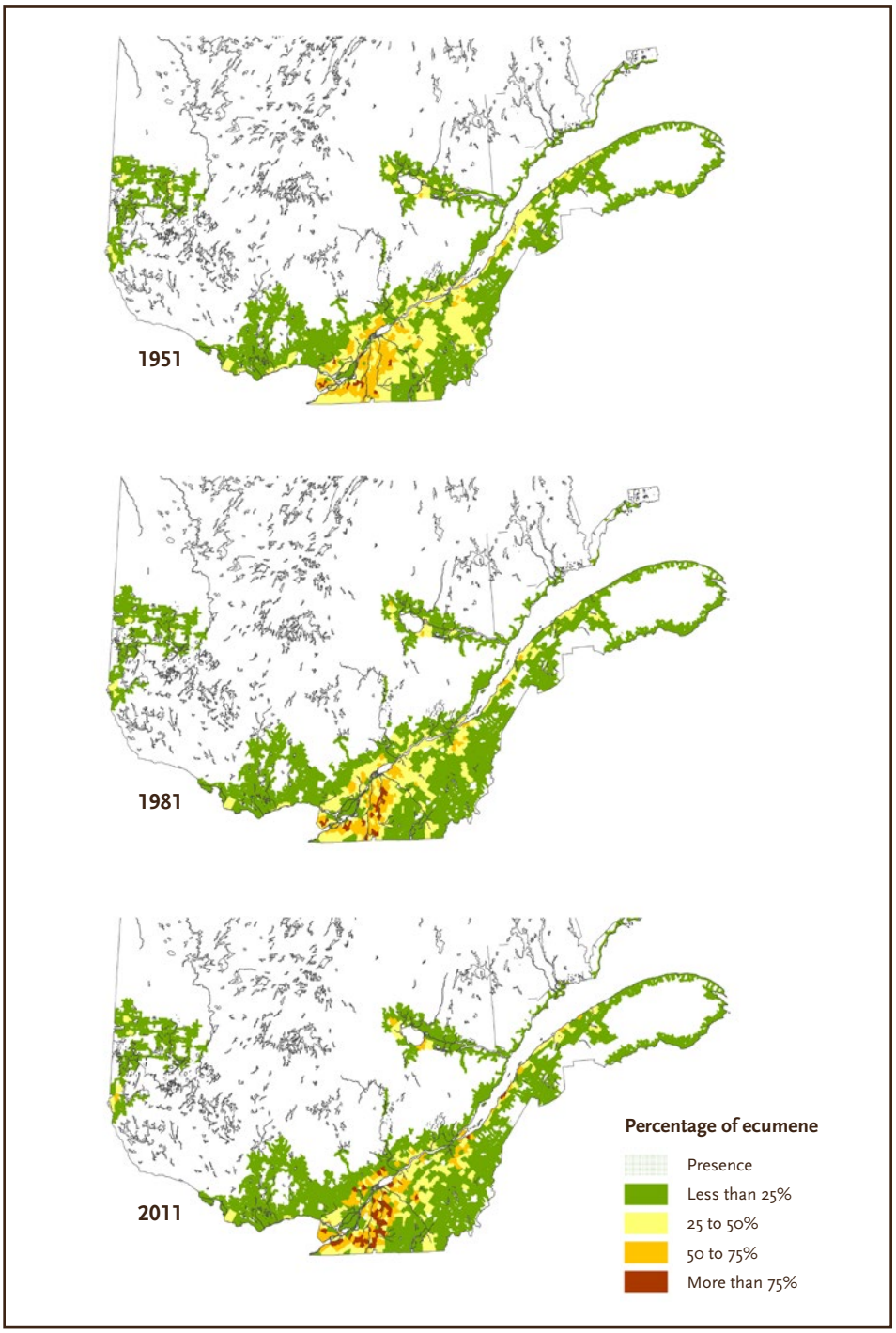


SOURCE: J. RUIZ AND G. DOMON (2005)

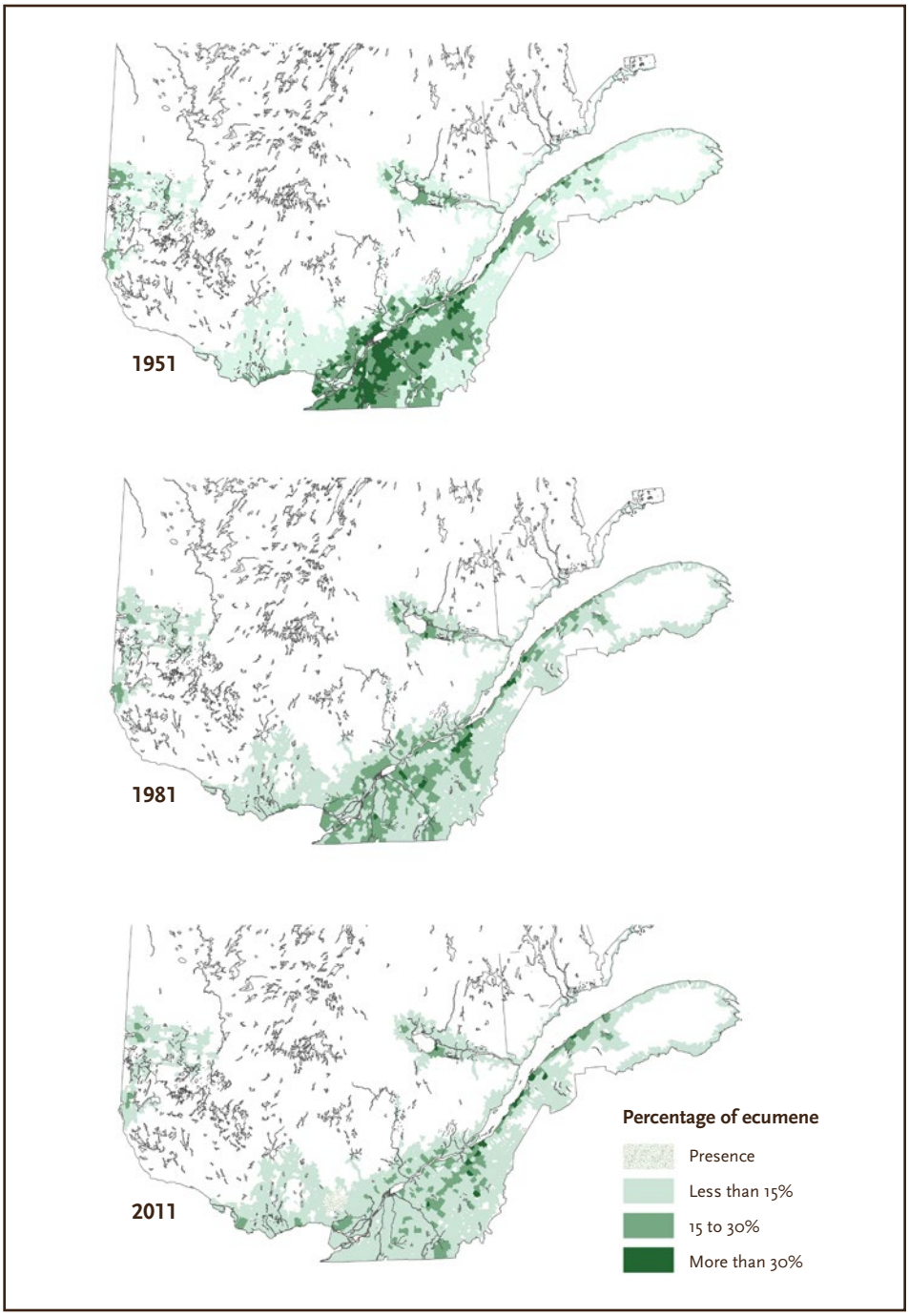
fig. 4

Cultivated Quebec Municipal Land

hayfields was observed throughout the province, including an almost complete disappearance from certain parts of southwestern Quebec [8] (Figure 5). However, pastures and meadows are considered to be the most productive habitats in terms of biodiversity. The latter have been replaced by commercial field crops, mainly grain corn and soybeans, both of which are undergoing rapid expansion (Figure 6) but support lower diversity [5, 12].

fig. 5

Quebec Municipal Land Occupied by Forage Crops



SOURCE: J. RUIZ AND G. DOMON (2005)

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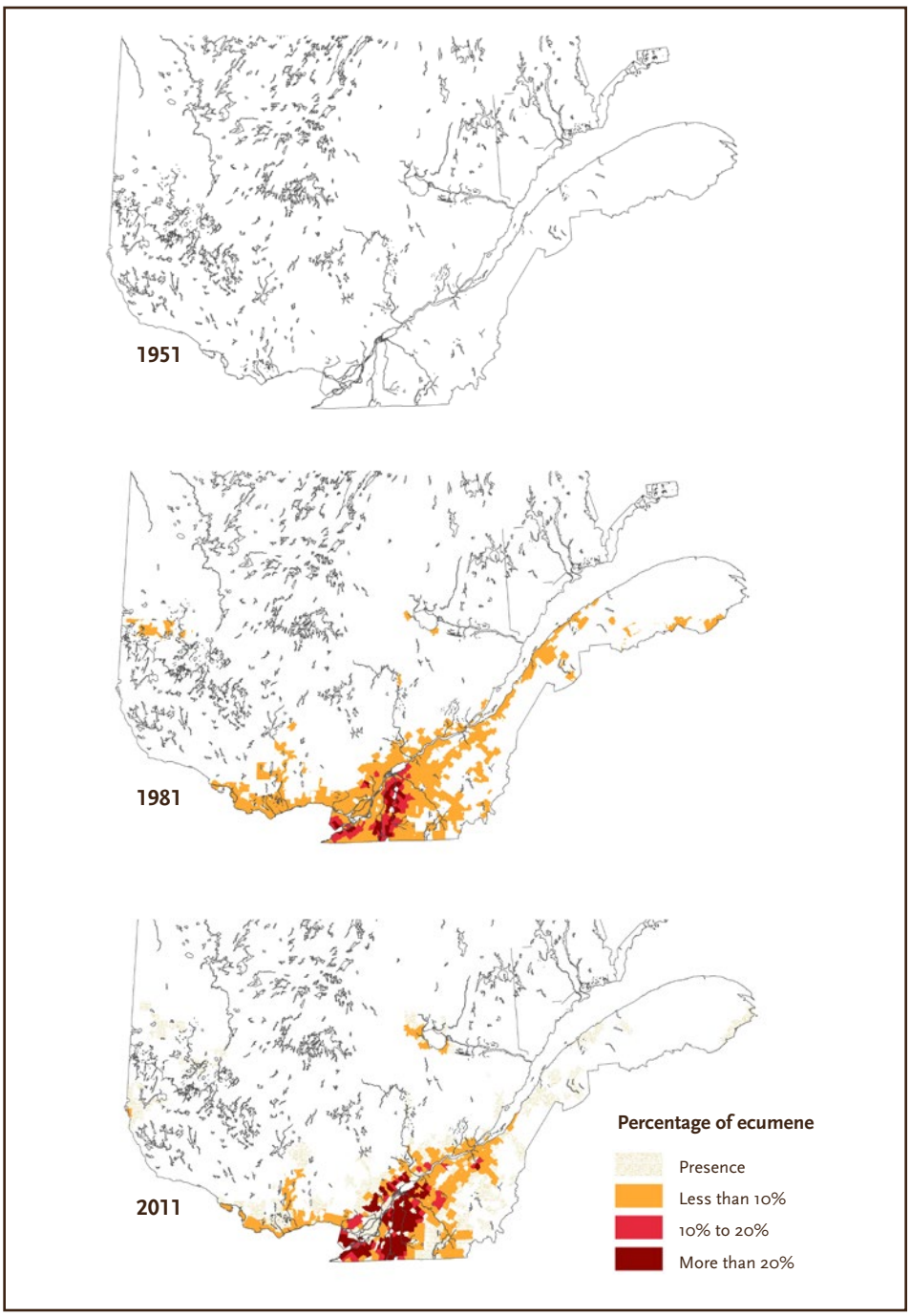
Maximization of crop acreage In parallel, the landscape has been greatly affected by the drive to maximize crop acreage, which notably translates into the loss of farm woodlots and numerous marginal habitats (hedges, solitary trees, snags, shrub thickets, diverse riparian areas, etc.) (Figure 7). This phenomenon has contributed to a decline in favourable habitats available to birds to nest and feed. Similarly, the realignment of watercourses, filling of ditches and drainage carried out to accelerate the conversion to cropland [13] played a role in the extensive loss of wetlands depended upon by a number of species.



SOURCE: J. RUIZ AND G. DOMON (2005)

fig. 6

Quebec Municipal Land Occupied by Grain Corn

The Vesper Sparrow is present in fields of annual and vegetable crops, pastureland and short-grass meadows. Excessive tilling, herbicide use and mowing of ditches can result in the destruction of its nest.

© David Trescak

Modification of anthropogenic structures Lastly, certain man-made structures such as stakes, barbed-wire fences, cribs, feeding stations, wooden silos or isolated farm buildings were removed from the fields, thereby reducing the number of elements available to birds as feeding, resting, nesting, display or lookout sites. Buildings become more concentrated and uniform as a function of the farm's specialty [8], which attracts species that are less desirable for owners such as the European Starling, House Sparrow and Rock Pigeon. Even changes in materials used for building construction or renovation can affect species that have adapted to traditional materials such as the Barn Swallow, whose clay nest will only adhere to porous surfaces.

fig. 7 **Like numerous other municipalities in southern Quebec, Saint-Marc-sur-Richelieu experienced significant changes within its jurisdiction between 1964 and 2006, e.g.: ❶ disappearance of isolated trees, ❷ disappearance of natural hedgerows, ❸ disappearance of woodlots, ❹ removal of field buildings, ❺ filling of ditches, ❻ realignment of watercourses, ❼ urban sprawl and ❽ concentration of farm buildings.**

PHOTOS: QUEBEC DEPARTMENT OF ENERGY AND NATURAL RESOURCES (1964, 2006),
AERIAL PHOTOS AND ORTHOPHOTOS, SAINT-MARC-SUR-RICHELIEU, GÉOBOUTIQUE QUÉBEC, QUEBEC.

CHANGING PRACTICES

It is now widely acknowledged that increasingly intensive agriculture has played a considerable role in changes in biodiversity, notably with regard to farmland birds. In this context, changing agricultural practices are believed to be accountable for 25 to 30% of the population shifts observed in a number of bird species in North America [14]. Likely contributing directly or indirectly to these trends are several aspects of modern farming techniques, examples of which are described below.

Mechanization of agricultural practices Amongst other impacts, the mechanization of agricultural activities (ploughing, seeding, spreading, harvesting) results in a significant loss of plant residue in the soil. Such residue, however, offers birds protective cover from predators and represents an important source of food and nest-building material [15]. The Vesper Sparrow, Horned Lark and Killdeer are particularly affected by this situation. Invertebrates, another food source, are also less abundant in fields devoid of plant residue. Additionally, modern and increasingly powerful machinery compacts the soil tremendously, making the ground less hospitable for invertebrates that birds feed upon.

“Every year, up to 1.2 million adult birds are believed to succumb to pesticides in Quebec.”

© Marc Lajoie, MAPAQ

Timing and frequency of field work With climate change and the development of cultivars suited to Quebec's climate, field activities are now being carried out at the same time as the peak nesting period for most farmland birds. However, many of these species nest on the ground, which makes them highly vulnerable to mechanized activities (mowing, ploughing, sowing, harvesting, etc.). In Canada, it is estimated that 500,000 adults are killed and 3.5 million nests destroyed annually by these activities [16]. Hay mowing and harvesting—now carried out up to four times a year in southern parts of the province—is believed to destroy large numbers of nests and nestlings [17]. In this specific case, the species most affected is believed to be the Bobolink, with 400,000 nestlings killed annually in the St. Lawrence Lowlands and Great Lakes regions [16]. Since farmland birds subsequently lack the time to lay a new clutch and fledge their young, their nesting success is incompatible with this cutting regime [18].

Pesticide use The use of pesticides and chemical fertilizers also has an impact on farmland birds. In Quebec, up to 1.2 million adult birds are believed to succumb to this threat every year [19]. Seed-eating birds ingest granular pesticides or treated seeds, notably neonicotinoids, while insectivorous species consume targeted pest insects and

Water-soluble, neonicotinoid residues can be found in ditches, watercourses and other wetlands, including puddles, at high enough concentrations to have an impact on species that frequent these places to drink.

© PleineTerre SENC

scavengers and predatory birds feed on contaminated prey. Pesticides are often applied during the bird nesting season. It is estimated that for every four adults killed, one nest (eggs and nestlings) is also lost, which would equate to an additional 2.2 million birds [19]. Water-soluble, neonicotinoid residues can be found in ditches, watercourses and other wetlands [20, 21], including puddles [22], at sufficient concentrations to have an impact on species that frequent these places to drink [23]. Added to this is a more complex problem for bird conservation, i.e. indirect mortality attributable to the loss of vegetation (herbicides) and invertebrates (insecticides) that makes these habitats unproductive for birds (loss of food resources, protective cover, etc.).

Livestock management Current livestock management practices also play a role in the demographic decline of Quebec's farmland birds. In fact, pastures and livestock attract more insects and aerial insectivores than any type of crop [24, 25]. However, since 1951, pastureland has shrunk by more than 80% following the conversion of these lands to annual crops and the advent of factory farming and the confinement of livestock [9]. The remaining land is often intensive pasture where the density of livestock and the ensuing overgrazing reduce plant cover while favouring nest predation—when the nests are not quite simply trampled over [26].

—

The high density of livestock in pastures leads to overgrazing, which reduces plant cover and favours nest predation – when the nests are not simply trampled over.

© David Gendron

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Population Trends and Statuses of Farmland Birds

Population trends Population changes in farmland birds triggered by the evolution of agricultural practices in recent decades can be observed both in Europe [27, 28] and North America [14]. Currently, farmland species are showing the most significant and most consistent declines of any bird group [29]. In fact, over 60% of farmland bird species show a statistically significant decline, while slightly less than one in every four forest species have experienced such a downward trend (Figure 8).

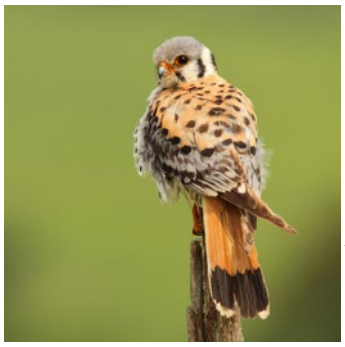

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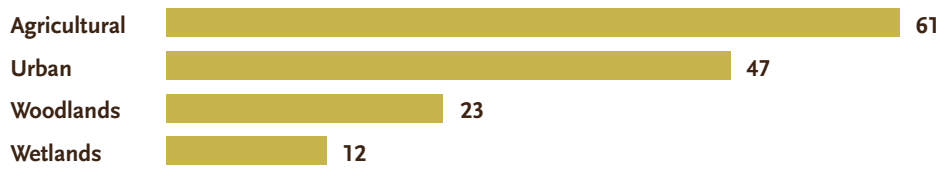
fig. 8 **Percentage of Bird Species Experiencing Significant Declines for Different Habitat Types**

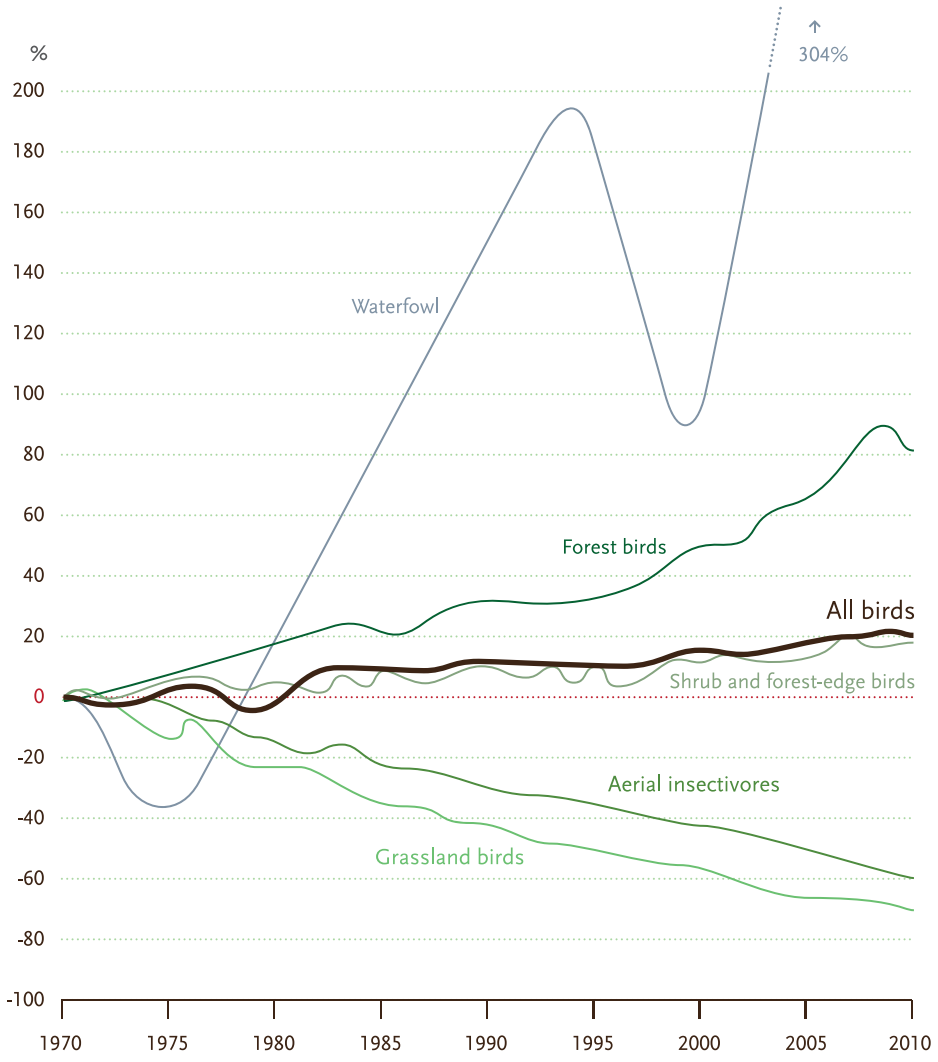


SOURCE: NORTH AMERICAN BREEDING BIRD SURVEY

In Canada, analysis of North American Breeding Bird Survey data collected between 1970 and 2010 reveals significant long-term declines in several species of farmland birds [30]. In the Lower Great Lakes–St. Lawrence region, it is the category of birds that has suffered the most pronounced declines (Figure 9).[1] A number of species are believed to have lost over half of their population in the past four decades.

fig. 9

Population Changes for Different Bird Groups for the Lower Great Lakes–St. Lawrence region from 1970 to 2010



SOURCE: NORTH AMERICAN BIRD CONSERVATION INITIATIVE (NABCI). 2012. ETAT DES POPULATIONS D'OISEAUX DU CANADA [AVAILABLE IN ENGLISH AS "STATE OF CANADA'S BIRDS"]. ENVIRONMENT CANADA, OTTAWA, CANADA. 36 PAGES

[1] In its species categories, the North American Breeding Bird Survey makes a distinction between aerial insectivores and farmland birds. In reality, a large number of species in this first category—swallows for instance—feed in fields. This is why the farmland bird category as defined herein includes both grassland birds and a significant portion of the aerial insectivores. Additionally, the authors also included in this definition bird species associated with shrub and forest-edge habitats that can be found in abandoned fields or in bockages, i.e. mixed woodland/pasture landscapes criss-crossed by hedgerows (natural windbreaks).

However, for the majority of these species, the declines have been growing more acute in recent years. In fact, in Quebec, for most grassland bird species, annual declines are more pronounced for the period 1989–2009 than for the period 1970–2009 (Table 1). Similarly, a comparison of the results of the first Quebec Breeding Bird Atlas (1984–1989) and the second Atlas (2010–2014) clearly indicate a contraction in the breeding range of several farmland species over a short period. This is the case for the Eastern Meadowlark, for example (Figure 10).

table 1 **Annual Population Trends (%) of selected Farmland Bird Species in Quebec according to the Breeding Bird Survey**

SPECIES	1970–2009	1989–2009*
Field Sparrow	-10.7	**-16.1**
Horned Lark	-8.9	**-14.1**
Bobolink	-6.1	**-6.3**
Eastern Meadowlark	-5.5	**-6.3**
Northern Harrier	-1.4	**-6.3**
Brown-headed Cowbird	-6.6	-6.2
Barn Swallow	-5.8	**-6.2**
American Kestrel	-1.5	**-6.2**
Upland Sandpiper	-0.5	**-5.7**
Killdeer	-3.7	**-5.5**
Savannah Sparrow	-3.6	**-5.1**
Tree Swallow	-0.8	**-4.2**
Vesper Sparrow	-7.8	-3.7
Eastern Kingbird	-1.8	**-3.5**

* Trends in bold indicate that the decline in this species has become more pronounced in recent years.

Despite being a brood parasite (the female lays her eggs in the nests of other species), the Brown-headed Cowbird is another farmland bird in decline.

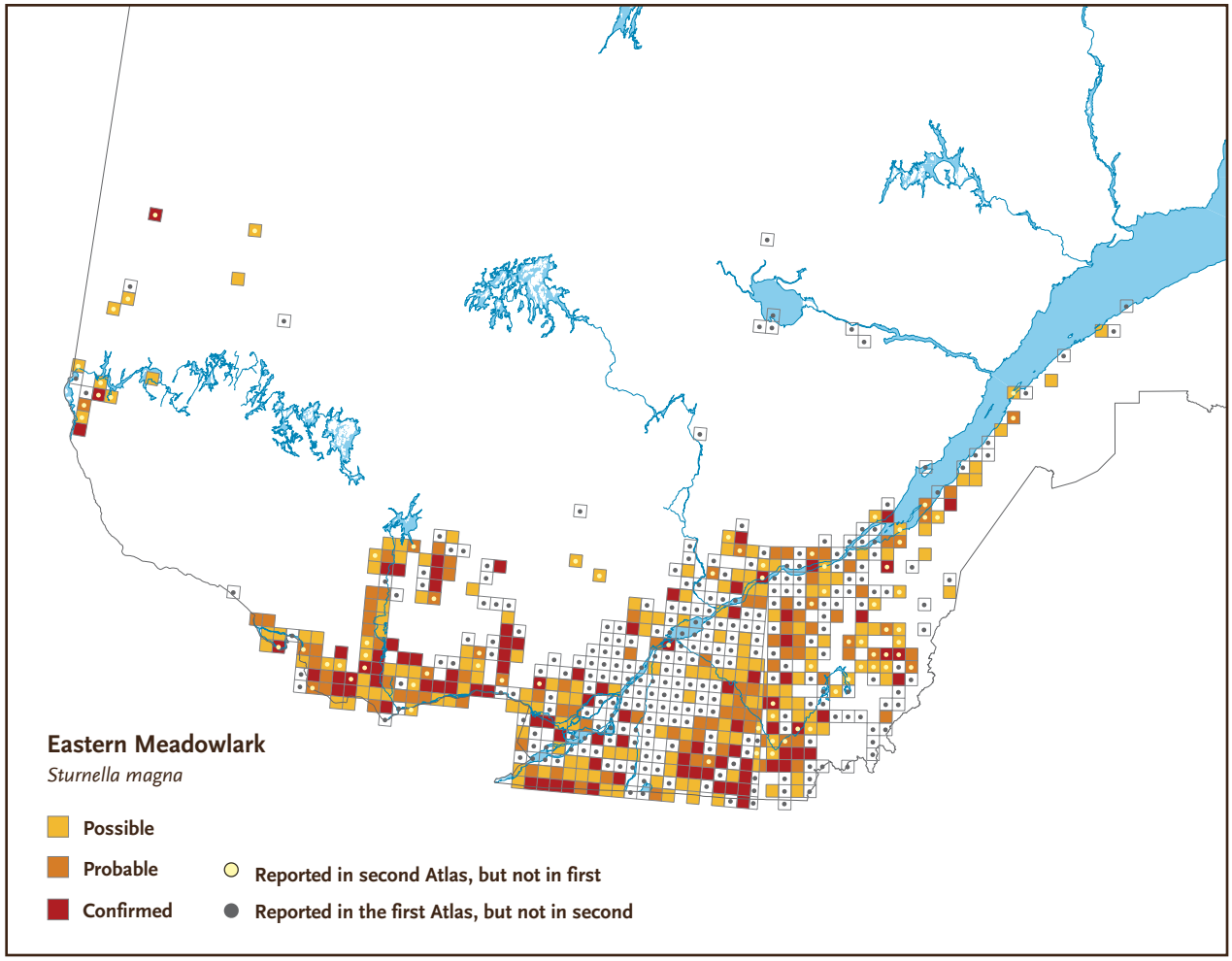
© David Trescak

—

Brown-headed Cowbird egg in a clutch belonging to a Red-winged Blackbird

© Alexandre Nicole

fig. 10 **Breeding Range of Eastern Meadowlark during the First Quebec Breeding Bird Atlas (1984-1989) compared to Second Atlas (2010-2014).** Parcels with a grey point indicate that the species was reported in the first Atlas but not in the second. The breeding range of this species associated with hayfields has retracted considerably in the past twenty years or so.



MAP: ANDREW COUTURIER, BIRD STUDIES CANADA

Statuses of farmland species Although comprising fewer species than other bird groups, the farmland bird category represents, relatively speaking, a large number of species at risk in the province. In fact, a dozen or so species have obtained or are in the process of obtaining special status at the provincial and/or federal level (Table 2). Of these, approximately half have obtained such status in the past four years, which underscores the seriousness of the increasingly pronounced declines. These include two emblematic species of the agricultural landscape that were once common and the population declines of which are clearly observable: the Bobolink and the Barn Swallow. Indeed, after being designated "Threatened" in 2010 and 2011 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), both these species were listed under the *Species at Risk Act* (SARA) in the fall of 2017. These two examples clearly demonstrate the precarious character of farmland birds, regardless of their abundance.

table 2 **Farmland Bird Species at Risk (or candidates)**

AT RISK FARMLAND SPECIES (OR CANDIDATES)	COSEWIC*	SARA*	ARTVS*
American Kestrel	Candidate for Assessment	None	None
Barn Owl	**Endangered** (2010)	**Endangered**	**LDTV***
Barn Swallow	**Threatened** (2011)	**Threatened**	None
Bobolink	**Threatened** (2010)	**Threatened**	None
Eastern Meadowlark	**Threatened** (2011)	**Threatened**	None
Field Sparrow	Candidate for Assessment	None	None
Golden-winged Warbler	**Threatened** (2006)	**Threatened**	**LDTV**
Grasshopper Sparrow	**Special Concern** (2013)	**Special Concern**	**LDTV**
Killdeer	Candidate for Assessment	None	None
Loggerhead Shrike	**Endangered** (2000)	**Endangered**	**Threatened**
Nelson's Sparrow	Not at Risk (1998)	None	**LDTV**
Sedge Wren	Not at Risk (1993)	None	**LDTV**
Short-eared Owl	**Special Concern** (2012)	**Special Concern**	**LDTV**

* **COSEWIC**: Committee on the Status of Endangered Wildlife in Canada; **SARA**: Canadian *Species at Risk Act*; **ARTVS**: *Quebec Act Respecting Threatened or Vulnerable Species*; **LDTV**: Likely to be designated as threatened or vulnerable. At the federal level, species evaluated by the COSEWIC are not legally protected until they are listed under SARA.

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iv

Ecosystem Services and Economic Impacts

© Chenda Duong

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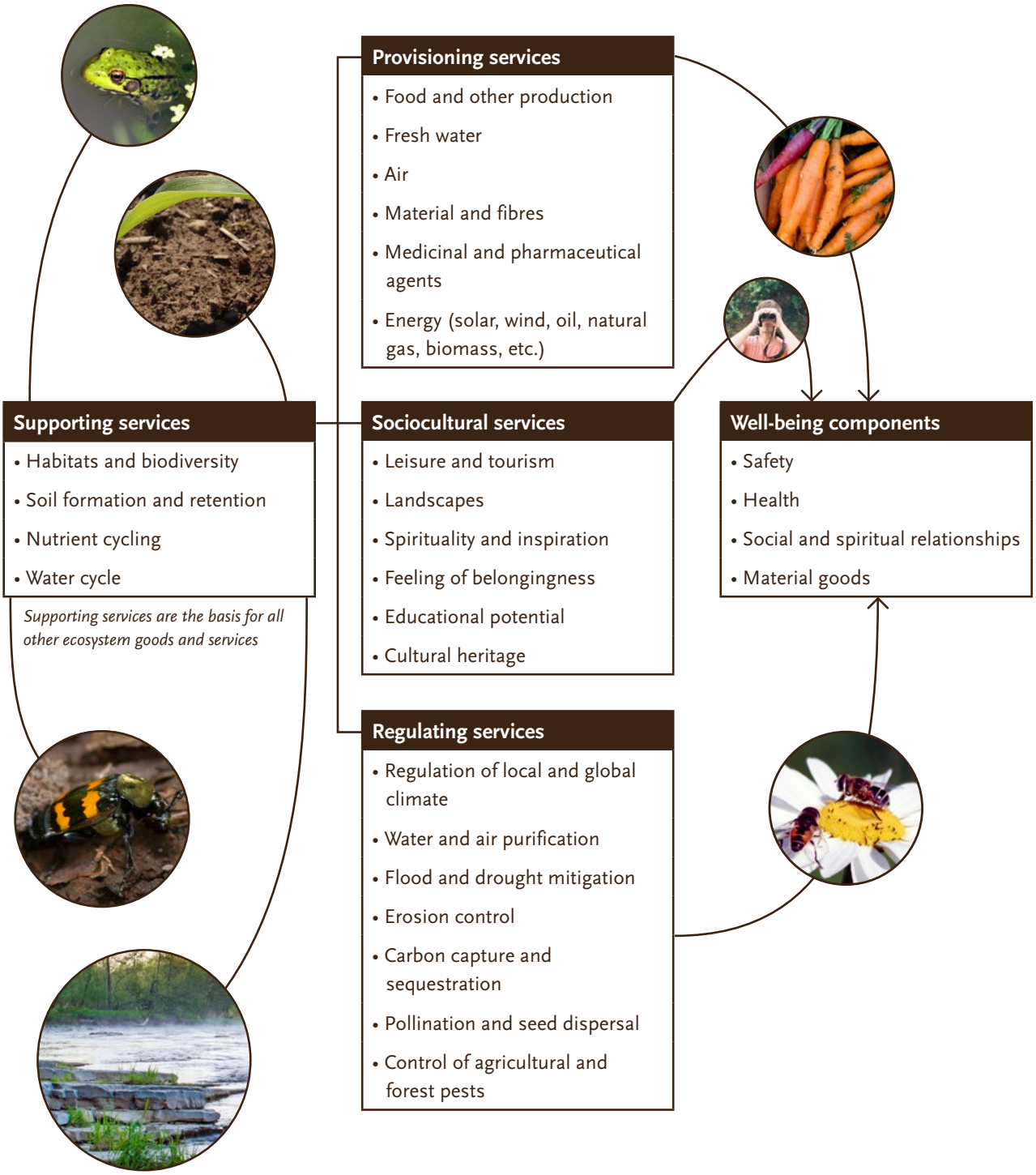
ECOSYSTEM SERVICES

Ecosystem services represent all material and non-material benefits that humans obtain from ecosystem functions. There are four categories of ecosystem services: supporting, regulating, provisioning and sociocultural [31]. Supporting services underlie the functioning of all ecosystem goods and services (Figure 11). The impact of supporting services is indirect or takes place over a very long period compared to other services whose impact is relatively direct and short term [31]. Regulating services relate to the ability of ecosystems to sustain themselves in favourable conditions for human life and to control certain hazardous phenomena [32]. Provisioning services provide goods that humans can consume or use to meet their needs with regard to well-being, shelter, leisure, etc. [32]. Lastly, sociocultural services provide non-material benefits. These intangible services include the pleasure derived from recreational or cultural activities, spiritual experiences as well as the pedagogical value of nature [32]. In agricultural regions, birds can directly contribute to any of these last three categories of services.

fig. 11 **Ecosystem Services**



ORIGINAL FIGURE: Regional conference of representatives (CRÉ), Montérégie Est, 2014. Biens et services écologiques en Montérégie Est – Un capital naturel essentiel au développement des collectivités. McMasterville, Quebec, 30 p. Which in turn was based on: MEA BOARD – MILLENNIUM ECOSYSTEM ASSESSMENT BOARD. "Ecosystems and Human Well-Being: Biodiversity Synthesis", World Resources Institute, Washington, D.C., 2005, 100 p. [online].

PHOTOS: **Frog** © Stéphane Lamoureux, **Soil** © PleineTerre SENC, **Burying beetle** © Suzanne Labbé, **River** © Martin Joly, **Carrots** © Ludovic Beauregard, **Birdwatcher** © Sophia Hobohm, **Bees** © Alexandre Nicole

Regulating services The services that birds provide to humans fall especially into the regulating category. Birds are excellent natural allies for agriculture. The diets of farmland birds vary from one species to another, but many of them are insectivores. When nesting and raising their young, most farmland birds feed on insects, regardless of what their diet consists of the rest of the year. It is interesting to note that birds tend to feed more on pest insects while avoiding natural enemy species [33]. They therefore consume insects that are harmful to crops and humans. Thanks to the elimination of these pests, farmers can reduce their use of insecticides while at the same time enjoying significant savings associated with their purchase and application. For example, it is estimated that up to 130,000 insects/day could be naturally eliminated in fields in proximity to natural hedgerows with high bird densities (158 individuals/ha) [33]. Likewise, seed-eating birds also provide a service in agricultural regions by consuming weed seeds [34], thereby reducing their propagation and the need for herbicides.

Birds also contribute to another regulating service: pollination. Though not to the same extent as insect pollinators, certain bird species can also help pollinate plants. For example, when feeding on larvae in fruit-bearing trees and bushes, birds carry in their feathers a few pollen grains to other flowers. Additionally, the Ruby-throated Hummingbird feeds on the nectar of a number of legumes, thereby fulfilling the same role as a pollinating insect.

Provisioning services Some bird species that make use of agricultural areas are consumed by humans, thus contributing to an important provisioning service for many families in Quebec. In fact, though not necessarily considered farmland birds, a few species of waterfowl (geese, ducks, teal, etc.) use agricultural areas during migration, where they may be hunted. Other game species such as American Woodcock and Wild Turkey regularly nest in agricultural areas, while Grey Partridge breeds exclusively in such habitats.

The Snow Goose has experienced exceptional population growth, increasing from several thousand individuals in the 1930s to one million in 1999. Consequently, the Snow Goose has been designated an "overabundant" species.

© France Paré

Approximately 1.5 million people in Quebec have an interest in birds and birdwatching represents one of the most important leisure activities in the province. Birding trip in farmland habitat, Sainte-Anne-de-Sorel.

© Alexandre Nicole

Sociocultural services Farmland birds also offer humans a significant sociocultural service in the form of recreational birdwatching. In fact, 1.5 million people in Quebec have an interest in birds [(35)] and birdwatching represents one of the most important leisure activities in the province. Likewise, numerous bird enthusiasts and wildlife photographers frequent rural areas throughout the year in search of farmland birds including certain emblematic species such as the Bobolink or the Barn Swallow, which are increasingly uncommon.

Services related to the presence of bird-friendly habitats It is also important to mention that if measures are taken to develop and maintain the types of habitats favoured by farmland birds, these habitats can provide a multitude of services for surrounding communities. For example, establishing high-diversity riparian areas composed of shrubs or hedges directly or indirectly results in numerous regulating (erosion control, carbon capture and sequestration, pollination, air and water purification, etc.), sociocultural (landscape, cultural heritage, etc.) and provisioning (food, materials and fibres, energy, medicinal compounds, etc.) services, depending on the species used.

ECONOMIC IMPACTS

Birds considered to be harmful or undesirable in agricultural areas such as blackbirds (Red-winged Blackbird, European Starling, etc.) or introduced and/or feral species (House Sparrow, Rock Pigeon) are not defined as farmland species—with the exception of the Grey Partridge—but rather as generalist species that frequent a variety of habitats. In the same regard, certain species of waterfowl (Canada Goose, Snow

Goose), which may make heavy use of agricultural areas during migration, are not considered farmland species. Thus, on the whole, farmland birds do not generally pose a significant risk for crops and, consequently, are rarely considered to be problematic.

The majority of farmland birds are insectivores during the breeding season. They therefore play a certain role in the biological control of insect pests, although it is currently impossible to measure their impact due to the limited number of studies conducted in this regard [33]. Fostering a better co-existence of agricultural practices and farmland birds is thus desirable, especially since promoting their presence is most often straightforward, low maintenance and inexpensive, and in certain cases can even be profitable for farmers.

In fact, although modifying agricultural practices or implementing habitat management projects can result in certain expenses, in general farmers ultimately benefit from measures put into place to promote farmland bird conservation. For example, direct seeding can generate substantial savings in terms of crop-related activities (reduced fuel/fertilizer use) while providing birds access to protective cover from predators, nest-building material and food thanks to the plant residues left in place. Furthermore, leaving a permanent plant cover increases the soil's ability to resist drought, acidification and water/wind erosion, all of which are considerable economic and agronomic benefits for farmers.

The majority of farmland birds are insectivores during the breeding season and thus play a role in the biological control of insect pests.

© Michèle Amyot

V

Recommendations

For the purposes of this guide, eight agricultural habitats were established, each of which corresponds to a chapter herein as outlined below:

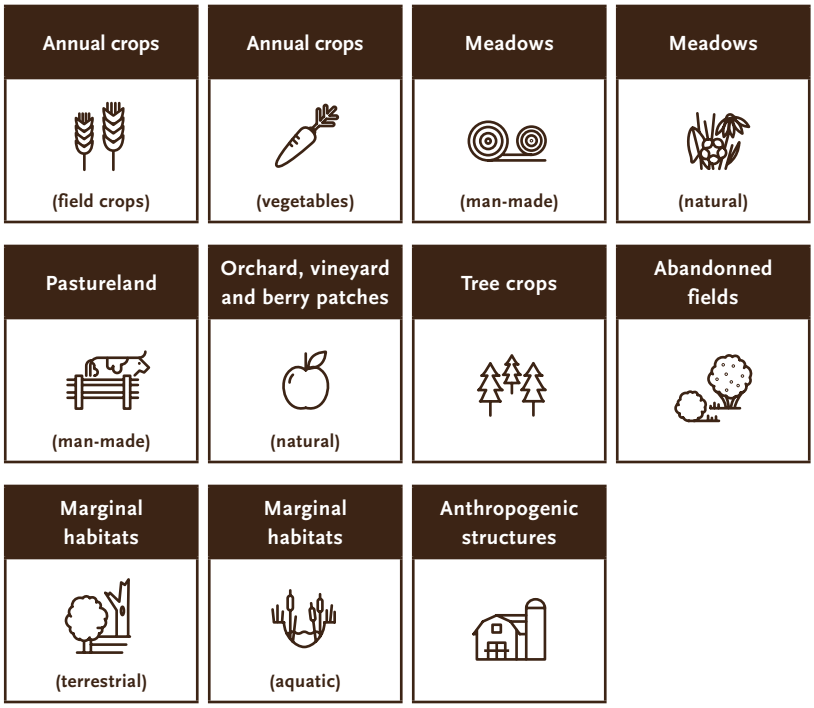
CHAPTERS	RECOMMENDATIONS (NUMBER)	PAGES
1. Annual Crops	8	37–52
2. Meadows	15	53–80
3. Pastureland	5	77–92
4. Orchards, Vineyards and Berry Patches	4	93–106
5. Tree crops	5	107–118
6. Abandoned Farmland	5	119–132
7. Marginal Habitats	7	133–152
8. Anthropogenic Structures	6	153–170

© Martin Joly

Content of "Habitat" chapters Each chapter first presents a brief description of the habitat as defined herein, as well as findings with regard to the farmland species associated with this habitat. For reference purposes, examples of species typically associated with the habitat are presented. Additionally, a series of recommendations was developed for each habitat. These recommendations are detailed one by one on the following pages. It should be noted that, in each chapter, other recommendations are also identified that can apply to this habitat, but are mainly associated with another habitat (Figure 12). Consequently, these other recommendations are detailed in a different chapter. The number of the recommendation corresponds to the number of the chapter with which it is associated (e.g. "Recommendation 4.3: Attract birds of prey" is detailed in Chapter 4).

fig. 12

Symbols Used to Designate Habitats Targeted by Recommendations



Content of "Recommendation" sheets Each sheet presents the habitats targeted by the recommendation (Figure 12), a brief description thereof, as well as the associated wildlife objectives. Tips for implementing the recommendation or suggestions to go further are also proposed so that each farmer has access to solutions that are applicable to his or her operations. Additionally, a number of agronomic, economic and/or emotional arguments have been identified as motivations to adopt each of the recommendations. Lastly, a cost rating and a benefit rating for birds were established as guidelines (see symbols in margin).

Cost rating:

low to high

Benefit rating:

+ (low) to +++ (high)

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1

ANNUAL CROPS

KILLDEER

Charadrius vociferus

STATUS

Candidate for Assessment (COSEWIC)

VARIATION FROM 1970 TO 2015

-87.3% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Killdeer nests and forages on the bare ground in vegetable and grain fields, as well as in pastures and lowgrass meadows. It feeds on large insects and occasionally small vertebrates.

THREATS

Reduction of cover due to herbicide use and tillage increases the risks of predation. Operating machinery and a heavy presence of livestock can disturb or destroy a clutch. Pesticide use can intoxicate Killdeer if the latter ingest contaminated prey.

ANNUAL CROPS

1

Description of habitat Annual crops are those that must be sown every year and include field crops such as corn, soy, wheat, barley, etc. The same holds true for vegetable crops. Herbaceous berry crops, notably strawberries, are also included in this category even if they do not have to be planted every year. Annual crops are traditionally grown on bare ground.

Habitat-specific findings Species diversity is generally considerably lower in annual crops than in meadows and pastures, as the more homogeneous habitat offered by annual crops is a poorer substitute for the natural habitats of the species that frequent it [36]. Nevertheless, a number of species have adapted to this habitat in the breeding season by nesting directly on the ground. Moreover, this environment offers an important feeding ground in winter for certain year-round residents (Horned Lark, Grey Partridge) or visitors from the North (Snowy Owl, Snow Bunting). These species feed on grain and seeds left on the ground, or, in the case of the Snowy Owl, species that consume them [1].

Soybean field, Montérégie region

© Stéphane Lamoureux

This type of crop requires various field operations involving frequent use of machinery (e.g. ploughing, weeding, seeding, spreading, spraying, etc.). Such activities have an impact on nesting birds, as the approach and passing of machinery can disturb or even destroy clutches [15].

SPECIES ASSOCIATED

- Grey Partridge
- Horned Lark
- Killdeer
- Vesper Sparrow
- etc.

Generally speaking, tillage reduces vegetative cover, which in turn increases the risks of predation of birds and their clutches, reduces the availability of nest-building material and reduces the availability of food sources (plants or invertebrates) [37]. Moreover, pesticides are commonly used to ensure that the presence of insects or weeds does not affect crop yields. However, the period of application—for corn or soybeans for instance–runs from May to June, which coincides with the nesting period for a number of species. Consequently, birds risk intoxication if they ingest contaminated prey or accidentally consume granules or coated seeds [38]. This phenomenon is most frequently observed within a 19-metre wide strip adjacent to field edges where farm equipment, when making turns, applies larger doses of pesticides [39].

Tillage reduces vegetative cover, which in turn increases the risks of predation of birds and their clutches, reduces the availability of nest-building material and reduces the availability of food sources. Below, weeding of yellow onions in Lanaudière.

© Ludovic Beauregard

RECOMMENDATIONS

1.1 Use pesticides rationally
1.2 Adopt reduced-tillage and direct-seeding practices
1.3 Avoid seeding while rounding field corners
1.4 Interrupt spreading/spraying when making turns
1.5 Maintain a pesticide-free strip
1.6 Plant rows of sunflower amid primary crop
1.7 Adapt ploughing period
1.8 Grow winter grains

OTHER RECOMMENDATIONS

2.5 Use a flusing bar mounted to the front of machinery
4.1 Practise integrated pest management
4.2 Plant native fruit-bearing trees and berry bushes as "diversions"
4.3 Attract birds of prey
5.2 Adapt fertilizer use
7.1 Conserve vegetation in existing marginal habitats
7.2 Plant isolated trees
7.3 Establish high-diversity hedgerows
7.4 Develop/enhance riparian areas
7.5 Delay mowing ditches until after nesting period
7.6 Manage drainage ditches to be suitable for wildlife
7.7 Create/enhance ponds
8.1 Plant cedar stakes for use as perches
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.5 Encourage Barn Swallow nesting
8.6 Maintain isolated buildings and other structures

HORNED LARK
Eremophila alpestris

STATUS
None

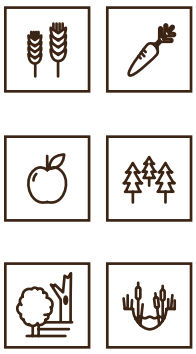
VARIATION FROM 1970 TO 2015
-97.1% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC
Year-round resident, breeder: The Horned Lark uses primarily grain/vegetable fields, pastures and lowgrass meadows as habitat both during the breeding season and in winter. The Horned Lark feeds on seeds lying on the ground, as well as insects during the reproduction period. In winter the species can often be observed on roadsides.

THREATS
As the Horned Lark nests on the ground, reduced ground cover due to herbicide use and tillage favours nest predation and reduces the availability of nest-building material. Operating machinery can disturb or simply destroy a clutch. Further, the Horned Lark can be intoxicated if it ingests pesticides or fertilizers.

1.1 USE PESTICIDES RATIONALLY

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Reduce the use of pesticides or use more natural methods to control crop pests, for example by attracting natural enemies of such pests, whether they be birds, parasitoids or other wildlife species [37].

WILDLIFE OBJECTIVES

- Limit the intoxication of birds exposed to pesticides or that consume them in the form of granules or contaminated prey [38];
- Avoid rendering the area unproductive for birds as a result of loss of vegetation (food, shelter) or reduced abundance of insects (food) [40, 41, 42].

TIPS

- Apply pesticides only if necessary, i.e. when pests are detected in significant numbers in surveys;
- Follow the recommendations in the Quebec Plant Protection Warning Network (RAP);
- Use anti-drift nozzles and avoid spraying in strong winds to lessen the risk of product drift;
- Maintain pesticide-free areas around field perimeters, which are used more heavily by birds (*see Recommendation 1.5*);
- Interrupt spreading/spraying when making turns (*see Recommendation 1.4*).

MOTIVATIONS

- Cost savings;
- Healthy and safe workplace;
- Lower health risks for humans.

Reduced cover due to herbicide use and tillage contributes to nest predation of species such as the Horned Lark and reduces the availability of nest-building material. © Mike Allen, Marcel Gauthier

1.2 ADOPT LOW-TILLAGE AND DIRECT-SEEDING PRACTICES

DESCRIPTION

Implement reduced tillage in order to reduce or avoid all soil preparation activities (ploughing, weeding, harrowing) and practise direct seeding of new crops into the crop residues of the previous year to offer superior quality habitat for farmland birds [37].

WILDLIFE OBJECTIVES

- Increase bird species density and diversity [43; 44; 45];
- Reduce the disturbance or destruction of nests caused by operating machinery [15];
- Increase the availability of nest-building material [37];
- Provide protective cover against predators (camouflage) [37];
- Provide food sources for wintering or migratory species [1].

Target Habitat(s)

Costs & Benefits

In addition to soil-related benefits, direct seeding increases protective cover against predators and the availability of nest-building material.

© Groupe ProConseil

TIPS

- Consult with an expert agronomist when implementing this practice;
- Establish experimental parcels if this practice has never been tested by the farmer;
- Increase annually the acreage designated for direct seeding;
- Encourage neighbouring farmers to implement this method in an effort to create a significant, unfragmented network of quality habitats;
- Use green manure crops as a complement to other techniques in order to offer superior protective cover from predators.

MOTIVATIONS

- Increasingly used practice recognized for its agronomic, economic and environmental benefits [46, 47];
- Time and labour savings [48];
- Reduced fuel/fertilizer use [48];
- Cost reductions for the purchase, operation and maintenance of machinery [48];
- Reduced wear and tear on machinery [48];
- Reduced soil compaction [48];
- Conservation of the fine soil fraction and organic matter in the soil matrix [49];
- Increased soil productivity [50];
- Moisture retention [50];
- Improved soil resistance against drought, acidification and water/wind erosion [48].

The Grey Partridge enjoys greater food availability in winter thanks to the direct-seeding technique. © Alain Daigle

1.3 AVOID SEEDING WHILE ROUNDING FIELD CORNERS

DESCRIPTION

Avoid seeding while rounding field corners by opting for an angular seeding pattern (Figure 1-1), which lowers the risk of contaminating birds [51].

WILDLIFE OBJECTIVES

- Ensure that pesticide-coated seeds do not accumulate at field edges after farm equipment has passed [39];
- Reduce mortality rates by intoxication of birds having ingested seeds on the ground [38].

TIPS

- Avoid raising the seed drill too quickly to prevent seeds from ending up on the ground surface where they will be accessible;
- Ensure that seeds are adequately drilled into the soil;
- Avoid using coated seeds (neonicotinoids);
- Install deflectors on pneumatic seed drills to reduce the spread of neonicotinoids;
- Carry out other work involving chemicals (spraying, fertilization, etc.) according to the same pattern (*see Recommendation 1.4*).

MOTIVATIONS

- Reduce fertilizer and pesticide costs by using less of them;
- Application easy and not overly demanding;
- No additional cost to apply this alternative with respect to the rounded-corner seeding method;
- Reduced seed losses, allowing for modest cost savings;
- Easier manoeuvring of machinery;
- Current technology conducive to accurate geopositioning;
- Less compaction in headlands (turn strips);
- Straighter and more uniform sowing;
- Satisfaction of knowing that all field corners are seeded;
- Pride associated with having a beautiful field.

NOTE *In addition to being harmful to pollinating insects, the neonicotinoids present in coated seeds have an impact on birds that drink contaminated water. It is therfore strongly recommended to avoid using these types of seeds.*

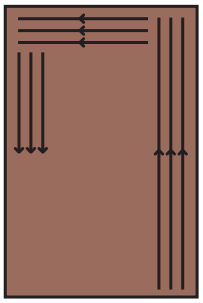
Target Habitat(s)

Costs & Benefits ++

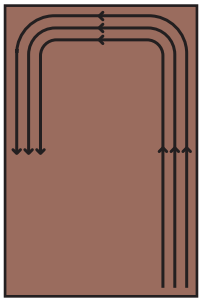
fig. 1-1

Seeding Patterns

A Angular-corner



X Rounded-corner



1.4 INTERRUPT SPREADING/SPRAYING WHEN MAKING TURNS

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Interrupt spreading/spraying of fertilizers and pesticides when making turns in order to avoid an over-accumulation of these chemicals at field edges [37].

WILDLIFE OBJECTIVES

- Limit the intoxication of birds exposed to pesticides or that consume them either in the form of granules or indirectly via contaminated prey [38, 52, 53];
- Preserve a certain structural complexity in plant communities in edge habitats to increase the amount of food available [40, 41, 42] and lower the risk of predation [36].

TIPS

- Avoid spreading or spraying in high winds in order to minimize the risk of drift in marginal habitats [37];
- Practise angular seeding in field corners so that work involving chemical inputs can be carried out according to the same pattern (*see Recommendation 1.3*);
- Maintain pesticide-free areas around field perimeters, which are used more heavily by birds (*see Recommendation 1.5*).

MOTIVATIONS

- Cost savings related to the purchase of fertilizers and pesticides;
- No cost to implement;
- Simple application.

Since tractors must slow down when making turns, pesticides are applied in greater quantities at these locations.

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1.5 MAINTAIN A PESTICIDE-FREE STRIP

DESCRIPTION

Maintain a 20 m wide pesticide-free strip around the perimeters of annual crop fields, which corresponds to the peripheral area most heavily used by birds in this type of habitat [39, 54, 55, 56].

WILDLIFE OBJECTIVES

- Limit the intoxication of exposed birds that can accidentally ingest pesticides or contaminated prey [38, 52, 53];
- Preserve a certain structural complexity in plant communities in edge habitats to increase available food sources [40, 41, 42] and lower the risk of predation [36].

TIPS

- Conserve a strip around field edges, which are more heavily used by birds compared to other cultivated areas due to the proximity of marginal habitats (ditches, shrubby edge habitats, streams, etc.);
- Consider applying this method first to just one side of the field (Figure 1-2), notably the transversal (shorter) sides or those running parallel to a watercourse (outlet or stream);
- If less burdensome to do so, start with a narrower strip (5-10 metres);
- Try to opt for a 20 m strip on one side rather than a narrower strip around the entire field perimeter, as for a given surface a wider strip will support greater biodiversity.

MOTIVATIONS

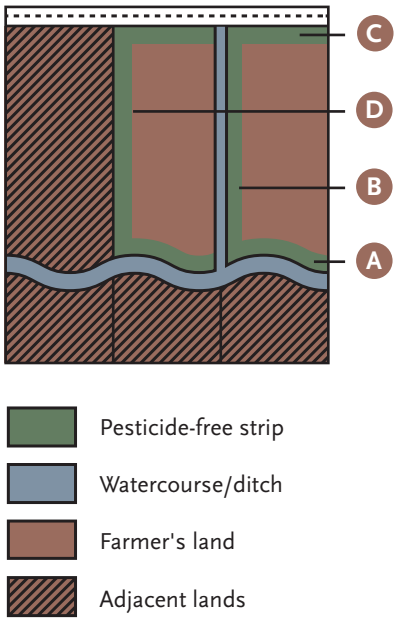
- Cost savings related to the purchase of pesticides and fuel;
- Reduced health risks;
- Very low risk of pesticide drift;
- Water erosion control;
- Regulation of pesticide and fertilizer runoff;
- Attraction of pollinators;
- Attraction of natural enemies of crop pests;
- Easier to avoid encroaching on riparian areas.

Target Habitat(s)

Costs & Benefits

fig. 1-2 **Options for Establishing a Pesticide-free Strip, from Most to Least Strategic:**

A in proximity to a watercourse;
B in proximity to an agricultural ditch;
C near a road right-of-way;
D along an adjacent field.



1.6 PLANT ROWS OF SUNFLOWER AMID PRIMARY CROP

Target Habitat(s)

Costs & Benefits

+

DESCRIPTION

Plant rows of sunflower at field edges or between rows of vegetable crops in order to attract birds that are natural enemies of insect pests and thereby reduce crop damage [57].

WILDLIFE OBJECTIVES

- Attract aerial insect-eating birds, which are natural enemies of crop pests [57];
- Create perches for bird species that are natural enemies of crop pests or other farmland species that nest in such habitats [1];
- Limit the intoxication of birds exposed to pesticides or that consume them in the form of granules or contaminated prey..

TIPS

- Implement this recommendation by initially planting sunflowers at the edge of a field;
- Strive to plant rows oriented perpendicular to the prevailing winds in order to protect crops;
- Use the sunflower seed harvested in order to diversify production (bird seed, sunflower oil, etc.).

MOTIVATIONS

- Simple and easy to apply;
- Clearly observable beneficial impact on birds;
- Attract natural enemies of crop pests;
- Lower production losses;
- Crop protection;
- Opportunity to diversify product variety;
- Reduced pesticide use (cost, time, health);
- Visual appreciation of this landscape element.

Planting sunflower at field edges is an excellent way to test this recommendation, as in the case of this farm in the Matapédia Valley.

© Paul-Claude Bérubé

1.7 ADAPT PLOUGHING PERIOD

DESCRIPTION

If possible, plough crop fields before late April for spring ploughing and after harvesting for fall ploughing in order to avoid the peak use period by birds [37].

WILDLIFE OBJECTIVES

- Reduce the disturbance or destruction of nests caused by operating machinery [15];
- Provide food sources to wintering or migratory species when fields are ploughed in spring following a fall harvest [1].

TIPS

- Favour fall ploughing, which poses less of a conflict for nesting than spring ploughing;
- If spring ploughing is necessary and if weather conditions allow, schedule for the dates proposed (before late April);
- Consider adopting low-tillage and direct-seeding practices (see *Recommendation 1.2*).

MOTIVATIONS

- Easy to schedule non-conflicting dates;
- Current period for carrying out these activities already mostly compatible with bird nesting.

Target Habitat(s)

Costs & Benefits

+

Fall ploughing is more compatible with birds than spring ploughing, particularly for the Killdeer, which nests in early spring, as shown by this nest in an asparagus field.

© Jean-Sébastien Guénette, Catherine Dion

1.8 GROW WINTER GRAINS

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Grow winter grains (wheat, rye, triticale or spelt), the field work for which (seeding and harvesting) is performed outside the bird nesting period and thus less conflicting than corresponding springtime activities [141].

WILDLIFE OBJECTIVES

- Reduce the disturbance or destruction of nests caused by passing machinery during the breeding season [141];
- Increase the density and diversity of bird species in annual crops [141];
- Provide protective cover against predators (camouflage).

Winter wheat just before harvest in July

© Élisabeth Vachon – Les Moulins de Soulanges

TIPS

- Consult with an expert agronomist when implementing this practice (appropriate technique, date and seeding density);
- Establish experimental parcels if this practice has never been tested by the farmer;
- As an alternative, consider applying this recommendation in the first 20 metres around fields of another annual crop (soybeans or corn), which corresponds to the peripheral area most heavily used by birds in this type of habitat [54];
- Encourage neighbouring farmers to implement this method in an effort to create a significant, unfragmented network of quality habitats;
- Harvest after July 15.

In addition to serving as ground cover during the colder months, winter cereal crops have the advantage of being sown and harvested outside the bird nesting season.

© Élisabeth Vachon – Les Moulins de Soulanges

MOTIVATIONS

- Diversification of alternating corn-soybean systems [142];
- Root system favourable to improving soil structure [142];
- Better ground cover and protection of soil against erosion [141, 142, 143];
- Crop competitiveness against weeds [141, 142];
- Reduce herbicide purchasing costs [141];
- Easy integration of intercropping and winter cover crops [142, 143];
- Possibility of double-cropping after harvest or planting a green manure catch crop [143];
- Staggering of work and reduced work load in spring (fall seeding, earlier harvest, etc.) [142, 143];
- Lower risks of fusarium infection than for spring cereals [141, 142, 143];
- Higher yield of winter cereals compared to that of spring cereals [141, 142, 143, 144];
- Improved yields of other crops [142, 144].

VESPER SPARROW

Poecetes gramineus

STATUS

None

VARIATION FROM 1970 TO 2015

-92.2% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Vesper Sparrow is present in fields of annual and vegetable crops, pastureland and short-grass meadows. The species nests and feeds on the ground. It is particularly fond of fence posts for use as perches.

THREATS

Excessive tillage, herbicide use and mowing of ditches can lead to the destruction or predation of nests as well as a decrease in available nest-building material. This sparrow can also become intoxicated upon ingesting contaminated prey, pesticides or fertilizers.

2

MEADOWS

BOBOLINK

Dolichonyx oryzivorus

STATUS

Threatened (SARA)

VARIATION FROM 1970 TO 2015

-88.1% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: the Bobolink nests in tall-grass meadows, hayfields and abandoned fields characterized by herbaceous vegetation. It feeds on insects as well as seeds and spiders that it finds on the ground. The Bobolink makes its nest in a depression in the ground that is concealed under the vegetation.

THREATS

Early and frequent hay mowing during the nesting period remains a very significant threat for the survival of the Bobolink population. It is estimated that 400,000 young Bobolinks are killed annually in the St. Lawrence Lowlands and the Great Lakes region.

MEADOWS

2

Description of habitat Man-made meadows are characterized by perennial crops (those that do not need to be sown every year) such as hay, clover and alfalfa. Unlike man-made meadows, natural grasslands are not the result of sowing with human-selected plant species. Natural grasslands are increasingly rare, as many of them have been converted to perennial or annual crops. Long used to graze livestock or mowed to produce saltwater hay (*Translator's note:* herbaceous vegetation growing naturally in saltwater environments along the St. Lawrence River and harvested for fodder), their agricultural use currently remains marginal [58].

Eastern Meadowlark

© Michèle Amyot

Habitat-specific findings Man-made meadows offer excellent habitat for a number of species. Unfortunately, in the past few years, hay mowing has probably become one of the most important causes of accidental bird mortality in agricultural regions [59, 60]. A system in which up to four cuts can be made is mostly incompatible with the reproduction of numerous ground-nesting species. In fact, these species do not have enough time to start a new clutch and fledge their young [18]. Eggs and young

SPECIES ASSOCIATED

- Bobolink
- Eastern Meadowlark
- Grasshopper Sparrow
- Savannah Sparrow
- Sedge Wren
- Short-eared Owl
- Yellow Rail
- etc.

nestlings are thus killed indirectly by operating machinery during various haymaking activities (mowing, tedding, windrowing, baling), or indirectly by the increased exposure to predation following mowing due to the lack of protective ground cover. For example, in Bobolinks, haymaking-related nest failure is believed to be attributable to operating machinery 78% of the time and to predation 22% of the time, most often by gulls, crows and ravens [61].

Moreover, the first hay harvest now generally takes place in early or mid-June in southern Quebec, which corresponds to the peak nesting period for most species that breed in this type of habitat such as the Bobolink and the Savannah Sparrow [1]. In fact, in these two species, early mowing results in near total mortality in the nests (94–100%) [59, 60].

In natural grasslands, prescribed burns pose a greater threat to nesting than does saltwater hay mowing. Saltwater hay is harvested in September when nesting has already ended. However, hay cutting can create a risk of mortality due to the concentrations of birds that are observed in wet meadows during this period [37]. Prescribed burning, a practice associated with islands in the St. Lawrence, is carried out especially to dispose of debris that has washed ashore and that can cause damage to machinery. Burns carried out during the nesting period can have dire consequences on ground-nesting birds such as the Short-eared Owl or Nelson's Sparrow [62].

Male (left) and female (right) Bobolink

© Alexandre Nicole, Michel Bordeleau

RECOMMENDATIONS

2.1 Maintain meadows for 4 to 5 years
2.2 Maintain a multi-hectare parcel as a meadow for 6+ years
2.3 Modify mowing pattern
2.4 Increase mowing height
2.5 Use a flushing bar mounted to the front of machinery
2.6 Adopt late- or early-maturing blends
2.7 Postpone mowing a few hectares until after the nesting period
2.8 Increase mowing interval for a few hectares
2.9 Leave a few hectares unmowed
2.10 Maintain forage crops at varied heights and densities
2.11 Mow smaller fields first
2.12 Refrain from mowing at night
2.13 Spread manure after the last cut
2.14 Adapt the periods and parcels targeted for prescribed burns
2.15 Adapt mowing period for saltwater hay

OTHER RECOMMENDATIONS

3.2 Limit the density of livestock in pastures
3.3 Control grazing by practising pasture rotation
3.4 Build exclosures in pastures
4.3 Attract birds of prey
7.1 Conserve vegetation in existing marginal habitats
7.2 Plant isolated trees
7.3 Establish high-diversity hedgerows
7.4 Develop/enhance riparian areas
7.5 Delay mowing ditches until after nesting period
7.7 Create/enhance ponds
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.5 Encourage Barn Swallow nesting
8.6 Maintain isolated buildings and other structures

SHORT-EARED OWL

Asio flammeus

STATUS

Threatened (SARA)

VARIATION FROM 1970 TO 2015

Special Concern (SARA), Likely to be Designated as Threatened or Vulnerable (ARTVS)

PRESENCE IN QUEBEC

Migratory breeder and occasional winter resident in southern Quebec. Less nocturnal than other owls, the Short-eared Owl uses meadows, pastures and abandoned fields to build its vegetation-covered nest on the ground. It feeds almost exclusively on small mammals such as the common vole.

THREATS

Short-eared Owl nests are vulnerable to hay cutting as well as intensive grazing. Pesticide use can result in the ingestion of contaminated prey and biomagnification. Land drainage and wetland reclamation have caused significant habitat loss for this species. Lastly, the elimination of marginal habitats and the removal of fences reduce the number of perches available.

2.1 MAINTAIN MEADOWS FOR 4 TO 5 YEARS

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Maintain meadows for 4 to 5 consecutive years before returning them to crops [51].

WILDLIFE OBJECTIVES

- Ensure quality, long-term reproduction sites for ground-nesting species [1];
- Contribute to the reproductive success of these birds.

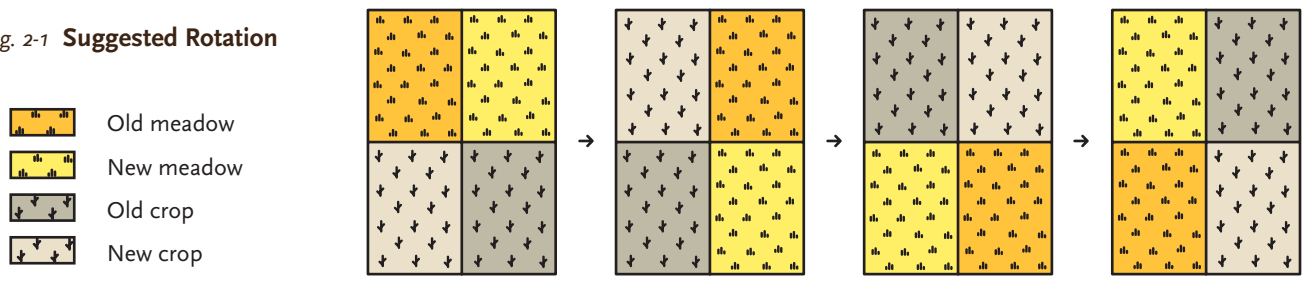
TIPS

- Establish a rotation system where new meadows are created annually and where meadows that have been present for 4 or 5 years are returned to cultivation (Figure 2-1);
- Practise this rotation in such a way that the meadows being returned to cultivation are adjacent to a new or an old meadow;
- If possible, apply this strategy to all meadows;
- Apply this strategy to half of the parcels if maintaining all meadows over such a period is impossible.

MOTIVATIONS

- Technique commonly applied by many farmers;
- Simple and easy to apply;
- Costs of implementation staggered over a longer period (several years);
- Compromise between hay quality and the cost of establishing a meadow;
- Hay in latter years dedicated specifically to heifers or other animals that do not require hay of the same quality as lactating cows[2] [63].

fig. 2-1 **Suggested Rotation**



[2] Also applicable to other dairy production: sheep, goats, etc.

2.2 MAINTAIN A MULTI-HECTARE PARCEL AS A MEADOW FOR 6+ YEARS

DESCRIPTION

Maintain grass-dominated meadows for 6 years or more on a 5-10 ha parcel [51].

WILDLIFE OBJECTIVES

- Ensure quality, long-term reproduction sites for species that remain faithful to their nest site [64];
- Contribute to the reproductive success of these species.

TIPS

- Opt for a forage blend consisting of mostly grasses [65];
- Select a parcel unsuitable for field crops as an implementation site (floodplain, poor drainage) [51];
- Establish a rotation system in which an old meadow targeted for recultivation is placed adjacent to a new meadow for two or three years before reconverting it to a long-term meadow.

MOTIVATIONS

- Utilization of floodplains and fields that have poor drainage;
- Productivity possible if established in light soil;
- Costs of implementation staggered over several years;
- Compromise between hay quality and the cost of establishing a meadow;
- Hay dedicated specifically to heifers or other animals whose nutritional requirements are not as high as those of lactating cows[3] [63].

Target Habitat(s)

Costs & Benefits

+++

[3] Also applicable to other dairy production: sheep, goats, etc.

2.3 MODIFY MOWING PATTERN

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Begin mowing in the middle of the field and progress outward (inside-outward mowing pattern) rather than from the field edge inward (outside-inward mowing pattern) (Figure 2-2) [66].

WILDLIFE OBJECTIVES

- Allow birds to flee field to adjacent areas rather than being trapped until the final cut (funnel effect) [66];
- Reduce the risk of predation by ensuring protective cover for birds.

TIPS

- For the first loop, leave a strip equal to one or two rows between the outward and return trips to facilitate the turn, then mow this area when completing the second (and third) loop;
- At each of field edges, mark the middle of the field beforehand using cedar stakes (perches) or nest boxes in order to find one's bearings more easily (*see Recommendations 8.1 and 8.3*);
- Apply such a mowing pattern especially in wide fields since the risks of predation are higher due to the fact that the field edges are farther from the centre;
- Apply an inside-outward mowing pattern, especially for the first two hay cuts (more conflicting with nesting);
- If desired, practise conventional mowing (outside-inward) if cutting after mid-July;
- Reduce mowing speed to approximately 10 km/h to give birds more time to react.

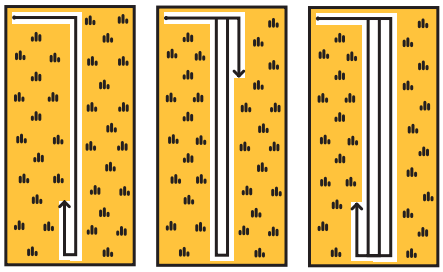
MOTIVATIONS

- No cost to implement;
- Simple to apply;
- Quality and quantity of hay remain unchanged;
- Lower bird mortality.

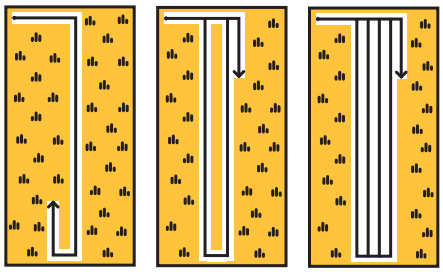
NOTE

Mowing in strips can also be considered as an alternative in order to give birds a chance to find cover in areas that are not immediately harvested.

A Inside-outward mowing



B Inside-outward mowing (adapted)



X Outside-inward mowing

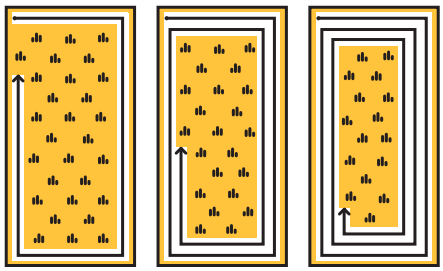


fig. 2-2 **Different Mowing Patterns**

Example of inside-outward mowing

© Alexandre Nicole

2.4 INCREASE MOWING HEIGHT

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Mow meadows at a height of between 100 and 120 mm [51].

WILDLIFE OBJECTIVES

- Reduce mortality rates of eggs, nestlings and adults caused by mowing hay during the reproduction period of ground-nesting species [67];
- Limit predation of eggs and nestlings by maintaining a certain protective cover.

TIPS

- Increase mowing height to 100 mm (3.9") if it is currently 80 mm (3.1"), and to 120 mm (4.7") if it is currently 100 mm (3.9");
- Begin applying this strategy over a few hectares before applying it to all meadows;
- Apply a higher mowing height, particularly for the first two cuts of hay (more conflicting), and reduce as needed for the following cuts;
- Reduce mowing speed to approximately 10 km/h to give birds more time to react.

Increasing mowing height can help avoid the destruction of nests of ground-breeding birds while optimizing hay regrowth. Bobolink eggs and nestlings

© Alexandre Nicole

A low cut limits alfalfa, red clover, fescue and cock's-foot while favouring buttercup, white clover and couchgrass. A higher cut helps improve the return of desired species since it leaves a larger surface area for photosynthesis and nutrient reserves needed for regrowth [68].

© Alexandre Nicole

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No cost to implement;
- Lower rate of toxins in the hay;
- Harvested forage less fibrous, leafier and of higher quality [69];
- Reduced dust [69];
- Higher quality regrowth [69];
- Better fermentation [68];
- Faster drying [69; 70];
- Reduced water stress for all forage crops [69];
- Reduced erosion related to surface runoff [71];
- Helps avoid stones [70, 71];
- Slower wear and tear on equipment (blades, tines, springs) [69];
- Reduced damage to crowns and tillering nodes [69];
- Reduced proliferation of weeds [69];
- Greater snow accumulation and higher winter survival rates [69, 70];
- Lower bird mortality [67].

2.5 USE A FLUSHING BAR MOUNTED TO THE FRONT OF MACHINERY

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

On the front of the tractor, install a horizontal bar as wide as the machinery itself and equipped with chains when performing any field work, particularly during the bird nesting period (mid-May to mid-July) [37].

WILDLIFE OBJECTIVES

- Flush ground-nesting birds (young that are able to move quickly enough, females incubating or protecting their nest) during field work, particularly during hay mowing when accidental mortality rates are high;
- Force females to flee rather than to "freeze" by reflex [37].

TIPS

- Design a flushing bar composed of a horizontal iron bar to which chains are attached (*see design in Appendix A*);
- Begin by testing a homemade flushing bar for mowing hay, then apply to other field activities;
- Contact organizations that have tested flushing bars in the province (e.g. SCIRBI);
- Consult with local agricultural machinery representatives to obtain a European demonstration device unavailable on the North American market (e.g. hydraulic system allowing side booms to be folded in, offered by Brard et Sarran);
- Create an interest for this device so that it becomes available in the medium term on the Quebec market.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Application compatible with conventional practices;
- Low cost if hand-crafted;
- Reduced bird mortality;
- Clearly observable beneficial impact on birds;
- Possibility to build the device oneself;
- Opportunity to be a trendsetter.

PHOTOS Flushing bar developed by the Société de Conservation, d'interprétation et de recherche de Berthier et ses îles (SCIRBI) and used in the Lac Saint-Pierre archipelago. The bar is composed of three sections maintained in closed or open position with two hitch pins. Two metal L-shaped bars secure the device to the tractor.

© Alexandre Nicole

2.6 ADOPT LATE- OR EARLY-MATURING BLENDS

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Use very late (late June) or, conversely, extremely early (early May) cultivars to allow the first cut of hay to be delayed or accelerated [37].

WILDLIFE OBJECTIVES

- Avoid having to mow hay in June, when most farmland birds are nesting [72, 73];
- Limit the number of cuts to two in order to allow ground-nesting birds to complete their reproduction, from egg-laying to fledging their young;
- Delay hay-cutting (late-maturing blend) to allow ground-nesting birds to complete their nesting so that their young are able to fly away or otherwise flee when mowing is taking place;
- Cut hay in May, before the nesting season for most ground-nesting species, thereby helping to reduce the mortality of eggs, nestlings and adults caused by such mowing [73].

TIPS

- Opt for very early cultivars of traditional blends comprising European grasses (brome, fescue, timothy, etc.) [74];
- Accompany or replace the traditional legume with garden bird's-foot trefoil (*Lotus corniculatus*), a species that sprouts in late spring and grows back slowly after mowing, in a blend consisting of 60% legumes (60% trefoil, 40% alfalfa) and 40% timothy [68];
- Consider late-maturing blends composed of native species such as big bluestem (*Andropogon gerardii*), old switch panicgrass (*Panicum virgatum*) and little bluestem (*Schizachyrium scoparium*) [75];
- Use switchgrass as a source of bedding if harvested in early spring or as a source of fodder in silage form if harvested in September [76];
- Test such early- or late-maturing blends in small fields or on a strip of a larger field;
- Ideally, have on one's land a combination of fields with conventional blends, very early blends and very late blends (*see Recommendation 2.10*).

Traditional blend of common timothy and red clover

© Stéphane Lamoureux

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Application compatible with conventional practices;
- Access to quality hay in early spring;
- Quality of fodder maintained despite delayed mowing;
- Clearly observable beneficial impact on birds;
- Opportunity to be a trendsetter.

2.7 POSTPONE MOWING A FEW HECTARES UNTIL AFTER THE NESTING PERIOD

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Delay the first hay-cutting on a few hectares until mid-July at the earliest, i.e. after the peak fledging period for ground-nesting species [60, 63].

WILDLIFE OBJECTIVES

- Reduce mortality rates of eggs, nestlings and adults caused by mowing hay during the reproduction period of ground-nesting species [60, 63];
- Allow nestlings to develop to the point where they are able to flee when mowing is taking place [60, 63];
- Reduce the predation of nests that have not been mowed over [60, 63].

TIPS

- Use hay from delayed mowing for heifers, non-lactating cows[4] and livestock that do not require hay of such high quality (horses, beef cattle, etc.) [63];
- For delayed cutting, choose a small field in its entirety, the central portion of a large field, or along a riparian area bordering several adjacent fields (Figure 2-3) [37];
- Give preference to an entire small field for delayed cutting;
- Designate areas for delayed cutting as a function of quality marginal habitats in proximity;
- Carry out a collective project by delaying mowing along a riparian area bordering adjacent fields owned by different landowners;
- Consider postponing mowing on the majority of lands used to produce hay for livestock that do not require such high quality fodder as dairy cows (horses, beef cattle, etc.) [63];
- Consider leaving certain areas uncut for the conservation of species at risk (*see Recommendation 2.9*).

Hay from delayed mowing can be used for heifers, non-lactating cows and livestock that do not require hay of such high quality as dairy cows (horses, beef cattle, etc.).

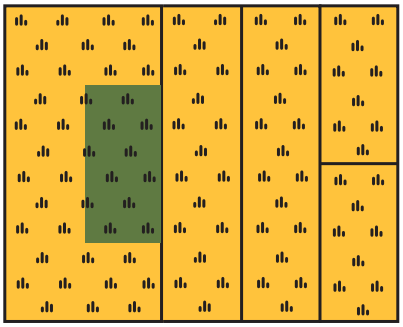
© Stéphane Lamoureux

[4] Also applicable to other dairy production: sheep, goats, etc.

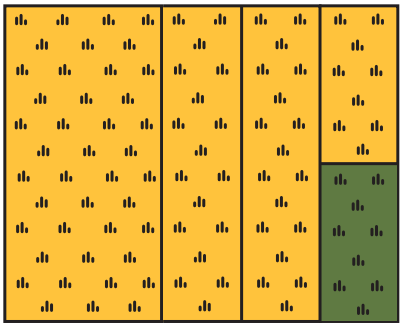
MOTIVATIONS
• Application simple, easy and not overly demanding;
• Application compatible with conventional practices;
• Low impact on the nutritional needs of horses or beef cattle [63];
• Quality of hay acceptable for heifers and non-lactating cows in a dairy farm context [63];
• Low impact on the nutritional needs of livestock other than those used for milk production (horses, beef cattle, etc.) [63];
• Clearly observable beneficial impact on birds;
• Opportunity to be a trendsetter.

fig. 2-3 **Different Options for Delayed Mowing**

A 1st cut after July 15:
Section of a large field



B 1st cut after July 15:
Small field



C 1st cut after July 15:
Edge of several fields

2.8 INCREASE MOWING INTERVAL FOR A FEW HECTARES

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Allow an interval of 65 days between the first and second hay cuts on a few hectares in order to allow ground-nesting species to complete their nesting cycle, from egg-laying to fledging their young [51].

WILDLIFE OBJECTIVES

- Reduce mortality rates of eggs, nestlings and adults caused by mowing hay during the reproduction period of ground-nesting species [60, 73];
- Allow nestlings to develop to the point where they are able to flee when mowing is taking place [60, 73].

TIPS

- Perform the first cut early in the season so that the mowing interval straddles the peak breeding period of ground-nesting birds (late May to mid-July);
- For dairy operations[5], use hay from the second cutting for heifers and non-lactating cows, which do not require such high quality hay;
- Increase the cutting interval for a small field in its entirety, a portion of a large field, or along a riparian area bordering several adjacent fields (Figure 2-4);
- Try to increase the mowing interval for a small field in its entirety;
- Designate areas for an increased cutting interval as a function of quality marginal habitats in proximity;
- Carry out a collective project by increasing the cutting interval along a riparian area bordering adjacent fields owned by different landowners;
- Consider postponing mowing on the majority of lands used to produce hay for livestock that do not require such high quality fodder as dairy cows (horses, beef cattle, etc.) [63];
- Consider an interval of 65 days between two cuts to ensure better reproductive success for most of the species that nest in this habitat [60, 73].

Sedge Wren

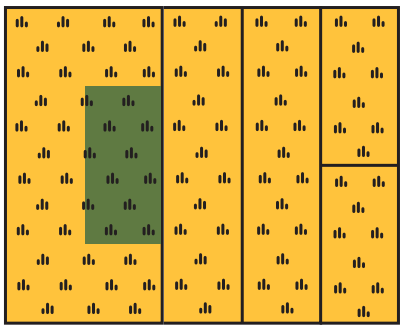
© Daniel Jauvin

[5] Also applicable to other dairy production: sheep, goats, etc.

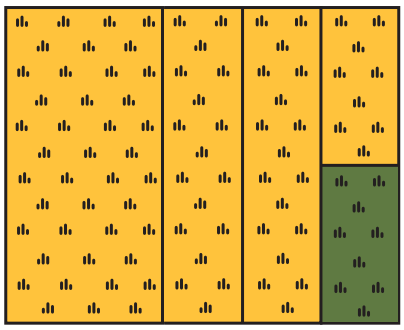
MOTIVATIONS
• Application simple, easy and not overly demanding;
• Application compatible with conventional practices;
• Low impact on the nutritional needs of horses or beef cattle [63];
• Quality of hay acceptable for heifers and non-lactating cows in a dairy farm context [63];
• Quality of hay only slightly lower after first cut [117];
• Quality of fodder more stable over time after first cut [117];
• Protein content tends to diminish less than before the first cut [77];
• Clearly observable beneficial impact on birds;
• Opportunity to be a trendsetter.

fig. 2-4 **Various Options for Increasing Intervals between Hay-Cutting**

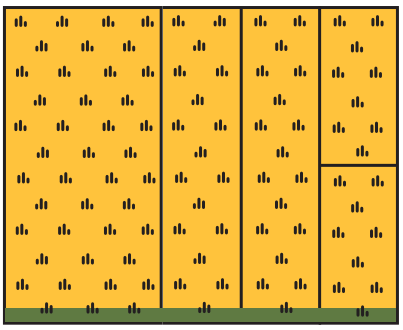
A 65 days between 1st and 2nd cuts: Section of a large field



B 65 days between 1st and 2nd cuts: Small field



C 65 days between 1st and 2nd cuts: Edge of several fields



2.9 LEAVE A FEW HECTARES UNMOWED

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Keep a few hectares of hay uncut in the central portion or around the perimeter of a field (Figure 2-5) [78].

WILDLIFE OBJECTIVES

- Offer farmland birds conservation zones not targeted for mowing where they can hide, make their nests and find food;
- Provide a habitat for species associated with tall-grass meadows (e.g. Grasshopper Sparrow) that favour areas where grasses reach 65 cm [73];
- Reduce mortality rates of eggs, nestlings and adults caused by mowing hay during the reproduction period of ground-nesting species.

TIPS

- Try to maintain an unmowed section near the middle of the meadow, which is more suitable for ground breeders since these species avoid building their nest near edge habitats [79, 80; 65];
- Keep at least one hectare unmowed for a centrally-located section (preferable) or a strip along the edge of the field [78];
- Apply this recommendation in low-yield or difficult-to-access areas (floodplain, poor drainage);
- Validate the presence of species at risk the preceding year in order to target the best area for conservation;
- Mark off the boundaries of those areas designated for conservation;
- Plant cedar stakes for use as perches within the conservation zone to encourage nesting in the area;
- Mow from the outside inward for fields whose central portion is preserved and vice versa for fields whose perimeter is preserved;
- If desired, consider grazing or mowing this conservation area after mid-July (*see Recommendation 2.7*) in order to produce hay for heifers[6] or other animals whose nutritional requirements are not as high as those of lactating cows [63];

NOTE

It is not advised to survey for nests of ground-breeding birds, as doing so could increase the risk of abandonment and predation. However, if nests have been identified, an area with a radius of 2.5 to 10 m (or a section measuring 25 to 400 m²) could be marked off limits for mowing [78, 81].

[6] Also applicable to other dairy production: sheep, goats, etc.

- As conservation areas, target edges around the perimeters of adjacent fields rather than isolated edge habitats;
- Refrain entirely from mowing a small field (over 1 ha) that is relatively unproductive, poorly drained or located in a floodplain [37].

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Application compatible with conventional practices;
- Reduced bird mortality;
- Clearly observable beneficial impact on birds;
- Possibility to leave a field or a few hectares fallow;
- Opportunity to support the conservation of species at risk;
- Opportunity to be a trendsetter.

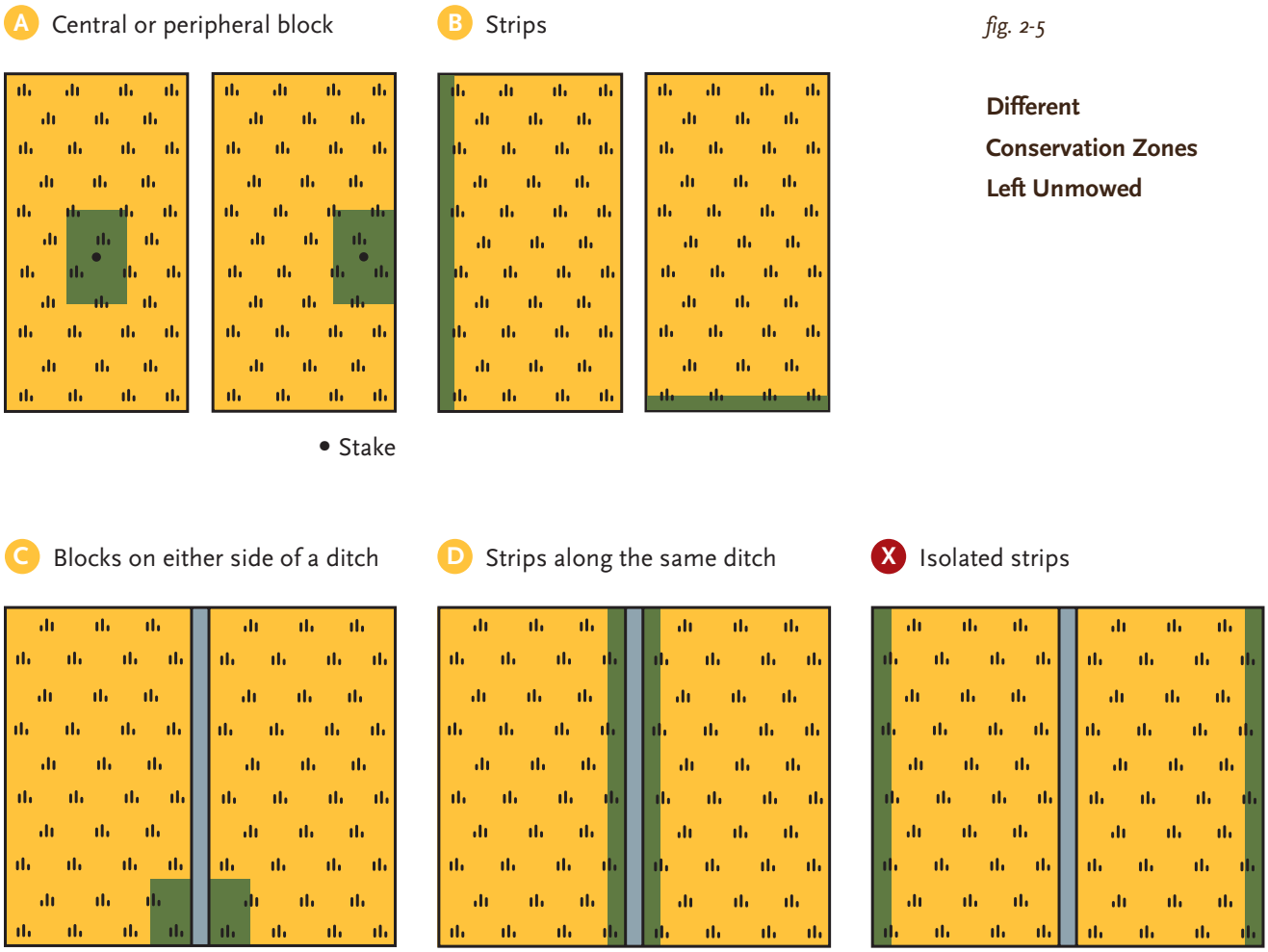


fig. 2-5

Different Conservation Zones Left Unmowed

2.10 MAINTAIN FORAGE CROPS AT VARIED HEIGHTS AND DENSITIES

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Mow each field at a different time in order to have different heights and densities of hay throughout the season.

WILDLIFE OBJECTIVE

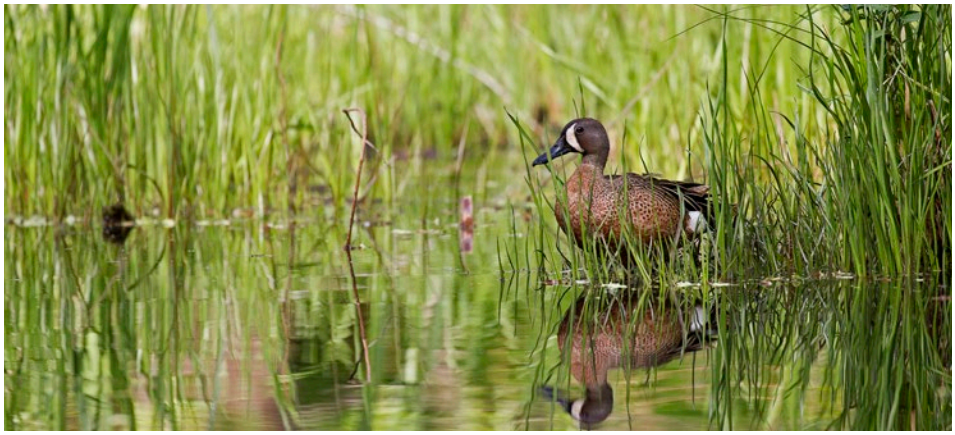
- Ensure the availability of bird habitats throughout the season.

TIPS

- Apply this recommendation on small parcels owned by farmers who do not grow other types of crops or ranchers who do not require high quality hay (horses, beef cattle, etc.);
- Use on these lands a combination of conventional blends, very early blends and very late blends (*see Recommendation 2.6*);
- Use hay from delayed mowing for heifers, non-lactating cows[7] and livestock that do not require high quality hay (horses, beef cattle, etc.) (63).

MOTIVATIONS

- Clearly observable beneficial impact on birds;
- Time dedicated to hay-making more staggered throughout the season;
- Lower risk of losing an entire hay harvest in the event of unfavourable weather conditions;
- Acceptable quality hay at different times of the season.



The Blue-winged Teal uses tall-grass meadows, hayfields, abandoned fields dominated by herbaceous vegetation and grassy pond edges as nesting habitat.

© Réjean Paquet

[7] Also applicable to other dairy production: sheep, goats, etc.

2.11 MOW SMALLER FIELDS FIRST

DESCRIPTION

Mow smaller fields first and larger fields later [37].

WILDLIFE OBJECTIVES

- Give birds nesting in large fields (which offer more favourable conditions for breeding) [73] a few extra days to complete their nesting;
- Allow nestlings in larger fields a few additional days to develop so that they might be capable of fleeing at the time of mowing [37];
- Spare a greater number of birds, which are more plentiful in larger fields.

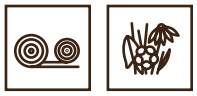
TIPS

- Wait an additional 5 to 10 days to mow a large field after cutting small fields [37];
- Use small fields to produce higher quality hay and that can be mowed earlier than a large field;
- As an alternative, for farms with similar-sized fields or that do not have extensive meadows, consider mowing half of a field and then waiting a few days before mowing the rest.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Application compatible with conventional practices;
- Production of quality hay throughout the property.

Target Habitat(s)



Costs & Benefits

2.12 REFRAIN FROM MOWING AT NIGHT

Target Habitat(s)

Costs & Benefits

+

DESCRIPTION

Avoid cutting hay at night when birds have more trouble moving and reacting to threats [82].

WILDLIFE OBJECTIVE

- Reduce the mortality rate of adults caused by night-time mowing during the nesting period.

TIPS

- Mow at night only if absolutely necessary;
- Use a flushing bar if night-time mowing cannot be avoided (*see Recommendation 2.5*);
- Reduce mowing speed to approximately 10 km/h to give birds more time to react.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No cost to implement;
- Application compatible with conventional practices;
- Faster drying;
- Absence of dew on the hay, which is not conducive to mowing;
- Lower the risk of accidents caused by sleepiness;
- Night-time mowing already uncommon.

Less nocturnal than its relatives, the Short-eared Owl is often active during the day and at dusk. The species nests and rests directly on the ground in meadows, pastures and other open expanses.

© Claudette Archambault

2.13 SPREAD MANURE AFTER THE LAST CUT

DESCRIPTION

Try to spread manure after the last hay cut, i.e. outside the bird nesting period [37].

WILDLIFE OBJECTIVE

- Avoid burying nests and eggs when spreading manure or causing accidental mortality with operating equipment in species that promptly attempt a second clutch after the first one has been destroyed [37].

TIP

- Spread manure within two days of mowing if spreading is unavoidable after the first or second cut.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No cost to implement;
- Application compatible with conventional practices;
- Less damage to meadows;
- Reduced soil compaction [68];
- Better use of elements [68];
- Already common practice.

Target Habitat(s)

Costs & Benefits

+

Spreading manure after the last hay cut reduces the need for machinery in the fields during the bird nesting period. © Marc-Oliver Gasser, IRDA

2.14 ADAPT THE PERIODS AND PARCELS TARGETED FOR PRESCRIBED BURNS

Target Habitat(s)

Costs & Benefits

++

Saltwater hay harvesting and the grazing of salt meadows are two important threats faced by the Nelson's Sparrow during the breeding season. © Réjean Paquet

DESCRIPTION

In natural grasslands, prescribed burns should preferably be carried out in fall or before the month of May if spring burning is unavoidable; work with small dispersed surfaces (mosaic pattern) rather than a single large surface [37, 62].

WILDLIFE OBJECTIVES

- Avoid mortality risks caused by prescribed burns carried out during the nesting period;
- Ensure a certain protective cover when birds are present or during the nesting period;
- Offer a diversity of habitats that meet the needs of multiple species.

TIPS

- Carry out prescribed burns in the fall in order to foster plant growth the following season [62];
- Give precedence to fall burns, which have little impact on farmland birds (which will have already migrated south), as opposed to spring burns, which coincide with the nesting period;
- Prescribed burns performed in the fall should be carried out after the first frosts, i.e. around November 15, in order to increase the beneficial effect on plant growth for the following season [62];
- Avoid carrying out prescribed burns in the summer, at which time they do not have the desired effect on vegetation anyway [62];
- Perform prescribed burning in spring only if it cannot be avoided;
- Burn a few small parcels each year rather than carrying out annual prescribed burns across the entire property [37];
- In so doing, encourage a mosaic of habitats with diverse characteristics that will meet the needs of a greater variety of species [37].

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Low cost to implement;
- Beneficial impact on plant growth the following season [62];
- Clearly observable beneficial impact on birds.

2.15 ADAPT MOWING PERIOD FOR SALTWATER HAY

DESCRIPTION

Schedule fall mowing of saltwater hay after the nesting period, i.e. between late July and mid-August, or after the staging (and moulting) period for the Yellow Rail (species at risk), which takes place from August 21 to September 15.

WILDLIFE OBJECTIVES

- Reduce mortality rates of eggs, nestlings and adults caused by mowing saltwater hay during the reproduction period of ground-nesting species;
- Allow nestlings to develop to the point where they are able to flee when mowing is taking place;
- Lower the risk of accidental mortality during the staging period of the Yellow Rail, when the concentration of individuals at a single location and the birds' reduced ability to fly make them highly vulnerable [62].

TIPS

- Consider preserving and maintaining natural meadows by mowing them every 2 or 3 years;
- If necessary, harvest saltwater hay annually as per the dates suggested [37, 62];
- Mow a few small parcels annually rather than the entire property [37];
- Give precedence to hay from already-existing seeded parcels, the quality of which is 15 to 20% higher than natural saltwater hay [58].

MOTIVATIONS

- No cost to implement;
- Application simple, easy and not overly demanding;
- Clearly observable beneficial impact on birds;
- Opportunity to support the conservation of species at risk.

Target Habitat(s)

Costs & Benefits

++

The Yellow Rail, a threatened species in Quebec, uses primarily the upper sections of large freshwater and brackish marshes located along the St. Lawrence and Saguenay Rivers.

© Christian Marcotte, Canadian Wildlife Service

BLUE-WINGED TEAL

Spatula discors

STATUS

Threatened (SARA)

VARIATION FROM 1970 TO 2015

-88.1% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: the Bobolink nests in tall-grass meadows, hayfields and abandoned fields characterized by herbaceous vegetation. It feeds on insects as well as seeds and spiders that it finds on the ground. The Bobolink makes its nest in a depression in the ground that is concealed under the vegetation.

THREATS

Early and frequent hay mowing during the nesting period remains a very significant threat for the survival of the Bobolink population. It is estimated that 400,000 young Bobolinks are killed annually in the St. Lawrence Lowlands and the Great Lakes region.

3

PASTURELAND

EASTERN MEADOWLARK

Sturnella magna

STATUS

Threatened (SARA)

VARIATION FROM 1970 TO 2015

-90.5% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Eastern Meadowlark uses meadows, pastures, hayfields and abandoned farmland as nesting habitat. It feeds on insects and completes its diet with seeds in the spring and fall. Like a number of other farmland birds, the Eastern Meadowlark builds its nest on the ground.

THREATS

The risks of mortality and nest predation are significant on account of hay-cutting, operating farm equipment and trampling by livestock. In the Eastern Meadowlark, pesticide use can lead to intoxication through the direct ingestion of these pesticides or contaminated prey. Indirectly, pesticide use renders the habitat unproductive for this species due to the loss of vegetation and insects.

PASTURELAND

3

Description of habitat Pastures are open planted or unplanted land used by livestock (dairy cows, beef cattle, horses, sheep, goats and other domestic ungulates) for grazing whenever the climate allows. Although some pastures may contain trees and shrubs, the habitat is dominated by herbaceous plants and grasses in particular.

Livestock and their excrement attract more insects than any type of crop, which makes pastures excellent hunting grounds for aerial insectivores such as the Barn Swallow.

© France Paré

Habitat-specific findings Due to the conversion of land to annual crops and the confinement of livestock, pastureland has shrunk by over 80% since 1951 [8]. However, livestock and their excrement attract more insects than any type of crop [24, 25]. With animals now spending far less time out-of-doors, the result is a decline in insect populations and thus the amount of food available for insectivorous birds that use pastures to nest [24, 83]. These birds depend on this food, especially when raising their young.

SPECIES ASSOCIATED

- Eastern Meadowlark
- Savannah Sparrow
- Upland Sandpiper
- etc.

When animals are put out to graze, the number of heads and the time spent at pasture are often high. In these intensive systems, heavy grazing reduces the plant cover needed to support nesting birds [18] and thus increases the risks of predation. On the other hand, high livestock density [18, 84, 85] and high exposure time [86] increase the risks that nests, eggs and/or nestlings might be trampled [18, 84, 85].

In addition to the grass they consume when grazing, livestock are provided hay or silage directly in the field. However, daily delivery of this supplementary feed by farm equipment can magnify the risk of nest destruction of ground breeders, which are already vulnerable to being trampled by livestock. Additionally, as feeding stations and feed trains are regularly relocated, the congregation of livestock at a single point greatly increases the risk of nests being trampled that happen to be built near a new feeding station.

Savannah Sparrow and its nest

© Alexandre Nicole

RECOMMENDATIONS

3.1 Let livestock out to graze more frequently
3.2 Limit the density of livestock in pastures
3.3 Control grazing by practising pasture rotation
3.4 Build exclosures in pastures
3.5 Adapt supplementary feeding practices

OTHER RECOMMENDATIONS

4.3 Attract birds of prey
6.3 Integrate livestock into abandoned fields in order to maintain them
7.1 Conserve vegetation in existing marginal habitats
7.2 Plant isolated trees
7.3 Establish high-diversity hedgerows
7.4 Develop/enhance riparian areas
7.6 Manage drainage ditches to be suitable for wildlife
7.7 Create/enhance ponds
8.3 Install species-specific nest boxes
8.5 Encourage Barn Swallow nesting
8.6 Maintain isolated buildings and other structures

SAVANNAH SPARROW

Passerculus sandwichensis

STATUS
None

VARIATION FROM 1970 TO 2015
-77.0% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUÉBEC
Migratory breeder: The Savannah Sparrow uses pastures, short-grass meadows, hayfields and abandoned farmland characterized by herbaceous vegetation as nesting habitat. The species feeds mostly on seeds, but also on insects, spiders and snails during the breeding season. It builds its plant residue-lined nest directly on the ground, where it is protected by high grasses. Savannah Sparrows can be observed on the ground or perched on fence posts or high grasses.

THREATS
Habitat loss as a result of the conversion of dairy farms to intensive cropping has had a great impact on the Savannah Sparrow. Mowing hay and ditches as well as intensive grazing destroys nests and increases predation. In the Savannah Sparrow, pesticide use can lead to intoxication through the direct ingestion of these pesticides or contaminated prey.pesticide use renders the habitat unproductive for this species due to the loss of vegetation and insects.

3.1 LET LIVESTOCK OUT TO GRAZE MORE FREQUENTLY

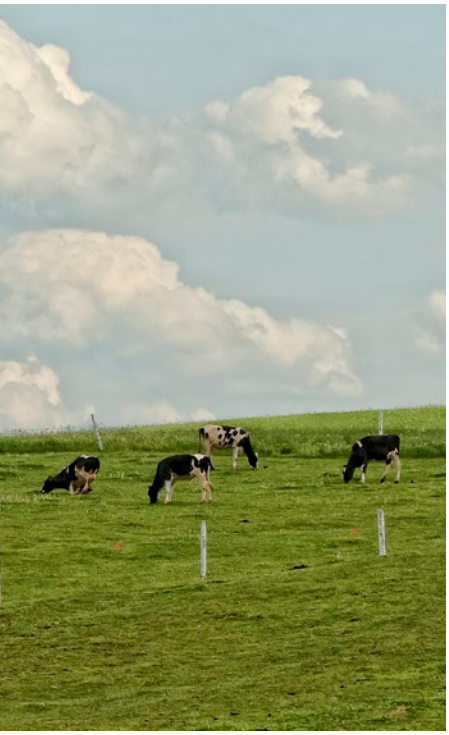
Target Habitat(s)

Costs & Benefits

++

Pastureland,
Eastern Townships

© Monique Laguë



DESCRIPTION

Put livestock out to pasture as regularly as possible.

WILDLIFE OBJECTIVES

- Expand pastures, a habitat of rich biodiversity that has practically disappeared from the agricultural landscape [(24)];
- Offer farmland birds quality sites to nest, feed and find cover;
- Attract insects, which are an important food source for aerial insectivores and all farmland birds when feeding their young [(83)].

TIPS

- Prefer square rather than elongated (or irregularly-shaped) pastures to reduce the perimeter/surface ratio, which is more conducive to bird abundance [(18)];
- Be sure to provide livestock with a source of shade by building structures (*see Recommendation 8.5*) or offering trees (*see Recommendation 7.2*), which can also be used by birds as perches;
- Maintain grass height of at least 10 cm to allow birds to be less conspicuous [(18)];
- Control grazing and the protective cover available to birds by limiting livestock density (*see Recommendation 3.2*) or by practising pasture rotation (*see Recommendation 3.3*);
- Build exclosures in pastures to create areas that are free from grazing (*see Recommendation 3.4*);
- Plant posts in the middle of pastures to be used as perches with a view to increasing the wildlife value of this habitat [(73)] (*see Recommendation 8.1*);
- For dairy operations[8], consider initially grazing heifers and dry cows;
- For dairy operations[8], consider grazing lactating cows at night, a few days a week or only in favourable weather;
- Consider restricting grazing by letting out just part of the herd each day.

[8] Also applicable to other dairy production: sheep, goats, etc.

Pasture, Lanaudière

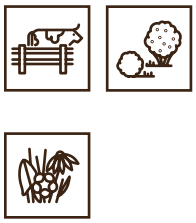
© Martin Joly

MOTIVATIONS

- Higher quality fodder for livestock (fresh grass vs. dry hay) [87];
- Production of leaner meat [88];
- Production of milk with higher concentrations of unsaturated fatty acids, vitamins and minerals [87, 89, 90, 91, 92];
- Exercise for livestock and reduced locomotor disorders [93];
- Mitigation of health problems such as lameness and mastitis [94; 95];
- Cost savings for the purchase or production of seeds and hay [96];
- Reduced veterinary expenses;
- Energy savings for buildings in summer (ventilation);
- Attraction of natural enemies of crop pests;
- Memories associated with farmers' past;
- Visual appreciation of this landscape element [88];
- Integral part of Quebec's agricultural heritage [88].

3.2 LIMIT THE DENSITY OF LIVESTOCK IN PASTURES

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Limit livestock density to no more than 2.5 heads/ha for continuous grazing and no more than 4 heads/ha for grazing of short duration (4-hour blocks) or in rotation (Table 3-1) [37].

WILDLIFE OBJECTIVES

- Ensure a certain protective cover for ground-nesting birds;
- Reduce mortality rates of eggs and nestlings caused by the trampling of nests by livestock during the reproduction period of ground-nesting species.

TIPS

- Follow the suggested density, particularly during the reproduction period for most species, i.e. early May to mid-July;
- Aim for a livestock density of between 4 and 10 heads/ha if it is difficult to comply with the suggested densities[9];
- Consider a compromise between the suggested densities and the grazing duration;
- Alternate sub-groups of lactating cows on a daily basis;
- Practise pasture rotation if it is difficult to reduce livestock densities to the suggested values (*see Recommendation 3.3*).

MOTIVATIONS

- Reduced soil compaction [96];
- Higher quality regrowth [96];
- Increased level of organic matter in the soil [97];
- Simple and easy to apply;
- Attract natural enemies of crop pests;
- Lower risk of infestations of fecal matter;
- No disturbance of livestock;
- Clearly observable beneficial impact on birds.

NOTE

Regardless of livestock density, pastures remain a more favourable habitat for birds and biodiversity than factory farming [24, 83].

[9] Also applicable to other dairy production: sheep, goats, etc.

table 3-1 **Desired Density for Different Livestock Types**

		Ideal Density (individuals/ha)	
LIVESTOCK TYPE	Correction Factor*	Continuous Grazing	Pâturage en rotation
Lactating cows	1,00	2,5	4,0
Other cattle (2 years)	1,00	2,5	4,0
Other cattle (6 months–2 years)	1,67	4,2	6,7
Other cattle (0–6 months)	2,50	6,3	10,0
Sheep (6+ months)	6,67	16,7	26,7
Goats (6+ months)	6,67	16,7	26,7
Horses (6+ months)	1,00	2,5	4,0
Alpacas	3,33	8,3	13,3
Llamas	2,22	5,6	8,9
Deer	3,03	7,6	12,1
Bison	1,20	3,0	4,8

* Inspired from the livestock unit (LSU) coefficient. Example: For a density of sheep equal to 10 individuals/ha of adult cattle, one must simply multiply this density by 6.67, i.e. 66.7 individuals/ha.

© Martin Joly

3.3 CONTROL GRAZING BY PRACTISING PASTURE ROTATION

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Practise pasture rotation to control grazing and ensure the presence of protective cover for birds (Figure 3-1) [18].

WILDLIFE OBJECTIVES

- Ensure a certain protective cover for ground-nesting birds;
- Reduce mortality rates of eggs and nestlings caused by the trampling of nests by livestock during the reproduction period of ground-nesting species [18];
- Allow birds to safely move about, find cover and feed in the sections off limits to livestock [96].

TIPS

- Maintain grass height of at least 10 cm to allow birds to be less conspicuous [18];
- Alternate grazing between 2 to 4 different pastures and transfer livestock whenever grass height approaches 10 cm (frequency variable as a function of livestock density and pasture size);
- Consider the use of portable fencing (e.g. fence spider manufactured by Gallagher) in order to partition a pasture into multiple sectors and facilitate rotation;
- In pastures with portable fencing, transfer animals if possible from one section to another on a weekly basis (or every other day) in order to reduce exposure time;
- Consider a deferred rotation system involving at least three pastures, including one that will be allowed to rest for a year [96].

Pasture divided into multiple sections, Saint-Ignace-de-Loyola

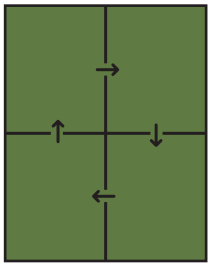
© Martin Joly

MOTIVATIONS
• Longer grazing season [96];
• Reduced soil compaction [96];
• Higher quality regrowth [96];
• Higher grass quantity and quality [96];
• Increased level of organic matter in the soil [96];
• Lower risk of parasitic infections of fecal origin [96];
• Higher weight gain [96];
• No real disturbance of livestock;
• Mitigation of impacts on fragile environmental zones such as riparian areas [96];
• Clearly observable beneficial impact on birds.

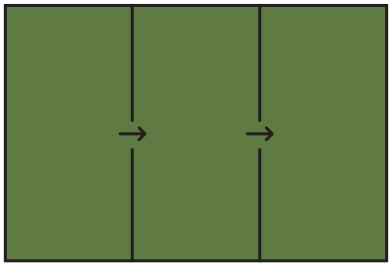
fig. 3-1

Different Rotation Techniques

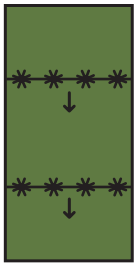
A 1 sub-divided pasture



B 3 large pastures

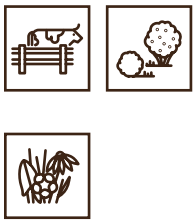


C Fence spider



3.4 BUILD EXCLOSURES IN PASTURES

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Build temporary or permanent exclosures (areas where birds find cover and livestock cannot access) in the middle of the pasture to maintain a section free of grazing (Figure 3-2) [18, 98].

WILDLIFE OBJECTIVES

- Offer nesting birds protective cover from predators;
- Reduce mortality rates of eggs and nestlings caused by the trampling of nests by livestock during the reproduction period of ground-nesting species;
- Increase the attractiveness of the pasture to wildlife.

TIPS

- Create square rather than elongated exclosures (lower perimeter/surface ratio) in herbaceous-type pastures [18];
- Create exclosures measuring approximately 25 to 400 m^2 [78, 81];
- Plant one or more cedar stakes to serve as perches near the centre of the exclosure;
- If desired, allow livestock to access exclusion zones after July 15;
- For a restricted period from May 1 to July 15, consider a larger exclusion zone than the one proposed;
- Change the location of the exclosure from year to year to maintain an herbaceous stratum or, conversely, maintain the same location to encourage the establishment of shrubby vegetation;
- Opt for a barbed wire fence for the exclosure rather than electric fencing, which will serve both as a barrier to livestock and a site for shrikes to impale their prey [37];
- For electrified exclosures, add sections of barbed wire here and there to offer prey-impalement sites for shrikes (*see Recommendation 6.2*).

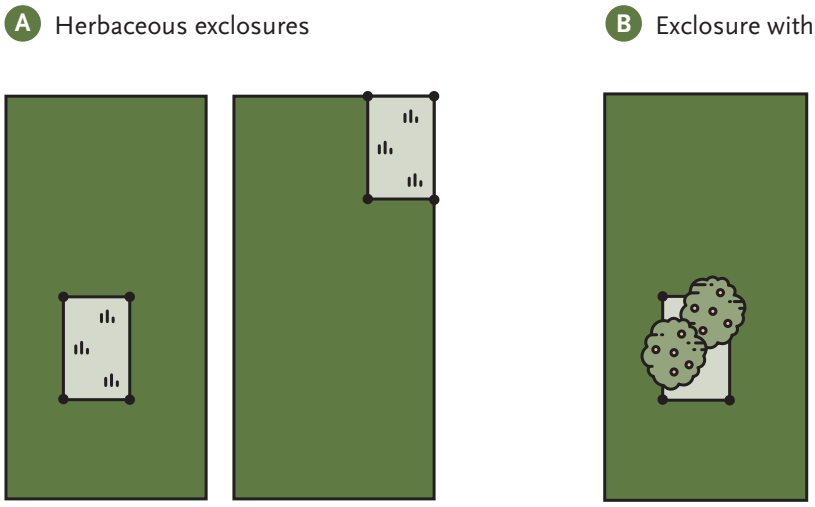
MOTIVATIONS

- Simple and easy to apply;
- Low installation costs and easy to maintain;
- Low maintenance;
- No disturbance of livestock;
- Clearly observable beneficial impact on birds.

NOTE

If herbaceous pastures contain thicketts, plant fence posts 1 m away from shrubs in order to reduce nest destruction caused by livestock brushing against vegetation in which certain species nest.

fig. 3-2 **Different Types of Exclosures**



Upland Sandpiper

© Larry Kirtley

3.5 ADAPT SUPPLEMENTARY FEEDING PRACTICES

Target Habitat(s)

Costs & Benefits

+

DESCRIPTION

Offer supplementary feeding indoors whenever possible. If this is not possible, install the feeding station on a concrete slab large enough to accommodate livestock around it or increase the number of feeding stations and position them a certain distance apart from one another (Figure 3-3) [37].

WILDLIFE OBJECTIVES

- Reduce the disturbance or destruction of nests or ground-nesting species by machinery operating in the pastures;
- Reduce the mortality rate of eggs and nestlings caused by the mass trampling of nests by livestock around feeding stations;
- Ensure a certain protective cover for ground-nesting birds.

Savannah Sparrow

© Simon Pierre Barrette

TIPS

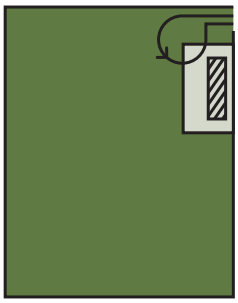
- Offer supplementary feed to lactating females when they are being milked;
- Install the feeding station (or feed train) on a concrete slab near the access (entrance) to the field in order to reduce farm equipment traffic in the pasture as well as the mass trampling of nests by livestock;
- Increase the number of feeding stations and position them a certain distance from one another so that livestock are spread over multiple locations and reduce the frequency at which these feeding stations are repositioned;
- Reduce unnecessary use of machinery in pastures.

MOTIVATIONS

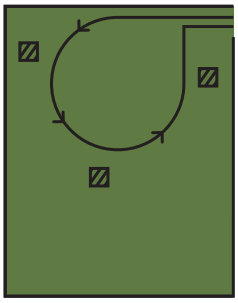
- Simple and easy to apply;
- Low maintenance costs;
- Fuel cost reductions;
- Simple maintenance;
- No real disturbance of livestock;
- Reduced soil compaction;
- Higher quality regrowth;
- Diet easier to control when lactating females come in for milking.

fig. 3-3 **Means of Minimizing Machinery Traffic in Pastures**

A 1 large feeding station



B Several small feeding stations



Feeding station

Concrete slab

Route taken by machinery

Drinking trough on
a concrete slab

© Chenda Duong

UPLAND SANDPIPER

Bartramia longicauda

STATUS

None

VARIATION FROM 1970 TO 2015

-56.1% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Upland Sandpiper uses meadows and pastures as nesting habitat. A large part of its diet consists of grasshoppers, crickets and other insects. The Upland Sandpiper requires low grass and short perches to hunt and feed, as well as higher grass to build its nest on the ground and raise its young.

THREATS

Early and frequent hay-cutting increases the risks of mortality and nest predation. Removal of fences reduces the number of perches available for the species and lowers the quality of its habitat. In the Upland Sandpiper, pesticide use can lead to intoxication through the direct ingestion of these pesticides or contaminated prey. Indirectly, pesticide use renders the habitat unproductive for this species due to the loss of vegetation and a decline in insect abundance.

4

ORCHARDS, VINEYARDS AND BERRY PATCHES

BROWN THRASHER

Toxostoma rufum

STATUS

None

VARIATION FROM 1970 TO 2015

-17.1% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Brown Thrasher prefers abandoned farmland with shrubby vegetation, orchards and hedgerows as breeding habitat. It feeds on insects on the ground, fruit and seeds. A large percentage of the Brown Thrasher's diet is made up of insects that are harmful to crops.

THREATS

In this species, pesticide use can lead to intoxication through the ingestion of contaminated prey. The loss of marginal habitats resulting from efforts to maximize crop acreage reduces the number of nesting and feeding sites available for this species.

ORCHARDS, VINEYARDS AND BERRY PATCHES

4

Description of habitat Fruit-bearing trees (orchards) grown in Quebec include mainly apple, pear, plum and cherry trees. Although shrub-like in nature, grape vines are grown in a manner very similar to fruiting trees (techniques, management, interventions). The same holds true for crops such as blueberries, raspberries, honeyberries, etc. For this reason all these crops have been placed in the same category.

"Summerred" apples

© Gilbert Nicole

Habitat-specific findings Birds do not always enjoy a very favourable reputation with owners of orchards and berry patches since some species can cause damage to fruit crops [34, 99]. However, the species that cause the most damage [34, 99] are not considered farmland birds. These are mainly so-called generalist (American Goldfinch, American Robin, Common Grackle, etc.) or introduced (European Starling, House Finch) species. Fruits make up a minute or occasional portion of the diet of a few species of farmland birds. Considering the benefits of their presence (control of crop pests, weed control, pollination), the damage caused by these species is negligible.

SPECIES ASSOCIATED

- Baltimore Oriole
- Brown Thrasher
- Eastern Screech-Owl
- etc.

Moreover, given the appeal of fruits for certain insect pests, pesticides are applied to orchards and berry crops frequently and in large doses. Since the application of herbicides and fungicides begins in mid-April and lasts through August or September [38], the potential period of exposure for birds is relatively long. Certain products such as carbamates and organophosphates are toxic and affect the survival of birds with lethal doses of less than 1 mg/kg [100]. By making the area unproductive, other chemical compounds have an indirect effect on bird survival by reducing undercover vegetation and modifying their food resources (insects and herbaceous plants) [100]. Certain products can also momentarily alter a bird's behaviour [101]. In this regard, birds drawn to this type of crop can become intoxicated by consuming contaminated prey or simply by exposure. As a result, their behaviour, reproductive success or survival may be affected.

Lastly, although ground nesters breed less frequently in this type of crop than they do in meadows, they are vulnerable to a similar issue, i.e. mowing between rows of trees or bushes [37]. Mowing intervals are generally too short to allow birds enough time to fledge their young before the following cut.

A large portion of the Brown Thrasher's diet is made up of insects (63%). The latter is particularly fond of beetles (leaf beetles, weevils) and moth larvae.

© Larry Kirtley

RECOMMENDATIONS

4.1 Practise integrated pest management
4.2 Plant native fruit-bearing trees and shrubs as "diversions"
4.3 Attract birds of prey
4.4 Adapt or consider alternatives to mowing

OTHER RECOMMENDATIONS

1.1 Use pesticides rationally
5.1 Conduct surveys and adapt pesticide application period accordingly
5.2 Adapt fertilizer use
5.3 Avoid pruning and trimming during nesting period
5.5 Diversify tree varieties within the same plantation
7.1 Conserve vegetation in existing marginal habitats
7.3 Establish high-diversity hedgerows
7.4 Develop/enhance riparian areas
7.5 Delay mowing ditches until after nesting period
7.6 Manage drainage ditches to be suitable for wildlife
7.7 Create/enhance ponds
8.1 Place cedar stakes for use as perches
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.6 Maintain isolated buildings and other structures

BALTIMORE ORIOLE

Icterus galbula

STATUS
None

VARIATION FROM 1970 TO 2015
-72.4% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC
Migratory breeder (species not exclusively associated with farmland). The Baltimore Oriole nests in orchards, large isolated trees, hedgerows, bocages (mixed woodland and pasture) and along watercourses. The species feeds on insects such as caterpillars, aphids, Colorado potato beetles and ants. It also drinks flower nectar, thereby playing a role in pollinating orchards.

THREATS
In this species, pesticide use can lead to intoxication through ingestion of the product itself or contaminated prey. The loss of marginal habitats resulting from efforts to maximize crop acreage reduces the number of nesting and feeding sites available for this species.

4.1 PRACTISE INTEGRATED PEST MANAGEMENT

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Implement environmentally-friendly crop protection methods that use natural elements with the objective of attracting natural enemies of crop pests such as birds, parasitoids and other animal species [102, 103].

WILDLIFE OBJECTIVES

- Reduce the direct and indirect effects of pesticides on bird behaviour, reproductive success and survival [37];
- Limit the intoxication of birds that are exposed to pesticides directly or that consume contaminated prey;
- Avoid rendering the area unproductive for birds through loss of vegetation (food, shelter) or diminished abundance of insects (food) caused by pesticide use;
- Reduce the harmful effects of pesticides on beneficial insects;
- Enjoy a balanced ecosystem conducive to crop growing [102, 103].

TIPS

- Consider the numerous alternative methods available to help reduce pesticide use, notably biological control measures such as the use of natural enemy insects, trap-setting, use of natural products and growth hormones and the development of resistant cultivars [102, 103];
- Avoid or reduce pesticide use during the bird breeding season, i.e. between the months of May and July [37];
- Increase the diversity of cultivars (or species) in orchards, vineyards and berry patches in order to prevent infestations and ensure a respectable harvest [103] while helping to attract a greater variety of natural enemies, including certain birds;
- Plant flowering or grassy vegetation as ground cover (e.g. buckwheat, phacelia, mustard, clover) or a composite hedge (e.g. goldenrod, yarrow) in order to attract more pollinators or natural enemies of crop pests [102, 103] while at the same time creating sites for birds to nest, feed and find shelter;

Banded garden spider
(Argiope trifasciata)
wrapping up its prey

© Stéphane Lamoureux

- Plant native fruit-bearing trees or shrubs to attract natural enemies [99], including certain birds (*see Recommendations 4.2 and 7.3*);
- Attract birds of prey as natural enemies of crop pests by installing or maintaining structures favouring their presence [99] (*see Recommendation 4.3*);
- Accept a minimum loss of 5% in exchange for the ecosystem services provided by the bird community [34, 99].

The seven-spotted ladybug, a natural enemy of spider mites, is a very useful insect in orchards.

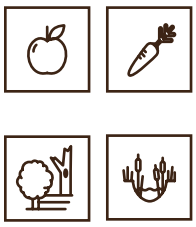
© Suzanne Labbé

MOTIVATIONS

- Lower pesticide costs;
- Mitigation of environmental impact [104];
- Attraction of natural enemies (predators and parasitoids) of crop pests;
- Attraction of pollinators;
- Healthy and safe workplace;
- Lower health risks for humans.

4.2 PLANT NATIVE FRUIT-BEARING TREES AND SHRUBS AS "DIVERSIONS"

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Divert birds to other food-producing areas by planting native fruit-bearing trees and shrubs (*see Appendix B*) in proximity to or along the perimeter of plantations in order to protect crop yields [99].

WILDLIFE OBJECTIVES

- Offer fruit-eating species a more interesting alternative food source [99, 105];
- Attract natural enemies of crop pests;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

- Opt for native species whose fruits are smaller than those of the crops being grown, since they are easier to consume and are favoured by birds [99];
- Choose species whose fruiting period precedes and extends beyond that of the species being cultivated [105];
- Select an assortment of species that will alternately bear fruit throughout the season [99];
- Prefer species that mature earlier and whose fruit is sweeter than the species being cultivated [99, 103];
- Choose species suited to the local soil and climate;
- If the site is exposed to strong winds, design the hedge to act as a windbreak [106] (*see Recommendation 7.3*);
- Accept a minimum loss of 5% in exchange for the ecosystem services provided by the bird community [34].

MOTIVATIONS
• Attraction of natural enemies (predators and parasitoids) of crop pests [105];
• Attraction of pollinators [105];
• Reduced production losses [105];
• Opportunity to diversify product variety;
• Lower pesticide costs;
• Healthy and safe workplace;
• Lower health risks for humans;
• Visual appreciation of this landscape element.

Various berry bushes likely to divert birds from main crops if planted in proximity to the latter:

1 Black chokeberry (*Aronia melanocarpa*)
© Jardin botanique de Montréal (Robert Mineau)

2 Red elderberry (*Sambucus pubens*)

3 Serviceberry (*Amelanchier sp.*)
© Suzanne Labbé

4 Highbush cranberry (*Viburnum trilobum*)
© Canadian Forest Service

5 Chokecherry (*Prunus virginiana*)
© Ressources forestières biotiques

4.3 ATTRACT BIRDS OF PREY

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Install structures (nest boxes, perches, nesting platforms) to attract birds of prey that are natural enemies of crop pests (rodents, insects, harmful birds).

WILDLIFE OBJECTIVES

- Control the presence of species that are undesirable for crops (including non-farm-land bird species) by favouring the presence of birds of prey;
- Offer birds of prey quality habitats to feed, rest and reproduce;
- Favour integrated pest management and enjoy a balanced ecosystem conducive to crop growing [102, 103].

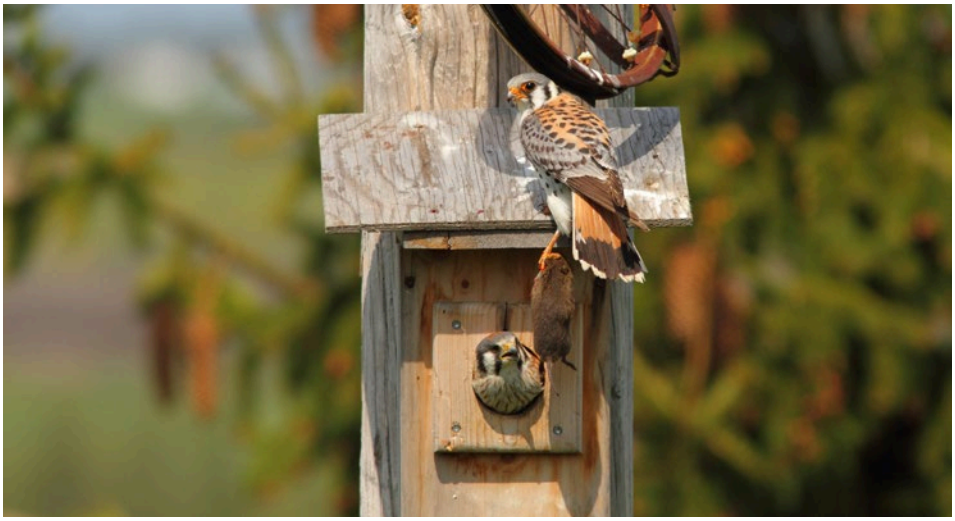
Two perches for birds of prey : 1 metal perch with crossbar in an espalier orchard and 2 wooden perch made with a felled tree in a raspberry patch.

1

© Association du mont Rougemont

2

© Chantal Leblanc (CAPSA)



The American Kestrel feeds primarily on insects (74%) and rodents (16%). This species can be attracted by installing a suitable nest box.

© Sylvain Rioux

TIPS

- Maintain snags that are used naturally as lookout and rest sites by various birds of prey or as a breeding site by cavity nesters (e.g. American Kestrel, Eastern Screech-Owl, etc.) [107] (*see Recommendation 7.1*);
- Install large perches (7-9 m high or 1-2 m higher than trees) with one or two 1-2 m wide crossbar perches [108] (*see Appendix C*);
- Plant small perches (cedar pickets) of variable height (average of 1.5 m) every 200-300 m to attract Northern Harriers and Short-eared Owls (*see Recommendation 8.1*);
- On a pole at least 14 feet (4.3 m) high, install a nesting platform (2' x 2') at the edge of a woodlot for Red-tailed Hawk or Great-horned Owl (*see Appendix C*);
- Install nest boxes for American Kestrel, Eastern Screech-Owl, Saw-whet Owl and Barred Owl while taking into consideration the specific characteristics of the species being targeted (*see Appendix D and Recommendation 7.1*).

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Inexpensive to implement;
- No disturbance to crops or agricultural activities;
- Attraction of natural enemies of crop pests;
- Cost savings with regard to depredation;
- Reduced production losses;
- Clearly observable beneficial impact on birds;
- Interest and sense of attachment to birds of prey;
- IAppeal of building the structures oneself;
- Reuse/recovery of materials (stakes, poles, wooden pallets).

4.4 ADAPT MOWING PRACTICES OR CONSIDER ALTERNATIVES TO MOWING

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Avoid mowing between rows during the nesting season (mid-May to mid-July) and consider alternatives to reduce the need for such mowing through the use of ground cover or straw mulch.

WILDLIFE OBJECTIVES

- Reduce the impact on birds of mowing between rows of fruit-bearing trees and berry bushes;
- Limit operating disturbance-causing machinery during the bird breeding season;
- Avoid destroying nests and birds during their reproduction period;
- Allow for regrowth of plant cover in order to reduce the risks of predation during the reproduction period;
- Offer reproduction/feeding sites and cover for birds nesting in these habitats.

TIPS

- If necessary, perform an early cut in mid-May, i.e. before the bird nesting period [37];
- Consider an interval of 60 to 65 days between the first spring cut and the following cut, if the latter is deemed necessary [37];
- If desired, mow without restriction (frequency and interval) after mid-July [37];
- Harrow and plant non-woody plants as ground cover in order to both control the spread of weeds and woody shrubs and reduce row maintenance [37];
- Consider buckwheat, phacelia, mustard or legumes such as Ladino clover as ground cover that will serve as shelter, feeding areas or nesting sites for birds and parasitoid insects [109];
- Use ground cover as green manure in order to stimulate soil life [103] (*see Recommendation 5.2*);
- Limit the spread of weeds by using straw mulch (8" thick) between rows of fruit trees and berry bushes [110].

MOTIVATIONS
• Application simple, easy and not overly demanding;
• Inexpensive to implement;
• Reduced need for maintenance between rows (time, cost);
• No disturbance to crops or agricultural activities;
• Attraction of natural enemies of crop pests;
• Lower bird mortality.

Baltimore Oriole in a cherry tree. During the nesting period, the oriole consumes large numbers of insects, including the larvae of several species of defoliating moths (>30% of its diet).

© Marcel Gauthier

EASTERN SCREECH-OWL

Megascops asio

STATUS

None

VARIATION FROM 1970 TO 2015

Non-available

PRESENCE IN QUEBEC

Year-round resident, breeder (species not exclusively associated with farmland). The Eastern Screech-Owl uses a number of habitats, including orchards. The species generally nests in natural cavities of large dead or dying trees. It feeds on insects and small mammals, making its presence in orchards of great value to farmers.

THREATS

The decline of dead or dying trees in agricultural areas limits the number of nesting sites available to the Eastern Screech-Owl. In this species, pesticide use can result in the ingestion of contaminated prey and biomagnification.

5

TREE CROPS

FIELD SPARROW

Spizella pusilla

STATUS

Candidate for Assessment (COSEWIC)

VARIATION FROM 1970 TO 2015

-86.3% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: In terms of habitat preferences, the Field Sparrow frequents young pine stands, pastures or abandoned farmland characterized by shrubby vegetation. The species nests on the ground or in bushes within 15 metres of the ground. It feeds on insects on the ground during the nesting period as well as seeds the remainder of the year.

THREATS

The Field Sparrow's decline is notably attributable to the loss of habitat resulting from the increasing scarcity of shrubby parcels and the natural plant succession of abandoned farmland. In this species, pesticide use can lead to intoxication through the ingestion of contaminated prey. Intensive grazing also increases the risks of nest predation.

TREE CROPS

5

Description of habitat In agricultural regions, tree crops grown for timber are largely found on abandoned plots characterized by herbaceous or shrubby vegetation. These are often parcels that were abandoned because they were less suitable for agriculture, whether small, poorly drained or not particularly fertile. Species used notably include hybrid poplars that are the result of cross-breeding different native and/or exotic species, as well as spruce, pines, balsam fir and cedars (Thuja). Poplar and pine plantings are mainly used for timber production, while firs are grown as Christmas trees.

Although multi-species plantations are increasingly encouraged, tree crops generally comprise a single species or a few different clones or hybrids of the same species (as is the case for hybrid poplars).

Stand of red pine

© Martin Joly

Habitat-specific findings Tree crops in agricultural regions constitute an interesting habitat for birds by offering tree cover in which they can hide, perch or make their nests. Herbaceous vegetation growing between the rows is mowed so it does not inhibit tree growth and to facilitate access for pruning or cutting. Unfortunately, as is the case for orchards and berry patches, such mowing increases the mortality rate of ground-nesting birds and reduces their reproductive success [37].

SPECIES ASSOCIATED

- Clay-coloured Sparrow
- Field Sparrow
- Vesper Sparrow
- etc.

Moreover, in the case of pines and hybrid poplars grown for their wood, the importance of a straight and knot-free trunk means their branches must be pruned frequently [111, 112]. These branches are often used by birds to build their nests, however, making them vulnerable to pruning carried out during the breeding season. Additionally, recurrent comings and goings to carry out such work during this period can be a source of disturbance for birds. Harvesting wood also requires the use of machinery, which can destroy entire clutches. When all the trees in a given parcel are felled, the habitat is eliminated completely [113].

Lastly, pesticides are also used in these crops to protect them against insect pests that can significantly compromise tree growth or even jeopardize their survival. As is the case in other crops on which they are used, these pesticides can affect the health of birds if the latter are directly exposed to them or through consumption of contaminated prey (insects or small mammals) [114]. Nestlings and eggs are likely the most affected when insecticides are applied to plantations [114]. Similarly, the use of granular fertilizers can also affect the health and survival of birds if they are consumed accidentally.

Planting multiple species (here: black walnut, white spruce and red ash) offers birds a diversified habitat that can meet various needs.© Ressources forestières biotiques

RECOMMENDATIONS

5.1 Conduct surveys and adapt pesticide application period accordingly
5.2 Adapt fertilizer use
5.3 Avoid pruning and trimming during nesting period
5.4 Avoid harvesting during nesting period
5.5 Diversify tree varieties within the same plantation

OTHER RECOMMENDATIONS

1.1 Use pesticides rationally
4.1 Practise integrated pest management
4.3 Attract birds of prey
4.4 Adapt or consider alternatives to mowing
7.1 Conserve vegetation in existing marginal habitats
7.4 Develop/enhance riparian areas
7.5 Delay mowing ditches until after nesting period
7.6 Manage drainage ditches to be suitable for wildlife
8.1 Place cedar stakes for use as perches
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.6 Maintain isolated buildings and other structures

CLAY-COLOURED SPARROW

Spizella pallida

STATUS
None

VARIATION FROM 1970 TO 2015
+406.0% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC
Migratory breeder: During the breeding season, the Clay-coloured Sparrow can be found in young conifer stands, pastures and abandoned farmland characterized by herbaceous vegetation. The species feeds of various seeds as well as insects during the breeding season. It generally builds its nest on the ground or in a bush less than 2 metres from the ground.

THREATS
The conversion of flat scrubland to crops causes significant habitat loss for the Clay-coloured Sparrow. Intensive grazing can result in nest destruction or significant disturbance during the breeding period. This species faces risks of ingestion of pesticides or contaminated prey.

5.1 CONDUCT SURVEYS AND ADAPT PESTICIDE APPLICATION PERIOD ACCORDINGLY

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Carry out an insect survey to limit spraying to infested areas. Adapt the pesticide application period so as to reduce the impacts of said pesticides on wildlife.

WILDLIFE OBJECTIVES

- Limit the intoxication of birds exposed to pesticides or that consume them in the form of granules or contaminated prey;
- Avoid rendering the area unproductive for birds through loss of vegetation (food, shelter) or diminished abundance of insects (food);
- Allow the majority of young birds to fledge before applying insecticides;
- Reduce the impact of insecticides on beneficial insects (predators and pollinators) [115].

TIPS

- Apply herbicides very early in the season, i.e. before bud break in early May [115];
- Postpone the application of certain pesticides to late June [37];
- Conduct a survey early in the season with a view to applying insecticides only in those parcels that are infested;
- Try to cut in very early spring in order to reduce herbicide use [116] (*see Recommendation 4.4*);
- Favour integrated pest control rather than the use of insecticides (*see Recommendation 4.1*).

MOTIVATIONS

- Reduced pesticide-related costs;
- Simple and easy to apply;
- No impact on trees;
- Lower bird mortality;
- Attraction of natural enemies (predators and parasitoids) of crop pests;
- Attraction of pollinators.

Damage to branches indicating the presence of aphids

© Quebec Department of Forests, Wildlife and Parks

5.2 ADAPT FERTILIZER USE

DESCRIPTION

Adapt the use of fertilizers in order to reduce their impact on wildlife, either by opting for organic fertilizers or by conducting soil analyses before applying them.

WILDLIFE OBJECTIVES

- Limit the amount of granular fertilizer accessible to birds;
- Avoid intoxicating birds that ingest granular fertilizers due to confusion with healthy seeds;
- Offer nest-making material and protective cover from predators (organic mulch).

TIPS

- Conduct soil analyses in order to use the appropriate fertilizers at the appropriate doses;
- Favour the use of organic (manure, compost) rather than granular fertilizers [116];
- Use an organic mulch as compost, which will serve as fertilizer while reducing weed growth between rows [116];
- Consider planting green manure crops (e.g. ryegrass, alfalfa, pearl millet, mustard, buckwheat, clover, etc.) in order to increase soil organic matter [103, 106].

MOTIVATIONS

- Ecological benefits for soil structure and microorganisms [116];
- Cost and time savings related to implementation;
- Time savings related to mowing, weeding and herbicide application;
- Reduction of unnecessary manure spreading or fertilizer use;
- Higher quality soil can be obtained by knowing what to apply;
- Lower bird mortality.

Target Habitat(s)

Costs & Benefits

Field Sparrow

© Todd Fellenbaum

5.3 AVOID PRUNING AND TRIMMING DURING NESTING PERIOD

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Avoid pruning trees or cutting branches to obtain knot-free wood as well as trimming bushes during the bird breeding season, i.e. from mid-May to mid-July.

WILDLIFE OBJECTIVES

- Offer birds sites to build their nests or perch;
- Offer birds higher quality protective cover;
- Reduce the disturbance or destruction of nests caused by these practices.

TIPS

- Prioritize pruning and trimming after mid-July for all species, despite the fact that optimal pruning/trimming periods vary from one species to another [118, 119, 120];
- Mark trees where nests have been identified so that they are not prioritized for treatment if pruning and trimming work cannot be entirely avoided during the bird breeding season.

MOTIVATIONS

- No cost to implement;
- Simple and easy to apply;
- Little impact on trees;
- Lower risks of trees becoming infected by diseases or insects;
- Lower bird mortality.

The Field Sparrow builds its nest directly on the ground or in the crotch of a bush or sapling up to 1.5 m above ground.

© Mike Allen

5.4 AVOID HARVESTING DURING NESTING PERIOD

DESCRIPTION

Harvest trees outside the bird breeding season, i.e. between mid-May and mid-July.

WILDLIFE OBJECTIVES

- Avoid modifying or destroying bird habitat during the nesting period;
- Offer perches that can be used by birds as lookouts;
- Offer protective cover from predators during the nesting period.

TIPS

- Limit the amount of work carried out during the bird breeding season, i.e. May to July;
- Avoid driving between crop rows during the breeding season;
- Harvesting should preferably be done in the fall, i.e. between mid-October and mid-November.

MOTIVATIONS

- No cost to implement;
- Simple and easy to apply;
- No impact on trees;
- Lower bird mortality.

The Clay-coloured Sparrow frequents young conifer stands during the nesting period.

© Raymond Ladurantaye

Target Habitat(s)

Costs & Benefits

5.5 DIVERSIFY TREE VARIETIES WITHIN THE SAME PLANTATION

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Combine more than one type of tree within a given plantation (Figure 5-1).

WILDLIFE OBJECTIVES

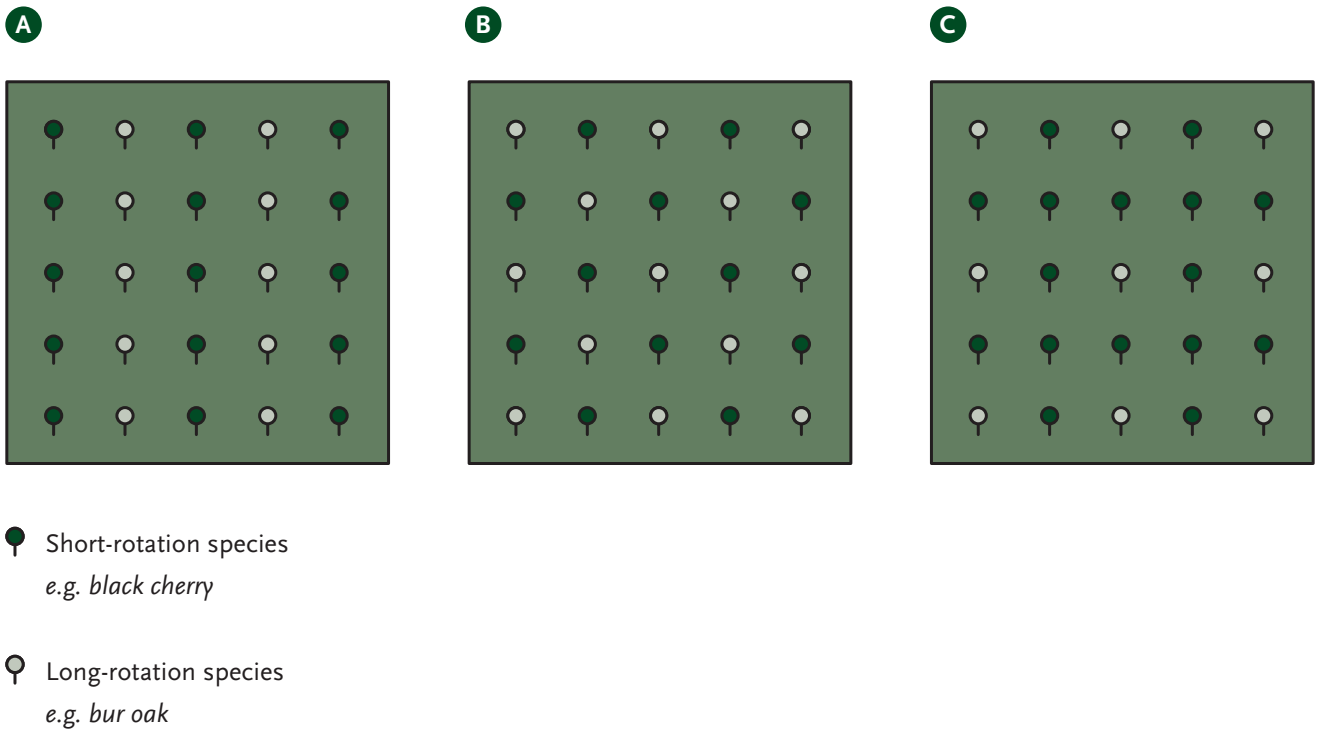
- Offer and ensure the long-term preservation of reproduction/feeding sites and cover for birds nesting in this habitat;
- Offer habitats with diverse characteristics that meet the needs of multiple species;
- Promote and maintain the presence of birds and insects that are considered to be natural enemies of crop pest species;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

- Favour native species and, if possible, those that produce seeds or fruits that can be consumed by birds (*see Appendix B*);
- Combine tree species that have differing aerial development and growth (e.g. bur oak and black cherry) in order to favour vertical growth and spread revenue over time [121];
- Combine slow-growing commercial hardwoods and fast-growing poplars on the same parcel, whether practising intensive sylviculture or intercropping [122];
- If possible, use more than one slow-growing species and more than one fast-growing species at the same site as per the planting model selected;
- Consider clones or cultivars with different characteristics (growth and aerial development) if it is not possible to plant a variety of species;
- Incorporate native berry bushes to complement deciduous trees in order to offer a more tiered structure and favour greater biodiversity (*see Appendix B*);
- Avoid using yellow birch in plantations in open areas, as this species is characterized by bushy growth that is difficult to control [121].

MOTIVATIONS
• Better vertical growth of commercial hardwoods [121, 122];
• Long-term preservation of landscape [122];
• Similar forest management practices from one species to another [122];
• Superior protection against disease and pest infestation [121, 122];
• Opportunity to diversify product variety;
• Better spreading of revenue over time [121];
• Clearly observable beneficial impact on birds;
• Increased biodiversity.

fig. 5-1 **Different Means of Establishing Diversified Plantations while Considering the Alternation of Short- and Long-rotation Species** [121]



6

ABANDONED FARMLAND

GOLDEN-WINGED WARBLER

Vermivora chrysoptera

STATUS

Threatened (SARA), Likely to be Designated as Threatened or Vulnerable (ARTVS)

VARIATION FROM 1970 TO 2015

Non-available

PRESENCE IN QUEBEC

Migratory breeder: The Golden-winged Warbler prefers abandoned farmland characterized by shrubby vegetation as nesting habitat. The species nests on or near the ground. It feeds on insects and spiders that it finds on the ground.

THREATS

Intensive farming and, inversely, forest regeneration are responsible for the destruction and loss of its habitat. Pesticide use increases the risks of ingesting contaminated prey. Indirectly, pesticide use renders the habitat unproductive for this species due to the loss of vegetation and insects.

ABANDONED FARMLAND

6

Description of habitat Abandoned farmland is open successional habitat, i.e. a parcel of agricultural land that is no longer used to grow crops or even maintained, and where shrubs or even trees have taken root. The composition of abandoned farmland varies depending on the history of the parcel [123]. These plots are often abandoned on account of their low productivity [124]. This habitat is a transitional one and requires a certain effort in order to maintain it in the desired state [125].

Habitat-specific findings Abandoned farmland is host to an abundance of birds and a high diversity of species [36]. This type of habitat attracts a large number of birds considered to be natural enemies of crop pest species. The issue with abandoned farmland is essentially a question of habitat loss for the species that depend on such habitat. On one hand, this loss is triggered by an effort to maximize crop acreage whereby abandoned farmland is returned to production as a result of pressure to intensify operations [123]. On the other hand, these habitats have naturally reverted to forest due to their instability [125] or have been purposely reforested by humans since this is the simplest way to enhance the value of abandoned farmland [126]. However, maintaining abandoned farmland is essential for species at risk that use such habitats almost exclusively such as the Golden-winged Warbler and Loggerhead Shrike.

Overgrown gullies, Lanaudière

© Martin Joly

SPECIES ASSOCIATED

- Brown Thrasher
- Eastern Towhee
- Field Sparrow
- Golden-winged Warbler
- Loggerhead Shrike
- etc.

The other threats faced by birds are related to the issues addressed under the habitats discussed above. First, pesticides applied to adjacent crops can (i) reach nests and affect the development and survival of young and (ii) disturb the composition of the plant community specific to abandoned farmland and increase the risk of predation [37].

Secondly, since abandoned fields are sometimes used as pastures, the same issues of trampling and intensive grazing can affect ground-breeding birds while the nests of species that make their nests in bushes (Golden-winged Warbler, Eastern Towhee) can be destroyed when livestock use these shrubs as a scratching post [37]. It should be noted, however, that livestock grazing pressure hampers plant succession, which in turn helps maintain abandoned farmland [127]. Introducing livestock is thus an option worth exploring to ensure the longevity of this habitat.

The Golden-winged Warbler is a species at risk that nests in abandoned farmland, a habitat that is not only scarce but also short-lasting due to its transitional nature.

© Régis Fortin

Lastly, abandoned fields are often used to park farm equipment. As the peak period for machinery use coincides with the bird nesting season, the comings and goings of farm equipment represent, as is the case for annual crops, a high risk of mortality for ground-nesting species [37].

RECOMMENDATIONS

6.1 Avoid or adapt recultivation in abandoned fields
6.2 Avoid or adapt tree planting in abandoned fields
6.3 Integrate livestock into abandoned fields in order to maintain them
6.4 Periodically mow abandoned fields in order to maintain them
6.5 Avoid operating and storing machinery in abandoned fields

OTHER RECOMMENDATIONS

3.2 Limit the density of livestock in pastures
3.3 Control grazing by practising pasture rotation
3.4 Build exclosures in pastures
4.3 Attract birds of prey
7.1 Conserve vegetation in existing marginal habitats
7.7 Create/enhance ponds
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.5 Encourage Barn Swallow nesting
8.6 Maintain isolated buildings and other structures

LOGGERHEAD SHRIKE

Lanius ludovicianus

STATUS

Endangered (SARA), Threatened (ARTVS)

VARIATION FROM 1970 TO 2015

-96.9% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Loggerhead Shrike's breeding habitat includes abandoned farmland characterized by shrubby vegetation as well as pastures and diversified hedgerows. It generally builds its nest in an isolated tree. The Loggerhead Shrike feeds on small birds and mammals as well as insects. Lacking talons, it captures its prey with its bill and impales the latter on barbed wire or on the thorns of a hawthorn bush.

THREATS

Agricultural intensification and forest regeneration are responsible for a decline of its habitat. Removal of fences due to livestock confinement, conversion of dairy farms to field crops and the elimination of hawthorns in agricultural regions all contribute to the deterioration of the Loggerhead Shrike's habitat. Pesticide use can lead to intoxication in this species through the ingestion of contaminated prey.

6.1 AVOID OR ADAPT RECULTIVATION IN ABANDONED FIELDS

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Strive to avoid recultivating abandoned farmland, which offers habitats that are used extensively by wildlife. If recultivation cannot be avoided, limit the targeted surfaces (Figure 6-1) and carry out work outside the bird breeding season.

WILDLIFE OBJECTIVES

- Ensure the presence of this habitat to offer the associated bird species a place to nest, feed and find cover;
- Ensure quality habitat for species at risk that nest almost exclusively in abandoned farmland characterized by shrubby vegetation (e.g. Golden-winged Warbler, Loggerhead Shrike) or regularly in abandoned parcels characterized by herbaceous cover (e.g. Grasshopper Sparrow and Eastern Meadowlark) [1];
- Avoid accidental mortality of eggs, nestlings and adults nesting in abandoned farmland during recultivation work involving the frequent use of machinery;
- Maintain the presence of birds and insects that are considered to be natural predators of pest species in nearby crops;
- Diversify the agricultural landscape;
- Maintain a certain connectivity between different habitats;
- Maintain or increase biodiversity.

The Grasshopper Sparrow regularly nests in abandoned farmland characterized by shrubby vegetation.

© Marcel Gauthier

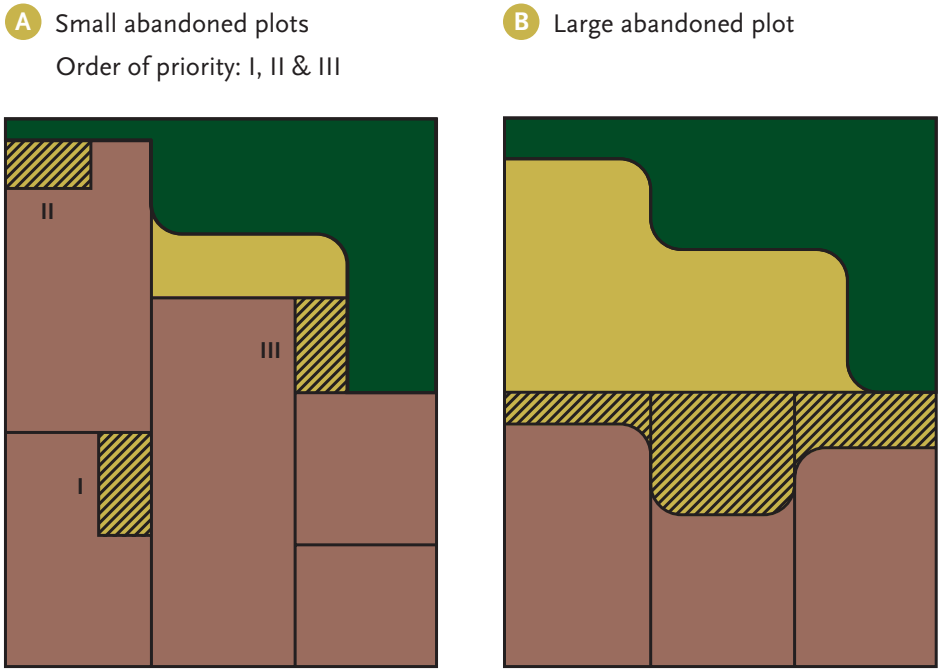


fig. 6-1 **Possible Adaptations for Recultivating Abandoned Farmland**

TIPS

- Survey abandoned parcels for the presence of species at risk (birds, herpetofauna, flora) before considering recultivation work;
- Avoid returning abandoned parcels to production where the presence of species at risk is known or has been validated;
- Consult with conservation organizations with regard to legal options for protecting sites that are home to species at risk;
- If recultivation is necessary and justified, conserve a portion of the abandoned plot—ideally at least 0.3 ha [128]—in its fallow state (Figure 6-1);
- Avoid recultivation work during the nesting period, i.e. between May and mid-July for most species;
- If recultivation cannot be avoided, choose as much as possible small abandoned fields (< 0.3 ha) isolated from high-potential wildlife habitats (Figure 6-1);
- If recultivation cannot be avoided, carry out work preferably in the fall.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No real disturbance to adjacent crops;
- Clearly observable beneficial impact on birds;
- Attraction of natural enemies of crop pests;
- Opportunity to support the conservation of species at risk.

NOTE

Some abandoned farmland hosts species at risk such as the Grasshopper Sparrow (herbaceous parcels) or the Golden-winged Warbler (shrubby parcels). It is thus recommended to verify whether or not such species are present before returning a plot to crop production or planting trees.

6.2 AVOID OR ADAPT TREE PLANTING IN ABANDONED FIELDS

Target Habitat(s)

Costs & Benefits

+++

The Blue-winged Warbler nests on or near the ground in abandoned farmland, generally within 30 m of a forest edge. The species is very rare in Quebec and is found only in southern Montérégie, specifically in the Huntingdon area.

© Alain Quenneville

DESCRIPTION

Strive to avoid reforesting abandoned farmland, which offers habitats that are extensively used by wildlife. If planting cannot be avoided, limit the targeted surfaces and carry out work outside the bird breeding season.

WILDLIFE OBJECTIVES

- Ensure the presence of this habitat to offer the associated bird species a place to nest, feed and find cover;
- Ensure quality habitat for species at risk that nest almost exclusively in abandoned farmland characterized by shrubby vegetation (e.g. Golden-winged Warbler, Loggerhead Shrike) or regularly in abandoned parcels characterized by herbaceous cover (e.g. Grasshopper Sparrow and Eastern Meadowlark) [1];
- Avoid accidental mortality of eggs, nestlings and adults nesting in abandoned farmland during recultivation work involving the frequent use of machinery;
- Maintain the presence of birds and insects that are considered to be natural predators of pest species in nearby crops;
- Diversify the agricultural landscape;
- Maintain a certain connectivity between different habitats;
- Maintain or increase biodiversity.

TIPS

- Survey abandoned parcels for the presence of species at risk (birds, herpetofauna, flora) before considering tree-planting work;
- Avoid planting trees in abandoned parcels where the presence of species at risk is known or has been validated;
- Consult with conservation organizations with regard to legal options for protecting sites that are home to species at risk;
- If planting is being considered, conserve a portion of the abandoned plot (ideally at least 0.3 ha) in its fallow state [128];
- Consider planting fruit crops that incorporate a diversity of native shrubs (e.g. serviceberry, black chokeberry, highbush cranberry) as an alternative to plantations intended for timber production (reforestation, intensive silviculture), since they more closely resemble the shrubby habitat found in abandoned farmland;

- If planting with the aim of timber production is being considered, opt for seed- or fruit-bearing trees (e.g. oak, hickory, black cherry) that offer a food source for birds [130];
- If such a habitat management project is being considered, incorporate open areas and patches of native bushes favoured by birds (*see Appendix B*) into the plantation, regardless what kind;
- Integrate hawthorns that can be used by shrikes as nesting sites and for impaling their prey [1] if a plantation (regardless what kind) is being considered;
- Avoid planting work during the nesting period, i.e. between May and mid-July for most species;
- Preferably, work should be carried out in the fall if tree planting is being considered.

Thanks to their complex plant structure, the transitional environments between meadows and forests that characterize abandoned farmland offer unique habitats and are home to a number of species that have adapted to such habitats. It is recommended to survey for the presence of species at risk if this type of habitat is being considered for reforestation.

© Stéphane Lamoureux

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Time and cost savings if reforestation work is not undertaken [129];
- No real disturbance to adjacent crops;
- Clearly observable beneficial impact on birds;
- Attraction of natural enemies of crop pests;
- Opportunity to support the conservation of species at risk.

6.3 INTEGRATE LIVESTOCK INTO ABANDONED FIELDS IN ORDER TO MAINTAIN THEM

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Ensure that abandoned plots are maintained by using them as pastureland, where the pressure associated with livestock grazing and trampling will limit plant succession (Figure 6-2) [127].

WILDLIFE OBJECTIVES

- Limit plant succession in abandoned plots;
- Ensure the presence of this habitat as a nesting/feeding site and sanctuary for certain bird species associated with such habitat;
- Ensure quality habitat for species at risk that nest almost exclusively in abandoned farmland characterized by shrubby vegetation (e.g. Golden-winged Warbler, Loggerhead Shrike) or regularly in abandoned parcels characterized by herbaceous cover (e.g. Grasshopper Sparrow and Eastern Meadowlark) [1];
- Promote and maintain the presence of birds and insects that are considered to be natural enemies of crop pests present in the vicinity;
- Curtail the spread of invasive/exotic plants [127] including glossy buckthorn and European buckthorn;
- Diversify the agricultural landscape;
- Maintain a certain connectivity between different habitats;
- Maintain or increase biodiversity.

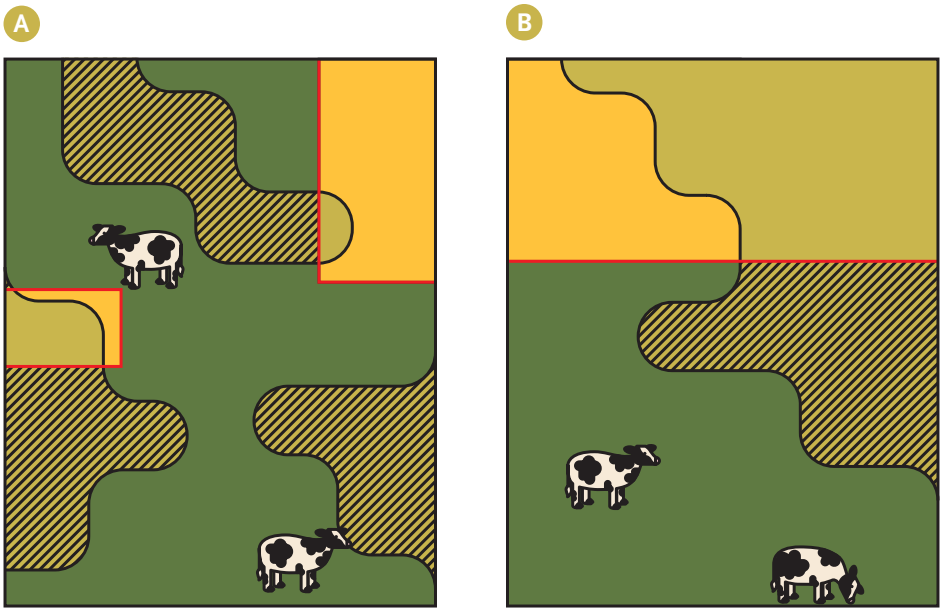


fig. 6-2 **Approaches for Integrating Livestock into Abandoned Farmland while Maintaining Bird Refuge Areas (exclosures)**

TIPS

- If possible, bring livestock into abandoned farmland only after mid-July when the nesting period has already been completed for most species [1];
- Limit livestock density to no greater than 2.5 heads/ha or limit time of exposure by means of pasture rotation [131];
- Consider installing an exclosure that overlaps both abandoned farmland and conventional pasture in order to preserve a section of the abandoned plot that will not be grazed or trampled by livestock;
- Build temporary or permanent exclosures (areas where birds find cover and livestock cannot access) around a few thickets to keep areas protected from grazing and prevent nests, both on the ground and in bushes, from being trampled or destroyed when livestock use these bushes as scratching posts [37, 98];
- Build temporary or permanent exclosures in areas where plant succession is desired in order to improve the quality of the abandoned parcel;
- Vary the location of the exclosure from year to year around thickets in order to regulate plant succession;
- Opt for a barbed wire fence for the exclosure rather than electric fencing, which will serve both as a barrier to livestock and a site for shrikes to impale their prey [37];
- For electrified exclosures, add sections of barbed wire here and there to offer prey-impalement sites for shrikes (*see Recommendation 8.2*).

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No real disturbance to adjacent crops;
- No real disturbance of livestock;
- Clearly observable beneficial impact on birds;
- Attraction of natural enemies of crop pests;
- Opportunity to support the conservation of species at risk;
- Alternative pastures;
- Accessible shade for livestock;
- Opportunity to reuse and give value to barbed wire;
- Less habitat maintenance work thanks to livestock [127];
- Reduced spread of exotic/invasive plants [127].

The Eastern Towhee uses pastures and abandoned farmland characterized by shrubby vegetation for nesting.

© Régis Fortin

6.4 PERIODICALLY MOW ABANDONED FIELDS IN ORDER TO MAINTAIN THEM

Target Habitat(s)

Costs & Benefits

+++

DESCRIPTION

Maintain abandoned fields by periodically mowing them every 2 to 10 years as appropriate and depending on the type of habitat desired [37, 130].

WILDLIFE OBJECTIVES

- Limit plant succession in abandoned plots;
- Ensure the presence of this habitat as a nesting/feeding site and sanctuary for certain bird species associated with such habitat;
- Ensure quality habitat for species at risk that nest almost exclusively in abandoned farmland characterized by shrubby vegetation (e.g. Golden-winged Warbler, Loggerhead Shrike) or regularly in abandoned parcels characterized by herbaceous cover (e.g. Grasshopper Sparrow and Eastern Meadowlark) [1];
- Promote and maintain the presence of birds and insects that are considered to be natural enemies of crop pests present in the vicinity;
- Diversify the agricultural landscape;
- Maintain a certain connectivity between different habitats;
- Maintain or increase biodiversity.

TIPS

- Mow in late summer (August), i.e. after the bird breeding season (mid-July) and when the ground is dry [130];
- Avoid mowing in the fall, which has a negative impact on the composition and growth of plant species while encouraging the spread of non-native/invasive species [130];
- If possible, identify rare or at-risk plants prior to mowing and thereby avoid cutting them [130].

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No real disturbance to adjacent crops;
- Attraction of natural enemies of crop pests;
- Opportunity to support the conservation of species at risk;
- Reduced spread of exotic/invasive plants [130].

NOTE

By annually alternating mowing sites within a large abandoned plot or a series of small adjacent abandoned plots, a variety of habitats can be offered for birds.

6.5 AVOID OPERATING AND STORING MACHINERY IN ABANDONED FIELDS

DESCRIPTION

Avoid operating and storing machinery in abandoned fields.

WILDLIFE OBJECTIVES

- Avoid disturbing birds in abandoned parcels during the nesting period;
- Reduce the mortality rate of eggs and nestlings caused by operating machinery.

TIPS

- Store machinery in areas of little interest to birds (shed, yard, etc.);
- Avoid storing machinery in abandoned farmland during the nesting period, i.e. between May and mid-July for most species;
- If storing such equipment in abandoned plots cannot be avoided, select machinery that will not be used or moved frequently;
- Generally limit the unnecessary use and recurrent comings and goings of machinery in abandoned plots.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Lower risks of damage to machinery caused by branches, stones or uneven ground;
- Tidy appearance;
- Visual appreciation of this landscape element;
- Good neighbourliness.

Golden-winged Warbler © Alain Quenneville

Target Habitat(s)

Costs & Benefits

EASTERN TOWHEE

Pipilo erythrophthalmus

STATUS

None

VARIATION FROM 1970 TO 2015

-78.3% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder and occasional winter resident in southern Quebec. The Eastern Towhee uses abandoned shrubby parcels, pastures and diversified hedgerows as nesting habitat. This species builds its nest on the ground or within 1.5 m thereof. It feeds on insects, spiders, seeds as well as fruits on occasion.

THREATS

Intensive grazing in abandoned plots characterized by shrubby vegetation can cause nest destruction/predation or represent a source of disturbance during the breeding period. For the Eastern Towhee, pesticide use can lead to intoxication through the ingestion of contaminated prey. Indirectly, pesticide use renders the habitat unproductive for this species due to the loss of vegetation and insects.

7

MARGINAL HABITATS

AMERICAN KESTREL

Falco sparverius

STATUS

Candidate for Assessment (COSEWIC)

VARIATION FROM 1970 TO 2015

-44.6% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder and occasional winter resident in southern Quebec. The American Kestrel uses pastures, meadows, hayfields, abandoned fields dominated by herbaceous vegetation and hedgerows as habitat both during the nesting periods and in winter. It is in these habitats that it finds its food sources, which include small mammals, birds and large insects. Kestrels nest mainly in cavities, but also use nest boxes when they are available.

THREATS

The American Kestrel suffers from a decline in marginal habitats, particularly dead or dying trees. In recent years, the decline of natural and man-made perches – which kestrels use as lookouts – has compromised the quality of this bird's habitat. Pesticide use represents a significant threat due to the ingestion of contaminated prey and the phenomenon of biomagnification.

EASTERN KINGBIRD

Tyrannus tyrannus

STATUS

None

VARIATION FROM 1970 TO 2015

-77.4% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Eastern Kingbird uses high-diversity hedges as habitat during the nesting period. The species also uses isolated trees to perch and even to make its nest. These marginal habitats are therefore of great importance for the species. The Eastern Kingbird feeds mainly on flying insects. In fall, when insects are less plentiful, it also feeds on fruit.

THREATS

The declining presence of trees in agricultural areas considerably reduces the number of suitable nesting sites for this species. For the Eastern Kingbird, pesticide use can lead to intoxication through the ingestion of contaminated prey. Indirectly, pesticide use renders the habitat unproductive for this species due to the loss of vegetation and insects.

MARGINAL HABITATS

7

Description of habitat Marginal shrubby or arborescent habitats are elements of the agricultural landscape that can be encountered in a number of crop types. These include diversified hedgerows, shrub thickets, isolated trees, woodlots and dead or dying trees (snags). Such habitats are often found at field edges along ditches or in difficult-to-access or unproductive cropland (floodplains, hard-to-reach corners of fields, gullies, rocky areas, etc.). Although these habitats are not perceived as being essential to crops, they are of critical importance for birds.

Marginal aquatic habitats mainly concern water bodies that can be found in agricultural areas, including permanent or temporary ponds, ditches and streams. Habitats adjacent to and overlapping these wetlands such as culverts or riparian areas are also considered in this category.

Isolated tree and natural hedgerows

© Martin Joly

Habitat-specific findings Agricultural intensification has translated into a maximization of crop acreage at the expense of marginal habitats and the wildlife that use them. Marginal shrubby and arborescent habitats have thus been and continue to be widely eliminated to make room for more extensive cropland. However, as marginal as they may seem, these habitats contribute to the heterogeneous character of the landscape and therefore to its biodiversity. Likewise, the loss of marginal habitats has a tremendous impact on the species that depend on such habitats.

SPECIES ASSOCIATED

- American Kestrel
- Blue-winged Teal
- Eastern Kingbird
- Red-tailed Hawk
- Rough-winged Swallow
- Tree Swallow
- etc.

All farmland birds benefit from these marginal shrubby or arborescent habitats. In this regard, thickets, diversified hedges and isolated woodlots are used as nesting sites by certain species while others use them for shelter. Marginal habitats are also excellent sources of food, whether it be seeds, invertebrates or small mammals. Even when they are isolated (e.g. a solitary tree), these habitats are regularly used for perches or lookouts. They also serve as stopover points for forest birds travelling from one woodlot to another. Lastly, snags or dying trees are appreciated by a number of bird species that nest in their cavities.

Marginal aquatic habitats have also been widely disturbed or even eliminated due to the pressure exerted by intensive farming. In fact, land drainage, realignment of watercourses and filling of ditches have greatly contributed to the loss of aquatic habitats used by farmland birds. These microecosystems are home to numerous insects and other invertebrates that are consumed by birds, notably aerial insectivores. They are sometimes the only quality feeding sites within intensively farmed areas. Ditches—often herbaceous in nature—are also used as protective cover or for nesting. However, mowing ditches is a practice that has an adverse impact on the availability of protective cover and thus the survival of species that use this habitat, particularly during the nesting period.

Snowy Owl in a lone elm, a hunting perch that has become scarce in agricultural regions after being devastated by Dutch elm disease.

© Catherine Dion

RECOMMENDATIONS

7.1 Conserve vegetation in existing marginal habitats
7.2 Plant isolated trees
7.3 Establish high-diversity hedgerows
7.4 Develop/enhance riparian areas
7.5 Delay mowing ditches until after nesting period
7.6 Manage drainage ditches to be suitable for wildlife
7.7 Create/enhance ponds

OTHER RECOMMENDATIONS

1.1 Use pesticides rationally
4.2 Plant native fruit-bearing trees and shrubs as "diversions"
4.3 Attract birds of prey
8.1 Place cedar stakes for use as perches
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes

TREE SWALLOW

Tachycineta bicolor

STATUS
None

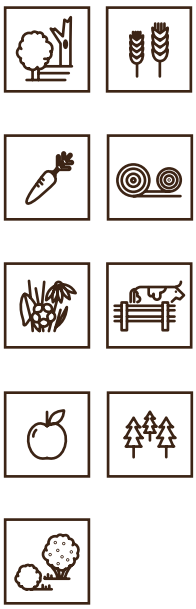
VARIATION FROM 1970 TO 2015
-77.4% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC
Migratory breeder: The Tree Swallow uses pastures and hayfields as habitat. The species feeds essentially on flying insects as well as spiders and snails. It uses natural cavities in dead trees for nesting, but readily adopts nest boxes when they are available.

THREATS
Land drainage and wetland reclamation have led to a significant loss of habitat where this species was once able to feed and reproduce. The dwindling number of snags in agricultural areas also has an adverse effect on the species' reproductive success. The use of pesticides causes significant declines in the abundance of prey (an essential food source), not to mention the risk of intoxication if contaminated prey are ingested.

7.1 CONSERVE VEGETATION IN EXISTING MARGINAL HABITATS

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Favour and maintain vegetation in already-existing marginal habitats such as isolated trees, shrub thickets, hedgerows and snags [51].

WILDLIFE OBJECTIVES

- Offer birds a diversity of habitats for nesting, feeding, resting and taking cover from predators;
- Attract aerial insectivores and birds of prey, which are natural enemies of crop pests;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

- Carry out minimal maintenance of these marginal habitats in order to prevent damage to machinery;
- Perform such maintenance outside of the bird breeding season;
- Foster connectivity between different marginal habitats in proximity to one another (isolated woodlots, wetlands, etc.);
- Avoid mowing along certain ditches to favour the establishment of shrubs (*see Recommendation 7.5*);
- Favour hawthorn thickets, which are highly sought by shrikes to impale their prey [1];
- Conserve any standing dead trees (snags) and dying trees that are present in order to encourage nesting birds of prey (American Kestrel) and aerial insectivores (Tree Swallow) [107].

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No cost to implement;
- Non-bothersome nature does not justify the time spent to remove them;
- Attraction of natural enemies of crop pests;
- Clearly observable beneficial impact on birds;
- Visual appreciation of this landscape element;
- Good neighbourliness.

NOTE

Natural hedges host a greater diversity of birds than planted hedges, contain fewer weeds and do not increase crop pest populations [33].

Natural marginal habitats:

1 Shrub thickets and hedges

© Martin Joly

2 Isolated shagbark hickory, which was probably planted by a squirrel

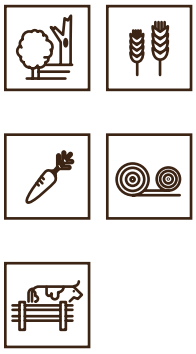
© Stéphane Lamoureux

3 Row of mature trees

© Martin Joly

7.2 PLANT ISOLATED TREES

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Plant native trees in corners of fields that are unused or unproductive due to poor drainage, presence of a floodplain or difficult to access with machinery [51].

WILDLIFE OBJECTIVES

- Increase the presence of isolated trees, which have practically disappeared from the agricultural landscape as a result of efforts to maximize crop acreage;
- Offer birds nesting, feeding and resting sites as well as lookout perches;
- Facilitate the movement of birds between isolated woodlots.

TIPS

- Diversify the species used throughout one's property;
- Choose native tree species suited to the local soil and climate (*see Appendix B*);
- Favour native species and those that produce seeds or fruits that can be consumed by birds (*see Appendix B*);
- Consider planting rare or less common native species such as common hackberry (*Celtis occidentalis*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*) or swamp white oak (*Quercus bicolor*);
- Opt for commercial tree species with a view to using them in the future for timber;
- Plant sizable trees (approx. 2 m high), which require less maintenance and vigilance than those that are just a few years old;
- Use stakes to favour straight growth;
- Plant trees after harvesting or hay-making to avoid damaging crops;
- Develop a collaborative project to establish a network of multiple isolated trees involving different farmers from the same area [51].

Relics of the past, snags are appreciated by a number of bird species that nest in their cavities. In agricultural areas, trees are often cut down before they have the chance to play this essential role.

© Stéphane Lamoureux

MOTIVATIONS
• Attraction of natural enemies of crop pests;
• Low installation costs and easy to maintain;
• No disturbance to crops or agricultural activities;
• Simple and easy to apply;
• Simple maintenance;
• No disturbance to crops or agricultural activities;
• Use of underutilized or agriculturally unsuitable land;
• Clearly observable beneficial impact on birds;
• Visual appreciation of this landscape element;
• Good neighbourliness.

This ash (left) and bur oak (right) break up the monotony of these agricultural landscapes that have undergone heavy intensification. A number of studies suggest a natural preference of people for open spaces interspersed with a few trees.

© Stéphane Lamoureux

7.3 ESTABLISH HIGH-DIVERSITY HEDGEROWS

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Establish a diversified hedgerow along the entire length of a field to allow for a better distribution of birds and maximize their impact on insect pests [33].

WILDLIFE OBJECTIVES

- Offer birds nesting, feeding and resting sites as well as lookout perches;
- Attract natural enemies of crop pests;
- Maintain a certain connectivity between different wildlife habitats;
- Provide wildlife movement corridors;
- Diversify the agricultural landscape;
- Increase biodiversity.

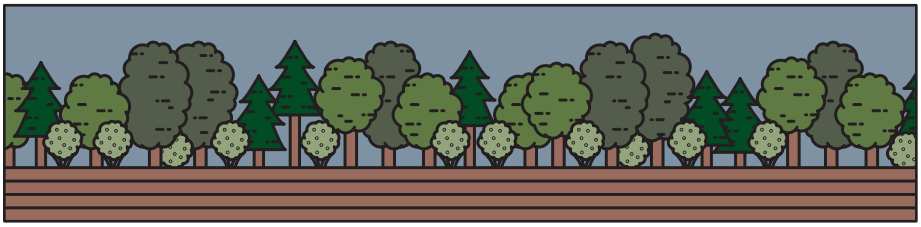
TIPS

- Choose native tree species suited to the local soil and climate;
- Opt for a diversity of plant species of different genera;
- Favour native species and those that produce seeds or fruits that can be consumed by birds (*see Appendix B*);
- Within the hedgerow, incorporate native bushes among the trees that are known to attract birds and pollinators (*see Appendix B*);
- Include the presence of both deciduous and coniferous trees;
- Opt for commercial tree species with a view to using them in the future for timber;
- Select slow-growing or deep-rooted species (e.g. nut trees) in order to lower the risk of drainage system deterioration [122];
- Diversify tree species within the hedgerow in order to minimize disease and lower the risks of pest infestation [122];
- Favour a random, more natural sequence rather than a systematic sequence in order to attract a greater density and variety of birds (Figure 7-1);
- Reduce cropland loss by favouring a staged structure with a variety of plants in a single row rather than a two-row pattern with low diversity (Figure 7-1) [33];
- Minimize the loss of cropland by establishing a hedgerow along a farm lane [122];
- Consider establishing a hedgerow on a north-south axis to offer protection from prevailing westerly winds [122, 132];
- Prepare the land after harvesting or hay-making to avoid damaging crops and plant the hedgerow the following spring.

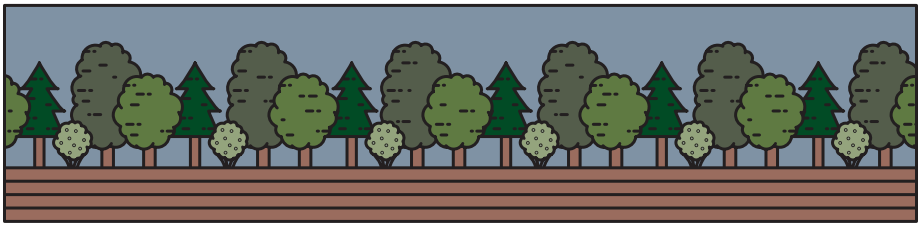
NOTE

A single-row hedge exhibiting a diversified structure (density of canopy foliage, trunk diameter, etc.), multiple strata and a variety of species will attract more birds than one that consists of several rows of low diversity [33].

A Single-row hedge, random sequence



B Single-row hedge, systematic sequence



C Three-row hedge, systematic sequence

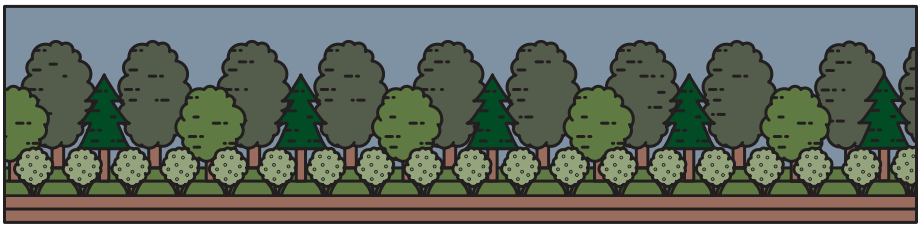


fig. 7-1 **Different Ways to Establish a Diversified Hedgerow. Of the three approaches illustrated, Option A maximizes the creation of wildlife habitat, minimizes cropland loss and blends into the landscape most harmoniously. Options B and C do not fulfil these criteria as well.**

Establishing a diversified hedgerow on the southern banks of a watercourse ensures that shade falls on the hedgerow and not on crops (*see Recommendation 7.4*)

© Stéphane Lamoureux

As an aerial insectivore, the Eastern Kingbird uses high-diversity hedges as habitat during the nesting period.

© Stéphane Lamoureux

MOTIVATIONS

- Wind erosion control [122, 132];
- Crop protection [122, 132];
- Increased yield [122, 132];
- Enhancement of soil by adding organic matter, improving its structure and increasing the diversity of micro-organisms [122];
- Protection of soil through reduced wind and water erosion [122, 132];
- Reduction of fertilizer and pesticide runoff;
- Lower energy costs near buildings [122, 132];
- Better snow distribution [122];
- Carbon sequestration;
- Attraction of natural enemies (predators and parasitoids) of crop pests [33];
- Attraction of pollinators;
- Odour control [132];
- Funding available to carry out work;
- Visual appreciation of this landscape element;
- Good neighbourliness;
- Clearly observable beneficial impact on birds;
- Increased biodiversity.

—

Establishing a hedgerow in proximity to a farm lane minimizes the amount of shade that falls on crops. In this example, the use of underutilized agricultural space between a road and a ditch offers only advantages.

© Stéphane Lamoureux

7.4 DEVELOP/ENHANCE RIPARIAN AREAS

DESCRIPTION

Improve riparian areas along watercourses by planting native trees and shrubs of various sizes and species.

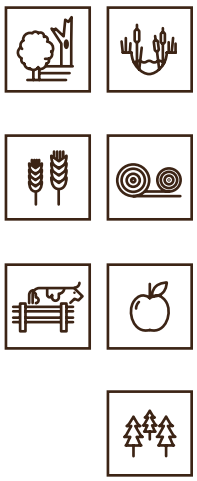
WILDLIFE OBJECTIVES

- Offer birds nesting, feeding and resting sites as well as lookout perches;
- Attract natural enemies of crop pests;
- Maintain a certain connectivity between different wildlife habitats;
- Provide wildlife movement corridors;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

- Ensure compliance with the minimum requirement of the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains, which stipulates the preservation of a 3 m wide strip of vegetation as measured from the high water mark (HWM), including at least 1 m beyond the bank if the latter is located less than 3 m from the HWM;
- Consider integrating suitable species of bushes (in terms of flood tolerance, rooting ability, etc.) on and beyond the banks of this minimally protected area generally composed of herbaceous vegetation;
- Make this minimal protective strip wider by integrating the three strata of vegetation (herbaceous vegetation, bushes and trees) wherever possible in order to attract a greater density and variety of birds while maximizing the effectiveness of the riparian area (stabilization of soil, interception of sediment and runoff, etc.);
- Favour a staged structure with a diversity of plants in one or more rows;
- Opt for a diversity of plant species of different genera;
- Use native trees and bushes that are known to attract birds and pollinators (*see Appendix B*);
- Select an assortment of species that will alternately bear fruit throughout the season;
- Choose species suited to the local soil and climate;
- Observing what grows naturally in the region is the best guarantee that the selected species will develop well [122];

Target Habitat(s)



Costs & Benefits

NOTE

The Pesticides Management Code (PMC) and the Agricultural Operations Regulation (AOR) respectively prohibit the application of pesticides and the spreading of mineral and organic fertilizers within riparian areas. Financière agricole du Québec also applies an eco-conditionality measure and subtracts riparian areas from insurable land.

- Consider planting on just one of the two banks, if possible on the south side so that shade will fall mainly on the watercourse, thereby reducing crop yield losses and facilitating potential watercourse maintenance work [122];
- Reduce the slope of the bank in order to help plantings take root more easily;
- Enquire about additional protective measures adopted in certain cases by municipalities and government authorities.

Creating widened riparian areas creates value for sectors that are not well suited to growing crops, whether due to overly steep slopes, a configuration that inhibits access for farm equipment or proneness to flooding.

© Ressources forestières biotiques

MOTIVATIONS

- Easier to avoid encroaching on riparian areas [122, 133];
- Increased yields of adjacent crops [122, 133];
- Control of wind and water erosion [122, 133];
- Regulation of pesticide and fertilizer runoff [122, 133];
- Improved water quality [122, 133];
- Mitigation of certain algae and invasive plants by lowering water temperature (via shading) [133];
- Mitigation of impact of muskrats [134];
- Lower costs to maintain watercourses [133];
- Attraction of natural enemies of crop pests [133];
- Attraction of pollinators [133];
- Funding available to carry out work;
- Visual appreciation of this landscape element;
- Observable benefits for birds and wildlife in general;
- Increased biodiversity;
- Good neighbourliness.

7.5 DELAY MOWING DITCHES UNTIL AFTER NESTING PERIOD

DÉFINITION

Do not mow ditches before July 15, which is when most farmland birds are nesting [51].

WILDLIFE OBJECTIVES

- Encourage the use of ditch edges by birds for nesting, feeding and shelter;
- Avoid mowing ditches during the bird breeding season or in a manner that adversely affects their reproduction;
- Limit the risk of nest abandonment and nestling mortality caused by mowing ditches during this crucial period.

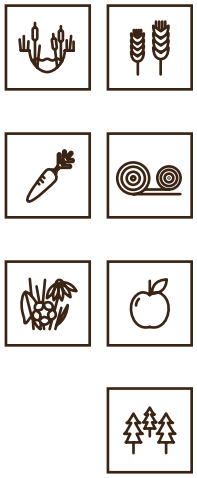
TIPS

- Mow after the 3rd hay cut for meadows and after the fall harvest for crops;
- Avoid mowing ditches after seeding or after the first hay cut;
- Limit mowing to certain fields or sections of fields rather than the entire property every year;
- Avoid mowing along certain ditches to favour the establishment of shrubs;
- Limit mowing preferably to the flat part of ditches, as opposed to the slopes.

MOTIVATIONS

- Simple and easy to apply;
- No damage to crops when mowing is delayed until after the harvest;
- Better access for machinery after harvesting;
- Satisfaction of contributing to biodiversity simply by rescheduling the date of an activity that is deemed indispensable;
- Clearly observable beneficial impact on birds.

Target Habitat(s)



Costs & Benefits

NOTE

Ditches, which sometimes offer the only quality feeding grounds for birds in areas of intensive farming, are used for cover or as nesting sites. In addition to maintaining microhabitats that are rich in biodiversity, they ensure a certain connectivity between different wildlife habitats while making the agricultural landscape less homogeneous. Merging fields by filling in ditches should therefore be avoided.

Mowing ditches in the fall or, ideally, not mowing them at all helps avoid any conflicts with bird nesting.

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7.6 MANAGE DRAINAGE DITCHES TO BE SUITABLE FOR WILDLIFE

Target Habitat(s)

Costs & Benefits

+

DESCRIPTION

Design drainage ditches (Translator's note: for the purposes or these guidelines, "drainage ditch" refers herein to a ditch equipped with a vertical, pipe-like structure called an inlet well for drainage) with a view to favouring the presence of wildlife by using duct tape to mask the first rows of openings (counting from the ground upward) of traditional inlet wells. Allow a certain quantity of water to accumulate in the ditches and thus for small aquatic habitats to be created [135, 136].

WILDLIFE OBJECTIVES

- Create aquatic microhabitats that are rich in biodiversity (native plants, insects, amphibians, etc.) and beneficial to birds;
- Attract insects, an essential component of the diet of aerial insectivorous birds (Barn Swallow, Tree Swallow, Eastern Kingbird, etc.) as well as the majority of nestlings of farmland species;
- Improve water quality by favouring soil particle sedimentation and by reducing sediment flow and phosphorous loading in watercourses located downstream [135, 136, 137];
- Maintain a certain connectivity between different wildlife habitats;
- Provide wildlife movement corridors;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

- Try to carry out such a habitat management project in clay since this soil type retains water better [135, 136];
- Opt for a site in proximity to adjacent woodlots or wetlands in order to foster connectivity between various wildlife habitats [135, 136];
- Consider implementing such a project in a ditch that has a gentle slope where accumulated water will cover a greater surface area and thus be more beneficial for wildlife [135, 136];
- Consult with specialists when undertaking such a project;

Establishing a sedimentation pond upstream of an inlet well is conducive to wetland creation. © Stéphane Lamoureux

- Consult with organizations that have implemented such a project (e.g. Groupe ProConseil);
- Visit with farmers who have already implemented such a project;
- Include in the project a sedimentation pond upstream of the inlet well measuring 30-40 cm deep and 5-10 m long [137];
- Maintain a higher section that will act as a dike between the sedimentation pond and the inlet well [137];
- Verify water levels during the first few years, especially during the spring thaw and after heavy rainfall in order to ensure that the inlet well is evacuating water adequately [135, 136];
- Ensure that water levels in the ditch are maintained long enough to allow the species present to complete their reproductive cycle (insects and amphibians) [135, 136];
- Clean out retention pond every 2 or 3 years by returning sediment to the fields.

Any habitat management project likely to attract insects is beneficial for aerial insectivores such as the Tree Swallow.

© Larry Kirtley

MOTIVATIONS

- Simple and easy to apply;
- Low installation costs if drainage ditch already exists;
- Design does not affect the effectiveness of the inlet well;
- No disturbance to crops or agricultural activities;
- Low cost and low maintenance;
- Reduced sediment flow into watercourses;
- Reduced phosphorus loading in watercourses;
- Observable benefits for birds and wildlife in general;
- Increased biodiversity.

—

Wetland of interest for wildlife

© Stéphane Lamoureux

Target Habitat(s)

Costs & Benefits

DESCRIPTION

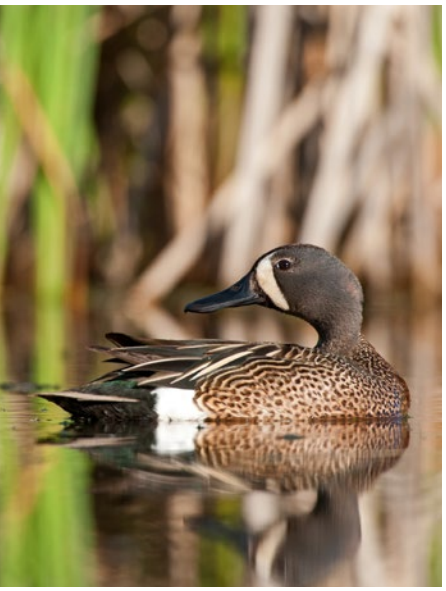
Create, enhance or preserve ponds in order to offer quality aquatic habitats for birds in agricultural areas [138].

WILDLIFE OBJECTIVES

- Create aquatic habitats that are rich in biodiversity (native plants, insects, amphibians, reptiles, etc.) and beneficial to birds;
- Offer birds nesting, feeding and resting sites as well as lookout perches;
- Attract natural enemies of crop pests;
- Attract insects, an essential component of the diet of aerial insectivorous birds (Barn Swallow, Tree Swallow, Eastern Kingbird, etc.) as well as the majority of nestlings of farmland species;
- Offer migratory staging areas and nesting sites for waterfowl (e.g. Blue-winged Teal);
- Maintain a certain connectivity between different wildlife habitats;
- Provide wildlife movement corridors;
- Diversify the agricultural landscape;
- Increase biodiversity.

TIPS

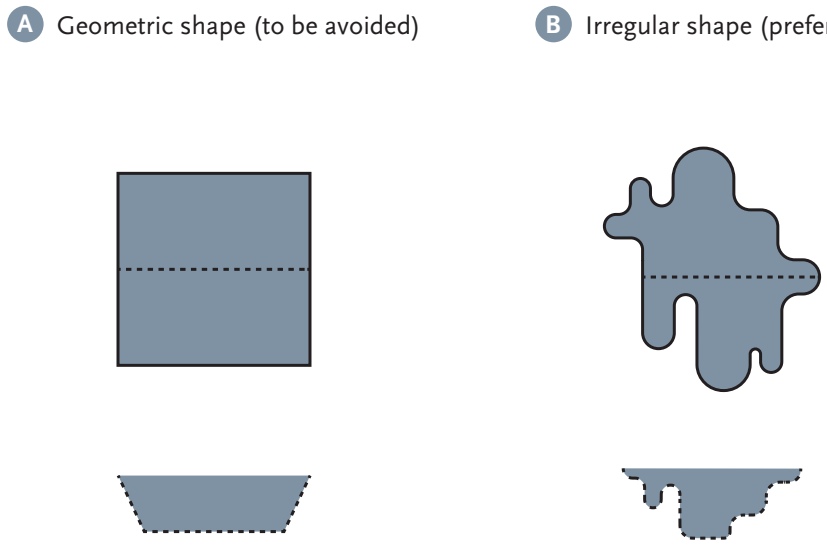
- Designate a non-cultivated, abandoned or low-yield sector to create a pond [138];
- Target a naturally wet or poorly drained site in flat or gently-sloped terrain, the bottom of which is preferably composed of clay, sand or silt so that it is impermeable [138];
- Opt for a site in proximity to adjacent woodlots or wetlands in order to foster connectivity between various wildlife habitats [138];
- Consult with specialists when undertaking such a project;
- Consult with organizations that have implemented such a project (e.g. Techno-Champ 2000);
- Visit the properties of other farmers who have created new ponds or added value to existing ones;
- Obtain all necessary permits prior to commencing work;
- Prefer an irregularly-shaped pond with a rounded shoreline, which will offer greater value for wildlife than one that is rectilinear (Figure 7-2) [138];



Blue-winged Teal

© Serge Deslex

fig. 7-1 **Opt for a pond that is irregular in shape and profile, which is more beneficial to wildlife than one that is rectilinear.**



- Create sections of variable depth to maximize biodiversity (Figure 7-2) [138, 139];
- Plan gently-sloped banks in order to allow wildlife (e.g. amphibians, reptiles, ducklings, etc.) to exit the water without difficulty [139];
- Establish a diversified riparian area to keep aquatic areas intact and conducive to biodiversity (*see Recommendation 7.4*);
- Integrate native aquatic plants;
- Plant native trees and bushes around the pond [139];
- Include in the project nest boxes for Tree Swallows and Wood Ducks (*see Recommendation 8.3*) or perches (*see Recommendations 4.3 and 8.1*).

MOTIVATIONS

- Attraction of natural enemies of crop pests;
- Clearly observable beneficial impact on birds;
- Funding available to carry out work;
- Visual appreciation of this landscape element;
- Creation or enhancement of a sanctuary;
- Pride associated with having completed such a project;
- Increased biodiversity.

Artificial pond with cattails in the Outaouais

© Catherine Dion

NORTHERN ROUGH-WINGED SWALLOW

Stelgidopteryx serripennis

STATUS

None

VARIATION FROM 1970 TO 2015

-91.8% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

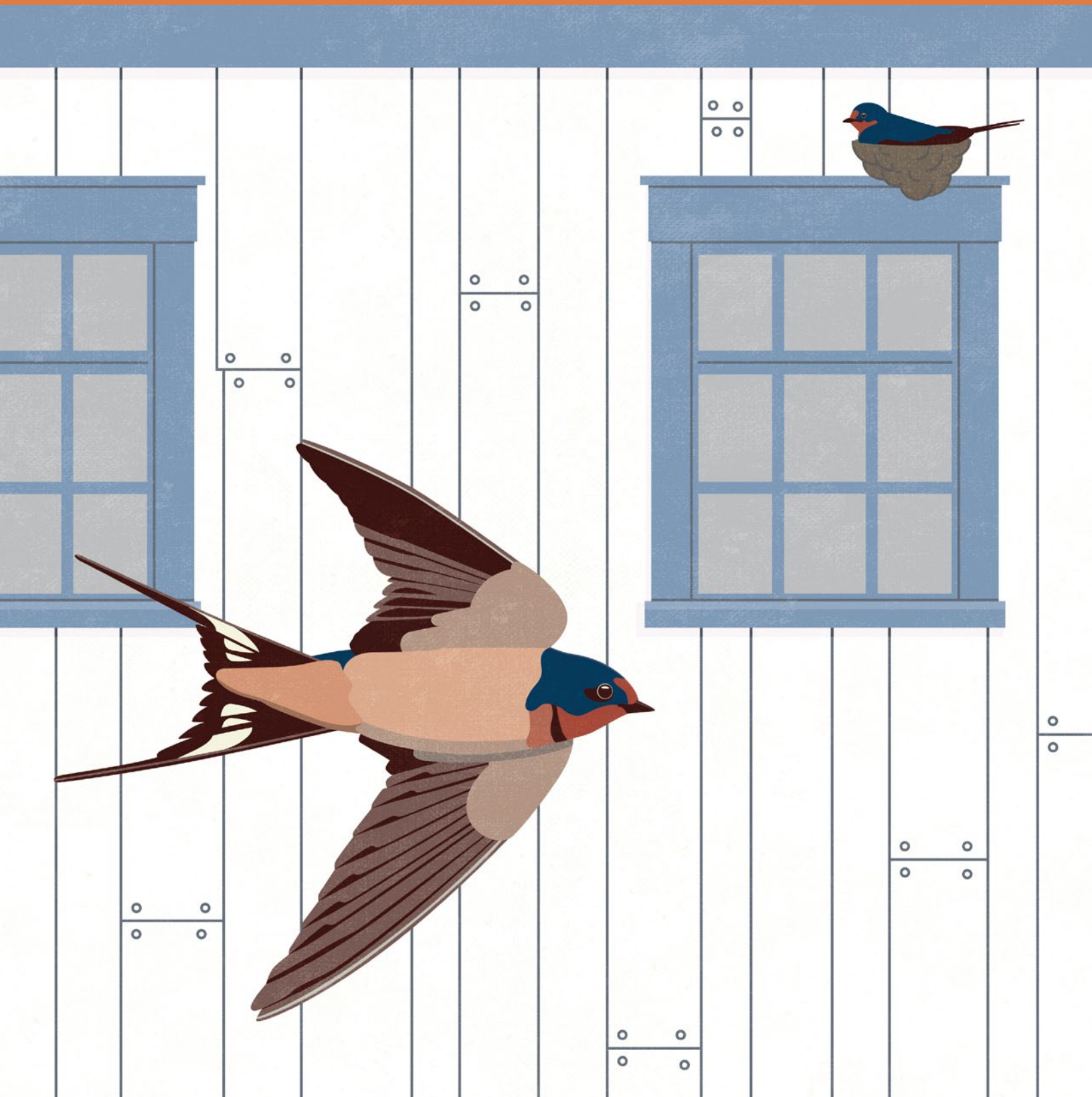
Migratory breeder: The Northern Rough-winged Swallow uses pastures and hayfields as habitat. The species nests on man-made structures such as bridges over watercourses, or in burrows in the banks or walls of sand quarries. As an aerial insectivore, this swallow consumes great quantities of insect pests.

THREATS

Watercourse realignment, filling of ditches and wetland reclamation have caused significant habitat loss for this species. The realignment of watercourses can result in nests being destroyed. The use of pesticides causes significant declines in the abundance of prey (an essential food source), not to mention the risk of intoxication if contaminated prey are ingested.

8

MAN-MADE STRUCTURES



BARN SWALLOW

Hirundo rustica

STATUS

Threatened (SARA)

VARIATION FROM 1970 TO 2015

-97.3% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder: The Barn Swallow inhabits pastures and hayfields during the summer. The species generally nests on buildings or artificial structures such as barns and garages, or underneath bridges and culverts. Barn Swallows nest in small colonies and feed on flying insects in grassy fields, farmland, meadows and near watercourses.

THREATS

Drainage has considerably reduced the number of wetlands where swallows can easily find food. The decline of insect populations (pesticide use and confinement of livestock) is a considerable threat for all aerial insectivores. Furthermore, it is difficult for the species to build its nest on buildings with new PVC or aluminum cladding, to which clay adheres poorly, if it adheres at all.

MAN-MADE STRUCTURES

8

Description of habitat In agricultural areas, a number of man-made structures have been adopted by farmland birds for nesting, feeding, shelter, or simply as perches offering a lookout or a place to rest or display [1]. The use of these structures is often associated with the loss of their natural counterparts. In this regard, farm buildings, fences, silos, cribs and other installations are commonly used by farmland birds. Although most of these structures are designed for human-related needs (e.g. for crops, pets, etc.), others, such as nest boxes, are built specifically for birds.

Isolated buildings offer birds a place to nest far from introduced species (European Starling, House Sparrow) and predators associated with humans (cats, rats).

© Alexandre Nicole

Habitat-specific findings Pasture fences are heavily used as lookout perches, for resting or for displaying by a number of species of farmland birds such as Savannah Sparrow, Short-eared Owl, Upland Sandpiper or Eastern Meadowlark [1]. In the past, the Loggerhead Shrike took advantage of the presence of barbed wire fences as an alternative to hawthorn bushes to impale its prey. Having lost their purpose with the confinement of livestock and factory farming, fences have been removed from the landscape more often than not.

SPECIES ASSOCIATED

- American Kestrel
- Barn Swallow
- Eastern Bluebird
- Northern Harrier
- Short-eared Owl
- Tree Swallow
- etc.

The modernization and concentration of buildings have reduced the number of sites available to farmland birds. On the one hand, the smooth PVC or aluminum cladding used today on farm buildings is less adhesive and prevents certain species—Barn Swallows in particular—from attaching their nests [(140)]. Further, when this species at risk does manage to build its nest, it is often removed by property owners for hygiene and sanitary reasons [(51)]. On the other hand, the concentration of buildings in proximity to highways and residences has led to the disappearance of isolated structures and buildings in fields [(8)]. However, these buildings once allowed certain bird species to nest without disturbance and competition from introduced or feral species (e.g. European Starling, House Sparrow) and predators closely associated with humans (cats, rats). These buildings and isolated structures were also used by birds of prey as lookout, resting and even nesting (e.g. Barn Owl) sites.

Moreover, building and installing nest boxes benefits certain species. These nest boxes are alternatives to the natural cavities found in dead or dying trees. As such trees are becoming scarce in agricultural regions [(107)], most cavity-nesting species have adapted well to these artificial structures.

Artificial nest boxes act as substitutes for cavities in dead or dying trees, which are used by a number of species, including the Tree Swallow. Often eliminated as a precautionary measure, such trees have become rare in agricultural regions.

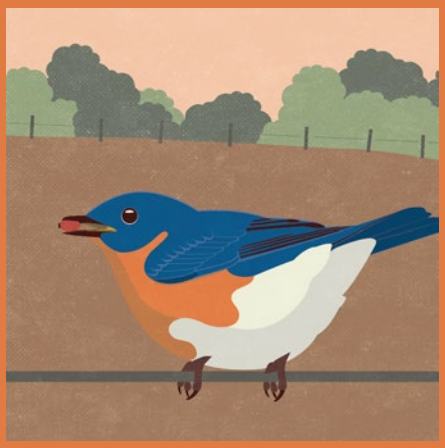
© Sonia Van Wijk

RECOMMENDATIONS

8.1 Place cedar stakes for use as perches
8.2 Conserve/maintain fences of former pastures converted to crops
8.3 Install species-specific nest boxes
8.4 Preserve Barn Swallow nests
8.5 Encourage Barn Swallow nesting
8.6 Maintain isolated buildings and other structures

OTHER RECOMMENDATIONS

N/A



EASTERN BLUEBIRD

Sialis sialis

STATUS
None

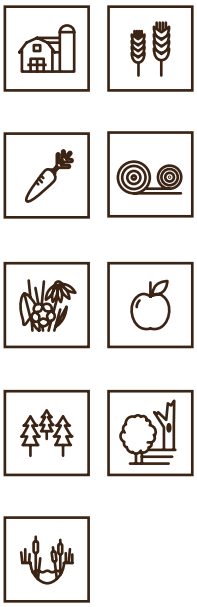
VARIATION FROM 1970 TO 2015
+179.0% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC
Migratory breeder: The Eastern Bluebird can be found in open habitats with low vegetation such as pastures, meadows and abandoned fields. By nature, the species nests in natural cavities in old trees or those excavated by woodpeckers. Although such trees have become rare in agricultural areas as a result of efforts to maximize crop acreage, nest boxes installed by landowners have been able to offset the loss of these natural nesting habitats.

THREATS
The Eastern Bluebird is sensitive to competition for nesting sites from introduced species such as the House Sparrow and European Starling. In this species, pesticide use can lead to intoxication through the ingestion of contaminated prey. Disturbance from human activities during the nesting period also has an impact on the species.

8.1 PLACE CEDAR STAKES FOR USE AS PERCHES

Target Habitat(s)



Costs & Benefits

DESCRIPTION

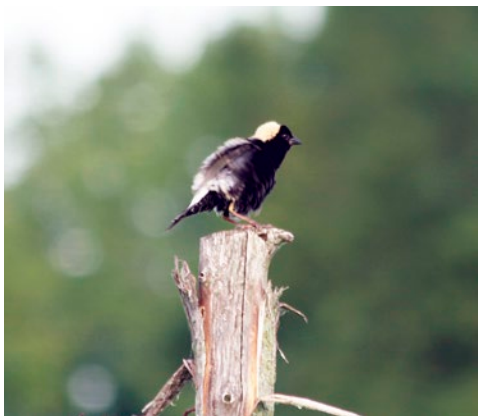
Plant cedar stakes on the slope or flat portion of ditches every 250 m (820 feet) [51].

WILDLIFE OBJECTIVES

- Ensure the availability of perches (used as lookouts or display/resting sites), which have considerably diminished in number due to efforts to maximize crop acreage and the decline of free-range livestock [8];
- Attract birds of prey as natural enemies of crop pests (large insects, small mammals or undesirable birds).

TIPS

- Reuse posts from old fences that have been removed but not disposed of;
- Enquire about the availability of stakes with neighbouring farmers;
- Purchase new stakes as part of a group;
- Install stakes in the fall so as not to damage crops or after meadows have been mowed;
- Plant stakes on slopes or along ditches so as not to be inconvenienced when mowing;
- Alternatively, install stakes in hard-to-reach corners of fields rather than along ditches;
- Install large perches in order to attract birds of prey (*see Recommendation 4.3*);
- Preserve fencing around pastures whenever the latter are converted to annual crops or meadows (*see Recommendation 8.2*).



Bobolink

© Alexandre Nicole

1

2

3

MOTIVATIONS

- Simple and easy to apply;
- Low installation costs;
- No maintenance once in place;
- No disturbance to crops or agricultural activities;
- Element that allows a regulatory or widened riparian area to be defined and maintained;
- Opportunity to reuse and give value to unused stakes;
- Attraction of natural enemies of crop pests;
- Clearly observable beneficial impact on birds;
- Increased biodiversity.

Examples of birds of prey found in agricultural regions that benefit from the presence of perches:

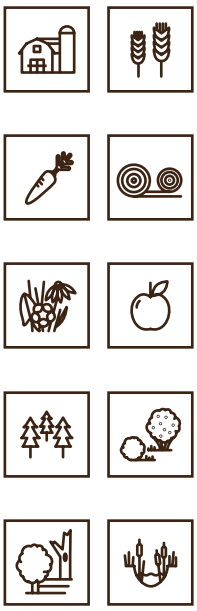
1 Northern Harrier
© Alain Daigle

2 American Kestrel
© Sylvain Rioux

3 Rough-legged Hawk
© Michèle Amyot

8.2 CONSERVE/MAINTAIN FENCES OF FORMER PASTURES CONVERTED TO CROPS

Target Habitat(s)



Costs & Benefits

DESCRIPTION

Conserve some or all electric or barbed wire fencing of former pastures that have been converted to crops so that they may continue to serve as perches for farmland birds.

WILDLIFE OBJECTIVES

- Ensure the availability of perches (used as lookouts or display/resting sites), which have considerably diminished in number due to efforts to maximize crop acreage and the decline of free-range livestock [8];
- Attract aerial insectivores and birds of prey, which are natural enemies of crop pests;
- Allow Loggerhead Shrikes (Endangered) during the breeding season and Northern Shrikes in winter to use barbed wire as an alternative to the thorns of the hawthorn tree to impale their prey [1].

TIPS

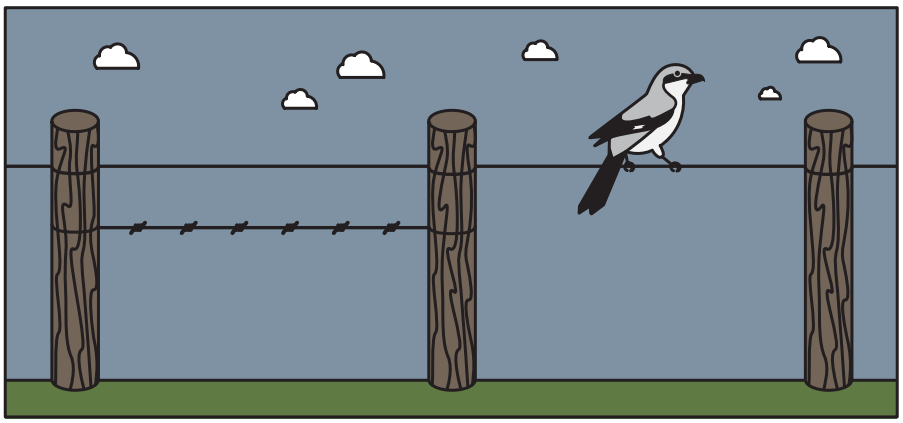
- As necessary, relocate or remove posts that represent obstacles to operating machinery;
- If desired, preserve fencing on one side of the former pasture or several metre long sections here and there around the perimeter (Figure 8-1);
- Make an effort to maintain fencing along riparian areas or along a field bordering a meadow;
- Consider using recovered barbed wire when building new pasture fencing or simply fasten such wire to certain sections of conventional wire fencing (Figure 8-1);
- Remove wire if there is potential for damage to machinery;
- Pay attention to this structure during field work in order to make any necessary corrections to avoid damaging machinery (remove broken wire, damaged posts, etc.);
- Bear in mind that this fence can be discontinued and that its main purpose is to offer places to perch.

The Loggerhead Shrike impales its prey on barbed wire.

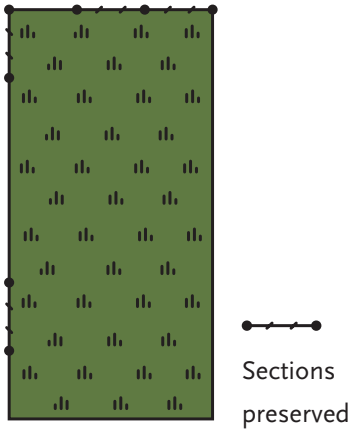
© Larry Kirtley

fig. 8-1 **Conservation and Enhancement of Former Pasture Fences**

A Addition of barbed wire to certain fence sections



B Preservation of fence sections of former pasture



MOTIVATIONS
• Simple and easy to apply;
• No cost to install;
• Low maintenance once in place;
• No disturbance to crops or agricultural activities;
• Element that allows a regulatory riparian area to be defined and maintained;
• Plant succession under fencing acts as a buffer zone;
• Visual appreciation of this landscape element;
• Opportunity to reuse and give value to unused stakes;
• Attraction of natural enemies of crop pests;
• Opportunity to support the conservation of species at risk;
• Clearly observable beneficial impact on birds;
• Increased biodiversity.

The Eastern Bluebird captures its prey on the ground after spotting them from an elevated perch.

© Larry Kirtley

8.3 INSTALL SPECIES-SPECIFIC NEST BOXES

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Install species-specific nest boxes as a function of the farmers' interests and the landscape elements present (e.g. Eastern Bluebird, Tree Swallow, American Kestrel, Eastern Screech-Owl, Wood Duck, etc.) [51].

WILDLIFE OBJECTIVES

- Ensure the availability of alternative nesting sites for species that naturally use cavities in dead or dying trees (snags), which have become nearly non-existent as a result of efforts to maximize crop acreage;
- Attract aerial insectivores and birds of prey, which are natural enemies of crop pests.

TIPS

- Take into consideration the particularities of the targeted species when building and installing nest boxes (size, opening shape and diameter, orientation, height, distance between each nest box, need to add nesting material, habitat, etc.) (*see Appendix D*);
- Build nest boxes at home to reduce costs (free construction plans available online);
- Purchase multiple nest boxes as part of a group;
- Avoid staining or painting the insides of nest boxes;
- Install nest boxes at least 250 m from farm buildings so as not to attract undesirable species such as European Starlings and House Sparrows;
- Adequately fasten nest boxes to fence posts, dying trees or steel posts while taking into account any requirements specific to the target species;
- Monitor nest boxes annually in late fall or early spring (before the breeding season) in order to check whether they have been used and to carry out light maintenance (adjustments to structures, placing of nesting material, removal of squirrel or mouse nests, etc.).

The Great-crested Flycatcher will use a suitably-sized nest box (*see Appendix D*) placed at the edge of a woodlot, in an open forest or in an orchard.

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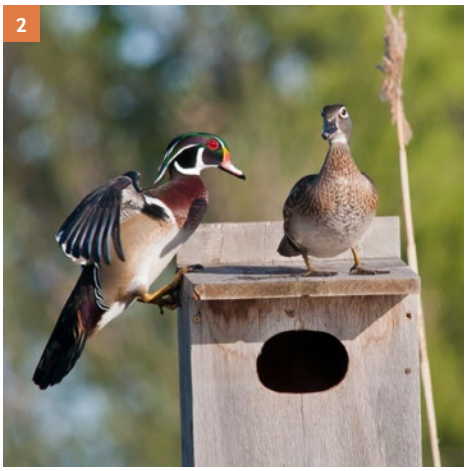
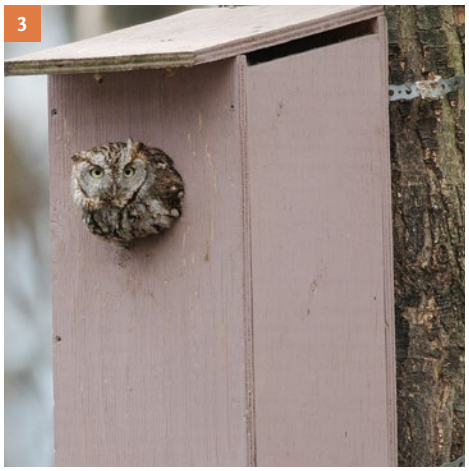




Various bird species making use of nest boxes in agricultural regions:

1 Eastern Bluebird
© Marcel Gauthier

2 Wood Duck
© Jim McConnell

3 Eastern Screech-Owl
© Robert Auger

4 Tree Swallow
© Jean-Sébastien Guénette

MOTIVATIONS

- Simple and easy to apply;
- Low installation cost and easy to maintain;
- Simple maintenance;
- No disturbance to crops or agricultural activities;
- Appeal of building nest boxes oneself;
- Attraction of natural enemies of crop pests;
- Clearly observable beneficial impact on birds;
- Increased biodiversity.

8.4 PRESERVE BARN SWALLOW NESTS

Target Habitat(s)

Costs & Benefits

++

DESCRIPTION

Do not destroy Barn Swallow nests, a species that was designated "Threatened" in 2017 under the *Species at Risk Act* (SARA) [51].

WILDLIFE OBJECTIVES

- Ensure nesting for a species that has experienced a sharp decline in recent years by tolerating its presence and nest-building activities;
- Enjoy the benefits of a species recognized for consuming large quantities of biting insects and crop pests [1].

TIPS

- Leave an opening of approx. 20 cm during egg-laying and raising of young if a pair has made its nest inside a structure [140];
- Install a small plank (30 cm x 30 cm) below the nest to contain nestling droppings and thus limit the unpleasantness associated with this aspect (Figure 8-2) [51];
- Install obstacles (e.g. flexible wire mesh or nets) to prevent Barn Swallows from building their nests in places considered inappropriate or undesirable;
- Avoid storing machinery, tools and materials within 180 cm around or below an occupied nest in order to reduce predation by cats or other predators [140];
- Preserve or incorporate wooden cladding (Figure 8-4), particularly on the tops of farm building walls;
- Encourage nest-building on the outsides of buildings or in an appropriate location inside a building by installing supports made of porous materials (Figures 8-4 and 8.5) in the first 20 cm of a side wall and not exposed to the elements (*see Recommendation 8.5*).

NOTE

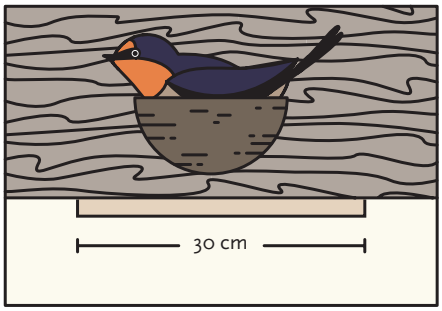
1 *Under the* Migratory Birds Convention Act of 1994, *it is prohibited to disturb, destroy or take the nests or eggs of a migratory bird such as the Barn Swallow.*

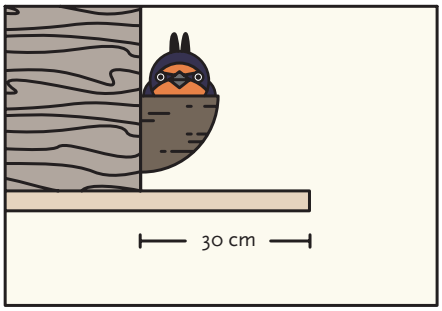
© Mike Allen

2 *In agricultural areas, the American Cliff Swallow also uses man-made structures to nest. Its nest is also made of mud like that of the Barn Swallow, but does not contain dry grass and its shape is nearly completely closed with a round opening.*

© Nicole Fournel

fig. 8-2 **Dropping Guard**





© Stéphane Lamoureux

MOTIVATIONS
• Application simple, easy and not overly demanding;
• No cost to implement;
• No disturbance to crops or agricultural activities;
• Attraction of natural enemies of crop pests;
• Clearly observable beneficial impact on birds;
• Sense of attachment to this emblematic species;
• Opportunity to support the conservation of species at risk.

The Barn Swallow was designated "Threatened" in 2017 under the *Species at Risk Act* (SARA). © Suzanne Labbé

8.5 ENCOURAGE BARN SWALLOW NESTING

Target Habitat(s)

Costs & Benefits

DESCRIPTION

Encourage Barn Swallows to nest on the outsides of buildings or in an appropriate place inside buildings by installing supports or structures that facilitate nest construction.

WILDLIFE OBJECTIVES

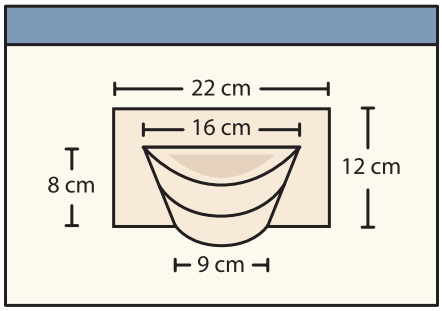
- Attract a species that has suffered a drastic decline in recent years by offering structures conducive to nest-building;
- Enjoy the benefits of a species recognized for consuming large quantities of biting insects and crop pests [(1)];
- Control the nesting sites of this species and avoid irritants.

TIPS

- In desired locations on the insides of buildings, install artificial nests (wooden nest cups, Figure 8-3), lateral supports (Figure 8-5), nails, staples, screen, mesh, or other porous material on a beam or 15-20 cm below the ceiling in order to facilitate nest-building [(140)];
- Place these supports close to the opening in the building from which nestlings are likely to fledge, i.e. 2 to 5 m away whenever possible [(140)];
- Leave an opening of approx. 20 cm during egg-laying and raising of young if a pair has made its nest inside a structure [(140)];
- On the outsides of buildings, install supports (permanent or removable; Figure 8-4 and 8.5) made of porous materials or artificial nests (wooden nest cups, Figure 8-3) within the first 20 cm of a side wall and not exposed to the elements (30 cm overhang) [(140)];
- In hard-to-reach corners of fields or other non-cultivated areas, install wooden structures specifically designed to accommodate nesting Barn Swallows (*see Appendix E*);
- Select a site containing multiple insect-rich habitats (e.g. watercourse, pond, pasture, abandoned field, hedgerow, shrub thicket, manure pit, etc.) within a 300 m radius for installing the nesting structure [(140)];
- Create or enhance ponds or other small wetlands to increase insect abundance and the availability of mud (*see Recommendations 7.5 and 7.7*);
- Maintain pastures and let out livestock more often in order to favour the presence of insects that Barn Swallows feed on (*see Recommendation 3.1*);

- Preserve or incorporate wooden cladding, particularly on the tops of farm building walls;
- Avoid storing machinery, tools and materials within 180 cm around or below an occupied nest in order to reduce predation by cats or other predators [(140)];
- Install a small plank (30 cm x 30 cm) below the nest to contain nestling droppings and thus limit the unpleasantness associated with this aspect (Figure 8-2) [(51)].

fig. 8-3 **Cup Offering Support for Nest, Installed 13 to 20 cm from a Ledge or Ceiling**



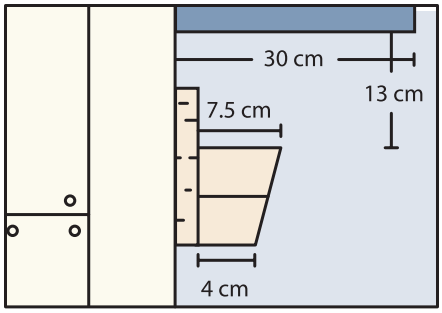


fig. 8-4 **Removable Support**

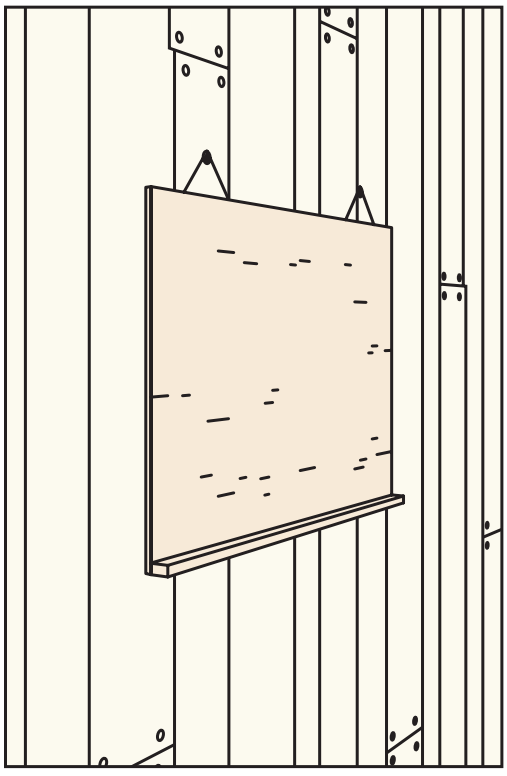
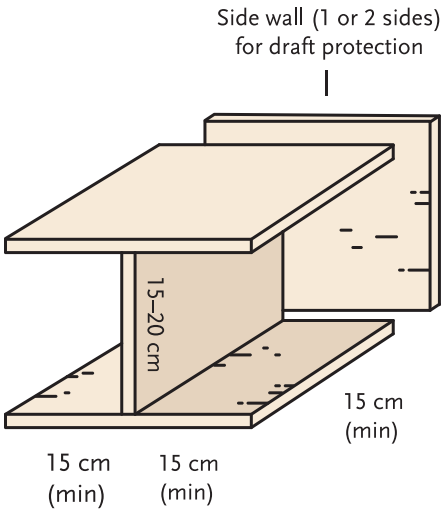


fig. 8-5 **Lateral Support**



Wooden shelter specifically designed for nesting Barn Swallow

© Stéphane Lamoureux

—

Wooden nest cups, affixed to ceiling joists

© Linda Pérez

—

Wooden nest cup, overhead view

© Regroupement QuébecOiseaux

MOTIVATIONS

- Application simple, easy and not overly demanding;
- Inexpensive to apply depending on the supports or structures used;
- No disturbance to crops or agricultural activities;
- Attraction of natural enemies of crop pests;
- Clearly observable beneficial impact on birds;
- Sense of attachment to this emblematic species;
- Opportunity to build species-specific artificial nest boxes or shelters oneself;
- Opportunity to support the conservation of species at risk.

8.6 MAINTAIN ISOLATED BUILDINGS AND OTHER STRUCTURES

DESCRIPTION

Maintain old buildings and other isolated anthropogenic structures in fields, even if they are no longer used (e.g. old barns, hangars, livestock shelters, corn cribs, wind pumps, etc.).

WILDLIFE OBJECTIVES

- Ensure the availability of nesting and shelter sites as well as perches for lookout, feeding, or display purposes;
- Attract birds of prey as natural enemies of crop pests (large insects, small mammals or undesirable birds);
- Reduce competition for nesting sites with introduced or feral species (e.g. European Starling, House Sparrow);
- Reduce predation by species associated with humans (cats, rats).

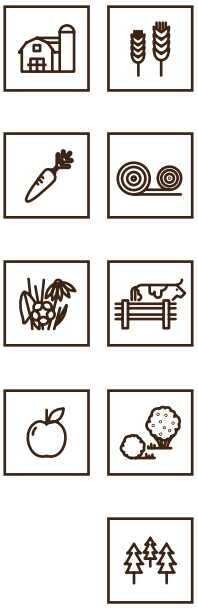
TIPS

- Perform periodic upkeep of buildings and other isolated structures in fields to ensure their continuity;
- Avoid covering isolated buildings in fields with aluminum- or PVC-based materials;
- If possible, avoid staining or painting isolated buildings in fields;
- If possible, create or leave openings in isolated buildings in fields, preferably opposite the direction of prevailing winds, so that they can be accessed by birds;
- Preserve nests found in isolated buildings or structures.

MOTIVATIONS

- Application simple, easy and not overly demanding;
- No cost to implement (already in place);
- Low or no maintenance required;
- Clearly observable beneficial impact on birds;
- Attraction of natural enemies of crop pests;
- Visual appreciation of this landscape element.

Target Habitat(s)



Costs & Benefits

© Luc Gilbert

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NORTHERN HARRIER

Circus hudsonius

STATUS

Not at Risk

VARIATION FROM 1970 TO 2015

-28.9% (Breeding Bird Survey, Quebec region)

PRESENCE IN QUEBEC

Migratory breeder and occasional winter resident in southern Quebec. The Northern Harrier is a raptor whose preferred habitats include pastures, tall-grass and short-grass meadows, hayfields and abandoned fields. It is most often observed on the ground, where it nests in patches of high grass, or perched on a fence post in search of prey. It feeds on small mammals, birds, frogs, snakes, and even carrion on occasion.

THREATS

Drainage has considerably reduced the number of wetlands where the Northern Harrier can feed or nest. The use of pesticides has an impact on the availability of its food resources. Operating machinery, hay mowing and intensive grazing can result in the destruction of nests and nestlings. The disappearance of man-made structures (e.g. fences) and the loss of marginal habitat (e.g. isolated trees) reduce the number of lookout perches available for the Northern Harrier.

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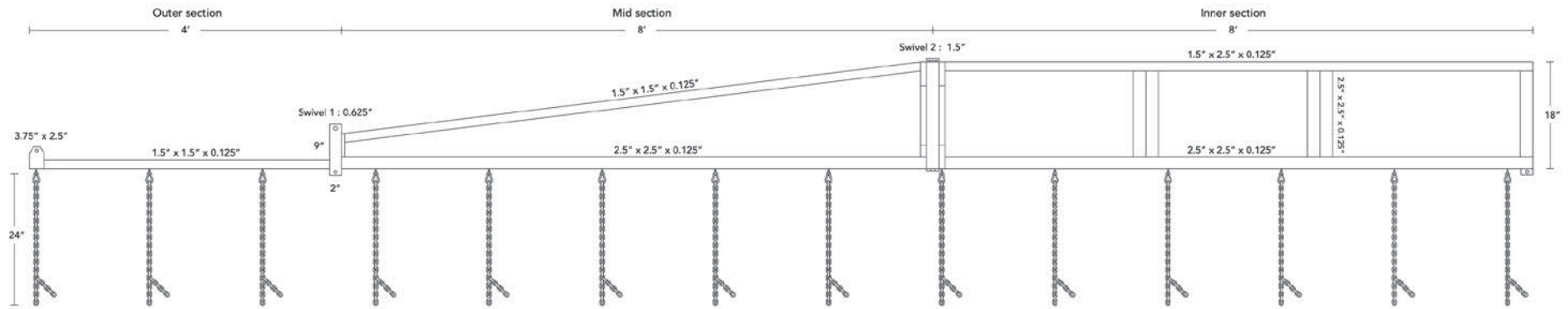
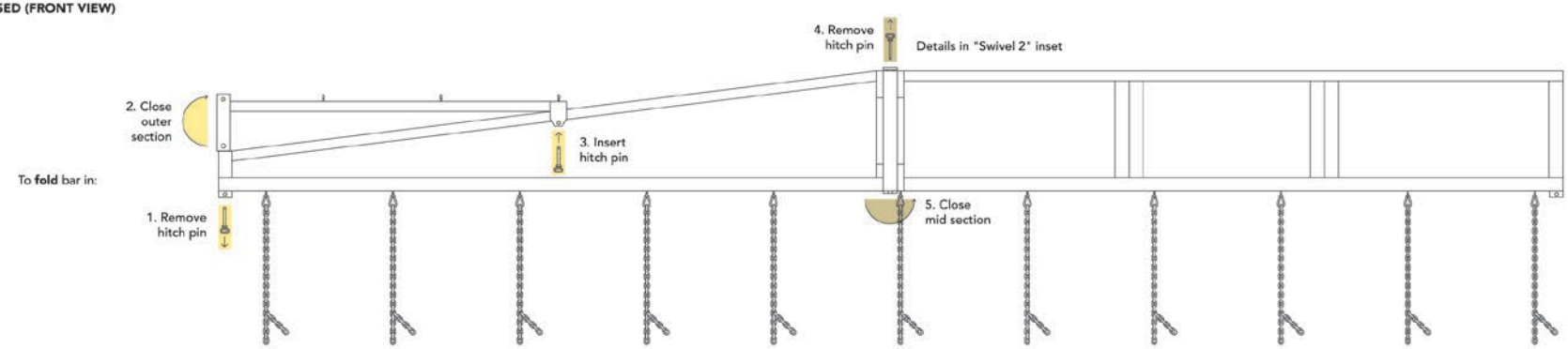
APPENDIX A | Flushing Bar Design

FLUSHING BAR PLANS | SOCIÉTÉ DE CONSERVATION, D'INTERPRÉTATION ET DE RECHERCHE DE BERTHIER ET SES ÎLES

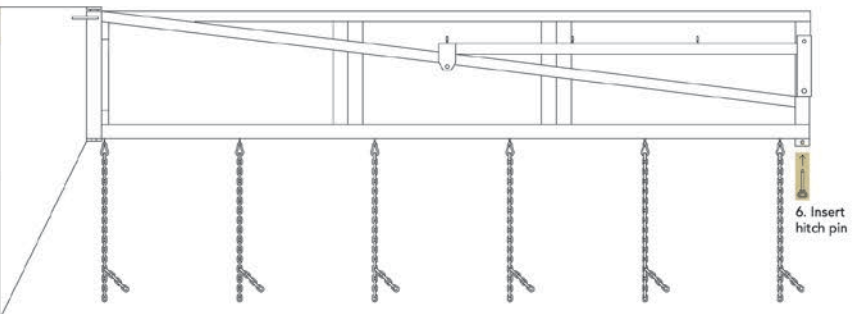
A. BAR (ALL SECTIONS DEPLOYED, FRONT VIEW)



B. OUTER SECTION CLOSED (FRONT VIEW)



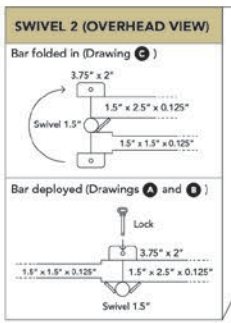
C. BAR CLOSED (FRONT VIEW)



GENERAL NOTES

- The bar is composed of three sections joined together by swivels and locked in open A or closed C position with hitch pins;
- Steel components are 0.125" (1/8") thick;
- Chain thickness is 0.3125" (5/16"). Links were added to the bottom of the chains to increase the noise produced by the device;
- The dimensions of the attachment for the bar vary from one tractor model to another. It is suggested to install the bar on the weight bracket in front of the tractor and to maintain it in place using two steel brackets (booms) placed on both sides of the weight bracket (not illustrated);
- At least two people are needed to lift the bar onto the weight bracket. Subsequently, the bar can remain attached to the tractor throughout the haymaking period and can be folded out and back in by a single person before and after cutting.

SWIVEL 2 (OVERHEAD VIEW)



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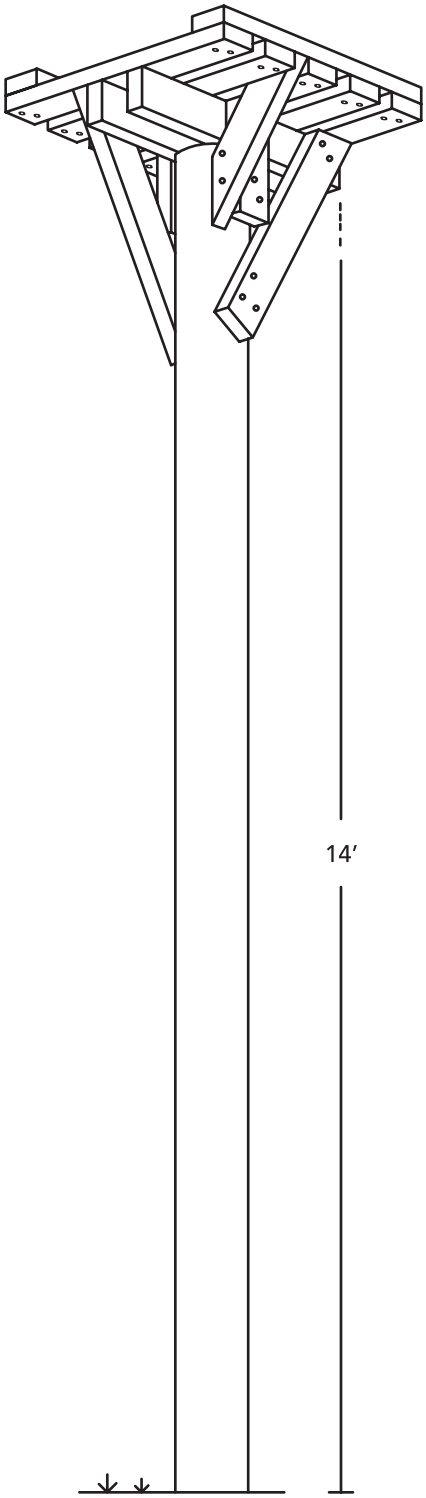
Bar design: Mécanique Houle-Tech | Drawings: Alexandre Nicole

APPENDIX B | Native Plants Favouring the Presence of Birds in Agricultural Areas

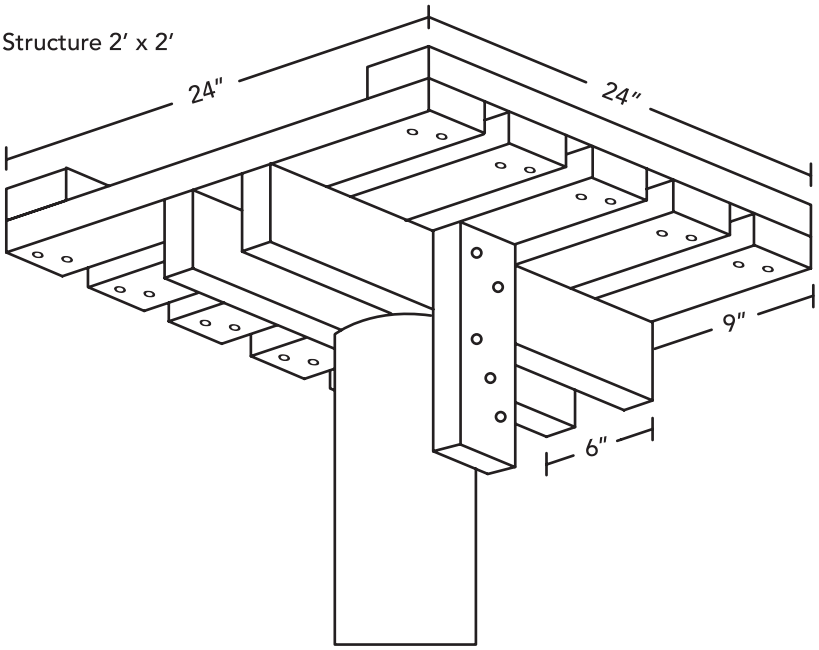
			Type of Soil			Location								Flowering / Fructification								
	Common name	Scientific Name	Clay	Sandy	Loamy	Field	Upper Slope	Mid-Slope	Lower Slope	Height (m)	Width (m)	Growth	Hardiness	M	A	M	J	J	A	S	O	N
Up to 2 m	Black chokeberry	*Aronia melanocarpa*	•	•	•	•				1	1	slow	4									
	Bracted honeysuckle	*Lonicera involucrata*	•	•	•				•	1.3	1	rapid	4b									
	Broadleaf meadowsweet	*Spiraea latifolia*			•	•	•	•		1.5	1.5	moderate	4									
	Canada fly-honeysuckle	*Lonicera canadensis*	•	•	•	•	•	•	•	1 to 1.8	1 to 1.5	rapid	3a									
	Common bearberry	*Arctostaphylos uva-ursi*	•	•	•		•	•	•	0.3	1.5	moderate	2a									
	Fernald's serviceberry	*Amelanchier fernaldii*		•	•	•	•	•		1	1	moderate	4									
	Fragrant sumac	*Rhus aromatica*	•	•	•	•	•	•		1 to 2	2 to 3	slow	3									
	Grey dogwood	*Cornus racemosa*	•	•	•	•				2	2	slow	2b									
	Maple-leaved viburnum	*Viburnum acerifolium*	•	•	•	•				2	2	slow	3									
	Northern bush-honeysuckle	*Diervilla lonicera*		•		•	•	•		0.9 to 1	0.9 to 1	rapid	3a									
	Red-osier dogwood	*Cornus stolonifera*	•	•	•	•	•	•	•	2	3	rapid	2a									
	Round-leaved dogwood	*Cornus rugosa*	•	•	•	•	•	•	•	1.5	2	moderate	3a									
	Round-leaved serviceberry	*Amelanchier sanguinea*		•	•	•	•	•		1	1	moderate	3									
	Swamp fly-honeysuckle	*Lonicera oblongifolia*	•	•	•	•	•	•	•	0.6 to 1.5	0.6 to 1	rapid	4									
	Sweet gale	*Myrica gale*	•	•	•				•	1 to 2	2	moderate	2a									
	Wild raisin	*Viburnum cassinoides*	•	•	•	•	•	•		1.5	1.2	moderate	2a									
2 to 7 m	American hazelnut	*Corylus americana*		•		•				3	1.5	rapid	2a									
	Beaked hazelnut	*Corylus cornuta*	•	•	•	•	•	•		2.4	2.4	slow	3									
	Canada plum	*Prunus nigra*	•	•	•					4	3	slow	4									
	Canada serviceberry	*Amelanchier canadensis*			•	•				7	4	moderate	4a									
	Chokecherry	*Prunus virginiana*	•	•	•	•	•	•		6	6	moderate	0a									
	Common elderberry	*Sambucus canadensis*	•	•	•	•	•		•	3	2	rapid	3a									
	Common winterberry	*Ilex verticillata*			•		•	•	•	2	1.8	slow	3b									
	Eastern ninebark	*Physocarpus opulifolius*	•	•	•	•	•	•		2.5	2.5	moderate	2b									
	Fan-leaved hawthorn	*Crataegus flabellata*			•	•	•	•		5 to 6	5 to 6	moderate	4									
	Fireberry hawthorn	*Crataegus chrysocarpa*	•	•	•	•	•	•		4 to 6	4 to 6	slow	4									
	Highbush cranberry	*Viburnum trilobum*			•	•	•	•		4	3	moderate	2a									
	Nannyberry	*Virburnum lentago*	•	•	•	•	•	•		3 to 6	2 to 3	rapid	2a									
	Northern prickly-ash	*Zanthoxylum americanum*		•		•				2.5	2.5	moderate	3									
	Red elderberry	*Sambucus pubens*		•		•	•	•	•	4	3	moderate	5									
	Showy mountain-ash	*Sorbus decora*		•		•				7	5	slow	2									
	Smooth sumac	*Rhus glabra*		•		•				3	2	rapid	3a									
	Staghorn sumac	*Rhus typhina*	•	•	•	•	•	•		6	5	rapid	3a									
	Wolf-willow	*Elaeagnus commutata*		•		•				2	3	rapid	4									

			Type of Soil			Location								Flowering		Fructification					
	Common name	**Scientific Name**	**Clay**	**Sandy**	**Loamy**	**Field**	**Upper Slope**	**Mid-Slope**	**Lower Slope**	**Height (m)**	**Width (m)**	**Growth**	**Hardiness**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**
7 m or more	Alternate-leaved dogwood	*Cornus alternifolia*			•	•				5 to 8	5	slow	3b									
	American mountain-ash	*Sorbus americana*		•		•				15 to 20	10 to 15	moderate	3									
	Common hackberry	*Celtis occidentalis*	•	•	•	•				18	12	mod. to rapid	2									
	Dotted hawthorn	*Crataegus punctata*	•	•	•	•	•	•		7 to 10	7 to 10	slow	5									
	Eastern white pine	*Pinus strobus*		•	•	•				30 to 50	7	rapid	2b									
	Grey birch	*Betula populifolia*		•		•				7 to 12	5	moderate	3									
	Pin cherry	*Prunus pensylvanica*		•	•	•	•	•		7 to 15	5.5 to 7.6	rapid	1 à 6									
	Quebec hawthorn	*Crataegus submollis*	•	•	•	•	•	•		5 to 8	5 to 8	slow	4									
	Red ash	*Fraxinus pensylvanica*	•	•	•		•	•	•	7 to 25	10 to 12	rapid	3a									
	Smooth serviceberry	*Amelanchier laevis*		•	•	•				6 to 8	5	moderate	2b									
	White spruce	*Picea glauca*			•	•				20 to 30	6 to 10	moderate	1a									

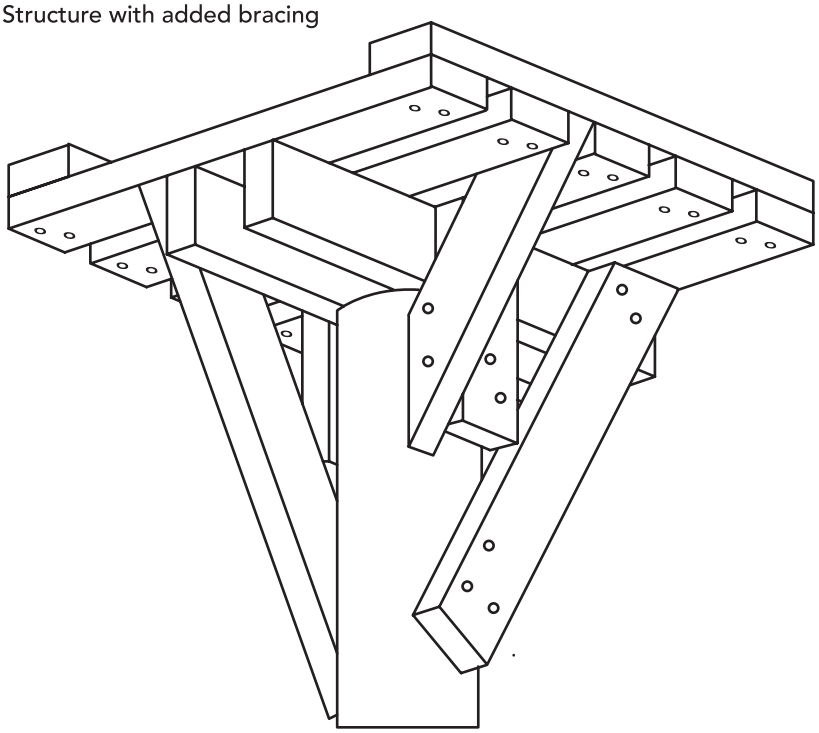
Nesting platform for birds of prey



Structure 2′ x 2′

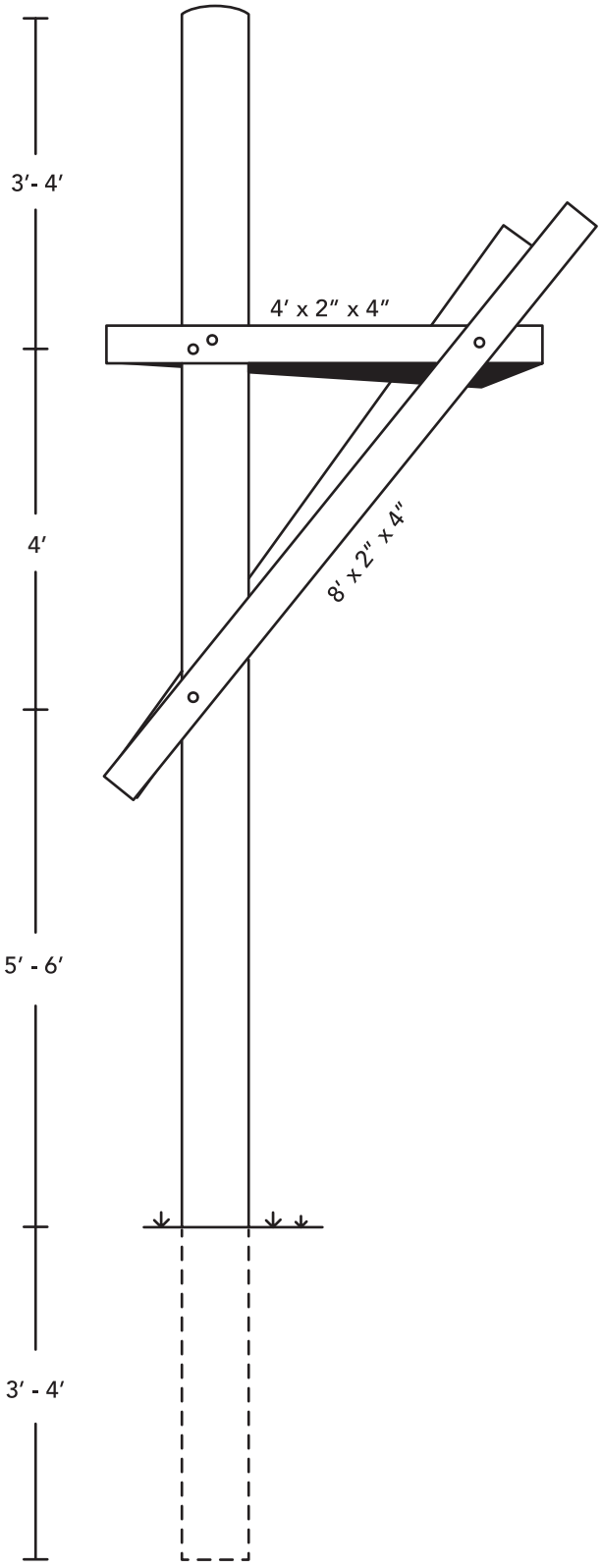


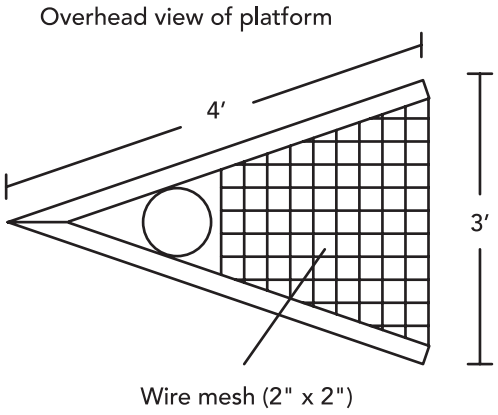
Structure with added bracing



Source: adapted from 50birds (www.50birds.com)

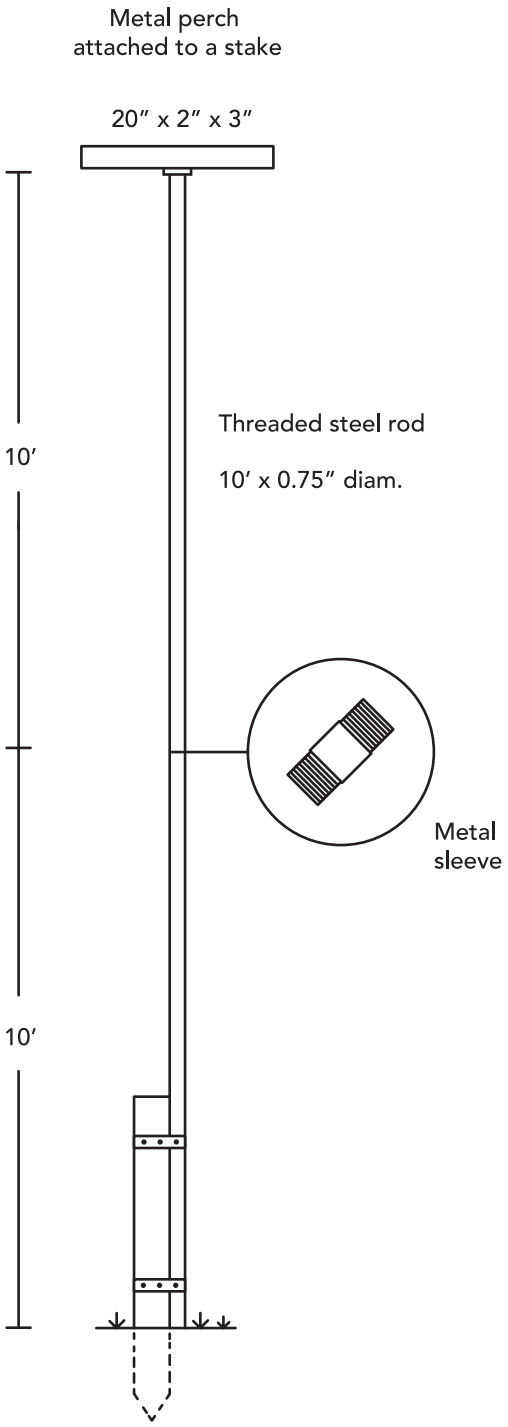
Nesting platform for birds of prey

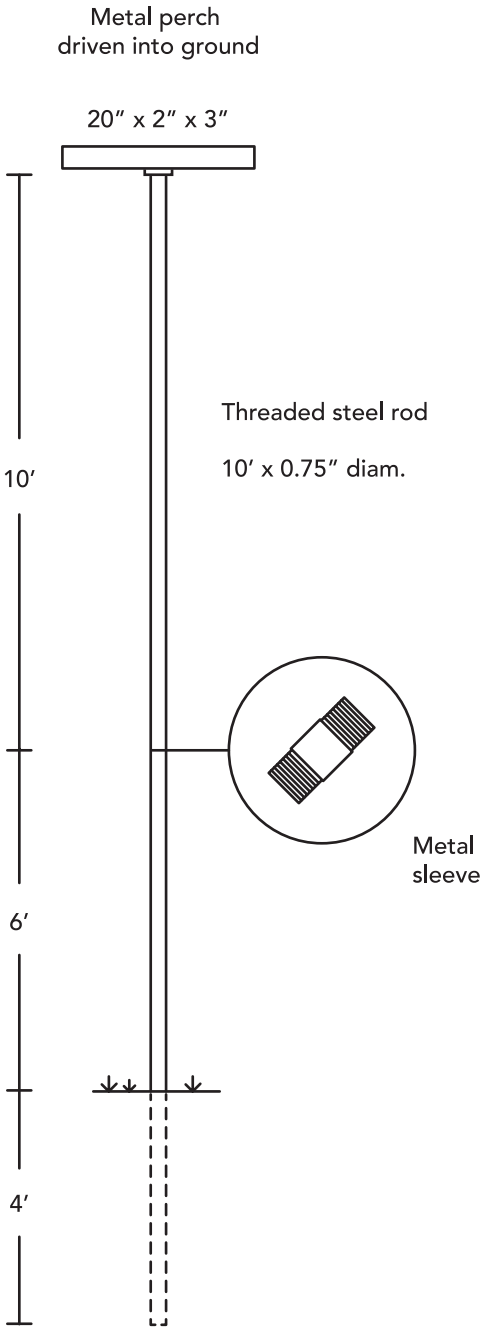




Source: adapted from GRIT (www.grit.com)

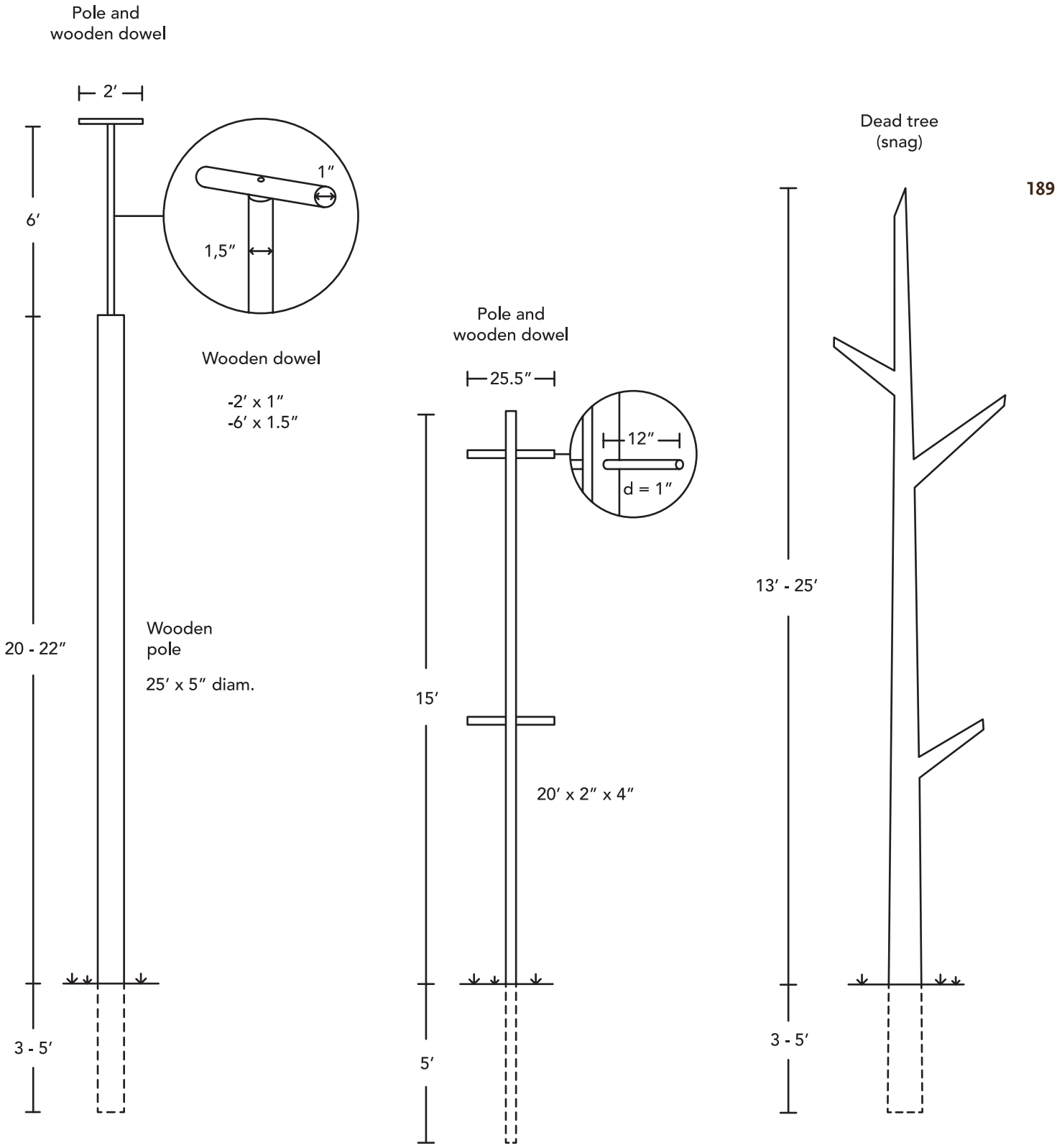
Different perches for birds of prey





Source: Association du mont Rougemont

Different perches for birds of prey



Sources: Askham, L. R. 1990. Affect of artificial perches and nests in attracting raptors to orchards. In Proceedings of the 14th Vertebrate Pest Conference (L. R. Davis and R. E. Marsh, Editors). University of California, Davis, CA USA. pp. 144–148

Reinert, S.E. 1984. Use of introduced perches by raptors: experimental result and management implications. Raptor Research. 18 (1): 25-29

	American Kestrel	Tree Swallow	Eastern Bluebird	Eastern Screech-Owl	Wood Duck	Great Crested Flycatcher	Saw-Whet Owl
Floor (cm)	20 x 20	13 x 13	13 x 13	20 x 20	30 x 30	15 x 15	15 x 15
Height (cm)	30–38	15–20	20–25	30–38	56	20–25	25–30
Diameter of opening (cm)	7.5	3.8	3.8	7.6	7.5 x 10.0 (H x L)	5.0	6.3
Shape of opening	Round	Round	Round	Round	Oval	Round	Round
Distance between opening and floor (cm)	23–30	10–15	15–20	23–30	43	15–20	20–25
Height of installation (m)	3.0–9.0	1.8–4.5	1.5–3.0	3.0–9.0	2.0–6.0	2.4–6.0	3.6–6.0
Orientation	South or east	South or east	South or east	Any direction	Facing water	South or east	South
Habitat	Open agricultural or agricultural-forested areas near fields	Urban, suburban, rural	Open areas near fields along roadways, near woodlots	Open woods, woodlot edges	Marshes, swamps, ponds, floodplains	Rural areas, pastures, fields, forest edges	Forest cutovers or woodlot/cutover edges

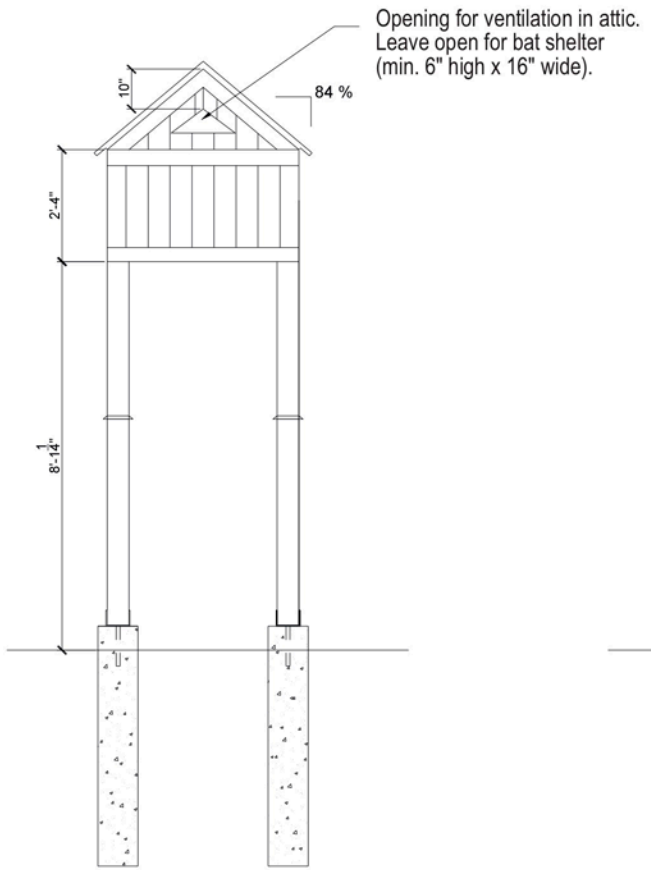
4' x 8' structure

© Regroupement QuébecOiseaux, 3D rendering made from a photo by Chenda Duong

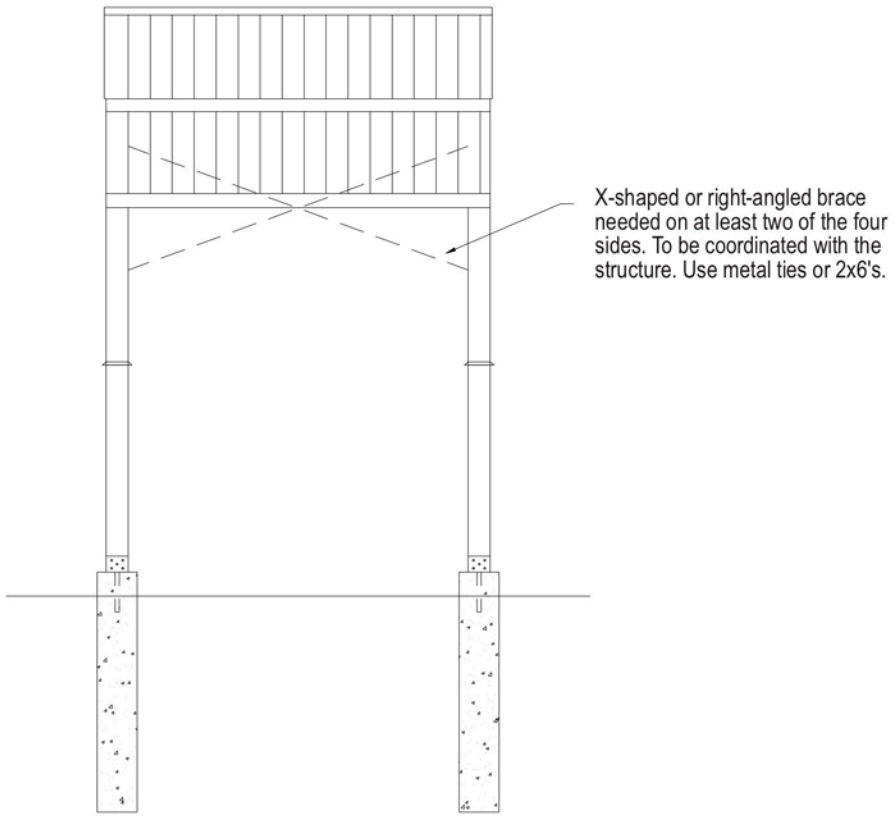
12' x 12' structure

© Regroupement QuébecOiseaux, 3D rendering made from a photo by Martin Joly

Appendix E | Plans for Barn Swallow Nesting Structures



FRONT AND BACK ELEVATIONS
SCALE: 1'-0" = 1/4"

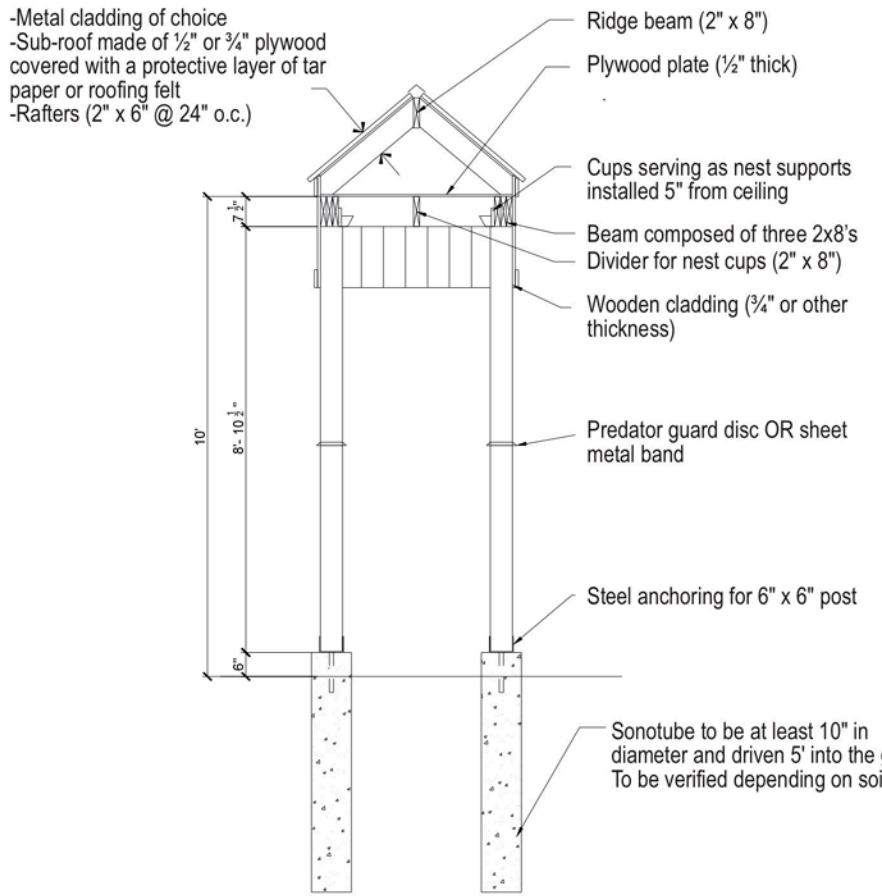


SIDE ELEVATIONS

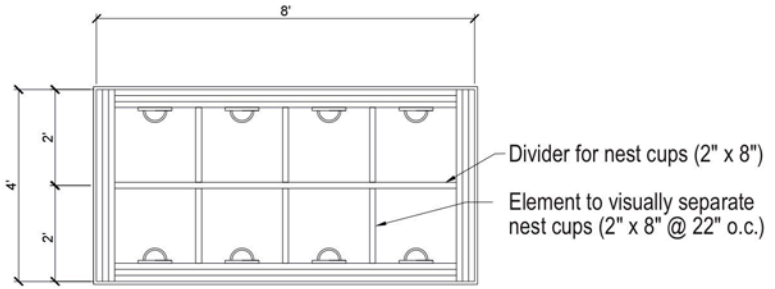
General notes

1. Barn Swallow nesting structures are to be constructed in accordance with the drawings and dimensions presented below.
2. Exact location of nesting structures to be determined on site at the time of construction. Install structures prior to performing any other site preparation or planting activities.
3. Use treated wood; do not use wood treated with arsenic.
4. Use plywood (½") to build the attic floor and install it above the ceiling joists. The plywood used should not be treated.
5. Ceiling joists should measure at least 2" x 6" to accommodate the nest cups (nest cups measure 4 ½" high by 8 ¼" long (Van Vleck, 2012)). Adding nest cups is optional; other supports may be added (8" from ceiling) to favour nest-building, e.g. nails, screens, mesh, etc.
6. The construction methods used in this document may be adjusted in the course of construction in order to ensure that the structure is safe, that it provides optimal nesting habitat for Barn Swallows and that it is weather resistant (snow, rain, wind).
7. Before beginning to build the structure, have a structural engineer validate the drawings presented herein in order to ensure the integrity and safety of the nesting structure for the site selected and its constraints and make any necessary adjustments or improvements accordingly.
8. Once work has been completed, clean up site and remove all waste material.
9. The drawings were adapted from the document "Barn Swallow Structure Design" by LGL Limited, Environmental Research Associates.

Appendix E | Plans for Barn Swallow Nesting Structures



CROSS SECTION
SCALE: 1'-0" = 1/4"



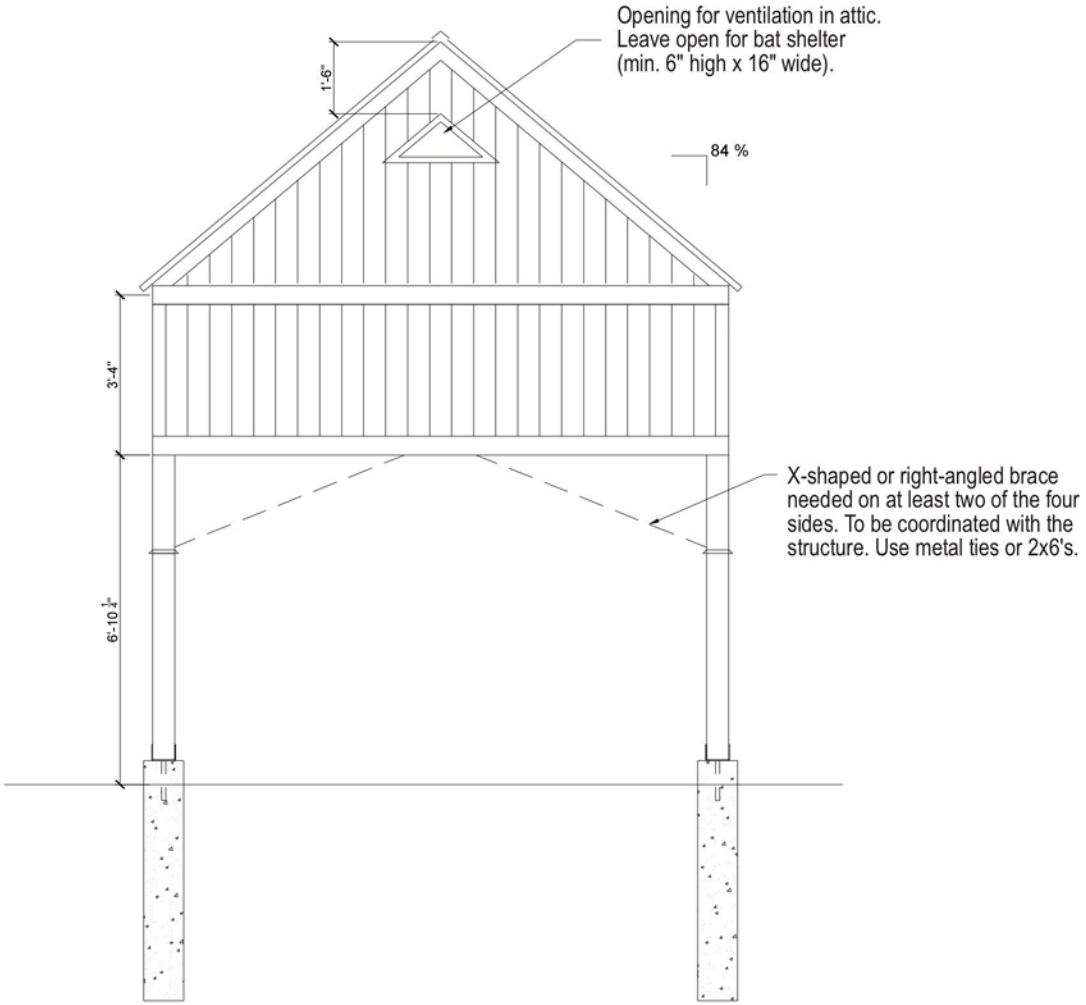
Possibility of installing up to 8 nest cups

PLAN

Notes regarding small structure

1. Use appropriate fastening screws and plates to ensure structural stability and roof system integrity (e.g. 2" x 10" plates to support roof rafters, 2" x 6" braces, etc.) or any other fastening material selected by a qualified professional at the time of construction.
2. Choose a cladding that matches well with its immediate surroundings and nearby farm buildings. The latter should cover a surface measuring at least 18" and no more than 30" from the base of the ceiling. Avoid metal sheets due to potential impacts from heated steel in proximity to the nest cups.
3. To make the roof structure, use rafters measuring 2" x 6" spaced 24" o.c. apart or as per the opinion of a qualified professional.
4. Sub-roof made of ½" plywood to be appropriately installed and covered with a protective layer of tar paper or roofing felt to provide a protective barrier against water, over which a metal roof (29 or 26 gauge) will be appropriately affixed to the sub-roof and roof rafters (e.g. Vicwest UltraVic 29 and SuperVic 26 roofing products offer a variety of steel roofing options.) Refinements to the roof system structure to be determined by a qualified professional at the time of construction.
5. Choose a light-coloured metal roof in order to reflect sunlight and secure it in such a way as to allow for ventilation while providing complete protection from rain and snow. Roof angle or height should be suitable to accommodate heavy snowfalls; a pitch of 40° is suggested.
6. Cover gable ends with same metal used for roof.
7. Soffit boards and fascia cladding shall be used to allow for air flow in the attic. Adjustments to ventilation elements should be made by a qualified professional at the time of construction.
8. Leave a space measuring at least 6" high and 16" wide above the front and rear façades to allow for cross airflow in the attic and provide access for bats, if desired.

Appendix E | Plans for Barn Swallow Nesting Structures



FRONT AND BACK ELEVATIONS
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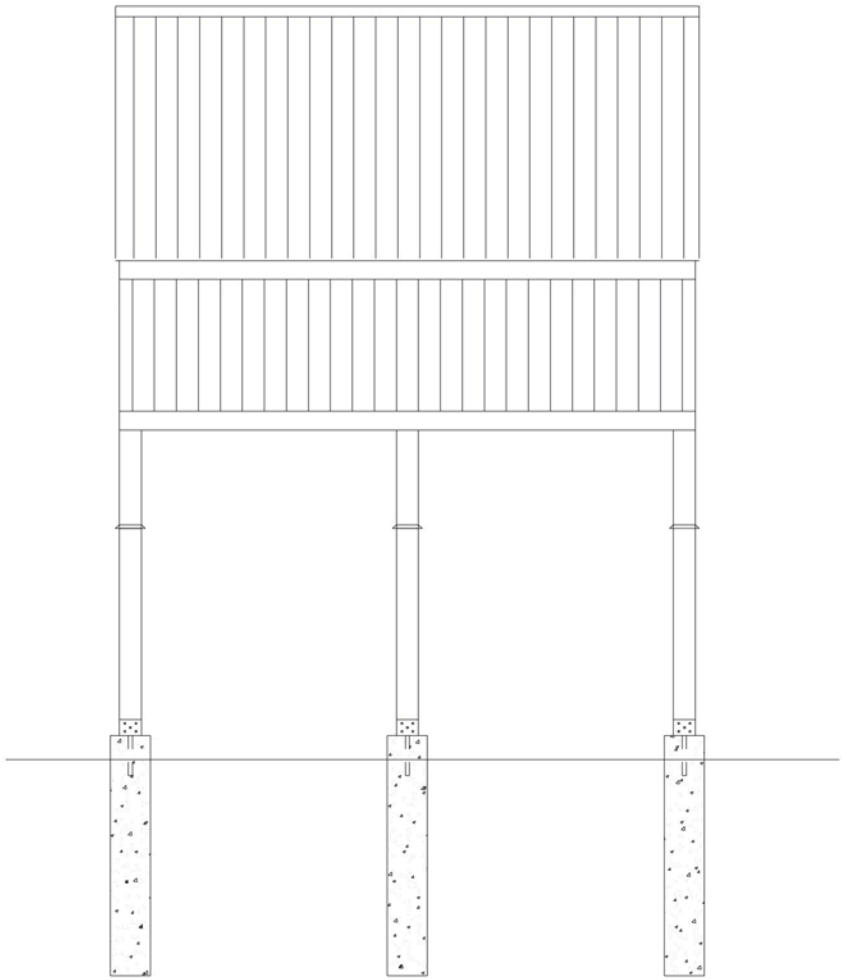

SIDE ELEVATION

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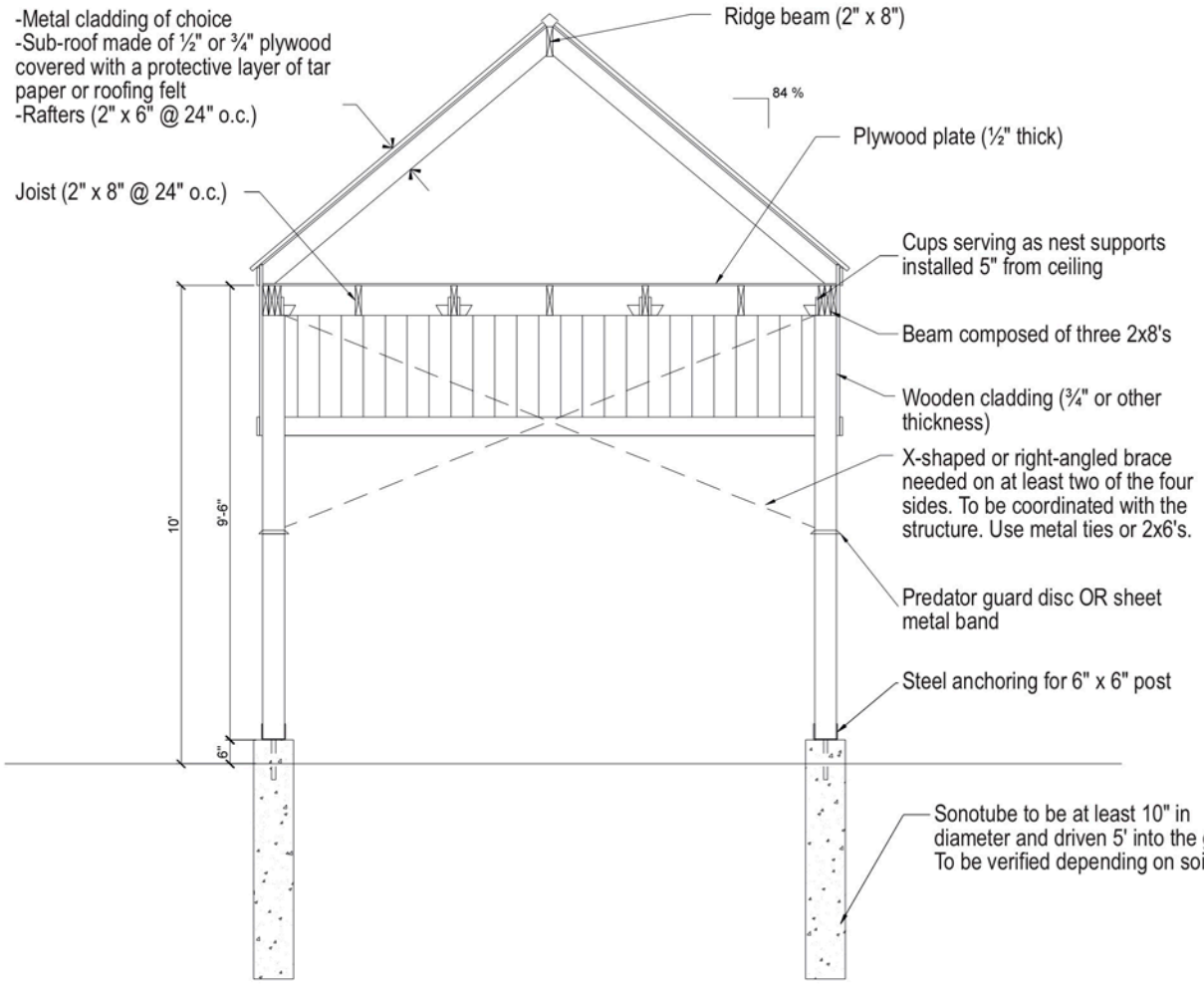

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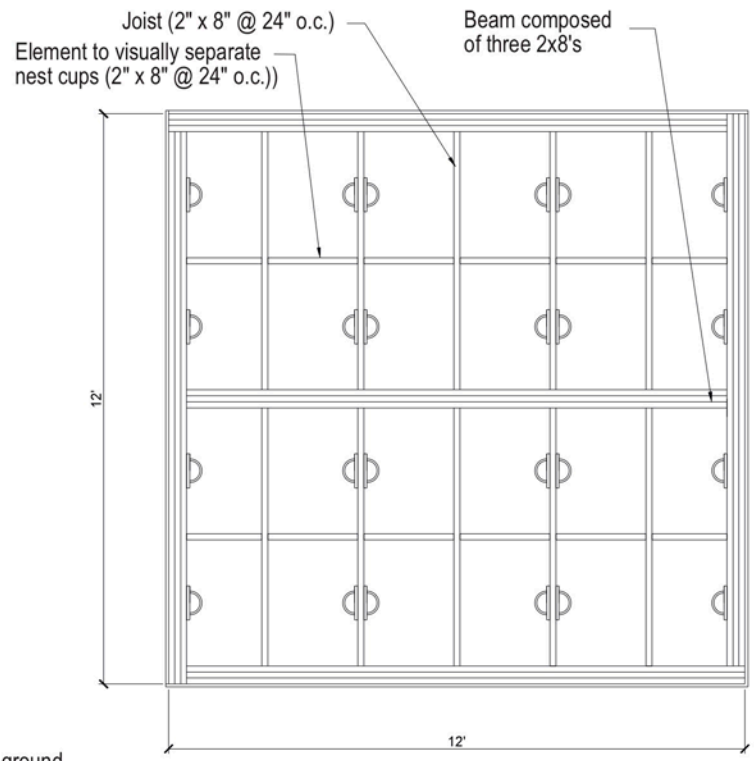
SCALE: 1'-0" = 1/4"



Possibility of installing up to 24 nest cups

PLAN

Notes regarding large structure

1. Use appropriate fastening screws and plates to ensure structural stability and roof system integrity (e.g. 2" x 10" plates to support roof rafters, 2" x 6" braces, etc.) or any other fastening material selected by a qualified professional at the time of construction.
2. Choose a cladding that matches well with its immediate surroundings and nearby farm buildings. The latter should cover a surface measuring between 36" and 42" high from the base of the ceiling. Avoid metal sheets due to potential impacts from heated steel in proximity to the nest cups.
3. To make the roof structure, use rafters measuring 2" x 6" spaced 24" o.c. apart or as per the opinion of a qualified professional.
4. Sub-roof made of ½" plywood to be appropriately installed and covered with a protective layer of tar paper or roofing felt to provide a protective barrier against water, over which a metal roof (29 or 26 gauge) will be appropriately affixed to the sub-roof and roof rafters (e.g. Vicwest UltraVic 29 and SuperVic 26 roofing products offer a variety of steel roofing options.) Refinements to the roof system structure to be determined by a qualified professional at the time of construction.
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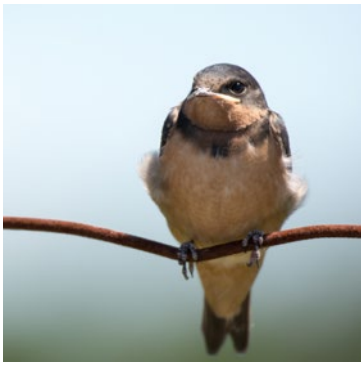

Barn Swallow

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Acknowledgements

The Recommendation Guide – Habitat Management Practices for the Protection of Farmland Birds is an initiative of Regroupement QuébecOiseaux as part of its program to train key stakeholders in bird habitat conservation in agricultural areas. Numerous partners agreed to join this project and we would be remiss not to express our sincere gratitude for their contributions.

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Photographs and other visuals We would like to thank the many collaborators that authorized us to use the various photos and other visuals that enhance this guide: Mike Allen, Michèle Amyot, Claudette Archambault, Robert Auger, Simon Pierre Barrette, Ludovic Beauregard, Paul-Claude Bérubé, Michel Bordeleau, Andrew Couturier (BSC-EOC), Alain Daigle, Serge Deslex, Catherine Dion, Benoît Dorion, Chenda Duong, Todd Fellenbaum, Régis Fortin, Nicole Fournel, Richard Fournier, Marc-Olivier Gasser (IRDA), Marcel Gauthier, David Gendron, Luc Gilbert, Sébastien Girard, Jean-Sébastien Guénette, Sophia Hobohm, Daniel Jauvin, Martin Joly, Larry Kirtley, Suzanne Labbé, Raymond Ladurantaye, Sylvain Lafrenière, Monique Laguë, Marc Lajoie (MAPAQ), Stéphane Lamoureux, Chantal Leblanc (CAPSA), Christian Marcotte (CFS), Jim McConnell, Robert Mineau, Gilles Murray, Alexandre Nicole, Gilbert Nicole, Réjean Paquet, France Paré, Linda Pérez, Alain Quenneville, Sylvain Rioux, Julie Ruiz, David Trescak, Sonia Van Wijk, Élisabeth Vachon (Les Moulins de Soulanges), Adapterre, Association du mont Rougemont, Quebec Breeding Bird Atlas, ECCC, Groupe ProConseil, Jardin Botanique de Montréal, Quebec Department of Energy and Natural Resources, Quebec Department of Forests, Wildlife and Parks, McCord Museum, Pleine Terre SENC, Regroupement QuébecOiseaux, Ressources forestières biotiques, Canadian Forest Service and SCIRBI.

Red-tailed Hawk © Richard Fournier

Lastly, we would like to extend a special thanks to Alexandre Nicole for his significant collaboration in producing this guide (graphic design, illustrations, language and technical review) and his tremendous motivation throughout the project. Thank you!

SUMMARY TABLE OF RECOMMENDATIONS

		1 Annual crops (field crops)	1 Annual crops (vegetables)	2 Meadows (man-made)	2 Meadows (natural)	3 Pastureland	4 Orchards, vineyards and berry patches	5 Tree crops	6 Abandoned farmland	7 Marginal habitats (terrestrial)	7 Marginal habitats (aquatic)	8 Anthropogenic structures	Cost rating	Benefit rating (for birds)
1.1	Use pesticides rationally *p. 38*	•	•				•	•		•	•		$$	+++
1.2	Adopt reduced-tillage and direct-seeding practices *p. 39*	•											$$	+++
1.3	Avoid seeding while rounding field corners *p. 41*	•											$	++
1.4	Interrupt spreading/spraying when making turns *p. 42*	•	•										$	++
1.5	Maintain a pesticide-free strip *p. 43*	•	•										$$	++
1.6	Plant rows of sunflower amid primary crop *p. 44*		•										$	+
1.7	Adapt ploughing period *p. 45*	•	•										$	+
1.8	Grow winter grains *p. 46*	•											$	++
2.1	Maintain meadows for 4 to 5 years *p. 54*			•									$$	+++
2.2	Maintain a multi-hectare parcel as a meadow for 6+ years 55 *p. 55*			•									$$	+++
2.3	Modify mowing pattern *p. 56*			•	•								$	++
2.4	Increase mowing height *p. 58*			•	•								$	++
2.5	Use a flusing bar mounted to the front of machinery *p. 60*	•	•	•	•								$$$	++
2.6	Adopt late- or early-maturing blends *p. 62*			•									$$	++
2.7	Postpone mowing a few hectares until after the nesting period *p. 64*			•	•								$	+++
2.8	Increase mowing interval for a few hectares *p. 66*			•	•								$	+++
2.9	Leave a few hectares unmowed *p. 68*			•	•								$$	+++
2.10	Maintain forage crops at varied heights and densities *p. 70*			•	•								$	++
2.11	Mow smaller fields first *p. 71*			•	•								$	+
2.12	Refrain from mowing at night *p. 72*			•	•								$	+
2.13	Spread manure after the last cut *p. 73*			•									$	+
2.14	Adapt the periods and parcels targeted for prescribed burns *p. 74*				•								$	++
2.15	Adapt mowing period for saltwater hay *p. 75*				•								$	++
3.1	Let livestock out to graze more frequently *p. 82*					•							$$	++
3.2	Limit the density of livestock in pastures *p. 84*				•	•			•				$$	++
3.3	Control grazing by practising pasture rotation *p. 86*				•	•			•				$$	++
3.4	Build exclosures in pastures *p. 88*				•	•			•				$$	++
3.5	Adapt supplementary feeding practices *p. 90*					•							$$	+
4.1	Practise integrated pest management *p. 98*	•	•				•	•					$$$	+++
4.2	Plant native fruit-bearing trees and berry bushes as "diversions" *p. 100*		•				•			•	•		$$	+++
4.3	Attract birds of prey *p. 102*	•	•	•	•	•	•	•	•	•	•	•	$	++
4.4	Adapt or consider alternatives to mowing *p. 104*						•	•					$	+
5.1	Conduct surveys and adapt pesticide application period accordingly *p. 112*						•	•					$$	++
5.2	Adapt fertilizer use *p. 113*	•	•				•	•					$$	+
5.3	Avoid pruning and trimming during nesting period *p. 114*						•	•					$	++
5.4	Avoid harvesting during nesting period *p. 115*							•					$	+
5.5	Diversify tree varieties within the same plantation *p. 116*						•	•					$$$	++
6.1	Avoid or adapt recultivation in abandoned fields *p. 124*								•				$	+++
6.2	Avoid or adapt tree planting in abandoned fields *p. 126*								•				$	+++
6.3	Integrate livestock into abandoned fields in order to maintain them *p. 128*					•			•				$$	++
6.4	Periodically mow abandoned fields in order to maintain them *p. 130*								•				$	+++
6.5	Avoid operating and storing machinery in abandoned fields *p. 131*								•				$	+
7.1	Conserve vegetation in existing marginal habitats *p. 138*	•	•	•	•	•	•	•	•	•			$	+++
7.2	Plant isolated trees *p. 140*	•	•	•		•				•			$	++
7.3	Establish high-diversity hedgerows *p. 142*	•	•	•	•	•	•			•			$$	+++
7.4	Develop/enhance riparian areas *p. 145*	•	•	•		•	•	•		•	•		$$	+++
7.5	Delay mowing ditches until after nesting period *p. 147*	•	•	•	•		•	•			•		$	++
7.6	Manage drainage ditches to be suitable for wildlife *p. 148*	•	•	•		•	•	•			•		$$	+
7.7	Create/enhance ponds *p. 150*	•	•	•	•	•	•		•		•		$$$	+++
8.1	Plant cedar stakes for use as perches *p. 158*	•	•	•	•		•	•		•	•	•	$	+
8.2	Conserve/maintain fences of former pastures converted to crops *p. 160*	•	•	•	•		•	•	•	•	•	•	$	+
8.3	Install species-specific nest boxes *p. 162*	•	•	•	•	•	•	•	•	•	•	•	$	+++
8.4	Preserve Barn Swallow nests *p. 164*											•	$	++
8.5	Encourage Barn Swallow nesting *p. 166*	•	•	•	•	•			•			•	$$	+
8.6	Maintain isolated buildings and other structures *p. 169*	•	•	•	•	•	•	•	•			•	$	+

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FARMLAND BIRDS (those associated with agricultural areas) have been exhibiting more pronounced declines than any other group of birds. This decline appears to be mostly attributable to the deterioration and loss of their habitats. Because this issue is not well understood by the agricultural community, this guide has been developed in an effort to address the situation. Recommendations for habitat management practices are presented by habitat type (land use or landscape structure). Implementation of these recommendations will help ensure better co-existence of farmland birds and agriculture.

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