

Management Plan for the Long-billed Curlew (*Numenius americanus*) in Canada

Long-billed Curlew



2013

Recommended citation:

Environment Canada. 2013. Management Plan for the Long-billed Curlew (*Numenius americanus*) in Canada. *Species at Risk Act Management Plan Series*. Environment Canada, Ottawa. iii + 24 pp.

Additional copies:

Additional copies can be downloaded from the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Cover illustration: Chuck Gordon

Également disponible en français sous le titre

« Plan de gestion du Courlis à long bec (*Numenius americanus*) au Canada »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2013. All rights reserved.

ISBN 978-1-100-20956-2

Catalogue no. En3-5/35-2013E-PDF

Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed Special Concern species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers for the management of the Long-billed Curlew and have prepared this plan, as per section 65 of SARA. It has been prepared in cooperation with the Provinces of Manitoba, Saskatchewan and Alberta.

Success in the management of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this management plan and will not be achieved by Environment Canada and the Parks Canada Agency or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this management plan for the benefit of the Long-billed Curlew and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

Contributions from the many individuals who offered unpublished reports, personal communications, and invaluable advice are gratefully acknowledged. They included C. Artuso (Bird Studies Canada), R. Cannings (Bird Studies Canada), K. De Smet (Manitoba Wildlife Branch), B. Downey (Alberta Sustainable Resource Management), C. Gratto-Trevor (Environment Canada) and S. MacAdam (Saskatchewan Environment).

An earlier draft of this management plan was prepared by Ursula Banasch, recently retired from Environment Canada, Canadian Wildlife Service, Prairie and Northern Region. M. Curteanu, M. Wayland (Environment Canada) and B. Downey contributed to re-drafting of the management plan. Additional comments and assistance in preparing the draft were kindly provided by M-C. Bélair, M. Dubé, W. Dunford, M. Harrison, B. Smith (Environment Canada), P. Fargey, J. Tuckwell (Parks Canada Agency), K. DeSmet and J. Pepper (Saskatchewan Environment).

EXECUTIVE SUMMARY

The Long-billed Curlew is an upland shorebird that breeds only in the North American grasslands. It winters in coastal and inland areas of California, Texas, Louisiana and along the Pacific coast of Mexico as far south as El Salvador and Costa Rica. Approximately 16% of the Long-billed Curlew's global breeding range occurs in Canada.

Market-hunting and a reduction in available habitat that occurred in the eastern part of the range prior to 1900, likely produced major population declines. In Canada, Long-billed Curlews once bred in British Columbia, Alberta, Saskatchewan, and Manitoba. Long-billed Curlews are considered to be extirpated in Manitoba and have been virtually extirpated from southeastern Saskatchewan. Canadian breeding population estimates in recent years have varied according to survey efforts. Recently, the Canadian population was estimated at a maximum of approximately 50,000 birds but confidence intervals are wide. Population trends for the species in Canada are unclear. Analyses of Breeding Bird Survey data suggest they are either stable or declining slightly in recent years.

Long-billed Curlews prefer to breed in contiguous, open, and short native and, to a lesser extent, non-native grasslands. Favoured brood-rearing habitats consist of taller vegetation, including hayfields and wet meadows. Habitats used in the winter include coastal sandy beaches, intertidal mudflats, salt marshes, coastal and inland pastures, freshwater wetlands and salt ponds. On the breeding grounds, Long-billed Curlews may forage in groups within wet lowlands, in croplands, and in stubble fields. Prey species include grasshoppers, earthworms, beetles, lepidopteran larvae as well as eggs and nestlings of small ground-nesting birds.

Major current and anticipated threats to the Long-billed Curlew include conversion of grasslands to agricultural uses, fire suppression resulting in encroachment of forested land and/or shrublands, urbanization, energy development, human developments in wintering habitat, predation and proliferation of certain non-native, invasive plant species, especially Leafy Spurge and Knapweeds. Historically, market-hunting was a severe threat to the species. Other threats with low causal certainty include: overgrazing, drought, use of agricultural pesticides, disturbance or harm caused by industrial activities and recreational use of ATV's, and accidental mortality caused by collisions with wind towers or vehicles, and agricultural activities.

The long-term objective of this management plan is to maintain or increase the recent (since 2004) breeding distribution of the Long-billed Curlew in Canada. Broad strategies to achieve these objectives are presented in the Broad Strategies, Conservation Measures and Implementation Schedule section.

TABLE OF CONTENTS

PREFACE	i
ACKNOWLEDGMENTS.....	i
EXECUTIVE SUMMARY.....	ii
1. Species Assessment Information from COSEWIC.....	1
2. SPECIES STATUS INFORMATION.....	1
3. SPECIES INFORMATION.....	2
3.1 Description of the Species	2
3.2 Populations and Distribution	2
3.3 Needs of the Long-billed Curlew.....	5
4. THREATS	7
4.1 Threat Assessment.....	7
4.2 Description of Threats.....	9
5. MANAGEMENT OBJECTIVE.....	12
6. BROAD STRATEGIES AND CONSERVATION MEASURES	12
6.1 Actions Already Completed or Underway	12
6.2 Broad Strategies, Conservation Measures and Implementation Schedule	14
7. MEASURING PROGRESS.....	15
8. REFERENCES.....	16
APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES.....	23
APPENDIX B: NATURESERVE (2009) LONG-BILLED CURLEW CONSERVATION RANK AND STATUS.....	24

1. SPECIES ASSESSMENT INFORMATION FROM COSEWIC*

Date of Assessment: May 2011

Common Name (population): Long-billed Curlew

Scientific Name: *Numenius americanus*

COSEWIC Status: Special Concern

Reason for Designation: In Canada, this large shorebird breeds in British Columbia, Alberta and Saskatchewan. Limited survey evidence suggests that the population has not changed significantly over the last 10 years, but there is anecdotal evidence suggesting regional declines. Historically, the extent and quality of its habitat has been significantly reduced by the conversion of native grasslands to agricultural crops and urban development. Ongoing threats include i) habitat loss and degradation from urban encroachment, cultivation of marginal native habitat and oil and gas development, ii) increased frequency of droughts associated with climate change, and iii) increase in predators associated with habitat fragmentation.

Canadian Occurrence: British Columbia, Alberta, Saskatchewan

COSEWIC Status History: Designated Special Concern in April 1992. Status re-examined and confirmed in November 2002 and May 2011.

*COSEWIC: Committee on the Status of Endangered Wildlife in Canada

2. SPECIES STATUS INFORMATION

Globally, the Long-billed Curlew (*Numenius americanus*) is ranked as Secure (G5) (Appendix B) but this ranking is from November 1996 (NatureServe 2009). In the United States, it is considered Secure (N5) while it is ranked as Apparently Secure in Canada (N4) (Appendix B). The species' conservation status ranges from Extirpated to Secure in the various states and provinces where it occurs (Appendix B). Approximately 16% of the Long-billed Curlew's (*Numenius americanus*) global breeding range occurs in Canada (Jones et al. 2008). The species was listed as Special Concern under Schedule 1 of the *Species at Risk Act* (SARA) in 2005. In British Columbia (B.C. Conservation Data Centre 2010) and Alberta (Government of Alberta 2007), the Long-billed Curlew is also a species of Special Concern. The province of Manitoba considers it to be Extirpated (Government of Manitoba 2009) while the species has not been listed in Saskatchewan.

3. SPECIES INFORMATION

3.1 Description of the Species

The Long-billed Curlew is a ground nester that breeds only in North America. This large long-legged North American shorebird has a long-decurved bill with the female's bill being longer than the male's. Its "curlew" call is often heard during the breeding season. The Long-billed Curlew's buffy-cinnamon plumage remains unchanged year round; no sexual colour dimorphism is known. During pair formation, this curlew species engages in a remarkable and obvious aerial display. One species similar to and sympatric with the Long-billed Curlew is the Marbled Godwit (*Limosa fedoa*), a slightly-smaller grassland nester of a similar colour but with a slightly recurved bill. Another similar species but a rare migrant, the Whimbrel (*Numenius phaeopus*) is smaller than the Long-billed Curlew, has a shorter bill and distinct headstripe, and lacks the buffy-cinnamon color.

Some authorities recognize two subspecies of the Long-billed Curlew (Bishop 1910, Am. Ornithologists' Union 1998, Blake 1977) but overlapping phenotypic characteristics indicate the need for genetic analysis. The nomenclature accepted by COSEWIC was followed in this management plan.

3.2 Populations and Distribution

Distribution

Long-billed Curlews breed throughout the grasslands of south-western Canada (British Columbia, Alberta and Saskatchewan), and south into Texas and east from Washington to Nebraska (Figure 1, COSEWIC 2002). Of all four North American curlew species, the Long-billed Curlew breeds in the most southerly parts and winters in the most northerly parts of the continent (Dugger and Dugger 2002).

Large numbers of Long-billed Curlews overwinter in coastal and inland areas in California, Texas, and Louisiana (Dugger and Dugger 2002). Smaller groups overwinter along the Gulf Coast of Florida and north from there to southern Carolina. Oregon and Washington's Pacific coast north to southern British Columbia. is also home to a small number of wintering Long-billed Curlews (Stevenson and Anderson 1994, Gilligan et al. 1994, Paulson 1993, Campbell et al. 1990). Further south, curlews overwinter along both coasts of Baja California (Morrison et al. 1992); on the Pacific coast from Sonora south to Colima (Mexico) and south to El Salvador and Costa Rica (Stiles and Smith 1980, Stiles and Skutch 1989).

Between the 1800s and early 1900s, major population declines occurred throughout the Long-billed Curlew's range due to the combination of a conservative breeding strategy¹, over-hunting and a reduction in the available breeding habitats, the latter two were greatest in the eastern part of its range (Grinnell et al. 1918, Bent 1929, DeSmet 2003). Extirpation occurred in New England, Illinois and Minnesota (US) during the late 1800s (Bent 1929).



Figure 1. Long-billed Curlew North American breeding and wintering distribution (map credited to Mike Artman published in Fellows and Jones 2009).

Canadian population and distribution

Within Canada, the Long-billed Curlew has been found to breed in the grasslands of east-central British Columbia, southern Alberta, and southwestern Saskatchewan (*see* COSEWIC 2002 for detailed locations). Long-billed Curlews historically wintered along the Atlantic coast as far north as Newfoundland; however, these populations have disappeared with the extirpation of the US eastern breeding populations (DeSmet 1992). There is some indication that the species' current range has contracted in its eastern portion (COSEWIC 2002). Long-billed Curlews have disappeared from Manitoba and virtually disappeared from southeastern Saskatchewan in less than a hundred years (Smith 1996, DeSmet 2003). It was considered a rare migrant by the 1920s in Aweme (MB) where it was a regular breeder thirty years before and is considered extirpated

¹ The Long-billed Curlew's breeding strategy is considered conservative because the species is long-lived and reproductively mature at 3 or 4 years of age, lays only one clutch per year and produces few young (COSEWIC 2002).

from Manitoba since the mid-1980s. The species underwent a similar fate in southeastern Saskatchewan where it is considered a rare observation since the late 1970s (COSEWIC 2002, DeSmet 2003). Contrastingly, the species' range has expanded in British Columbia (British Columbia Breeding Bird Atlas 2011).

Estimates of population size in Canada have varied widely since the early 1990s, mainly due to changes in survey effort and methods. Estimates have ranged from as low as approximately 5,000 adults to as high as approximately 50,000 adults (DeSmet 1992, COSEWIC 2002, C. Gratto-Trevor, pers.comm. in COSEWIC 2011). As part of a North America-wide estimate whose 90% confidence interval ranged from about 120,000 – 550,000 individuals, the Canadian population was estimated at 43,000 adults (Jones et al. 2008, P. Blancher and C. Gratto-Trevor, unpub. data in COSEWIC 2011). The wide variation in population estimates for the species, both within Canada and across North America, indicates a high degree of uncertainty regarding the true abundance of Long-billed Curlews.

Table 1. Population estimates for adult Long-billed Curlews in Canada.

Region	Year	Population estimate
British Columbia	1999 ¹	min 500
	2004 ²	2,934
	2005 ²	7,436
Alberta	2001 ³	23,884 ±4,762
	2004 ²	7,554
	2005 ²	19,714
Saskatchewan	1988-89 ⁴	min 4,000
	1996 ⁵	3,000
	2004 ²	6,500
	2005 ²	15,706

¹ Cannings 1999; ² Jones et al. 2008; ³ Saunders 2001; ⁴ Smith, A. pers. comm. in COSEWIC 2002; ⁵ Smith 1996

The Breeding Bird Survey (BBS) may not provide a reliable estimate of temporal trends in Long-billed Curlew numbers, in part because of their low occurrence and/or low detectability at the time of year that BBS surveys are conducted (Fellows and Jones 2009). Thus, any reporting on trends in Long-billed Curlew populations from BBS analyses should be viewed cautiously. COSEWIC (2002 and 2011) reported that analyses of BBS data showed a decline of 1.7% per year across their entire breeding range between 1980 and 2000 and a non-significant decline of 1.5% in Canada during the same period. Further analyses of data from BBS surveys done from 2000-2009 show an apparent slight increase in their numbers across their entire breeding range (Sauer et al. 2011), while in Canada, their population trend during this period was unclear – numbers may have declined by 4.5% per year according to analyses done by Environment Canada (2010) or they may have remained relatively stable according to analyses done by the United States Geological Survey (Sauer et al. 2011).

Throughout its range, regional differences in population trends are discernible for this species. BBS data show that populations in the eastern part of their breeding range appeared to decline between 1966 and 2003 whereas populations in the western part of their breeding range appeared to increase (Fellows and Jones 2009).

3.3 Needs of the Long-billed Curlew

3.3.1 Habitat and biological needs

Nesting and brood-rearing sites

Long-billed Curlews prefer to breed in contiguous, open and short native, and to a lesser extent, non-native grasslands, offering maximum predator visibility (Allen 1980, Pampush and Anthony 1993). In South Dakota, home ranges of Long-billed Curlews averaged 1.9 km² and 0.75 km² during the nesting and brood-rearing periods respectively (Fellows and Jones 2009). Home range size increased substantially during a drought, presumably in response to lower food availability (Fellows and Jones 2009). Territory size ranged from about 6 – 20 ha per pair (summarized by Dechant et al. 1999). Areas of suitable habitat should be about 3 times greater than territory size to accommodate the species' requirement of an unoccupied buffer strip of 300-500 m wide surrounding the territory as observed by Redmond et al. (1981).

Both sexes usually exhibit site fidelity (Redmond 1984) but, in an Idaho study, males displayed more site fidelity than females (Redmond and Jenni 1982, 1986). Long-billed Curlews do show some flexibility in their choice of their breeding site. Areas of extensive cultivation, steep slopes, and ridges are avoided. In the Columbia Basin of Oregon, selected nesting habitats have “considerable structural variability” but a low vertical profile (Pambush and Anthony 1993). These attributes, combined with the tendency to nest within sight of one another, may enhance both the survival of adults and nest contents and result in group protection (Allen 1980).

In British Columbia, where breeding areas are disjunct, Long-billed Curlews nest in dry short grasslands and pastures between 280-1220 m elevation but usually below 600 m (Cannings et al. 1987, Cannings 1999, Campbell et al. 1990). These preferred nesting habitats have low shrub and high grass cover. Preferred brood-rearing habitats consist of taller vegetation, including hayfields and wet meadows (Cannings 1999, Fellows and Jones 2009).

Long-billed Curlews breeding in Alberta prefer large undisturbed, moderately grazed, short, mixed-grass prairie, fescue prairie, and sandhill sites but also breed at lower densities in tame pastures (Prescott and Bilyk 1996, Saunders 2001). Within the Suffield National Wildlife Area, Long-billed Curlews selected upland grasslands, disturbed grasslands (i.e., formerly cultivated, mowed, or heavily grazed), and moist grasslands (Dale et al. 1999). Gratto-Trevor (1999) found that Long-billed Curlew did not select nest sites near wetlands. There is recent evidence of nesting in cropland in Alberta (Devries et al. 2010). However, it would be speculative to comment on the relative importance of such habitat to Long-billed Curlew populations at this time.

In Saskatchewan, nesting Long-billed Curlews appear to favour areas with a higher percentage of grasses than forbs, grasses less than 10 cm tall, and a low percentage of bare ground and dead litter (Foster-Willfong 2003). Pastures of grazed, non-native Crested Wheatgrass (*Agropyron cristatum*) are important habitats for Long-billed Curlews in Saskatchewan (Foster-Willfong 2003). Brood-rearing areas consist of taller, denser vegetation than nesting areas, often in close proximity to or within crops (Maher 1973, Fellows and Jones 2009).

Foraging sites and prey species

On the breeding grounds Long-billed Curlews may forage in groups (King 1978) within wet lowlands, in croplands, and in stubble fields. Prey species include grasshoppers, earthworms, beetles and lepidopteran larvae. They are opportunistic feeders and sometimes consume eggs and nestlings of ground-nesters such as Horned Larks (*Eremophila alpestris*) and McCown's Longspurs (*Calcarius mccownii*). Long-billed Curlews also forage under cow dung for beetles and other terrestrial insects (COSEWIC 2002, Dugger and Dugger 2002). Foraging may occur not only in close proximity to the nest site but also in cropland up to 10 km away from the nesting territory (Redmond 1986). Areas of dense vegetation may be avoided, even when they contain abundant prey, due to limited visibility of predators and the difficulty young may experience in traversing such habitats. Alfalfa (*Medicago sativa*) fields, once swathed to a height of less than 30 cm, are favored foraging sites, especially during the early spring (Pampush and Anthony 1993).

Staging and migratory stopover sites

Considered a short distance migrant, the Long-billed Curlew's actual migration routes are still unknown. Groups of adults and young gather at specific sites termed "staging sites", which may include fallow and plowed fields, Alfalfa and wheat (*Triticum spp.*) fields, shallow wetlands, low grasslands, reservoir and lake edges, and centre pivot irrigation fields (Fellows and Jones 2009). Usually at these locations, roosting sites are available and prey species are abundant. The former provides safety from predators while the latter enables birds to build up fat reserves for their upcoming migration. Migratory stopover sites have similar attributes to staging sites but are available along the migration route. Long-billed Curlews use a greater number of migratory stopover sites than some species of shorebirds which concentrate in large numbers at a small number of sites during migration (reviewed by Dugger and Dugger 2002).

No regularly-used staging sites are known in British Columbia. Dale et al. (1999) noted some staging sites in the Suffield National Wildlife Area, Alberta. During August 1920, observers saw a group of 100 Long-billed Curlews in the Medicine Hat, Alberta area (Renaud 1980). In Saskatchewan, groups of varying size were seen at Luck Lake during late July and early August of 1943; at Matador from 1967 – 1972; and at the Junction Reservoir during 1976 (Renaud 1980).

Wintering sites

During the winter, Long-billed Curlews use aquatic habitats more than they do during the breeding season. Habitats used in the winter include coastal sandy beaches, intertidal mudflats, salt marshes, coastal and inland pastures, freshwater wetlands and salt ponds (Fellows and Jones 2009).

3.3.2 Limiting factors

Long-billed Curlew distribution and abundance may be limited by the occurrence and quality of suitable breeding, foraging, migratory, staging or wintering habitats as well as the species' biological characteristics. Such factors may affect management potential. Some studies in the United States reported that certain breeding habitats were not saturated (Bicak 1977, Allen 1980, Jenni et al. 1981), suggesting that in some specific locations population size may be limited by factors other than the availability of suitable breeding habitat.

Environmental conditions such as drought may limit Long-billed Curlew abundance and distribution. Drought reduces vegetation needed for brood-rearing and may affect prey species by altering their occurrence, the timing of their availability, and their quantity and quality (Allen 1980, DeSmet 1992).

The survival of adults is poorly understood. Male Long-billed Curlews initiate breeding at 2-3 years of age whereas females start at 3-4 years of age (Redmond and Jenni 1986). Long-billed Curlews have a low reproductive output. Past data indicate that renesting does not occur or it is rare (COSEWIC 2002). During the late summer months, prey availability and quality may decrease, further diminishing the likelihood that renesting attempts will produce fledged young.

4. THREATS

4.1 Threat Assessment

Table 2. Threat assessment table.

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Habitat Loss or Degradation						
Conversion of grassland to agricultural uses	Medium	Widespread	Historical and Current	Continuous	Medium	High
Fire suppression	Medium	Widespread	Historical and Current	Seasonal	Medium	Medium
Urbanization	Medium	Local	Historical and Current	Continuous	Medium	Medium
Energy development	Medium	Widespread	Current	Continuous	Medium	Medium
Human developments in wintering habitat (outside Canada)	Medium	Widespread	Historical and Current	Recurrent	Medium	Medium
Overgrazing	Low	Widespread	Historical and Current	Recurrent	Low	Medium

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Changes in Ecological Dynamics or Natural Processes						
Predation	Medium	Widespread	Current and Anticipated	Seasonal	Medium	Medium
Drought	Low	Widespread	Anticipated	Seasonal	Low/Medium	Low/Medium
Exotic, Invasive, or Introduced Species						
Leafy Spurge and Knapweed	Medium/Low	Widespread	Current	Seasonal	Unknown	Low
Old, tall Crested Wheatgrass plantings	Low	Localized	Current	Seasonal	Unknown	Low
Pollution						
Agricultural pesticides	Low	Widespread	Historical and Current	Seasonal	Low	Low
Disturbance or Harm						
Industrial activities	Low	Widespread	Current	Recurrent	Low	Low
Recreational use of ATV's	Low	Localized	Current	Recurrent	Low	Low
Accidental Mortality						
Agricultural activities	Low	Widespread	Current	Recurrent	Low	Low
Vehicle collisions	Low	Widespread	Current	Recurrent	Low	Low
Collisions with wind towers	Low	Localized	Current and Anticipated	Recurrent	Low	Low
Biological Resource Use						
Hunting	Low	Widespread	Historical	Unknown	High	High

¹ *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*

² *Severity: reflects the population-level effect (High - very large population-level effect, Medium – medium population effect; Low – low population effect; Unknown – unknown effect on populations).*

³ *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

4.2 Description of Threats

Threats are listed in order of decreasing level of concern. Threats ranked as “low level of concern” in Table 2 are not described in this section.

Conversion of grassland to agricultural uses

In Alberta and Saskatchewan, about 57% and 79% of native prairie grasslands have been lost, primarily, though not exclusively, to agriculture in the past century (Nernberg and Ingstrup 2005). By 1996, cropland, summer fallow and improved pasture accounted for about 70% of all land use in the Canadian prairies (Agriculture and Agri-Food Canada 2000). While most of the prime land was converted for cultivation and grazing purposes long ago, some conversion has continued to occur in recent years. Between 1985 and 2001, about 6-8% and 8-11% of remaining native grasslands were converted to other uses within different grassland ecoregions of Saskatchewan and Alberta, respectively (Watmough and Schmoll 2007). Most of these losses were the result of small remnant grassland areas within larger mosaics of cultivated land generally being converted to cropland (Watmough and Schmoll 2007). In western Canada, it is anticipated that the biofuel industry will grow rapidly in the coming years in order to meet a federal regulation enacted in 2010, requiring an average of 5% renewable energy content in gasoline. The growth in this industry is anticipated to increase competition for grains among livestock, food and fuel sectors, resulting in the sacrifice of forage and pasturelands to grain and biomass production, and to a shift in livestock production to increasingly marginal land, which is environmentally fragile (Alberta Agriculture and Rural Development 2008).

In British Columbia, grasslands in the Okanagan Valley and Thompson River Valley have been converted to agricultural uses such as orchards and vineyards (Lea 2008). However, losses of habitat in those areas may have been counterbalanced by gains in the Rocky Mountain Trench resulting from the clearing of forested lands for field crops, such as Alfalfa, which were judged to be compatible with Long-billed Curlew habitat needs (Cannings 1999). Approximately 3 to 11% of native grasslands have been lost to cultivated fields in the southern interior of British Columbia (Grasslands Conservation Council of British Columbia 2004).

The conversion of native grasslands to agricultural use not only results in a direct loss of habitat but also fragments the remaining habitat. Interspersed habitats with roads, trails, fencelines, hedgerows, shelterbelts and other human-altered features can provide perches, roosts, corridors or cover for mammalian and avian predators (Bergin et al. 1997). Trees, power poles and fence posts serve as perch or observation sites for avian predators such as Ferruginous Hawks (*Buteo regalis*) and Swainson's Hawks (*Buteo swainsoni*) (Bechard et al. 1995; Bechard et al. 2010). Corridors created by fragmentation may increase predation (Kuehl and Clark 2002) by Coyotes (*Canis latrans*) and Red Foxes (*Vulpes vulpes*), two important predators of Long-billed Curlews (COSEWIC 2011). Excessive fragmentation of habitat may not only expose Long-billed Curlews to higher rates of predation, but can also disrupt connecting corridors between neighbouring areas of suitable habitat, making it difficult for Long-billed Curlews to move their young from one suitable habitat patch to another (Mader 1984).

Fire suppression

Until western Canada was settled, fire was an important tool used by First Nations people to manage and maintain grasslands. As the land was settled and converted to agricultural uses, the use of fire as a management tool decreased and natural fires were suppressed, either directly or indirectly, by means of fire breaks, roads or other habitat alterations. In the mixed-grass prairie of the North American Great Plains, land burned at 3-5 year intervals prior to European settlement. In contrast, today, <1% of the mixed grass prairie burns in any given year (Samson et al. 2004). Fire suppression can result in encroachment of shrub growth into prairie grasslands. In British Columbia, the decrease in fire frequency has been linked to encroachment of coniferous forests into grassland and savannah habitats of the South Okanagan and Similkameen valleys as well as the Chilcotin grasslands (Strang and Parminter 1980, Turner and Krannitz 2001). Encroachment of shrubs and forests into grasslands results not only in direct loss of habitat but also reduces the quality of the remaining habitat. Long-billed Curlews are purported to avoid nesting in grassed areas that are close to surrounding shrublands or forests (reviewed by Cannings 1999).

Urbanization

The greatest loss of grasslands in the valleys of southern British Columbia has been attributed to urbanization and the associated extensive transportation corridors needed to support them, especially in the vicinities of Kelowna, Cranbrook and Kamloops (Lea 2008). In the Prairie Provinces, urbanization has not been identified as a threat to Long-billed Curlews. Nevertheless some cities in the southern prairies have grown in recent years by expanding into adjacent grasslands. For instance, Regina (SK) has had a 10% population growth rate on its outskirts whereas a slight decrease has been observed in its center (Canadian Prairie Partners in Flight 2004).

Energy development

Habitat loss and fragmentation due to the rapid growth of the energy sector (i.e. oil, gas, etc.) in grasslands (COSEWIC 2010) is an increasing threat to Long-billed Curlews (COSEWIC 2011) who prefer large undisturbed tracts of native prairie (Prescott and Bilyk 1996, Saunders 2001). Since the late 1980s, the number of oil and gas wells have more than doubled in Alberta and Saskatchewan (COSEWIC 2010) fragmenting an estimated 33,000 ha in well sites and pipelines in the former province alone. In coming years, this threat is expected to affect an additional 9,000 ha of grassland habitat on an annual basis in Alberta (Canadian Prairie Partners in Flight 2004). Furthermore, energy development may enhance other threats to this species. Activities related to the energy sector have been shown to facilitate the introduction and expansion of invasive plant species (see Table 2) (Bayne and Dale 2010). The risk of collisions with vehicles may also increase with the higher traffic volume resulting from oil and gas activities on already established roads and access trails (see Table 2) (Bayne and Dale 2010).

Human Development in wintering habitats outside Canada

Long-billed Curlew wintering habitat includes primarily coastal habitats as well as inland grasslands, specifically tidal mudflats and estuaries, wet pastures, salt marshes, rice fields (flooded/unflooded), managed wetlands, evaporation and sewage ponds, and grasslands (Fellows and Jones 2009). During the past centuries, the expanding human population and urban encroachment have degraded coastal wetlands extensively. New energy developments, increased sedimentation of wetlands resulting in more tidal marshes than tidal flats, wetland drainage (Kennish 2001), and conversion of habitat to row crops, vineyards, and orchards have all decreased the availability of these wintering areas (Taft and Haig 2003). Recreational use of the shallow waters has increased but their effects on foraging shorebirds are unknown. Potential future rising sea levels may also reduce the extent of tidal flat foraging areas (Colwell and Mathis 2001).

Predation

Coyotes, Red Foxes, Black-billed Magpies (*Pica pica*), Common Ravens (*Corvus corax*), Ferruginous Hawks, Swainson's Hawks and Great-Horned Owls (*Bubo virginianus*) are important predators of Long-billed Curlews (Allen 1980, COSEWIC 2002). Predators destroyed 10 – 35% of nests in two study areas in the northern United States and accounted for 23% of known chick mortality at one of those sites (Redmond and Jenni 1986, Pampush and Anthony 1993). Predation rates on adults are unknown. Populations of some of these species, such as Coyotes have increased in the Canadian prairies in recent years (COSEWIC 2002), perhaps resulting in heightened predation pressure on Long-billed Curlews.

Leafy Spurge and knapweed

COSEWIC (2002) indicated that Leafy Spurge (*Euphorbia esula*) and knapweed (*Centaurea sp.*) are invasive species that could be problematic for Long-billed Curlews. As early as the 1950s, Leafy Spurge had invaded approximately 5,000 ha of grasslands in Saskatchewan and an additional 5,000 ha of cultivated land (Selleck et al. 1962). In Alberta, Leafy Spurge has infested approximately 6,000 ha of land, mainly in the southeastern part of the province (McLay and Cole 1995). The distribution of this invasive species in Alberta and Saskatchewan broadly overlaps the distribution of Long-billed Curlew in the two provinces. Displacement of native graminoid vegetation by this aggressive species would reduce the amount of suitable habitat for Long-billed Curlews (COSEWIC 2002).

Knapweeds are highly competitive herbs which occupy over 100,000 ha of land in British Columbia, primarily in the grasslands of the southern interior portion of the province where Long-billed Curlews occur. Once established in an area, they can significantly reduce the abundance and productivity of native grasses, resulting in the degradation of habitat for grassland birds and other wildlife (British Columbia Ministry of Forests, Lands, and Natural Resource Operations 2011). Knapweeds have been implicated in an overall loss in the integrity of grassland ecosystems in the southern interior of British Columbia (Gayton 2004).

While Leafy Spurge and knapweeds have been postulated to be among the most serious invasive species in contributing to the decline of breeding habitat for Long-billed Curlews in Canada (COSEWIC 2002), there are numerous other invasive weeds affecting the quality of native grasslands. However, the threat they pose to Long-billed Curlew remains speculative.

Invasive plant species are a threat to Long-billed Curlews not only on their Canadian breeding areas, but also on the wintering grounds. Cordgrass (*Spartina alterniflora*) is an introduced, invasive species found in the tidal areas of San Francisco Bay in California. It can outcompete native vegetation resulting in less suitable tidal flats for foraging by shorebirds (Frenkel 1987, Daehler and Strong 1996).

5. MANAGEMENT OBJECTIVE

At this time, it is not possible to develop a quantitative management objective for the Long-billed Curlew. Population abundance and trend estimates have ranged widely over the years and have wide confidence intervals. BBS data is often used to estimate abundance and population trend for this species. However, BBS protocols are not adequate for monitoring Long-billed Curlews (see section 3.2).

The long-term objective of this management plan is to maintain or increase the recent (since 2004) breeding distribution of the Long-billed Curlew in Canada. This should be attainable by maintaining and improving the amount and quality of breeding and migration habitat available for current and future Canadian populations, and by promoting the conservation of suitable habitat in Canada as well as on the wintering grounds.

6. BROAD STRATEGIES AND CONSERVATION MEASURES

6.1 Actions Already Completed or Underway

Since the writing of an initial COSEWIC status report (DeSmet 1992) and two revised status reports (COSEWIC 2002, 2011), responsible agencies have conducted surveys and continued to monitor some populations. In addition there are numerous ongoing activities whose purpose is to conserve and manage grassland habitat for use by wildlife and people.

Surveys and Monitoring

- BBS volunteers continue to monitor Long-billed Curlew numbers to determine population trends. The BBS data are enhanced by annual monitoring of grassland birds done by Environment Canada and known as the Grassland Bird Monitoring Program (Dale et al. 2005).
- During 2004 and 2005, a North-America wide survey was conducted to determine population size and distribution of the Long-billed Curlew (Jones et al. 2008).
- In Alberta, Saunders (2001) conducted a random stratified survey to determine a population estimate.

- From 2001-2007, the Government of Alberta annually surveyed a subsample of 20 roadside transects to determine yearly population trends.
- Point counts at Onefour Research Sub-station, Alberta were conducted during 2002, 2003 and 2005 (Knapton et al. 2005).
- Foster-Wilfong (2003) conducted surveys in the early 2000s and studied the use of habitat of Long-billed Curlews.
- In British Columbia, volunteer inventories were conducted in the Cariboo and Thompson area.

Management

- Alberta published a status report (Hill 1998) and drafted a Long-billed Curlew conservation management plan during 2008.
- British Columbia published a status report on the species (Cannings 1999).
- British Columbia has drafted recommendations for Long-billed Curlew management in the Identified Wildlife Management Strategy (British Columbia Ministry of Environment, 2004).
- Eleven Wildlife Habitat Areas have been established for Long-billed Curlew in the Rocky Mountain Forest District, British Columbia, covering 936 ha of provincial Crown Land.
- Skookumchuck Prairie Important Bird Area (approx. 200 km²) has been designated in the East Kootenay region of British Columbia, primarily in recognition of the significant number of breeding pairs of Long-billed Curlews.

Habitat Conservation and Outreach

- The Saskatchewan Prairie Conservation Action Plan is a partnership of conservation organizations, created in 1995, whose purpose is to promote, sustain and conserve the remaining native prairie.
- The Government of Saskatchewan completed the Great Sands Hills Regional Environmental Study in 2007 with recommendations for protecting the ecological integrity of this sensitive grassland area, faced with increasing development pressures.
- The Alberta Multiple Species at Risk group (MULTISAR), a joint provincial government-stakeholder initiative has developed and promoted multi-faceted approaches for conserving species at risk in the grasslands of southern Alberta.
- The Alberta Prairie Conservation Forum was created in 1994 to promote conservation of Alberta's grasslands. It released its Alberta Prairie Conservation Action Plan in 2006.
- The Grasslands Conservation Council of British Columbia, established in 1999, developed a strategic plan for 2009 - 2014 to contribute to grassland conservation in that province.
- The South Okanagan-Similkameen Conservation Program in British Columbia encourages landowners to responsibly manage privately owned grasslands (COSEWIC 2011).

6.2 Broad Strategies, Conservation Measures and Implementation Schedule

To achieve the objective of this management plan, five broad strategies are recommended:

1. Identify, manage and conserve key breeding and migration sites within the Canadian range;
2. Promote conservation of native grasslands and other important habitats within the species' range;
3. Conduct public outreach and education;
4. Collaborate with international partners; and
5. Assess population size and trends.

The measures required to implement these strategies are listed in Table 3 together with a schedule for implementation. These strategies may be implemented in a multi-species approach that would benefit Long-billed Curlews as well as other species at risk.

Table 3. Conservation measures and implementation schedule.

Measure	Priority	Threats Addressed	Timeline
Broad Strategy: Identify, manage and conserve key sites within the Canadian range			
1. Develop habitat use models and use Long-billed Curlew survey information to identify locations of key sites	High	Information gap that must be addressed in order to reduce all threats	2018
2. Adopt and implement best management practices for agricultural and industrial activities to manage human activities at key sites	Medium	Conversion of grassland to agricultural uses; Energy development; Overgrazing; Leafy spurge and Knapweed invasion; Old, tall Crested Wheatgrass plantings; Agricultural pesticides; Industrial activities; Agricultural activities; Collisions with wind towers	2018
3. Develop conservation agreements with private landowners that focus on conservation of native grasslands at key sites	High	Conversion of grassland to agricultural uses; Overgrazing; Leafy spurge and Knapweed invasion; Old, tall Crested Wheatgrass plantings; Agricultural pesticides; Agricultural activities	2018
4. Ensure Long-billed Curlew needs are considered in any new or updated management plans for public grassland areas	High	Overgrazing; Fire suppression; Leafy spurge and Knapweed invasion; Old, tall Crested Wheatgrass plantings; Agricultural pesticides; Industrial activities; Recreational use of ATV's; Agricultural activities; Collisions with wind towers	2018

Measure	Priority	Threats Addressed	Timeline
5. Ensure that any proposed developments that are subject to the environmental assessment process consider the needs of the Long-billed Curlew	High	Conversion of grassland to agricultural uses; Urbanization; Energy development; Leafy Spurge and Knapweed invasion; Industrial activities; Collisions with wind towers	2018
Broad Strategy: Promote conservation of native grasslands and other important habitats within the species' range			
6. Promote best management practices to important agricultural and industrial stakeholders at key sites	Medium	Conversion of grassland to agricultural uses; Energy development; Overgrazing; Leafy spurge and Knapweed invasion; Old, tall Crested Wheatgrass plantings; Agricultural pesticides; Industrial activities; Agricultural activities; Collisions with wind towers	2018
Broad Strategy: Conduct public outreach and education			
7. Raise awareness and promote benefits of grassland conservation to landowners	High	Conversion of grassland to agricultural uses; Overgrazing; Leafy spurge and Knapweed invasion; Old tall Crested Wheatgrass plantings; Agricultural pesticides; Agricultural activities; Recreational use of ATV's	2018
Broad Strategy: Collaborate with international partners			
8. Promote conservation of Long-billed Curlew and their wintering habitat, in collaboration with efforts of American and Mexican Partners in Flight	Medium	Human developments in wintering habitats	2018
Broad Strategy: Assess population size and trends			
9. Evaluate Alberta's current monitoring protocol to determine its appropriateness throughout the species' Canadian range and modify accordingly	Medium	Information gap that must be addressed in order to measure progress in meeting Management Objective	2018
10. Assess the quality of population size and abundance data available range-wide and identify knowledge gaps	Medium	Information gap that must be addressed in order to measure progress in meeting Management Objective	2018
11. If necessary, implement improved monitoring protocols where needed within the Canadian range	Medium	Measure that may need to be implemented in order to measure progress in meeting the Management Objective	2018

7. MEASURING PROGRESS

Success in implementing this management plan will be measured against the following performance indicator:

- By 2018, the recent (since 2004) breeding distribution of the Long-billed Curlew in Canada will be maintained or increased.

8. REFERENCES

- Agriculture and Agri-Food Canada. 2000. Prairie agricultural landscapes: a land resource review. Prairie Farm Rehabilitation Administration, Agriculture and Agri-Food Canada, Regina.
- Alberta Agriculture and Rural Development. 2008. A Canadian perspective on land management risks associated with biofuels and their production. *Capturing Feed Grain and Foraging Opportunities 2007 Proceedings*, Red Deer, Alberta ([http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/crop12127](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/crop12127), accessed June 15, 2011)
- Allen, J. 1980. The ecology and behavior of the Long-billed Curlew in southeastern Washington. Wildlife Monograph No. 73. The Wildlife Society.
- American Ornithologists' Union. 1998. Check-list of North American birds. 7th ed. Am. Ornithol. Union, Washington, D.C. *In* B.D. Dugger and K.M. Dugger, Long-billed Curlew. The Birds of North America, No. 628.
- Bayne, E.M., and Dale, B.C. 2010. Effects of Energy development on songbirds. *In* Naugle, D.E. (ed) Energy development and Wildlife Conservation in western North America, Island press, 308 pp.
- B.C. Conservation Data Centre. 2010. BC Species and Ecosystems Explorer. B.C. Ministry. of Environment. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed Feb 8, 2010).
- Bechard, Marc J. and Josef K. Schmutz. 1995. Ferruginous Hawk (*Buteo regalis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/172doi:10.2173/bna.172>
- Bechard, Marc J., C. Stuart Houston, Jose H. Sarasola and A. Sidney England. 2010. Swainson's Hawk (*Buteo swainsoni*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/265doi:10.2173/bna.265>
- Bent, A.C. 1929. Life histories of North American shorebirds. U.S. National Museum Bulletin No. 146.
- Bergin, T.M., Best, L.B., and Freemark, K.E. 1997. An experimental study of predation on artificial nests in roadsides adjacent to agricultural habitats in Iowa. *Wilson Bulletin* 109(3): 437-448.

- Bicak, T.K. 1977. Some eco-ethological aspects of a breeding population of Long-billed Curlew (*Numenius americanus*) in Nebraska. Master's thesis, University of Nebraska, Omaha.
- Bishop, L.B. 1910. Two new subspecies of North American birds. *Auk* 27:59-61. In D. Dugger and K.M. Dugger, Long-billed Curlew. *The Birds of North America*, No. 628.
- Blake, E.R. 1977. Manual of Neotropical birds. Vol. 1: Spheniscidae (penguins) to Laridae (gulls and allies). Univ. of Chicago Press, Chicago, IL. In B.D. Dugger and K.M. Dugger, Long-billed Curlew. *The Birds of North America*, No. 628.
- British Columbia Breeding Bird Atlas. 2011. Species and Effort Map. Available at: <http://www.birdatlas.bc.ca/bcdata/maps.jsp> (Accessed on July 9, 2011).
- British Columbia Ministry of Environment. 2004. Identified wildlife management strategy, version 2. British Columbia Ministry of the Environment, Victoria, BC. Available from: <http://www.env.gov.bc.ca/wld/frpa/iwms/iwms.html>. (Accessed on 10 July, 2011).
- British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 2011. Available from: <http://www.for.gov.bc.ca/dos/programs/range/docs/> (Accessed on July 4, 2011).
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia, Vol. 2. Royal British Columbia Museum, Victoria, BC. 636 pp.
- Canadian Prairie Partners in Flight. 2004. Landbird Conservation Plan for Prairie Pothole Bird Conservation 11 in Canada. Canadian Wildlife Service, Edmonton, AB.
- Cannings, R.J. 1999. Status of the Long-billed Curlew in British Columbia. Wildlife Working Report No. WR-96.
- Cannings, R. A., R.J. Cannings, and S.G. Cannings. 1987. The birds of the Okanagan Valley, British Columbia. Royal British Columbia Museum, Victoria, BC. 420 pp.
- Colwell, M.A., and Mathis, R.L. 2001. Variation in territory occupancy of non-breeding Long-billed Curlews in intertidal habitats. *Waterbirds: The International Journal of Waterbird Biology* 24(2): 208-216.
- COSEWIC 2002. COSEWIC assessment and status report on the Long-billed Curlew *Numenius americanus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 31 pp.
- COSEWIC 2010. COSEWIC assessment and status report on the Sprague's Pipit *Anthus spragueii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 34 pp.

- COSEWIC. 2011. COSEWIC status appraisal summary on the Long-billed Curlew *Numenius americanus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 17 pp.
- Daehler, C.C. and D.R. Strong. 1996. Status, prediction and prevention of introduced cordgrass *Spartina* spp. invasions in Pacific estuaries, USA. *Biological Conservation*. 78:51-58.
- Dale, B.C., P.S. Taylor, and J.P. Goossen. 1999. Avifauna component report. Canadian Forces Base Suffield National Wildlife Area Wildlife Inventory. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region. Edmonton, AB. 161 pp.
- Dale, B., M. Norton, C. Downes, and B. Collins. 2005. Monitoring as a means to focus research and conservation – the grassland bird monitoring example. USDA Forest Service Gen Tech. Rep. PSW-GTR-191.
- Dechant, J.A., Sondreal, M.L., Johnson, D.H., Igl, L.D., Goldade, C.M., Rabie, P.A., and Euliss, B.R. 1999. Effects of management practices on grassland birds: long-billed curlew. Northern Prairie & Wildlife Research Centre, Jamestown, ND.
- DeSmet, K.D. 1992. COSEWIC status report on the Long-billed Curlew *Numerius americanus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 33 pp.
- DeSmet, K.D. 2003. Long-billed Curlew *In* P. Taylor (ed), The birds of Manitoba. Manitoba Naturalists Society. Winnipeg, Manitoba, 504 pp.
- DeVries, J.H., Rimer, S.O., and Walsh, E.M. 2010. Cropland nesting by long-billed curlews in southern Alberta. *Prairie Nat.* 42: 123-129.
- Dugger, B.D. and K.M. Dugger. 2002. Long-billed Curlew. *In* The Birds of North America, No. 628 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Environment Canada 2010. North American Breeding Bird Survey - Canadian results and analysis website version 3.00. Environment Canada, Gatineau, Quebec.
- Fellows, S.D. and S.L. Jones. 2009. Status assessment and conservation action plan for the Long-billed Curlew (*Numenius americanus*). U.S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication, FWS/BTP-R6012-2009, Washington, D.C.
- Foster-Willfong, J.M. 2003. Census methodology and habitat use of Long-billed Curlews (*Numenius americanus*) in Saskatchewan. M.Sc. thesis. University of Regina.
- Frenkel, R.E. 1987. Introduction and spread of cordgrass (*Spartina*) into the Pacific northwest. *Northwest Environ. J.* 3:152-154.

- Gayton, D. 2004. Native and non-native plant species in grazed grasslands of British Columbia's southern interior. *BC J Ecosystem Management* 5:51-59
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. *Birds of Oregon: status and distribution*. Cinclus Publ., McMinnville, OR
- Government of Alberta. 2007. Alberta's Long-billed Curlew (*Numenius americanus*). Available at: <http://www.srd.gov.ab.ca/fishwildlife/escc/speciesassessed.aspx> (Accessed on October 7, 2009).
- Government of Manitoba. 2009. State of the Environment Reports. Available at: <http://www.manitoba.ca/conservation/annual-reports/soe-reports/> (Accessed on October 7, 2009).
- Grasslands Conservation Council of British Columbia. 2004. British Columbia grasslands mapping project: a conservation risk assessment, final report. Grasslands Conservation Council of British Columbia, Kamloops, BC.
- Gratto-Trevor, C.L. 1999. Use of managed and natural wetlands by upland breeding shorebirds in southern Alberta. Pages 252-259 in J. Thorpe, T.A. Steeves and M. Gollop (eds.). Proceedings of the Fifth Prairie Conservation and Endangered Species Conference, February 1998, Saskatoon, Saskatchewan. Provincial Museum of Alberta Natural History Occasional Paper No. 24.
- Grinnell, J.H., H.C. Bryant, and T.I. Storer. 1918. Game birds of California. Univ. of California Press, Berkeley. In B.D. Dugger and K.M. Dugger, Long-billed Curlew. The Birds of North America, No. 628.
- Hill, D.P. 1998. Status of the Long-billed Curlew (*Numenius americanus*) in Alberta. Alberta Environmental Protection, Fisheries & Wildlife Management Division, and Alberta Conservation Association, Wildlife Status Report No. 16, Edmonton, AB. 20 pp.
- Jenni, D.A., R.L., Redmond, and T.K. Bick. 1981. Behavioral ecology and habitat relationships on Long-billed Curlews in western Idaho. Dept. Int., Bur. Land. Manage. Boise District, Idaho.
- Jones, S.L., C.S. Nations, S.D. Fellows, and L.L. McDonald. 2008. Breeding abundance and distribution of Long-billed Curlews (*Numenius americanus*) in North America. *Journal of the Waterbird Society* 31(1):1-14
- Kennish, M.J. 2001. Coastal Salt Marsh Systems in the U.S.: A Review of anthropogenic impacts. *Journal of Coastal Research* 17(3): 731-749.
- King, R. 1978. Habitat use and related behaviors of breeding Long-billed Curlews. Master's thesis, Colorado State University, Fort Collins, CO.

- Knapton, R.W., G.L. Holroyd, and H.E. Trefry. 2005. Vertebrate species at risk at Onefour Research Sub-station, Alberta. CWS Tech. Rep Series No. 446.
- Kuehl, A.K., and Clark, W.R. 2002. Activity related to landscape features in northern Iowa. *The Journal of Wildlife Management* 66(4): 1224-1234.
- Lea, T. 2008. Historical (pre-settlement) ecosystems of the Okanagan Valley and Lower Similkameen Valley of British Columbia – pre-European contact to the present. *Davidsonia* 19:3-36.
- Mader, H.J. 1984. Animal habitat isolation by roads and agricultural fields. *Biological Conservation* 29: 81-96.
- Maher, W.J. 1973. Birds: I. Population dynamics. Canadian Component of the International Biological Programme, Matador Project Technical Report Number 34, Saskatoon, SK.
- McLay, A.S. and Cole, D.E. 1995. Biological control of leafy spurge in Alberta: progress and prospects. AECV95-R2. Alberta Environmental Centre, Vegreville, AB.
- Morrison, R.I.G., R.K. Ross, and S. Torres M. 1992. Aerial surveys of nearctic shorebirds wintering in Mexico: some preliminary results. *Canadian Wildlife Service Progress Note* No. 201.
- NatureServe Explorer. 2009. An Online Encyclopedia of Life. Available at: <http://natureserve.org/explorer/servlet/NatureServe?> (Accessed on October 7, 2009).
- Nernberg, D. and Ingstrup, D. 2005. Prairie conservation in Canada: the Prairie Conservation Action Plan experience. USDA Forest Service Gen. Tech. Rept. PSW-GTR-191.
- Pambush, G.J. and R.G. Anthony. 1993. Nest success, habitat utilization and nest-site selection of Long-billed Curlews in the Columbia Basin, Oregon. *Condor* 95:957-967.
- Paulson, D. 1993. *Shorebirds of the Pacific Northwest*. University of Washington Press, Seattle.
- Prescott, D.R.C. and L. Bilyk. 1996. Avian communities and NAWMP habitat priorities in the southern Prairie biome of Alberta. Alberta NAWMP Centre and Land Stewardship Centre of Canada. NAWMP-026. Edmonton, AB. 43 pp.
- Redmond, R.L. 1984. The behavioral ecology of Long-billed Curlews (*Numenius americanus*) breeding in western Idaho. PhD. Thesis, University of Montana, Missoula, MT.
- Redmond, R.L. 1986. Egg size and laying date of Long-billed Curlews, *Numenius americanus*: implications for female reproductive traits. *Oikos* 46:330-338.

- Redmond, R. L., T. K. Bick, and D. A. Jenni. 1981. An evaluation of breeding season census techniques for Long-billed Curlews (*Numenius americanus*). *Studies in Avian Biology* 6:197-201.
- Redmond, R.L. and D.A. Jenni. 1982. Natal philopatry and breeding area fidelity of Long-billed Curlews (*Numenius americanus*): patterns and evolutionary consequences. *Behav. Ecol. Sociobiol.* 10:277-279.
- Redmond, R.L. and D.A. Jenni. 1986. Population ecology of the Long-billed Curlew (*Numenius americanus*) in western Idaho. *The Auk* 103:755-767.
- Renaud, W.E. 1980. Long-billed Curlew in Saskatchewan: status and distribution. *Blue Jay* 38:221-237.
- Samson, F.B., Knopf, F.L., and Ostlie, W.R. 2004. Great Plains ecosystems: past, present and future. *Wildl. Soc. Bull.* 32: 6-15.
- Sauer, J.R., Hines, J.E., Fallon, J.E., Pardieck, K.L., Ziolkowski, D.J., and Link, W.A. 2011. The North American Breeding Bird Survey, results and analysis 1966-2009, version 3.23.2011. United States Geological Survey, Patuxent Wildlife Research Center, Laurel, MD.
- Saunders, E.J. 2001. Population estimate and habitat associations of the Long-billed Curlew (*Numenius americanus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division. Alberta Species at Risk Report No. 25. Lethbridge, AB. 58 pp.
- Selleck, G.W., Coupland, R.T., and Frankton, C. 1962. Leafy spurge in Saskatchewan. *Ecol. Monogr.* 32: 1-29.
- Smith, A.R. 1996. Atlas of Saskatchewan birds. Saskatchewan Natural History Society, Special Publication No. 22, Regina, Saskatchewan, Canada, p.147.
- Stevenson, H.M. and B.H. Anderson. 1994. The birdlife of Florida. University of Florida Press, Gainesville.
- Stiles, F.G. and S.M. Smith. 1980. Notes on bird distribution on Costa Rica. *Brenesia* 17:137-156.
- Stiles, F.G. and A.F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, NY.
- Strang, R.M. and J.V. Parminter 1980. Conifer encroachment on the Chilcotin grasslands in British Columbia. *Forest Chronicles* 56(1):13-18.
- Taft, O.W., and Haig, S.M. 2003. Historical wetlands in Oregon's Willamette Valley: Implications for restoration of winter Waterbird habitat. *Wetlands* 23(1): 51-64.

Turner, J.S. and Krannitz, P.G. 2001. Conifer density increases in semi-desert habitats of British Columbia in the absence of fire. *Northwest Sci.* 75: 176-182.

Watmough, M.D. and M.J. Schmoll. 2007. Environment Canada's Prairie and Northern Region Habitat Monitoring Program Phase II. Recent habitat trends in the Prairie Habitat Joint Venture. Technical Report Number 493. Environment Canada, Canadian Wildlife Service, Edmonton, Alberta Canada.

APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the action plan itself, but are also summarized below in this statement.

Overall, this management plan should have a positive effect on other grassland species because it discourages conversion of native grasslands to habitats of lower biodiversity, such as intensive cultivation of crops. This management plan encourages maintenance of native grassland habitats, which should have a beneficial effect on grassland ecosystem integrity, and should aid species such as the threatened Sprague's Pipit (*Anthus spragueii*) whose preferred habitat also consists mainly of native prairie. Several species that are of conservation concern locally or regionally share similar habitat needs to Long-billed Curlew and thus will directly benefit from the actions in this plan. These species include Ferruginous Hawk, McCown's Longspur, Chestnut-collared Longspur (*C. ornatus*), Swift Fox (*Vulpes velox*), Burrowing Owl (*Athene cunicularia*), Lewis's Woodpecker (*Melanerpes lewis*) and American Badger (*Taxidea taxus*). Conservation measures for Long-billed Curlews are not known to have any specific adverse effects on any other species.

APPENDIX B: NATURESERVE (2009) LONG-BILLED CURLEW CONSERVATION RANK AND STATUS

Region	NatureServe Rank	Conservation Status ¹
Global	G5	Secure
Canada	N4B	Apparently secure
British Columbia	S3B	Vulnerable breeding population
Alberta	S3	Vulnerable
Saskatchewan	S3B, S4M	Vulnerable breeding population, apparently secure, occurring regularly on migration
Manitoba	SXB	Extirpated breeding population
United States	N5B, N5N	Secure breeding population, Secure non-breeding population
Arizona	S2N	Imperilled non-breeding population
Arizona	S1B, S3S4N	Critically imperilled breeding population, Vulnerable to Apparently secure breeding population
California	S2	Imperilled
Colorado	S2B	Imperilled breeding population
Florida	SNA	Not applicable
Georgia	S3	Vulnerable
Idaho	S2B	Imperilled breeding population
Illinois	SXB	Extirpated breeding population
Iowa	SXB	Extirpated breeding population
Kansas	S1B, S2N	Critically imperilled breeding population, Imperilled non-breeding population
Louisiana	S5N	Secure non-breeding population
Minnesota	SXB, SXM	Extirpated breeding population, Extirpated migrant population
Mississippi	SNA	Not applicable
Montana	S2B	Imperilled breeding population
Nebraska	S5	Secure
Nevada	S2S3B	Imperilled to Vulnerable breeding population
New Mexico	S3B, S4N	Vulnerable breeding population, Apparently secure non-breeding population
North Carolina	SNA	Not applicable
North Dakota	S2	Imperilled
Oklahoma	S2B	Imperilled breeding population
Oregon	S3B	Vulnerable breeding population
South Carolina	SNA	Not applicable
South Dakota	S3B	Vulnerable breeding population
Texas	S3B, S5N	Vulnerable breeding population, Secure non-breeding population
Utah	S2S3B	Imperilled to Vulnerable breeding population
Washington	S2, S3B, S2N	Imperilled, Vulnerable breeding population, Imperilled non-breeding population
Wisconsin	SXB	Extirpated breeding population

¹ – Presumed extirpated - believed to be extirpated from the jurisdiction (i.e., nation or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

Possibly extirpated - Known from only historical records but still some hope of rediscovery.

Critically imperilled - extreme rarity or some other factor(s) such as very steep declines make it especially vulnerable to extirpation from the jurisdiction

Imperilled - rare due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction

Vulnerable - due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.

Apparently secure - uncommon but not rare; some cause for long-term concern due to declines or other factors

Secure - common, widespread, and abundant in the jurisdiction.