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Sprague's Pipit (*Anthus spragueii*) Conservation Plan

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Executive Summary

Apparently widespread during early European settlement, Sprague's Pipits breeding distribution has contracted sharply from its historical range. Sprague's Pipits were recorded as abundant during early European exploration; currently, they are common only in remnant large grassland patches in the northern mixed-grass native prairie of North America. Much of the decline of Sprague's Pipits occurred in the late 19th and early 20th centuries as the short- and mixed-grass prairies were converted to agriculture. Since ca. 1900, approximately 75% of native Canadian prairie and 80% of aspen parkland have been converted from native grassland; in the United States, approximately 60% of native mixed-grass prairie has been converted to cropland.

Sprague's Pipits are short distance migrants, moving from breeding grounds in the northern prairies of southern Canada and northern United States to the wintering grounds in southern United States and northern México. The breeding range in Canada has contracted from the eastern and northern portions of the historic range in Alberta and Manitoba. Similarly, the breeding range in the United States has contracted to the north and west in North Dakota and Minnesota, and north in Montana. There are no details on the historical distribution of Sprague's Pipits on the wintering range in the southern United States and México.

In 1999, Sprague's Pipits were listed as "Threatened" in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); the status was re-examined and confirmed in May 2000. Sprague's Pipits were officially listed under the Canadian Species at Risk Act (SARA) as "Threatened" on 5 June 2003. They are also protected under provincial Wildlife Acts in British Columbia, Alberta, Saskatchewan, and Manitoba. In the United States, Sprague's Pipits were petitioned for listing under the Endangered Species Act in 2008. On 14 September 2010 the U.S. Fish and Wildlife Service determined that this petition presented substantial information that listing Sprague's Pipits as "Endangered" or "Threatened" was warranted but precluded by higher listing priorities. Sprague's Pipits are listed as a "Species of Conservation Concern" by the U.S. Fish and Wildlife Service's Division of Migratory Bird Management and classified as "Endangered" by the state of Minnesota. Sprague's Pipits are a protected migratory bird species in México; they have no other official or legal designation there.

The principal causes for the declines in Sprague's Pipit populations are habitat conversion to seeded pasture, hayfield, and cropland, as well as overgrazing by livestock. Moreover, management favoring intensive cattle grazing and reduced fire frequency may lead to the degradation of remaining suitable grassland tracts over much of their range. Without proper fire intervals, shrubs and excessive vegetative litter may reduce habitat quality; in addition, grasslands may even eventually succeed to shrubland or savannah. Energy development, introduced plant species, nest predation and parasitism, drought, and fragmentation of grasslands are all threats that currently impact Sprague's Pipits populations throughout their present range.

Management for Sprague's Pipits consists of protecting, maintaining, and restoring native mixed-grass prairie in suitably large expanses. Converting cultivated land adjacent to native prairie to perennial cover, including seeding with a native grass mix, or one that includes a prostrate (versus erect) form of legume, could make smaller land tracts attractive to Sprague's Pipits. Management through fire, grazing, or mowing may assist in maintaining native grasslands in many areas; however, the intensity and frequency of disturbance is dependent upon soil productivity and climate factors, and thus the geographic area. Therefore, recommendations on fire, grazing and haying frequency and intensity should be area-specific.

The goals for the conservation of Sprague's Pipit populations are to maintain or increase the current population size, distribution and viability. This can be achieved by simply preventing further loss and degradation of native prairie within their historic range. To achieve this goal, management strategies and recommendations must be researched and developed that are specific to particular geographic regions. To this end, this Conservation Plan includes a prioritized list of actions and needs that will begin to achieve long-term range-wide conservation of Sprague's Pipits. In addition, several states and provinces have developed objectives and actions designed to address state-wide conservation of Sprague's Pipits. Updated information on life history and population status are included here in support of this goal. Implementing effective conservation measures will require the cooperation of a coalition of local, regional, national, and international partners.

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Taxonomy

Class: Aves

Order: Passeriformes

Family: Motacillidae

Scientific Name: *Anthus spragueii* Audubon 1844

Common Name: Sprague's Pipit

French: Pipit des Prairies; Pipit de Sprague

Spanish: Bisbita Ilamera

There are no unsettled taxonomic issues. There are no subspecies designated (American Ornithologists' Union 1957, Pyle 1997a). Sprague's Pipits were named *Alauda spragueii* by Audubon after Isaac Sprague. The first (type) specimen was documented as collected near Fort Union, North Dakota in 1843 by Audubon, although the location that John Bell and Edward Harris shot the first bird could have been in or near Montana (J. Marks, pers. comm.).

Molecular data indicate that the closest living relatives to the Sprague's Pipit are the Yellowish Pipit (*A. lutescens*) and the Short-billed Pipit (*A. furcatus*) of South America; these species form a clade to the other South American pipits. Thus, the Sprague's Pipit may only be distantly related to the American Pipit (*A. rubescens*) and other Old World pipits (Robbins and Dale 1999).

Legal Status

Global

Sprague's Pipits (pipits) are federally protected in the United States, Canada, and México under the Migratory Bird Treaty Act of 1918 as amended (16 U.S.C. 703-711: 40 Stat. 755; U. S. Fish and Wildlife Service 2008a). They are listed on the International Union for the Conservation of Nature (IUCN) Red List as Vulnerable (Hilton-Taylor 2000), but are not listed on the Convention on International Trade in Endangered Species list (Inskipp and Gillett 2005; Table 1).

The species' conservation status includes "Species of Special Concern/Watch List Species" by Partner's in Flight and National Audubon Society (Rich et al. 2004, Butcher et al. 2007). The Nature Conservancy has assigned it a global rank of "apparently secure", and rare (Table 1; NatureServe Explorer 2009). Sprague's Pipit is also considered a Species of Highest Tri-National Concern by Partners in Flight (Berlanga et al. 2010).

Canada

Sprague's Pipits were listed in 1999 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "Threatened"; the status was re-examined and confirmed in May 2000 (Committee on the Status of Endangered Wildlife in Canada 2002), based on status reports (Prescott 1997, Prescott and Davis 1998). Sprague's Pipits were officially listed under the Species at Risk Act (SARA) as "Threatened" on 5 June 2003 (Environment Canada 2008). Although this species remains relatively common in suitable habitat, numbers have declined significantly and there is evidence of a contraction of its range on the periphery (Prescott and Davis 1998, Environment Canada 2008).

Sprague's Pipits are protected under provincial Wildlife Acts in British Columbia, Alberta, Saskatchewan, and Manitoba (Table 1). In Alberta, Sprague's Pipits are a "Species of Special Concern": a species that without human intervention may soon become threatened with extinction in the province. This designation was made on the basis of rapidly declining populations and a lack of research into the biology and management of the species (Prescott and Davis 1998). Sprague's Pipits have no legal designation in Saskatchewan and are listed as "Threatened" in Manitoba. Pipits are included on the "Red List" of species considered to be candidates for designation as "Threatened" or "Endangered" in British Columbia. However, the very small number of reports for Sprague's Pipits in British Columbia suggests that its occurrence there is accidental or casual, and it may be removed from the "Red" list in the future (Prescott 1997).

United States

Sprague's Pipits are a Candidate for listing as "Endangered" or "Threatened" under the Endangered Species Act of 1973 as amended (16 U.S.C. 1531 *et seq.*; U. S. Fish and Wildlife Service 2008b, 2010). After being been petitioned for listing in 2008 (WildEarth Guardians 2008), the U. S. Fish and Wildlife Service (USFWS) determined that the petition presented substantial information indicating that listing the Sprague's Pipit is warranted but precluded by higher listing priorities (U. S. Fish and Wildlife Service 2010). Sprague's Pipits were listed as a "Species of Conservation Concern" by the USFWS Migratory Bird Management Office in 2008 (U. S. Fish and Wildlife Service 2008c). Sprague's Pipits are classified as "Endangered" in Minnesota (Table 1). They are considered a "Sensitive Species" in Region 1 (Northern Region) of the U. S. Forest Service (U. S. Forest Service 2005).

México

Sprague's Pipits are a protected migratory bird species in México; they have no other official or legal designation (Secretaría de Medio Ambiente y Recursos Naturales 2002).

Table 1 is a summary of the legal status of Sprague's Pipit in the states and provinces where it occurs.

Table 1. Status and trends of Sprague's Pipits throughout their range. "Status" definitions from NatureServe Explorer (2009). BCC=Birds of Conservation Concern-2008 (U.S. Fish and Wildlife Service 2008c); COSEWIC=Committee on the Status of Endangered Wildlife in Canada (2002); ESA=Endangered Species Act (U.S. Fish and Wildlife Service 2008b); BBS=Breeding Bird Survey (Sauer et al. 2008); IUCN=International Union for Conservation of Nature.

Area	Status	State or Province Status	BBS Trend (1966-2007)	BBS Trend (1980-2007)	Species Status
United States	N4B, N4N	Candidate 1 (ESA), BCC National Concern	-2.4 (p=0.35; n=49)	-3.1 (p=0.47; n=45)	Regular breeder, migrant and winter resident
Montana	S2B	Species of Greatest Conservation Need[1]	-0.6 (p=0.85; n=21)	-0.3 (p=0.90; n=20)	Regular breeder and migrant
North Dakota	S3B	Species of Conservation Priority	-2.0 (p=0.62; n=25)	-2.4 (p=0.75; n=23)	Regular breeder and migrant
South Dakota	S2B	Species of Greatest Conservation Need[1]	-12.7 (p=0.36; n=3)[2]	-3.5 (p=0.75; n=2)[2]	Regular breeder and migrant
Minnesota	S1B	Endangered[3]			Rare breeder
Wyoming	S4N	None			Rare migrant
Kansas	SNA	None			Uncommon to rare migrant and casual winter resident
Nebraska	SNRN	None			Uncommon spring and fall migrant
USFWS Region 6	n/a	BCC Regional Concern	-2.4 (p=0.35; n=49)	-3.1 (p=0.46; n=45)	Regular breeder and migrant
Arizona	S2N	None			Regular winter resident and migrant
New Mexico	S2N	Species of Greatest Conservation Need[1]			Regular winter resident and migrant
Texas	S3N	None			Regular winter resident
Oklahoma	SNRN	Species of Greatest Conservation Need[1]			Uncommon to rare migrant and casual winter resident
USFWS Region 2	n/a	BCC Regional Concern			Regular winter resident and migrant
Canada	N4B	Threatened (COSEWIC)	-4.3 (p=0.00; n=120)	+3.2 (p=0.05; n=111)	Regular breeder
Alberta	S4B	Species of Special Concern[4]	-4.1 (p=0.01; n=61)	-3.1 (p=0.23; n=58)	Regular breeder
Saskatchewan	S4B	None	-4.2 (p=0.05; n=45)	-3.0 (p=0.13; n=40)	Regular breeder
Manitoba	S2B	Threatened	-4.6 (p=0.31; n=14)	-10.2 (p=0.18; n=13)	Regular breeder
BBS survey-wide	G4	Vulnerable (IUCN)[5]	-3.9 (p=0.00; n=169)	-3.7 (p=0.03; n=156)	Regular breeder
México	n/a	None	n/a	n/a	Regular winter resident

Other records: State/province (NatureServe Explorer 2009): Alabama (SNR), Arkansas (SNA), British Columbia (none), California (none), Colorado (SNA), Georgia (S3), Louisiana (S3S4N), Mississippi (SNA), Missouri (SNA)

[1]State Wildlife Action Plan
[2]Reflects data with an important deficiency
[3]Minnesota Department of Natural Resources (http://www.dnr.state.mn.us/ets/birds.html)
[4]Alberta Species at Risk (http://www.srd.alberta.ca/BioDiversityStewardship/WildSpecies/Birds/Songbirds/SpraguesPipit.aspx)
[5]IUCN Red List (Hilton-Taylor 2000)

Description

Sprague's Pipits are grassland specialists endemic to the mixed-grass prairie in the northern Great Plains of North America (Robbins and Dale 1999). Sprague's Pipits are a passerine about 14 cm in length (range: 10-18 cm). The wings and tail are dark brown with two pale indistinct wing-bars and mostly white outer retrices, the crown, nape and upperparts are buffy with blackish streaking and the face is buffy with a pale eye-ring creating a large-eyed appearance. The underparts are whitish, the breast has fine blackish streaks, and the breast and flanks are often faintly washed with buff. The bill is relatively slender, short, and straight, with a blackish upper mandible and a pale lower mandible with a blackish tip. The tarsi are yellow to pale pinkish brown and are relatively long with an elongated hind claw (Pyle 1997a, 1997b).

Molt and Juvenile Plumage.—Hatching year individuals may be separated from adults by the primary coverts which appear tapered and worn compared with the broader, less worn basic primary coverts of adults (Pyle et al. 2008). Knowledge of the molts of this species is preliminary and based on a small number of specimens (Pyle 1997a, 1997b; Pyle et al. 2008).

Range

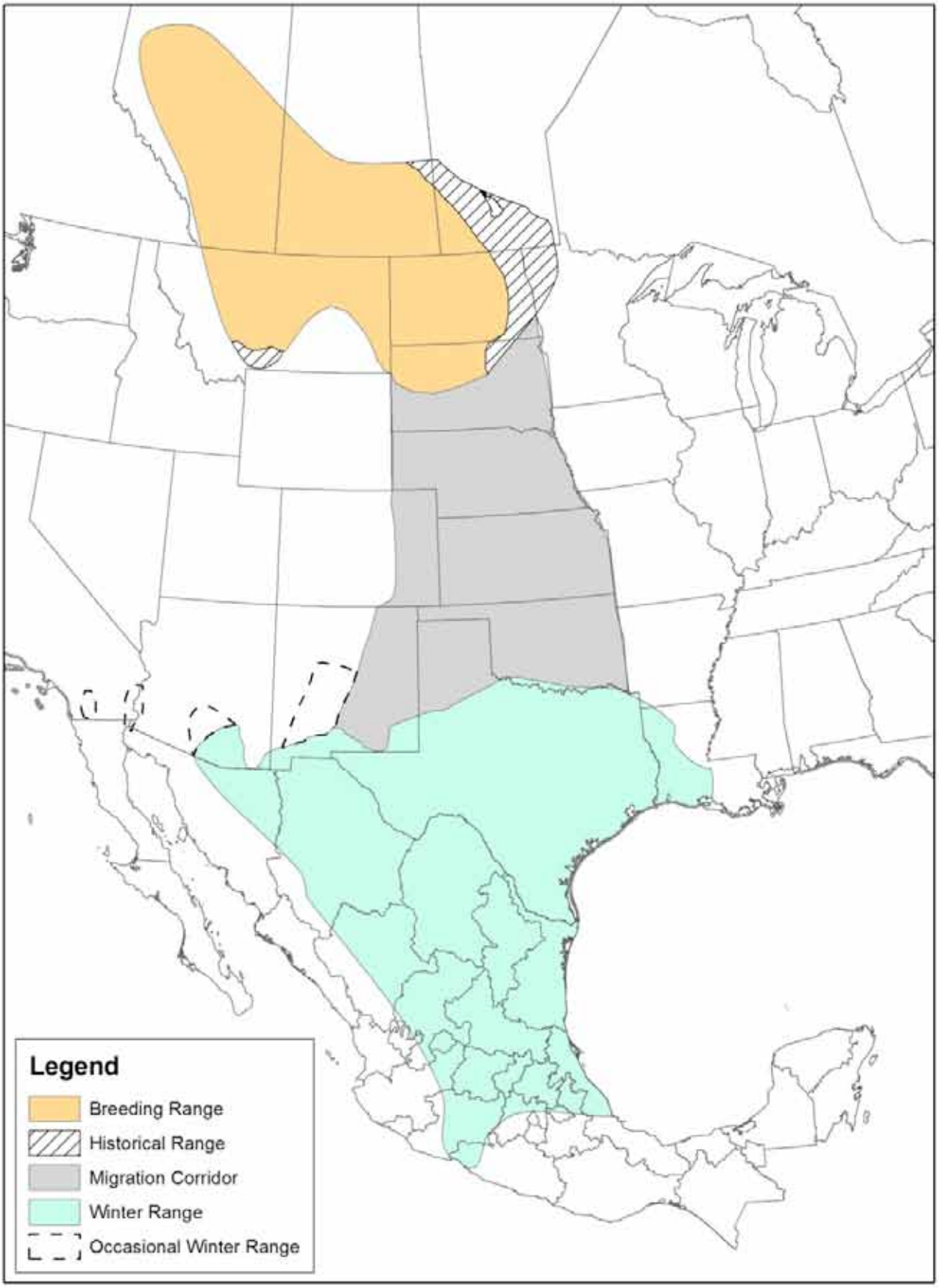

Figure 1. Current and potential historical range for Sprague's Pipit.

Sprague's Pipits are short to medium distance migrants, moving from breeding grounds in the northern prairies of southern Canada and northern United States to the wintering grounds in southern United States and northern México (Fig. 1; Robbins and Dale 1999). Sprague's Pipits migrate through the Great Plains states of the United States (Fig. 1).

Canada

Breeding.—Sprague's Pipits are largely confined to the grassland and aspen parkland regions of the prairie provinces (Fig. 1; Godfrey 1986, Prescott and Davis 1998) and breed in southeast Alberta west to the Rocky Mountain foothills, throughout southern Saskatchewan (Robbins and Dale 1999) and west-central (Prescott and Davis 1998) and southwestern Manitoba (Robbins and Dale 1999). Historically common in Manitoba (Coues 1874, Carey et al. 2003), their range has contracted and Sprague's Pipits are now rare, though locally they may be numerous (Carey et al. 2003). In south-central British Columbia a single breeding record was recorded in 1991, the first breeding record in that province; no subsequent breeding has been documented, although pipits have occasionally been observed (Prescott and Davis 1998). Historically, they probably bred near Kimberly, British Columbia in 1959 (Prescott and Davis 1998).

Migration.—Sprague's Pipits generally arrive in Canada in the spring in mid-Apr and depart in the fall by mid-Oct.

Winter.—Sprague's Pipits do not winter in Canada.

United States

Breeding.—Sprague's Pipits breed in the northern Great Plains, with their highest numbers occurring in the central mixed-grass prairie (Fig. 2). Their breeding range is primarily in north-central and eastern Montana, to North Dakota through to northwestern and north-central South Dakota (Fig. 1). They occur casually in northwestern Minnesota and locally in southern South Dakota (Stewart 1975, South Dakota Ornithologists' Union 1991, American Ornithologists Union 1998, Robbins and Dale 1999, Tallman et al. 2002).

Migration.—Spring migration primarily occurs through the central Great Plains in Apr and May (Johnsgard 1979, Thompson and Ely 1992), with two early Nebraska reports from 17 Mar (Sharpe et al. 2001). The latest date they were observed in Texas is 14 May (B. Freeman, pers. comm.). Fall migration primarily occurs through the Great Plains from late Sep through early Nov, with a few sightings from 30 Aug (Sharpe et al. 2001), and extending in some

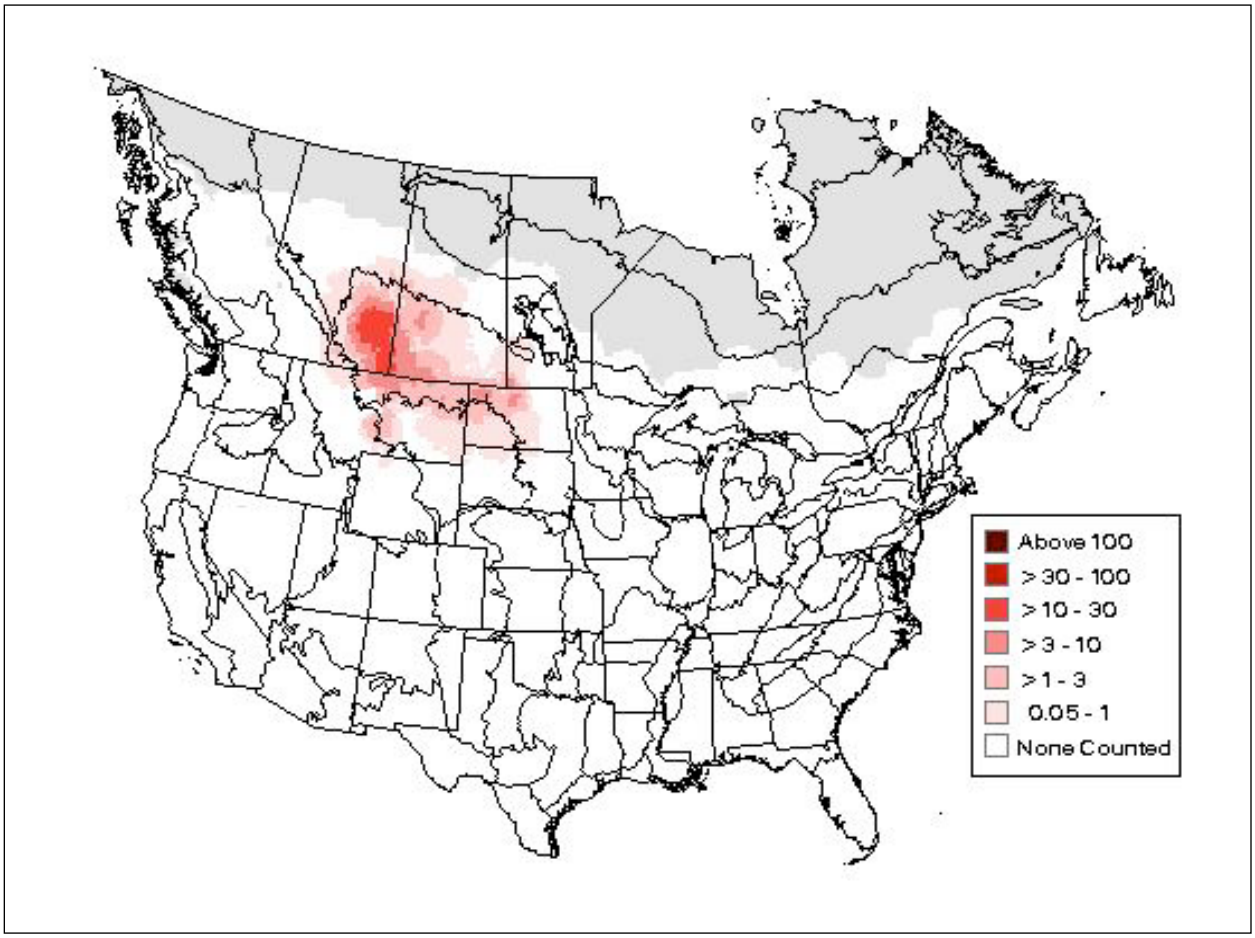

Figure 2. Relative abundances of Sprague's Pipits in their breeding range; data from the Breeding Bird Survey for 1996-2007 (Sauer et al. 2008).

years through the first week of Dec in New Mexico (W. H. Howe, pers. comm.). Sprague's Pipits are rarely seen on migration, which has been attributed to a number of reasons, including: 1) many short-distance grassland species migrate high and at night without using stopover sites, potentially including Sprague's Pipits (Thompson and Ely 1992; SLJ), however, it is uncertain whether their night flight calls that were recorded in Nebraska and Kansas came from migrants or from birds flushed from the ground (W. Evans, pers. comm.); 2) they have solitary and cryptic behavior during the non-breeding season (Prescott and Davis 1998); 3) many observers are largely unfamiliar with the flight call notes (Seyffert 2001; W. H. Howe, pers. comm.); and 4) there are few migration studies in grasslands (J. M. Ruth, pers. comm.) or few observers in remote grassland areas (M. Howery, pers. comm.).

Sprague's Pipits are generally described as being an uncommon migrant immediately south of the breeding range (Fig 1). They are described as "accidental" in Iowa, "a rare migrant" in Wyoming and Illinois, and generally uncommon in Oklahoma. They are occasionally found from late Sep through Nov in eastern New Mexico, but the later records are probably late migrants (W. H. Howe and J. M. Ruth, pers. comm.). In Oklahoma, Sprague's Pipits have been documented in the central and western two-thirds of the main body of the state, and in the southern portion of the panhandle. They are undocumented in the eastern third of Oklahoma (M. Howery, pers. comm.). Sprague's Pipits are found in all months except Jun through Aug in Texas; those seen inland and north of the primary wintering areas are probably migrants, although some individuals may linger into the winter there (Freeman 1999). Sprague's Pipits are a rare migrant in California and a casual fall migrant in the eastern United States (Robbins and Dale 1999).

Winter.—Sprague's Pipits winter in the United States from the southeast corner of Arizona, southern New Mexico, central and southern coastal prairies in Texas, through southern Oklahoma. There are regular sightings in southern Louisiana and Arkansas (Root 1988) and occasional sightings in southern Kansas and Missouri, Tennessee, northwestern Mississippi, and other portions of Texas (Fig. 1; American Ornithologists' Union 1998). Winter distribution data show highest densities in Texas (National Audubon Society 2009).

México

Breeding.—There are no breeding occurrences in México.

Migration.—There is no migration information from México.

Winter.—Sprague's Pipits winter in northern México from northeastern Sonora, Chihuahua, Coahuila, and Nuevo León south to northern Michoacán, Puebla, central Veracruz, and perhaps Guerrero (Fig. 1; Howell and Wilson 1990, Howell and Webb 1995, American Ornithologists' Union 1998). Christmas Bird Count (CBC; National Audubon Society 2009) data show Sprague's Pipits occur every year in northern Chihuahua and some years in Coahuila. There is very limited data from México documenting the status and distribution of Sprague's Pipits.

Historical Changes

Canada.—The eastern and northern portions of the historical breeding range of Sprague's Pipits has contracted in Alberta, Manitoba, and Saskatchewan (Committee on the Status of Endangered Wildlife in Canada 2002). Range contractions may occur temporarily due to climatic conditions, however; there are suspected long-term range contractions for Sprague's Pipits in the Canadian provinces that are their primary range. In the 1980s and 1990s, Pipits were not recorded from the Peace parkland of northwestern Alberta; this may not represent a "dramatic" reduction in the breeding range as they were probably never widespread here (Prescott and Davis 1998). In Saskatchewan, Sprague's Pipits were described in the 1930s as "not uncommon", by the 1950s, the species was described as being "rather rare" (Prescott and Davis 1998). In Manitoba, Sprague's Pipits have declined dramatically. Sprague's Pipits were once one of the commonest prairie birds in the western portion of the province (Carey et al. 2003). Their range has contracted several hundred kilometers south from areas north and east of Winnipeg in Manitoba; they are now considered "fairly rare" or "virtually absent" from areas where they were once a regular, but uncommon summer resident. Pipits are still fairly numerous, although localized, in parts of southwest Manitoba (Carey et al. 2003).

United States.—The range for Sprague's Pipits in the United States has contracted notably on its periphery. Changes and declines in abundance have contracted the range west and north in North Dakota and Minnesota and to the north in Montana. Data on South Dakota are inconclusive.

As he traveled near present-day Lostwood National Wildlife Refuge (NWR) in northwestern North Dakota in 1873, Elliot Coues remarked on the "...trio of the commonest birds…" encountered: Baird's Sparrow (*Ammodramus bairdii*), Sprague's Pipits, and Chestnut-collared Longspur (*Calcarius ornatus*), stating "…Sprague's Pipits were sometimes so numerous that the air seemed full of them..." (Coues 1878, Madden et al. 1999). After fewer than 100 years of settlement and agricultural development, Sprague's Pipits in North Dakota have declined to the point that they are no longer among the 15 most common birds and are currently absent in the easternmost counties (Stewart 1975). In Montana, there have been no breeding records in the southern and south-central counties since

1991 or earlier (Lenard et al. 2003), although some singing males have been noted in Jun (C. Wightman, pers. comm.). In South Dakota, pipits are absent in the eastern portion of the state and considered a rare and local summer resident (South Dakota Ornithologists' Union 1991, Tallman et al. 2002). The only breeding records are a nest found in 1907 and fledglings in 1996 (Tallman et al. 2002). The species was recorded in the summer months during the first South Dakota Breeding Bird Atlas (1988-1993) in McPherson, Dewey, Corson, Perkins and Pennington counties. There are also summer records in Edmunds and Harding counties in the 2000's (R.P. Russell, pers. comm.). Sprague's Pipits may always have been local and uncommon breeders in South Dakota, but historical data is lacking.

In Minnesota, Sprague's Pipits range has contracted substantially since European settlement and since the 1920s there has been a steady decline in numbers and breeding numbers and occurrence in the state. Currently, it is only a casual visitor and unknown as a breeding species (R. P. Russell, pers. comm.). Prior to 1890, the species could be found throughout the southwestern and south-central parts of Minnesota, breeding as far south as Pipestone and adjacent counties and as far east as Ottertail County (Roberts 1932). It was a common breeder in Kittson County in the northwest corner of the state in 1898, then no other data until 1928 when a dedicated trip to the Red River Valley found that it was only a casual summer resident on virgin prairie areas of the northwest valley (Roberts 1932). In recent years, a few birds have been observed on fall migration with Sep records from Dakota County in the southeast and Duluth in the northeast and Oct records from Cottonwood and Wilkin counties in the west. Likely these are birds straying eastward from breeding populations to the west or northwest of Minnesota (R. P. Russell, pers. comm.). The Minnesota County Biological Survey recorded a few birds at one site in Roseau County in 1991 and a single bird at another site in the same county in 2009 (S. Stucker, pers. comm.).

México.--There is no information on historical range in México.

Biology

Breeding

Arrival.—Sprague's Pipits arrive on the breeding grounds from the third week of Apr to mid-May (Maher 1973, Stewart 1975, SLJ); some individuals linger on the wintering grounds into early May. Pair formation begins shortly after arrival on the breeding grounds and eggs are laid between the second week of May through early Aug (Sutter 1996, Davis 2003, Jones et al. 2010). In Montana, the median nest initiation date was 25 May; the earliest date a nest was initiated was 7 May, while the latest date a nest was initiated was 31 Jul (Jones et al. 2010). Nest initiation dates tended to differ among years, and did not appear to be influenced by arrival dates (Davis 2003, SLJ).

Breeding Display.—Sprague's Pipits are unique in being so easy to hear yet so difficult to see with their "…prolonged and unique aerial display…" (Robbins 1998). The male's flight song is delivered high above the prairie in a series of high-pitched jingling notes that are audible>300 m. Males often hurry from view immediately after returning to the ground at the end of the display. Sprague's Pipit display bouts are prolonged, and persistent male display occurs from the time of arrival (approximately the third week of Apr) through the third week of May at Lostwood NWR in North Dakota (Robbins 1998). This was followed by a period of two to three weeks where display rates were reduced, followed by another period of elevated display rates (Robbins 1998) with some display into mid-Aug (Robbins and Dale 1999). This bimodal display regime is probably related to the breeding cycle, with display rates decreasing once a first clutch of eggs is laid and copulation opportunities decrease (Robbins 1998, Robbins and Dale 1999). This display is also observed, although rarely, during early migration in late Apr or very early May in Texas (Freeman 1999).

Territoriality.—Sprague's Pipit breeding territories are used for both nesting and feeding. These territories are presumably established and maintained through the aerial display. Occasionally, territorial males interrupt aerial displays and give chase to other presumed males that pass through the territory (Robbins and Dale 1999). Mapping of territory boundaries in 2007 indicated pipit territories rarely crossed trails (Dale et al 2009); territories were reported as 2.5±0.5 (SD) ha (n=30; Davis and Fisher 2009). In North Dakota, males were not uniformly distributed; all territories were located in elevated areas with short grass and relatively low sedge and forb densities (Robbins 1998).

Foraging Behavior.--Sprague's Pipits typically forage alone throughout the day in all seasons. They walk or run while gleaning food from the ground surface or grasses, typically in grass that is several centimeters tall (Robbins and Dale 1999).

Diet.—The diet of Sprague's Pipits during the breeding season is almost entirely comprised of arthropods with a small amount of vegetable matter (Robbins and Dale 1999). Sprague's Pipits feed primarily on arthropods during migration and on wintering grounds, with the addition of seeds during the later part of the winter (Emlen 1972, Robbins and Dale 1999).

Nest Characteristics.—Sprague's Pipits build ground nests in grasslands primarily with native grasses of intermediate height and density, with little bare ground and few shrubs; many times the nest is at the base of a dense tussock of grass (Sutter 1997, Dieni and Jones 2003). Coarse and fine dried grasses (about 5-15 cm in length) were woven into a cup; long grass growing adjacent to the nest is sometimes interwoven with loose grass forming a dome (Sutter 1997). This canopy can range from almost a complete dome to almost full exposure (Harris 1933, Sutter 1997). Nest entrances frequently have runways that extend up to 15 cm in length (Harris 1933, Sutter 1997). Nests were usually <100 m from roads and far (mean 20.7 m) from the nearest perch (shrubs and rocks) (Sutter 1996, 1997).

Nesting Behavior.—The female remains on the nest until an approaching observer is close. Once flushed, she flies low for a few meters then lands in the grass or climbs in an undulating flight to circle the area. When undisturbed, she approaches the nest by flying low to within a few meters and then walks to the nest. Incubation and brooding is primarily by females; although males will incubate and brood at an unknown rate (SLJ). Adult pipits responded aggressively to researcher presence if nestlings or dependent young were nearby (Davis and Fisher 2009), and during late incubation or with taped call playback (SLJ).

Incubation.—In Montana, the mean incubation time was 12.2±0.12 days (range: 7-15 days, n=85; Jongsomjit et al. 2007, Jones et al. 2010). In Saskatchewan from 1996-2000 the incubation period was 13 days (Davis 2003); mean incubation from Manitoba and Saskatchewan combined was 13.4±0.3 days (n=9; Davis 2009).

Clutches per Year.—The hatching rate for Sprague's Pipits in Montana was 85% (Jones et al. 2010). Re-nesting and second broods have been occasionally

documented for Sprague's Pipit (n=4; Sutter 1996; n=1; Davis 2009), as has polygyny (n=1; Dohms and Davis 2009).

Clutch Size.—Mean clutch size was 4.6±0.17 eggs (n=123; Jongsomjit et al. 2007, Jones et al. 2010) in Montana; 4.4 eggs (n=49; Maher 1973), 4.6 eggs (n=51; Sutter 1996), and 4.8 eggs (n=57; Davis 2003) in Saskatchewan. Sprague's Pipits clutch size generally increased during the first month of the breeding season (Davis 2003, Jones et al. 2010).

Nestling Stage.—In Montana, the mean nestling period was 13.1 days (range: 9 17 days, n=17; Jongsomjit et al. 2007, Jones et al. 2010). In Saskatchewan, Sprague's Pipit young left the nest 11-13 days after hatching (Robbins and Dale 1999); mean nestling period was 11 days (Davis 2003). The average nesting period for Manitoba and Saskatchewan combined was 12.1±0.2 days (n=43; Davis 2009). In Montana, the mean number of nestlings per all nests initiated was 4.0±0.26 nestlings (n=97; Jones et al. 2010).

Fledging.—Fledging dates ranged from 13 Jun through the last week of Aug, with 50% of pipits fledging between late Jun and mid-Jul at Matador, Saskatchewan (Maher 1973). Fledging ranged from 11 Jun to 19 Aug with 50% of fledging dates after mid-Jul at Last Mountain Lake and other sites in Saskatchewan (Dale 1983). A brood fledged as late as 31 Aug near Winnipeg, Manitoba (Harris 1933). At Bowdoin NWR in northcentral Montana, the earliest date for fledging was 6 Jun and the latest 24 Aug (Jones et al. 2010, SLJ).

Fledglings spent the first two days sitting in relatively tall (20-30 cm high) grasses and remained motionless when approached; by day 9, fledglings flew at least 25 m when approached, and by day 11, young pipits were able to make longer distance flights of 50-60 m (Davis and Fisher 2009). In Saskatchewan from 1996 - 2000, the mean number of young fledged per successful nest was 3.4±0.32 (n=20; Davis 2003). In Montana from 1997–2007, the mean number fledged per successful nest was 3.4±0.35 (n=49) and the mean number fledged per pair was 1.3±1.07 (Jones et al. 2010).

Nest Success.—Mayfield nest success (Mayfield 1975) was reported to be 24% (n=65) in Saskatchewan (Davis 2003) and 27.7% (n=120) in Montana (Jones et al. 2010). Predation was the primary cause of nest failure in Saskatchewan from 1996-2000 (Davis 2003) and from 1997-2007 in Montana (Jones and Dieni 2007, Jones et al. 2010). Nest predation was highest during the nestling stage with daily survival rates typically lower than those of the incubation period (Davis 2003, Jones et al. 2010). Predation may influence nest site choice, but nest age appears to be a stronger predictor of nest survival than nest site (Davis 2005, Davis et al. 2006; SLJ).

Predation.—Documented and suspected nest predators are diverse and include: mammals, such as Richardson's ground squirrel (*Spermophilus richarsonii*), American badger (*Taxidea taxus*), long-tailed weasel (*Mustela frenata*), red fox (*Vulpes vulpes*), and coyote (*Canis latrans*); mice and voles (*Zapus, Reithrodontomys, Peromyscus,* and *Microtus* spp.); and snakes, such as bull snake (P*ituophis melanoleucus*), garter snakes (*Thamnophis* spp.), and western rattlesnake (*Crotalus viridis*). Potential avian predators, such as Merlin (*Falco columbarius*), gulls (*Larus* spp.), Short-eared Owl (*Asio flammeus*), Loggerhead Shrike (*Lanius ludovicianus*), Black-billed Magpie (*Pica hudsonia*) and American Crow (*Corvus brachyrhynchos*) have been observed within the immediate vicinity of pipit nests (Jones and Dieni 2007). Documented nest predators from camera data in Saskatchewan and Montana are Northern Harrier (*Circus cyaneus*), Black-billed Magpie, Western Meadowlark (*Sturnella neglecta*), garter snakes, mice, 13-lined ground squirrel (*Spermophilus tridecemlineatus*), deer (*Cervidae*), striped skunk (*Mephitis mephitis*) and coyote (Davis et al. *in prep.*).

Nest Parasitism.—Brown-headed Cowbirds (*Molothrus ater*; cowbirds) parasitize Sprague's Pipit nests; pipits accept cowbird eggs and their nesting season largely overlaps with that of cowbirds (Davis 2003). Parasitism of Sprague Pipit nests by cowbirds is low compared with other grassland species (Davis 2003, Jones et al. 2010) and appears to be lower in more extensive prairies than in fragmented ones (Dechant et al. 2003). The rate of cowbird parasitism on pipit nests varied regionally: 18% (southwestern Manitoba: n=17; Davis and Sealy 2000), 15.4% (Saskatchewan: n=54; Davis 2003), and 2.4% (Montana: n=128; Jones et al. 2010). Sprague's Pipits failed to fledge cowbird young in Montana (Jones et al. 2010) and Saskatchewan (Davis 2003); in Manitoba, one cowbird young was fledged (Davis 2003), suggesting Sprague's Pipits are a poor quality cowbird host. However, in Manitoba and Saskatchewan, the presence of cowbird eggs/nestlings resulted in reducing clutch size and hatching success of Sprague's Pipits, with an overall cost of 1.3–1.6 young per parasitized nest (Davis and Sealy 2000, Davis 2003).

Mortality Other Than Predation.—High mortality rates in nestlings occurred due to prolonged periods of cold wet weather, flooding, trampling by cattle (*Bos* spp.), exposure, and desertion (Davis and Fisher 2009; SLJ). During the 2004–2006 breeding seasons at Last Mountain Lake, Saskatchewan, over 90% of active nests failed during periods of cool wet weather, due to flooding and exposure or starvation (Environment Canada 2008).

Return Rates.—Sprague's Pipits have low return rates (2.1%, n=48; Jones et al. 2007). Low site fidelity rates are typical of many passerines breeding in northern grasslands where habitat suitability varies with annual weather patterns, but may also be in response to fire frequency and grazing intensity (Andersson 1980, Jones et al. 2007). Sprague's Pipits respond to their unpredictable environment by settling in the most suitable habitats they encounter each spring (Andersson 1980, Jones et al. 2007).

Habitat

Breeding

Sprague's Pipits are closely associated with native grassland throughout their range (Sutter 1996, 1997; Sutter and Brigham 1998; Madden et al. 2000; Grant et al. 2004) and are less abundant (or absent) in areas of introduced grasses than in areas of native prairie (Kantrud 1981, Johnson and Schwartz 1993, Dale et al. 1997, Madden et al. 2000, Grant et al. 2004). Generally, pipits prefer to breed in well-drained native grasslands with high plant species richness and diversity. They prefer higher grass and sedge cover, less bare ground, and an intermediate average grass height when compared to the surrounding landscape, <5-20% shrub and brush cover, no trees at the territory scale, and litter cover <12 cm (Sutter 1996, Madden et al. 2000, Dechant et al. 2003, Dieni and Jones 2003, Grant et al. 2004). The amount of residual vegetation remaining from the previous years' growth also appears to be a strong positive predictor of Sprague's Pipits occurrence (Madden 1996, Sutter 1996, Prescott and Davis 1998, Sutter and Brigham 1998) and where they put their nests (Dieni and Jones 2003, Davis 2005).

Sprague's Pipits prefer breeding sites in grasslands with a range of vegetative structure, which may vary geographically. In Saskatchewan, in native pastureland, Sprague's Pipits occurred more frequently in areas with <10% bare soil and <10% clubmoss (*Selaginella densa*; Davis et al. 1999). In Montana, nest abundance was positively associated in sites with ≤ 22% clubmoss cover and dominated by native grass (*Stipa*, *Bouteloua*, *Koeleria*, and *Schizachyrium* spp.); abundance was negatively associated with prickly pear cactus (*Opuntia* spp.) cover, and density of low-growing shrubs (Dieni and Jones 2003). In North Dakota, Sprague's Pipits were negatively impacted by increasing tall shrub (>1 m) and brush (<1 m) cover and increasing litter depth >12 cm (Grant et al. 2004). They had a negative reaction to tall shrub cover in the landscape and, with other grassland endemics, preferred areas with <20% shrubs; however, they were not woodland-sensitive at the landscape scale but were negatively associated with trees at the territory scale (Grant et al. 2004).

Sprague's Pipits rarely occur in cultivated lands, and are uncommon on non-native planted pasturelands (Owens and Myres 1973, Sutter 1996, Davis et al. 1999, McMaster and Davis 2001). They have not been documented to nest in cropland (Owens and Myres 1973, Koper et al. 2009), in land in the Conservation Reserve Program (Higgins et al. 2002) or in dense nesting cover planted for waterfowl habitat (Prescott 1997). However, territorial displays have been recorded in non-native grasslands where the structure of the vegetation was similar to that of native vegetation (Dale et al. 1997, Sutter and Brigham 1998, Davis et al. 1999, Higgins et al. 2002, Dohms 2009). In Saskatchewan, Sprague's Pipits have been documented nesting in non-native hayfields at Last Mountain Lake National Wildlife Area (Dale 1983); conversely, they were not associated with hayfields in the Missouri Coteau (Dechant et al. 2003).

Nests and Nest Sites.—In Montana, Sprague's Pipit nest sites were in grasslands primarily with native grasses of intermediate height and density, with little bare ground or clubmoss and few shrubs, and in nest patches with greater litter cover and depth, while avoiding areas with prickly pear cactus cover (Dieni and Jones 2003). They tended to nest in patches that had little or no clubmoss cover, nor was clubmoss ever used as a nesting substrate (Dieni and Jones 2003). These nest site data were consistent with findings reported from Saskatchewan (Sutter 1997), except there was no evidence of selection against forb cover (Dieni and Jones 2003). Selection for vertical habitat characteristics by this species appears to be occurring at the scale of the nest site rather than the nest (Dieni and Jones 2003, Grant et al. 2004). In Saskatchewan, Sprague's Pipits nest sites were most abundant in areas with intermediate cover values, higher grass and sedge cover, higher maximum height, lower forb and shrub cover, lower bare ground cover, and lower forb density than random sites; average vegetation characteristics at nest sites were: 52.7% grass and sedge cover, 10.5% forb and shrub cover, 15.2% litter cover, 16.8% bare ground cover, 55.6 forb contacts per m^2, 27.7 cm maximum vegetation height, 2.4 cm litter depth, and vegetation density of 1.1 contacts above 10 cm and 3 contacts below 10 cm (Davis et al. 1999).

Patch Size.—Sprague's Pipits are likely influenced by the size of grassland patches and the amount of grassland in the landscape (Davis 2004). In southern Saskatchewan, Davis (2004) found that Sprague's Pipits abundance was influenced by the size and configuration of suitable grassland patches and the amount of grassland in the landscape. Pipits also had a 50% probability of occurring on patches ≥ 145 ha (95% CI=69-314 ha); pipits were absent from grassland patches <29 ha (Davis 2004). A smaller edge:area ratio had higher pipit abundances, and was an important predictor of their occurrence (Davis 2004). No consistent effect of patch size was found on nest success (Winter et al. 2006; SLJ).

Management.—Grazing, fire, and mowing are the most common management techniques used in grasslands to

create or restore suitable habitat for Sprague's Pipits or to prevent further degradation. The effects will vary with intensity and frequency, as well as environmental conditions, such as moisture, soil type, plant species composition and geography (see Threats, below; Maher 1973, Owens and Myres 1973, Karasiuk et al 1977, Kantrud 1981, George et al. 1992).

Migration

No data. Migration habitats are poorly known. Where pipits have been seen during migration, the habitats used are similar to those documented on the breeding and wintering grounds, including pastures, prairie-dog (*Cynomys* spp.) towns, fallow cropland, and short-, mixed- and heavily grazed tall-grass prairies (Thompson and Ely 1992).

Winter

United States.—Winter habitats are similar to breeding habitats; i.e., large grasslands areas that may or may not primarily consist of native grass (Dieni et al. 2003, Desmond et al. 2005). In southern Texas, Sprague's Pipits were located almost exclusively in grass-forb prairie (27 individuals/km^2), and rarely in shrub grassland (2 individuals/km^2; Emlen 1972). Sprague's Pipits southern distribution is coincident with the occurrence of *Andropogon* spp. grasses (Root 1988), although this may be due to limited sample sizes. In Arizona and New Mexico they are found in extensive areas of well developed desert grasslands (Merola-Zwartjes 2005).

In Texas, Sprague's Pipits winter in heavily grazed grasslands dominated by little bluestem (*Schizachyrium scoparium*) and *Andropogon* spp, and in large, over-grazed pastures (Grzybowski 1982); they are often found in patches where the grass is very short (Freeman 1999). Large numbers were also found on approximately 2000 ha (~5000 acres) of former rice fields, that had been re-planted to Bermuda grass (*Cynodon* spp.) a decade or more earlier and heavily grazed; in these fields, pipits occurred most frequently on the saline outcroppings where there was little vegetation (B. Ortego, pers. comm.). The 2nd highest densities of wintering pipits in Texas were observed on grasslands at the Attwater Prairie Chicken NWR in Colorado County and the Mad Island complex in Matagorda County These areas each consists of > 4000 ha (~10,000 acres) of native grasslands with moderate grazing and with the dominant grasses being normally about 0.2 m high. Pipits were also found frequently on turf grass farms, golf courses, heavily gazed Bermuda grass (Freeman 1999; B. Ortego, pers. comm.) and areas of burned pasture (Freeman 1999).

In both Texas and México, Sprague's Pipits are often observed using roads through appropriate habitat (Freeman 1999; B. Ortego, pers. comm.). These are typically either paved or unpaved secondary or tertiary roads with grass shoulders in agricultural settings without much traffic (Freeman 1999; B. Ortego, pers. comm.).

México.—In northwestern Chihuahua, Sprague's Pipits showed strong association with open grasslands, both densely and sparsely vegetated, and were not found in grassy agricultural borders or overgrazed *ejido* lands, and they were negatively associated with shrub abundance (Desmond et al. 2005). Comparisons of avian species assemblages on *ejido* land and an adjacent private ranch found that overgrazed *ejido* land did not support Sprague's Pipits (Desmond et al. 2005). A seasonal study of bird distribution in Cuatro Ciénegas, Coahuila, México (Contreras-Balderas et al. 1997) noted that Sprague's Pipits were found in three vegetation types: 1) scrub dominated by creosote bush (*Larrea tridentata*); 2) mesquite dominated by catclaw acacia (*Acacia greggi*); and 3) alkali scrub dominated by *Atriplex* sp., salt-tolerant grasses (*Sporobolus, Distichlis*, and *Monanthochloe* spp.) and mesquite (*Prosopis laevigata*).

In north-central México (Sonora, Chihuahua, Durango, Coahuila, and portions of Nuevo León and San Luis Potosí), Sprague's Pipits were a widespread winter resident in Chihuahuan desert grasslands (Panjabi et al. 2010). Densities have some annual variation, however, estimates of global densities were similar across years (2007–2009; Panjabi et al. 2010). Shrub cover had a strong negative influence on pipit abundance, with grass and other cover variables important positive predictors (Panjabi et al. 2010).

Population Trends and Estimates

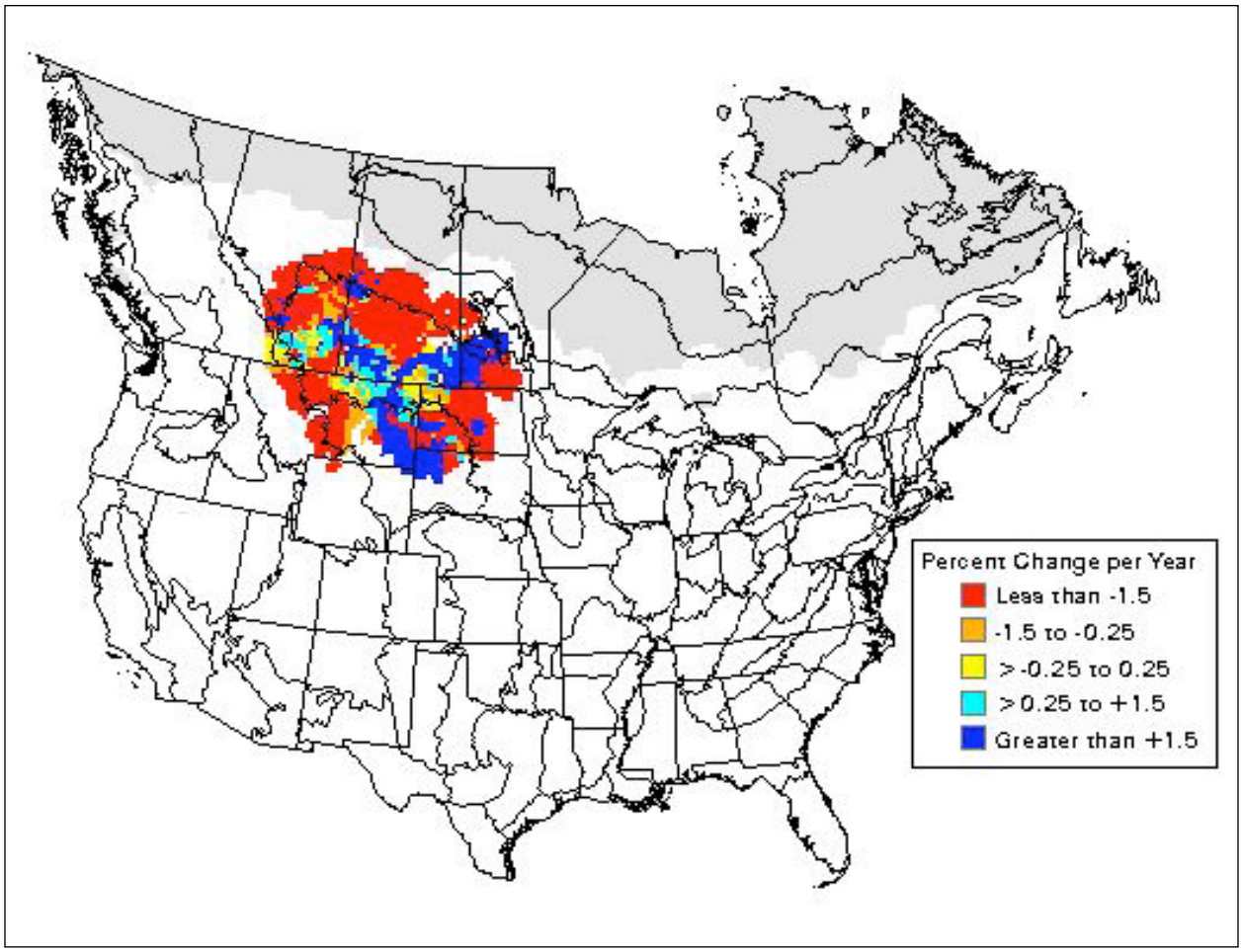

Figure 3. Trends for Sprague's Pipit, percent change per year; data from the Breeding Bird Survey for 1996-2007 (Sauer et al. 2008). These trends do not necessarily reflect statistical significance (see Table 1)

Trends

Breeding Bird Survey

Rangewide.—Breeding Bird Survey (BBS) data show Sprague's Pipit populations experiencing a statistically significant rangewide decline of 3.9% per year (1967-2007, n=169, p=0.00; Table 1; Sauer et al. 2008). The most dramatic population decreases occurred in Canada (6.0% per year between 1966 and 1996; n=37, p=0.09; Sauer et al. 2008). On a continental scale, most areas show declining populations over the past 30 years, with non-significant increases occurring only in the southwestern portion of the breeding range (Fig. 3; Sauer et al. 2008). Population monitoring in Sprague's Pipits is complicated by their nomadic behavior in response to annual weather conditions (Fig. 4; Root 1988, Jones et al. 2007).

Canada.—Sprague's Pipit experienced a 4.8% annual decline between 1966 and 2005; pipit populations in all jurisdictions and physiographic strata experienced their largest declines between 1966 and 1979 (Environment Canada 2008). A recent analysis of BBS routes within the Prairie Habitat Joint Venture indicates a 4.5% annual decline between 1970 and 2005; 2.8% annual decline in the prairie region compared with a 6.4% decline in the northern parkland region (Environment Canada 2008). Trend results for Grassland Bird Monitoring-Canada (1996–2004) show a decline of 10.5% annually in the prairie region compared with a 1.8% annual decline measured by the BBS in Bird Conservation Region (BCR) 11 for the same period (B. Dale and B. Collins, pers. comm.).

Declines in Alberta, where the species reaches its highest continental abundance, have been more rapid (10% per year) over the same period (Environment Canada 2008). Declines are also steep in Saskatchewan,

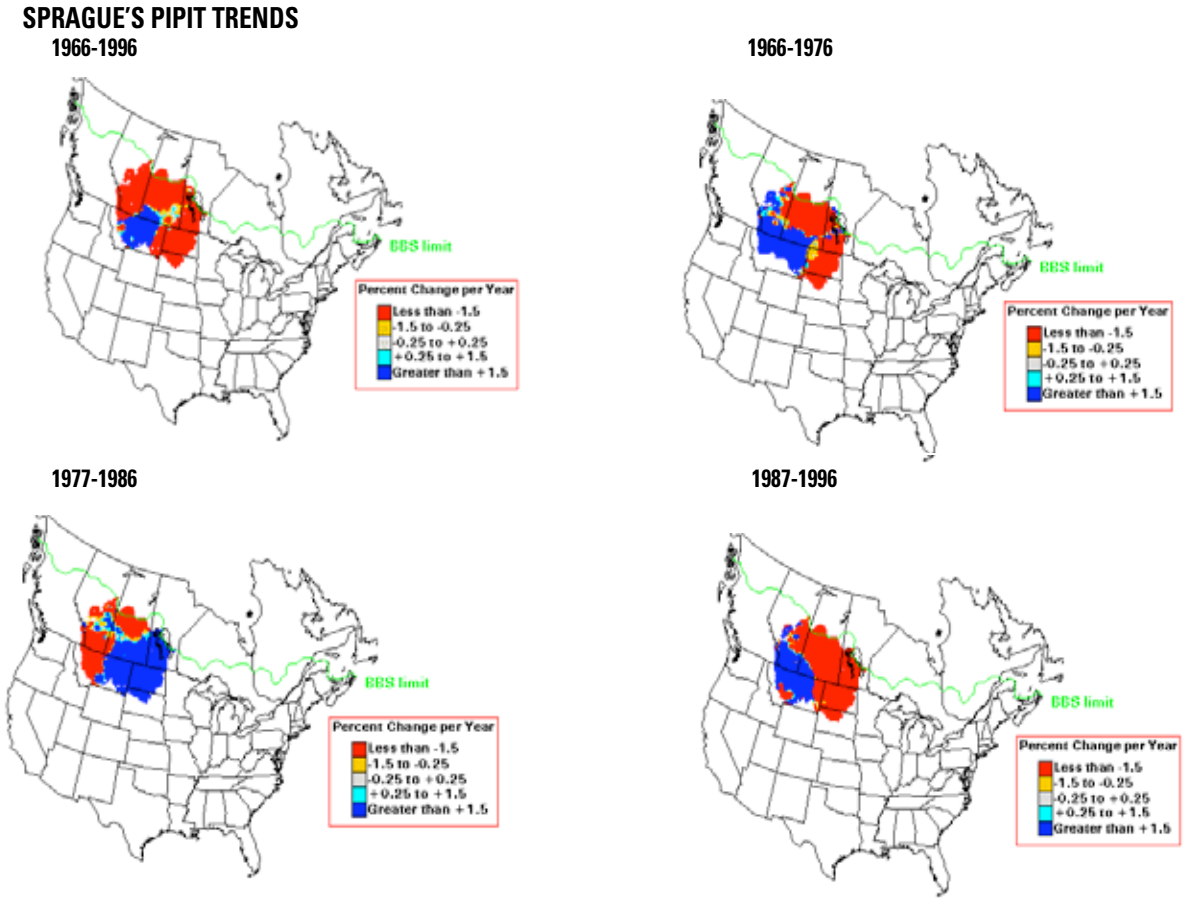

Figure 4. Trends for Sprague's Pipit for different time periods, data from the Breeding Bird Survey (J. R. Sauer, pers. comm.). Trends do not reflect statistical significance (see Sauer et al. 2008).

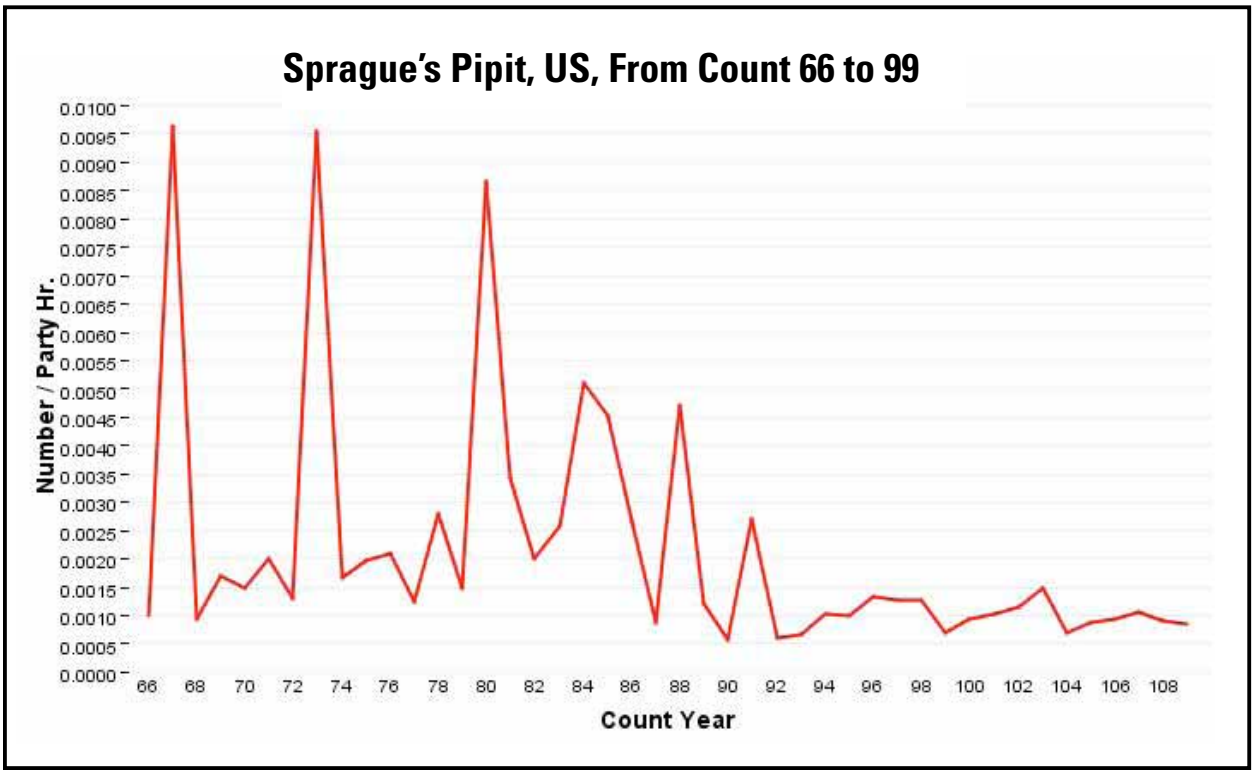

Figure 5. Christmas Bird Count data showing yearly variation in Sprague's Pipit densities for the U.S. (National Audubon Society 2009).

4.2% per year (n=45, p=0.05) for the survey period (1966–2007; Environment Canada 2008). Sprague's Pipits populations in Saskatchewan have declined 4.8% per year since 1966, and 7.9% per year since 1980 (Prescott 1997).

United States.—In the United States trends are largely non-significant (Table 1; Sauer et al. 2008). There was no change in the population size of Sprague's Pipits in North Dakota between 1967 and 1993 (Igl and Johnson 1997).

Christmas Bird Count

United States.—CBC data show large yearly swings in numbers (Fig. 5; National Audubon Society 2009), and in general, the abundance of pipits was too low and sporadic for CBC data to yield meaningful information (Root 1988). Some of this variation may be due to measurement error, or to Sprague's Pipits nomadic behavior in response to annual weather conditions (Root 1988). There is also some annual variation in the areas of the highest winter densities; however, while poorer quality sites are inconsistent in the number of pipits from year to year, the higher quality sites consistently have high numbers of pipits each winter (B. Ortego, pers. comm.).

In another analysis of CBC data (National Audubon Society 2009), the 40-year (winters of 1996 through 2005) trend data for Sprague's Pipits showed a decline for Texas (2.54%), Louisiana (6.21%), Mississippi (10.2%), and Arkansas (9.27%), although abundances were very low and variable (U. S. Fish and Wildlife Service 2010). Overall, the 40-year trend showed a median declining population of approximately 3.23% annually; however, no tests of statistical significance were given (U. S. Fish and Wildlife Service 2010).

México.—CBC data (National Audubon Society 2009) data show Sprague's Pipits occurring every year in northern Chihuahua (Ejido San Pedro) and some years in Coahuila. Few individuals have been observed, with only one pipit documented in 1979, 1980, and 1986. Beginning in 1989, pipits were observed in northern México in all years. The highest number of individuals was in 1996, with 54 reported on one circle, and in 2004, with 48 individuals reported on five circles (National Audubon Society 2009). Generally, there is limited CBC data from México and therefore, CBC data could be misleading in the relative importance of México to wintering populations (J. M. Ruth, pers. comm.).

Historic

Anecdotal accounts from early naturalists suggest that Sprague's Pipits were one of the most common grassland songbirds in the northern Great Plains. Since its discovery, the Sprague's Pipit has suffered greatly throughout its breeding range from conversion of short- and mid-grass prairie to agriculture by Euro-Americans. There have been dramatic declines in pipits as prairie has disappeared through cultivation, overgrazing, and invasion by exotic plants (see Historical Changes, above; Prescott and Davis 1998).

Population estimates

Breeding.—Using BBS data, a global population estimate of 870,000 birds was derived (Sauer et al. 2003, Rich et al. 2004); however, this was calculated using a standard set of assumptions and calculations (Rosenberg 2004) that are unverified with the existing data and is a rough estimate with unknown, but potentially large, error. Similarly, populations have been estimated for the sub-regions of the U.S. states and Canadian provinces (Blancher et al. 2007). These estimates range from 400,000 (47.9% of the global population) in Alberta to 3000 (0.3% of the global population) in South Dakota (Blancher et al. 2007).

Wintering.—CBC data show that the highest wintering densities of Sprague's Pipits are recorded in north-central Texas (Prescott and Davis 1998, Sauer et al. 2008); however, this data has noteworthy biases (B. Ortego, pers. comm.). Grzybowski (1982) described the highest numbers in the central coastal prairie region of Texas and the highest numbers reported on a CBC route was 196 individuals at Corpus Christi in the winter of 1966-1967; currently, either Matagorda or Attwater Prairie Chicken CBC routes have the highest tallies with ca. 36 individuals (B. Ortego, pers. comm.). The small numbers of individual pipits on the CBC in southern Oklahoma and northern Texas may be due in part to the sometimes slow migration these birds exhibit during the dates of the CBC period; in mid to late Jan, the Sprague's Pipits are difficult to locate north of the coastal plain and become more common in southern Texas (B. Freeman, pers. comm.). The largest wintering populations in the Unites States were in coastal short-grass prairie in southern Texas, where "…many hundreds…" were observed in a single day in a 154 km^2 (60 sq. mile) area; the numbers of individuals peaked in Mar and early Apr (B. Freeman, pers. comm.). However, since abundance data is largely lacking from México, it is unknown how much of the population generally winters in México.

Densities

Breeding.—Densities of 21.5-41.2 pairs/100 ha were reported on native prairie in Saskatchewan (Maher 1973). A partially randomized survey of Saskatchewan grasslands found Sprague's Pipits on 18% of 1858 half-circles in native pasture (Antsey et al. 1995). In 1996-1997, a BBS-type study reported Sprague's Pipits on 32.5% of 1650 point counts in southwest Saskatchewan and southeast Alberta (Dale et al. 1997). In Alberta in 1994 and 1995, Sprague's Pipits were encountered on 54.1% of 741 point counts (Robbins and Dale 1999). In Montana, from 2001-2007, 49.8–71.3% of point counts (n=1410 points) detected Sprague's Pipits (C. Wightman, pers. comm.).

Wintering.—Densities of wintering pipits in the coastal prairies of Texas were 64 to 90 birds/100 ha (Grzybowski

1982) and 4.4 individuals/km^2 in southern Texas (n=23; Emlen 1972). The highest concentrations were in southwest Texas, where the maximum abundance was 0.68 individual/party hour (n=56 circles; Root 1988). In portions of northern México adjacent to Texas, Sprague's Pipits were recorded on 11.2% of survey points (Prescott and Davis 1998). Densities of Sprague's Pipits from 1 to 11 birds per km^2 were documented throughout northern México (Chihuahua, Sonora, Coahuila, Durango, and Nuevo León). Densities of 10 individuals/km^2 were found at Cuchillas de la Zarca in Durango and Valle Colombia in Coahuila; densities of 5-10 individuals/km^2 were found in El Tokio in Coahuila/ Nuevo León and Sonorita in Sonora. Sprague's Pipits were also regularly found at lower densities at Janos and Valle Centrales in Chihuahua (A. O. Panjabi, unpubl. data). The Janos Valley in Chihuahua may represent a northern limit of regular wintering by large numbers of Sprague's Pipits (Dieni et al. 2003).

Monitoring Activities

Grassland Bird Monitoring-Canada.—Grassland Bird Monitoring-Canada (GBM-Canada) started in 1996 in prairie Canada (Dale et al. 2003). GBM-Canada uses the same methodology as the BBS but additional random routes were added to the regular BBS routes to target grassland cover within the mixed-grass prairie region. Originally 30 routes were selected in Canada, and the Canadian Wildlife Service continues to run about 15 per year. GBM-Canada results in a higher number of grassland birds per route compared to BBS routes within grasslands. Population trends differ between GBM-Canada and BBS as well, both positively and negatively – the combined trends are probably the most accurate (Dale et al. 2003).

Other-Canada.—Priority grassland bird surveys on Canadian federal lands (e.g., National Wildlife Areas, Prairie Farm Rehabilitation Administration (PFRA) pastures, and Grasslands National Park) in Saskatchewan and Alberta are conducted to monitor local populations and refine the status, distribution, and abundance of pipits in these areas (Environment Canada 2008). The Manitoba Conservation Data Centre has collected and collated Sprague's Pipit occurrence data from 1987 to 2006. A federal database has been established to manage and distribute Sprague's Pipit data collected by various agencies across the prairie region in Canada and the United States (Environment Canada 2008). Pipit populations are monitored by staff at Suffield National Wildlife Area in southeast Alberta (Dale et al. 2003). Demographic monitoring was initiated at Last Mountain Lake National Wildlife Area in central Saskatchewan in 2004 and has recently expanded to nearby PFRA pastures (Environment Canada 2008).

Grassland Bird Monitoring-United States.—In 2009, USFWS Region 6 started a GBM-US program in southwestern North Dakota, northwestern South Dakota, and eastern Montana expanding the GBM-Canada in the mixed-grass prairie regions of the United States (Jones and Niemuth 2009). GBM-US will add new BBS routes in degree blocks with >50% grass in Montana. These new routes will be selected in conjunction with the methods established by GBM-Canada program. Additionally, GBM-US will target running all BBS routes in the priority GBM-US area and habitat (Jones and Niemuth 2009).

Other-United States.—Priority areas and species are the focus of state agency projects. These include the second South Dakota Breeding Bird Atlas (2008-2012; E. Dowd-Stukel, pers. comm.) and monitoring projects in Montana, one ongoing from 2001, and the other started in 2009 (C. Wightman, pers. comm.). The Bureau of Land Management and Montana Natural Heritage Program have conducted surveys of breeding birds, including Sprague's Pipits, from 2001 - 2007 in northern Valley County, Montana (C. Wightman, pers. comm.).

Mexican Plateau Monitoring-México—In January 2007, the Rocky Mountain Bird Observatory initiated a study to inventory, research, and monitor wintering birds in Chihuahuan Desert Grassland Priority Conservation Areas (GPCA) in México (Levandoski et al. 2008, Panjabi et. al 2010). The project assessed key vegetation and habitat parameters at selected sites considered important in determining grassland bird use, including use by Sprague's Pipits. Variation in densities and richness of wintering grassland birds across GPCAs and changes in regional distribution between 2007 and 2008, suggested plasticity in wintering range for pipits (Levandoski et al. 2008, Panjabi et al. 2010).

Threats

Habitat loss, degradation, and fragmentation, inappropriate management, nest predation and parasitism, energy development, climate change, and drought are threats that currently or potentially effect Sprague's Pipits populations throughout their range.

Breeding

Regulatory Protection.—Current regulations appear to provide Sprague's Pipit individuals with adequate protection throughout its breeding range. Sprague's Pipits are federally protected in Canada and the United States under the Migratory Bird Treaty Act of 1918 as amended (16 U.S.C. 703-711: 40 Stat. 755; U.S. Fish and Wildlife Service 2008a).

Sprague's Pipits are protected as "Threatened" in Canada (Committee on the Status of Endangered Wildlife in Canada 2002). In Canada, a national recovery strategy for Sprague's Pipits has been prepared with guidance on recovery efforts required to mitigate threats (Environment Canada 2008); this recovery strategy provides some protection for their habitat.

Sprague's Pipits are proposed for listing as "Endangered" or "Threatened" in the United States, but further action is precluded by higher listing priorities (U.S. Fish and Wildlife Service 2010). No current protection for Sprague's Pipit habitat exists in the United States, except on public lands, and lands under grassland easements; many tribal lands have lower rates of conservation. Incentive programs such as the U.S. Farm Bill Grassland Reserve Program and the Farm and Ranchland Protection Program offer some breeding habitat protection in upland easements that are held in perpetuity. Most native grassland habitat suitable for Sprague's Pipit is owned primarily by private landowners and is afforded little or no protection from alteration and disturbance from human activities. There are currently no specific requirements in state agency regulatory systems that protect Sprague's Pipits habitat (U. S. Fish and Wildlife Service 2010), although many state and provicial lands are protected from cropland conversion. Although not protected specifically for pipits, large grassland tracts are protected by the National Wildlife Refuge System, National Parks, Bureau of Land Management, and Forest Service lands in the United States and the Grasslands National Park in Canada; however, these areas would not be enough to sustain pipit populations throughout their lifecycle.

Habitat.—The conversion, degradation, fragmentation, and loss of native prairie are the primary threats to Sprague's Pipit populations. The once abundant grasslands of the Great Plains have been drastically reduced, altered, and fragmented by intensive agriculture, roads, tree plantings, encroachment by woody vegetation, invasion of exotic plants, and other human activities, including the removal of native grazers and a change in the natural fire regime (Igl and Johnson 1997, Dechant et al. 2003, U. S. Fish and Wildlife Service 2010). It has been estimated that at least 75% of native grasslands in the Canadian prairies have been lost primarily to cultivation, succession, road construction, gravel extraction, petroleum exploration and extraction, and settlement (i.e., urban and rural expansion) (Environment Canada 2008). Mixed-grass prairie has declined 60 - 99% in acreage in the prairie provinces of Canada with over 90% of the converted grasslands in Canada being used for agriculture (Robbins and Dale 1999). In the United States, about 60% of native mixed-grass prairies in Montana, North Dakota, and South Dakota have been converted to cropland (Higgins et al. 2002). Data from South Dakota indicate that 1.4 million hectares (3.5 million acres) of rangelands (a 14% decrease) were converted to cropland and other developments from 1977 to 1997 (Higgins et al. 2002).

Grassland conversion has greatly reduced the quality and availability of suitable habitat for Sprague's Pipits. Land cover images of the Great Plains in Canada and the United States indicate that only 30% of native prairie remains from pre-colonial times (Samson and Knopf 1994). However, due to expected demographic change in human populations and subsequent landowner changes, it is likely that more grassland will be lost in the near future (Prescott and Davis 1998, Environment Canada 2008). Since pipits rarely use land enrolled in the Permanent Cover Program in Canada or the Conservation Reserve Program in the United States or seeded cover planted for waterfowl production (Johnson and Schwartz 1993, Prescott and Davis 1998) these programs will not mitigate the effects of prairie conversion for Sprague's Pipits.

Although Sprague's Pipits will use non-native replanted grasslands, their abundance is lower than in native grasslands (Dale et al. 1997, Sutter and Brigham 1998, Davis et al. 1999), and they are generally associated with native prairie (Sutter 1996, Madden et al. 2000, Davis 2004, Grant et al. 2004, McMaster et al. 2005). Pipits may nest in non-native grassland sites that were previously cultivated if the vegetation structure is appropriate (Dale et al. 1997, Sutter and Brigham 1998, Davis et al. 1999). Abundances are lower in these

habitats than in native grasslands (McMaster and Davis 2001); however, nest survival is similar (Dohms 2009).

Since most native grasslands in the mixed-grass prairie in both Canada and the United States are grazed by livestock, Sprague's Pipits are susceptible to habitat degradation as a result of high-intensity grazing (see Grazing, below; Prescott and Davis 1998, Madden et al. 2000). Other grassland changes can alter the structure of vegetation so that it is no longer attractive to pipits. These changes include increased woody vegetation in the form of tree plantings and shrub encroachment, and invasive grasses and forbs (Johnson and Igl 1995, Dechant et al. 2003, Environment Canada 2008).

Sprague's Pipits nested in patches that had little or no clubmoss cover, nor was clubmoss ever used as a nesting substrate (Dieni and Jones 2003) although at the territory scale, pipits were positively correlated with ≤22% clubmoss cover (Dieni and Jones 2003). The potential for clubmoss to increase during drought sometimes makes it a management target; generally accepted methods of clubmoss removal, e.g., burning, grazing, mechanical and chemical treatments (Crane 1990), may themselves alter grassland conditions making the area unsuitable for nesting Sprague's Pipits, particularly in the short-term.

Burning.—Sprague's Pipits have evolved with periodic fires on the prairies, and may be limited by reduced fire frequencies that have accompanied human settlement. Reduced fire frequency allows encroachment by woody vegetation and invasive grasses and forbs, excessive growth of vegetation, and excessive accumulation of litter (Madden 1996, Environment Canada 2008), degrading breeding habitat in many geographic areas (Environment Canada 2008).

Large increases in Sprague's Pipit populations were recorded two years after a burn in Saskatchewan (Environment Canada 2008). Sprague's Pipits did not occur on North Dakota grasslands that had not been burned for over eight years; breeding abundances were highest two to seven years after a fire (Madden 1996). In more arid regions, Sprague's Pipits were common on native pastures that had not been burned for more than 15 years (Sutter 1996, Dale et al. 1997) and 26 years (Dieni and Jones 2003, Jones et al. 2010). Thus, the effects of burning likely vary with frequency, soil type, and moisture regimes, and land productivity. In the arid regions of the mixed-grass prairie, fire frequency recommendations are 8-20 years (Askins et al. 2007). Burning can have adverse short-term effects on Sprague's Pipits abundance and occurrence; however, it may have long-term benefits through improved habitat quality, if it occurs in an appropriate periodicity (Prescott and Davis 1998, Environment Canada 2008).

Grazing.—Livestock grazing can greatly influence vegetation structure, and, therefore, influence Sprague's Pipits occurrence and abundance (Prescott and Davis 1998). The effects of cattle grazing on Sprague's Pipits distribution depend on a variety of factors, including grazing intensity and frequency, as well as environmental conditions, such as moisture, soil type, and plant species composition (Maher 1973, Owens and Myres 1973, Karasiuk et al. 1977, Kantrud 1981, George et al. 1992). Therefore, the response of Sprague's Pipits to grazing intensity and frequency likely varies with geography.

While Sprague's Pipits generally avoid heavily-grazed pastures (Maher 1973, Owens and Myres 1973, Prescott and Wagner 1996, Sutter 1996, Davis et al. 1999), lightly- to moderately-grazed pastures have been identified as optimal habitat for pipits throughout much of their breeding range (Owens and Myres 1973, Davis et al. 1999, Robbins and Dale 1999, Dechant et al. 2003). In North Dakota, a greater abundance of Sprague's Pipits was reported from moderately to heavily grazed pastures (Kantrud 1981). Intensive grazing, however, may render some grassland habitat unsuitable, both indirectly through impacts to vegetation structure and directly through reproductive failure due to disturbance and trampling of nests (Environment Canada 2008).

In the eastern portion of Sprague's Pipits range, in the mesic mixed-grass prairie, disturbance (primarily fire at appropriate intervals, and secondarily grazing, at appropriate rates) can be used to create and maintain healthy pipit habitat (Kantrud 1981, Madden et al. 1999). In the drier, less densely-vegetated mixed-grass prairie particularly in the southwestern portions of Sprague's Pipits range, it has been documented that the number of Sprague's Pipits decreased significantly with increased grazing intensity (Maher 1973, Dale 1983, Robbins and Dale 1999). During 1994-2007, a small but consistent breeding population was documented at Bowdoin NWR in north-central Montana in idle mixed-grass prairie (Dieni and Jones 2003, Jones and Dieni 2007, Jones et al. 2007, Jones et al. 2010).

The effects of grazing must also take into account vegetation potential in the form of structure (i.e., vertical and horizontal density) as well as plant species composition, which varies within and across geographic locales. Cattle presence can also result in increased abundances of cowbirds (Duffy 2000, Danley et al. 2004).

Fire and Grazing, Combined.—In units that were burned, and then grazed, pipit numbers were similar to those in units that were only burned; Sprague's Pipits had lower abundances the first year after treatment, and increased in the second and third year, whether grazing was added or not (Danley et al. 2004). However, cowbirds occurred 2.4 times more frequently on burned and grazed units then those only burned (Danley et al. 2004). The implications of increased cowbird abundance on pipit populations are currently unmeasured.

Mowing.—Haying in native prairie may have negative impacts on Sprague's Pipits populations (Prescott and Davis 1998, Robbins and Dale 1999, McMaster et al. 2005). Sprague's Pipits are not common on planted hayfields, and haying native prairie during the nesting season may substantially lower reproductive

success through mechanical destruction of nests and adults, or by reducing vegetative cover and exposing nests to predators and inclement weather (Dale et al. 1997, Davis 2005). Mowing has been found to destroy approximately 50% of ground nests and the productivity of breeding birds in hayfields is below that required to maintain stable populations (Dale et al. 1997, Prescott and Davis 1998). In Manitoba, native hayland was more attractive to Sprague's Pipits than brome/alfalfa hayland or idle native grassland, but it was less attractive than non-native pasture. In Alberta, hayed native fescue was less attractive to Sprague's Pipits than idle fescue, but more attractive than grazed fescue (Robbins and Dale 1999). In Saskatchewan, Sprague's Pipits were significantly more common in idle native grassland than in either annually or periodically hayed exotic grasses (Robbins and Dale 1999, McMaster et al. 2005).

Introduced Vegetation.—Sprague's Pipits have a strong negative response to exotic grasses (Sutter 1996, Madden et al. 2000, Grant et al. 2004). Consequently, the introduction of Eurasian plant species has had a negative effect on Sprague's Pipit populations. In Manitoba, Sprague's Pipits were significantly more abundant in native prairie than in introduced vegetation (Wilson and Belcher 1989). Singing males were two to three times more abundant in native grass than in crested wheatgrass (*Agropyron cristatum*) and four to 25 times more abundant in native grass than in brome-dominated grassland in south-central Saskatchewan (Prescott and Wagner 1996). They were more than twice as abundant in native grass than crested wheatgrass or absent from crested wheatgrass in southern Alberta sites (Prescott and Wagner 1996). Greater Sprague's Pipit densities were significantly correlated with native grasses at Lostwood NWR in North Dakota (Madden 1996). Exotic plant species planted for the Conservation Reserve Program and for nesting cover for waterfowl are generally not used by Sprague's Pipits (see Threats, Breeding, Habitat, above; Robbins and Dale 1999).

Pesticides.—Use of pesticides to control grasshoppers may impact Sprague's Pipit populations, since grasshoppers are an important food item for the adults and nestlings during the breeding season (George et al. 1992, Environment Canada 2008). Anecdotal observations suggest that Sprague's Pipits may occasionally forage in cropland and thus could be exposed to pesticides (Environment Canada 2008). The amount of time pipits could be exposed to pesticides during the breeding and non-breeding season is unknown.

Fragmentation.—Fragmentation of native prairie has likely contributed to the decline of Sprague's Pipit populations through a reduction in average patch size, increased isolation of habitat patches, an increase in the ratio of edge:area to interior habitat (Davis 2004, Davis et al. 2006) and potentially, an increase in parasitism (Davis and Sealy 2000). In fragmented landscapes, habitat interior species such as Sprague's Pipits (Davis 2004) may experience lower reproductive success when nesting near habitat edges, where they are more susceptible to nest predators and brood parasites (Prescott and Davis 1998, Davis et al. 2006). Sprague's Pipit abundance was inversely correlated with distance to cropland and to water (Koper and Schmiegelow 2006a, 2006b; Koper et al. 2009). Pipits had higher densities by at least 0.3 individuals per point count per km away from cropland, and the average number of individuals per point count increased by at least 0.4 per km away from water, with distance to road having no effect (Koper and Schmiegelow 2006b).

Roads.—Sprague's Pipits may avoid roads and trails during the breeding season (Sutter et al. 2000) and the increased roads densities associated with energy development effects Sprague's Pipits habitat (Dale et al. 2009, Linnen 2008). The type of road (e.g., secondary or tertiary, the presence of deep ditches on the sides, heavily graveled) and the level of traffic are the potential issues in determining the degree of effect roads and trails have on Sprague's Pipit populations (N. Koper, pers. comm.; SLJ; see Winter, below).

In Saskatchewan, Sprague's Pipits were significantly more abundant along trails (wheel ruts visually indistinct from surroundings) than along roadsides (fenced surfaced roads with adjacent ditches), which may be attributed to the 20 - 30% reduction of suitable habitat associated with the road right-of-way (Sutter et al. 2000). Sprague's Pipits avoidance of roads in this study may be due to the roadside habitat which also tended to have non-native vegetation, dominated by smooth brome (*Bromus inermis*) (Sutter et al. 2000). Other data found that there was no significant effect of roads (Koper et al. 2009); there was no effect of trails on pipit nest survivorship in Montana (SLJ).

Linnen (2008) examined the effects of oil and gas disturbances, including road establishment and suggested that Sprague's Pipits tended to occur in lower numbers and at fewer sites near natural gas wells and trails than in interior habitat patches; however, the relationship was not statistically significant (Linnen 2008). Dale et al. (2009) documented that pipit territories rarely crossed trails. However, the method used to map the breeding territories was not detailed and no tests of statistical significance were reported (Dale et al. 2009), thus sampling error was never eliminated as a possible explanation.

Depredation.—Predation is the primary factor influencing nest survival throughout the species' range (Davis and Sealy 2000, Davis 2003, Jones and Dieni 2007, Jones et al. 2010) and in some years, predation can result in near complete nesting failures (Davis 2005). It is difficult to determine whether current predation rates are higher than historic levels; changes in predator communities, habitat structure, and composition and configuration of current grassland habitat could increase the risk of predation; however, little data are available.

Nest Parasitism.—Cowbird parasitism rates on Sprague's Pipit nests vary throughout their range. Habitat fragmentation potentially increases the rate of cowbird parasitism, and the degree of impact from parasitism on nest survival (Davis and Sealy 2000). However, pipits do not seem to be a good host for cowbirds; the cost of parasitism to pipit populations overall is unknown (see Parasitism, above; Davis 2003, Jones et al. 2010).

Climate Change.—Sprague's Pipits are susceptible to climate change (Price 1995). Modeling and predictions of climate change indicate that pipits will become extirpated as a breeding species in the United States and the lower third of Canada due to increasing temperature (Price 1995). It is also predicted that Sprague's Pipits may shift their range north, as southern areas become too warm (Price 1995). The impact of climate change at a population level is unknown. Prolonged periods of cool and wet weather may impact local Sprague's Pipit populations by reducing productivity (Environment Canada 2008). In addition, predictions for harsher, drier temperatures in México, changes in frequency and intensity of drought could impact wintering Sprague's Pipit populations further. These predictions may also affect migration areas (C. M. Rustay, pers. comm.).

Drought.—Drought can be a significant factor affecting Sprague's Pipits nesting habitat and possibly food supply at the local level (Environment Canada 2008) and also affecting wintering habitats (Dieni et al. 2003, J. M. Ruth, pers. comm.). Sprague's Pipits disappeared or declined from many transects in North Dakota during a severe drought in 1988 (George et al. 1992, Niemuth et al. 2008); pipits rebounded once the drought cycle was reversed (George et al. 1992). The effects of drought could be exacerbated by the impact of grazing and fire, particularly in the xeric areas of their range (Askins et al. 2007).

Energy Development.—Energy exploration and extraction are expected to continue to be a threat to Sprague's Pipits habitat and populations into the future as demands for resources increase globally (Environment Canada 2008). Sprague's Pipits abundance decreases within 300 m of oil wells (Linnen 2008). A substantial amount of new oil and gas production is predicted to occur throughout Sprague's Pipits' breeding range, particularly in Alberta (Environment Canada 2008). Currently, no regulatory mechanisms exist for many of these activities to ensure that drilling and associated activities avoid nesting habitat. In the United States, much of the Sprague's Pipit's breeding range overlaps major areas of oil production in eastern Montana, western North Dakota and northwestern South Dakota. Areas with a high density of oil production may also decrease migration and wintering habitats available.

Wind energy has been increasing in recent years; more than 45% in 2007 and more than 50% in 2008 (A. Manville, pers. comm.). Area and patch size (Davis 2004) are important habitat attributes for Sprague's Pipits, and habitat fragmentation a threat to their populations. Wind projects can fragment native prairie habitat through the construction of roads, turbines, electrical grids, and associated facilities; several of the states where Sprague's Pipits breed or winter are the top states potential for wind energy development (Elliott et al. 1991). Sprague's Pipits negatively respond to shrub and tree densities, and it is likely that they exhibit negative responses to other vertical structures in their habitat (e.g., wind turbines, telecommunication towers, power line towers), although specific data are limited.

The effects of increased biofuel production (converting native prairie to agriculture) would likely further decrease breeding habitat.

Industrial Noise.—Industrial noise caused reduced pairing success and influenced age structure in some breeding bird species (Environment Canada 2008, Barber et al. 2009). Expanding energy development (wind energy and oil and gas) in grassland regions may result in increased noise levels and subsequently interfere with male song in Sprague's Pipits. The effect of anthropogenic noise on Sprague's Pipit breeding success is unmeasured.

Winter

Sprague's Pipits are federally protected on their winter range in the United States and México under the Migratory Bird Treaty Act (U.S. Fish and Wildlife Service 2008a). Enforcement of regulatory mechanisms are inadequate to protect individuals in México; no regulatory mechanism currently protects Sprague's Pipit habitats on their winter range.

Specific threats on the winter range in the United Sates or México are many of the same issues identified as threats on the breeding range, (e.g., over-grazing, fragmentation, degrading, and conversion of grasslands, invasive species, and climate change) although the level of each threat may be different.

Protected Sprague's Pipit habitat exists in the United States largely on public lands. Although not protected specifically for pipits, large grassland tracts are protected by the National Wildlife Refuge System, National Parks, Bureau of Land Management and Forest Service lands in the southern United States. Smaller areas of grassland are protected by The Nature Conservancy and other private land owners committed to managing lands for conservation. In México, few truly protected areas of grassland exist. A few private reserves containing pipit habitat (e.g., the Reserva Ecológíca El Uno in northern Chihuahua) have been established. Few national or state-level protected areas exist in México for Sprague's Pipits and those that do, such as the Janos Biosphere Reserve, offer limited protection against landscape-level disturbance. These protected areas would not be enough to sustain pipit populations throughout their winter cycle.

Although large numbers of Sprague's Pipits frequent heavily grazed pastures on the Texas coast during winter (Freeman 1999), this is in contrast to observations in México that heavy grazing is a threat to pipits (Desmond 2004; below). This apparent conflict may be due to a number of causes, including the level of grazing, as "heavy" is largely undefined; differences in the environmental conditions, such as moisture, soil type, and plant species composition, or to lack of data, as most information from the wintering range is limited in scope.

United States

In general, there are few data from the wintering range in the United States, and little is known about the level of the threats here. Sprague's Pipits occur on the largest patches of grasslands in Texas, but are also found on turf-grass farms, grassy roadsides, and other areas with short grass, and on heavily grazed areas (Freeman 1999). They will also use areas with introduced Bermuda grass, with high concentrations of pipits found in saline openings in a large exotic grassland that were heavily grazed (B. Ortego, pers. comm.). Overgrazing, conversion of grasslands, drought, climate change, energy development, and fire suppression are all potential threats to grasslands in the southern United States, but the relative levels are unknown.

Sprague's Pipits appear to use roads frequently on the wintering grounds (Freeman 1999; B. Ortego, pers. comm., SLJ) and during migration (SLJ). The loss of native coastal prairie in Texas is extensive; however, Sprague's Pipit do use introduced grasses at some level during the winter period.

México

Overgrazing by domestic livestock and agricultural practices are the most extensive land uses thought to threaten habitat for Sprague's Pipits in Chihuahua, México (Desmond 2004). In addition, large-scale habitat alterations are occurring throughout the Chihuahua Desert (Desmond 2004). These include conversion of grasslands to agriculture and the large-scale conversion of desert grasslands to shrub dominated systems. These changes are occurring from current and historic overgrazing by domestic livestock, loss of native herbivores, fire suppression, drought, and climate change (Desmond 2004). Shrub encroachment into areas of extensive grasslands is also occurring and may have contributed to reduced numbers of grassland obligate passerines, including Sprague's Pipits (Desmond 2004). Sprague's Pipits were found in significant numbers after a wet year in Chihuahua, but were local and rare in dry years (Dieni et al. 2003). The relative levels of the threats to Sprague's Pipits on the winter range are unknown.

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Management

Management for Sprague's Pipit consists primarily of protecting, maintaining, and restoring native mixed-grass prairie in large expanses (Stewart 1975; Sutter 1996, 1997; Davis 2004). In general, Sprague's Pipit abundances are higher in native grass then in non-native fields. The breeding habitat attributes important to Sprague's Pipits abundance include prairie dominated by native grass, with a particular structure, and area size (see Habitat above; Sutter 1996, 1997, Davis et al. 1999, Table *in* Dechant et al. 2003, Dieni and Jones 2003). Converting cultivated land adjacent to native prairie to perennial cover, including seeding with a native grass mix or one that includes a prostrate (versus erect) form of legume could make smaller tracts attractive to pipits (Winter et al. 2006). The conservation value of large prairie tracts is obvious, but several small habitat patches surrounded by treeless landscape might offer similar conservation value for grassland passerines as a single large prairie patch (Davis 2004, Winter et al. 2006).

Successful management of many grassland habitats often requires some form of disturbance. In many cases, management through fire, grazing, mowing or herbicides can assist in maintaining native grasslands appropriate for Sprague's Pipits; however, the intensity and frequency of disturbance is dependent upon soil productivity, geographic area, and climate. Idling grassland habitat can reduce its suitability for Sprague's Pipits in the mesic portions of their range (e.g., moist mixed grasslands and aspen parkland regions), while disturbance can reduce habitat suitability if the timing, frequency, intensity, or duration of disturbance is inappropriate, particularly in the drier portions of their range (Askins et al. 2007). The following discussion is primarily for the breeding range, unless otherwise mentioned; there is little data on migration or wintering habitat and their management.

Patch Size.—Large native prairie grasslands are needed for Sprague's Pipit conservation. Native grassland tracts of ≥145 ha should be retained for breeding (Davis 2004, Anonymous 2007) although some high quality smaller patches (≤ 29 ha) could provide conservation value, if the landscape is neutral (e.g., no trees or other vertical structure) for Sprague's Pipits, rather than hostile (e.g., development) (Winter et al. 2006).

Preclude Woody Vegetation.—Optimal breeding habitat for Sprague's Pipits will require the removal of woody vegetation from the interior of grassland patches (Grant et al. 2004). In native and planted grasslands this can be accomplished through burning, grazing, mowing, herbicides, or manual removal, as long as the treatment does not result in long-term damage to the grassland (Anonymous 2007) or cause excessive vegetation disturbance, increases in small mammal predators due to leaving slash piles, or excess removal of litter. Avoid planting trees and/or shrubs within 100 m of native grasslands (Anonymous 2007).

Invasive Grass and Forb Species.—Removing exotic plant species, especially smooth brome, sweet clover (*Melilotus* sp.), and alfalfa (*Medicago* sp.) in native grasslands will improve habitat for pipits. Monitor roadsides for invasive species, and remove these species before they move into native prairie (Anonymous 2007).

Mowing.—Mow haylands on a rotational schedule of every other year. Although hayfields are limited in their use by pipits, mowed hayfields can provide better habitat than those idled (Denchant et al. 2003, Anonymous 2007). Delaying mowing until after 15 Aug, should allow >70% of Sprague's Pipit nests to fledge. Minimum dates for mowing of hayfields are after 15 Jul in the dry mixed-grass prairie, after 21 Jul in the xeric mixed-grass prairie, and southern aspen parkland and after 31 Jul in the northern aspen parklands (Anonymous 2007).

Prescribed Fire.—In general, prescribed burning reduces shrub encroachment as well as residual grass cover and may reduce or restrict invasion of exotic plants (Robbins and Dale 1999). Fire is important to maintain Sprague's Pipits' breeding habitat, especially in the eastern portion of the species' range. In Saskatchewan, Sprague's Pipits were most abundant two to three years, and sometimes up to seven years, post-fire; none were present on native prairie that had not been burned or grazed for more than eight years (Anonymous 2007). In North Dakota, burning grasslands every two to four years over a 15-year period resulted in the highest abundance when compared to unburned areas or areas burned only once or twice in 15 years (Madden et al. 1999). Recommendations for timing of burns in the aspen parklands in Canada are 5-10 year intervals, 10 - 15 year intervals in moist mixed-grass regions, and as much as 20-26 year intervals in the mesic mixed-grass prairies or not at all if the vegetation structure can be maintained (Anonymous 2007, Askins et al. 2007). Optimal burning intervals will vary with local and climatic conditions, such as during a drought (where the interval may be significantly longer).

On the wintering grounds, in the coastal prairie of Texas, herbicides are used to control invading mesquite

(*Prosopis* spp.) and huisache (*Acacia smallii*) in the prairie. The burn intensity and frequency needed to control mature brush is generally not practical in Texas and burning tends to only control the small brush at lower intensities (B. Ortego, pers. comm.).

Grazing.—Grazing reduces residual grass cover and may stimulate growth of native plants and prevent or slow invasion by exotic plants (Robbins and Dale 1999). Grazing during the breeding season should be light to moderate (Dechant et al. 2003), although intensity varies geographically. Moderate intensity grazing should be used in the aspen parklands, low to moderate grazing intensities in the mesic mixed-grass prairie, and low grazing intensities or no grazing in the xeric or semi-arid mixed-grass prairie, where disturbance is rarely needed to make the habitat attractive to Sprague's Pipits (Anonymous 2007). However, these terms are relative and difficult to quantify. Local focus should be on getting absolute, rather than relative, measures of vegetation as inherent problems exist in defining, for example, "heavy" or "moderate" or "low" grazing levels (Madden et al. 2000).

There is little data on optimum grazing levels on the wintering grounds, and some conflicting information from the United States and México. It seems likely that different grazing management prescriptions would be needed for Sprague's Pipits in the desert grasslands of the arid southwestern United States and northern México then in areas of Texas coastal prairie. However, information is so limited it is difficult to make recommendations.

Both fire and grazing should be conducted on smaller habitat patches rather than over large areas to achieve an increased vegetation mosaic and to provide a mix of native habitats (Fuhlendorf et al. 2006). Grazing, fire and herbicides could be used together, in conjunction, and in rotation, to achieve the desired conditions (Fuhlendorf et al. 2006).

Restoration.—Restoration programs can be used to enhance the attractiveness and reproductive potential of irregular shaped grassland patches by focusing efforts on increasing patch size and minimizing the amount of edge habitat (Davis 2004). Seed with finer grasses in forage mixes, and seed herbaceous species that grow well in a stand with other species. Do not seed with coarse, tall, or dense growing grasses like smooth brome, or with aggressive competitors, like crested wheatgrass, where litter levels are too low and bare ground coverage is too high (Anonymous 2007).

Roads.—Construction of built-up roads (e.g., dikes) in native or planted grasslands should be avoided. Use native grasses and forbs to re-vegetate pipelines, roads, and other linear development (Anonymous 2007).

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Conservation

This Conservation Plan (Plan) is designed to highlight actions needed to achieve conservation for Sprague's Pipits. This Plan includes a prioritized list of actions and needs that will begin to address the requirements to achieve the long-term rangewide conservation of Sprague's Pipits; actions are prioritized within each major group (Table 2).

The goals for the conservation of Sprague's Pipits are to increase and maintain population size and distribution throughout the pipit's historic range and to prevent further loss and degradation, including fragmentation, of native prairie within its historic range. In addition, the restoration of currently unsuitable habitat is a conservation priority.

No current recovery strategy exists for Sprague's Pipits in United States or México. Implementing these strategies will encompass different issues in each of the three countries. Canada currently has a recovery plan (Environment Canada 2008) and the United States has completed a status review (U. S. Fish and Wildlife Service 2010). In México, implementation will be primarily dependent on NGOs and will require gathering basic baseline data and developing educational programs.

Other Species Covered

Other species that could benefit by habitat management, modification and protection for Sprague's Pipits, in the portions of their breeding and wintering ranges that overlap, include Northern Bobwhite (*Colinus virginianus*), Marbled Godwit (*Limosa fedoa*), Upland Sandpiper (*Bartramia longicauda*), Common Nighthawk (*Chordeiles minor*), Grasshopper (*Ammodramus savannarum*), Baird's, LeConte's (*A. leconteii*), and Savannah (*Passerculus sandwichensis*) sparrows, Dickcissel (*Spiza americana*) and Western and Eastern (*Sturnella magna*) meadowlarks.

Species that could be negatively affected by proposed Sprague's Pipit habitat management include species that use tree and brush vegetation in a grassland savannah, including Loggerhead Shrikes (*Lanius ludociianus*) and Clay-colored Sparrows (*Spizella pallida*). Grassland species requiring tall and dense or short and sparse grass, including Mountain Plovers (*Charadrius montanus*) and McCown's Longspurs (*Rhynchophanes mccownii*), may be negatively affected locally by habitat management for Sprague's Pipits.

Canada

In Canada, conservation goals will be accomplished through grassland conservation initiatives, such as stewardship and management agreements, conservation easements, policy reform, and tax incentives (Environment Canada 2008). Voluntary stewardship agreements have been widely used by conservation groups as a means of establishing and building relationships with producers, and this will be one of Canada's main tools (Environment Canada 2008). Management agreements are typically short-term (10–15 years) formal agreements that are legally binding and represent an agreement between a producer and conservation organization. Incentives are provided (e.g., watering system development, fencing materials, forage seed, etc.) to encourage landowners to alter current management regimes for species at risk, including Sprague's Pipits (Environment Canada 2008).

The Canadian recovery strategy lists the primary actions required to effectively recover Sprague's Pipit populations (Environment Canada 2008). Action plans are scheduled for development by 31 Mar 2011, to cover jurisdictions within the range of Sprague's Pipits in Canada (Environment Canada 2008). Critical habitat determinations in Canada are scheduled for development in 2010 (Environment Canada 2008).

United States and México

Knowledge of the response of breeding Sprague's Pipits to invasive species, and the effects of both timing and method of eradication actions are needed to make informed management recommendations. Grazing, haying, and prescribed burning are all recommended management tools for maintaining native prairie grasslands for breeding Sprague's Pipits (Hagen et al. 2005). Determining the best timing and intensity of these management tools are important to maximize benefits and reduce disturbance both to breeding pipits and their habitat. However, recommendations can vary across the pipit's range, and management of other high priority wildlife species (e.g., prairie-dogs or Mountain Plovers) could conflict with recommendations developed for Sprague's Pipits. This reinforces the need for local evaluation of management actions that can then be integrated into a rangewide perspective.

Although data is available on timing and breeding distribution, identifying all of the important sites used by wintering Sprague's Pipits, particularly in México, has not been completed. As a general strategy, conservation will initially require identifying important migration and wintering areas, assessing their functional ability to support Sprague's Pipits, and then, if warranted, developing conservation actions and evaluation measures for these areas. The effects of energy development

Table 2. Prioritized conservation plan and actions for Sprague's Pipit (SPPI). "Lead for current work" represents groups and individuals currently working on this aspect of SPPI biology in each of the three countries; "Potential" refers to partners with the knowledge and potential to collaborate in this area. "Critical" habitat is used for Canada under the SARA listing as threatened; for the United States and México, it is used in the non-legal sense, meaning important habitat types and areas. Organization abbreviations: CRT = Canada Recovery Team; CWS = Canadian Wildlife Service; FWS = U.S. Fish and Wildlife Service; FWS-ES = FWS Bismarck Ecological Services Office; FWS-MBNG = FWS Migratory Birds, Nongame, Region 6; FWS-HAPET: FWS HAPET Office, Regions 6 and 3; USGS = U. S. Geological Survey, Biological Research Division; USFS = U. S. Forest Service; USBLM = U. S. Bureau of Land Management; USDOD = U. S. Department of Defense; TNC = The Nature Conservancy; CEC = Commission for Environmental Cooperation; RMBO = Rocky Mountain Bird Observatory; NCC = Nature Conservancy of Canada; INEGI = Instituto Nacional de Estadística y Geografía; CONANP = Comisión Nacional de Áreas Naturales Protegidas; WWF = World Wildlife Fund; PLJV = Playa Lakes Joint Venture; PPJV = Prairie Potholes Joint Venture; PPP-LCC = Prairie Landscape Conservation Cooperative; JV-LCC = Joint Ventures and Landscape Conservation Cooperatives. Individuals abbreviations: NK = Nicola Koper, University of Alberta, Edmonton; SKD = Stephen K. Davis, University of Regina, Saskatchewan; MD = Martha Desmond, New Mexico State University; SLJ = Stephanie L. Jones, FWS.

					Lead for current work				
Priority	**Sub-priority**	**Section**	**Sub-section**	**Description**	**Canada**	**United States**	**México**	**Potential**	**Comments**
1		**Habitat**							
	1.A		*Protect and restore larger tracts of native grasslands.*						
		1		Use conservation easements (voluntary and paid) or purchase of larger tracts of land with native grassland protecting large tracts of existing native grasslands from conversion and fragmentation.	NCC	TNC, FWS	TNC, ProNatura	USBLM, USFS, State Agencies, USDOD, WWF	No specific easement programs have yet been planned for SPPI; existing grassland easement programs can be used.
		2		Identify priority areas to target habitat conservation activities.	CRT, NCC	FWS-ES, FWS-HAPET	TNC, WWF	TNC, CEC	Evaluate the potential to convene regional groups to establish priorities, maybe through TNC.
		3		Convert non-native uplands, including hay and pasture, to native vegetation; join tracts of restored and native grasslands to form larger tracts.				FWS, TNC	
		4		Establish protected natural areas.	Parks Canada	FWS, FS, USBLM	CONANP		Janos Biosphere Reserve recently declared in Chihuahua, México.
	1.B		*Identify important (critical) habitat*						
		1		Use current technology and other data to document and map the existing grassland habitat critical for SPPI.	CRT	FWS-HAPET, PPJV	TNC, WWF	PPP-LCC	TNC, states, and others may have information from México.
		2		Update land cover data with ground-truthing to verify current and future model predictions, and to confirm habitat suitability and SPPI use.	CRT	PLJV	INEGI	States, FWS, JV-LCC	Texas & other states will be completing a land cover classification in the next couple of years.

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	3			Develop and refine predictive models of occurrence and abundance using existing data to identify potential source breeding areas. Produce geographic information system (GIS) maps to delineate regions of high probability of occurrence and abundance, in all seasons.	CRT	FWS-HAPET, PPJV		PPP-LCC	Study ongoing on landscapes and spatial analysis linking populations to habitat (Montana).
	4			Conduct field surveys to verify predictive models and collect SPPI location and abundance data on the breeding range. High-ranking sites confirmed to have high densities of SPPI should be identified.					
	5			Assess wintering areas in s. U S and n. México to identify and protect areas with high value for SPPI populations.			RMBO, TNC	JV-LCC	
	1.C		*Identify important habitat components*						
	1.C.b		*Breeding*						
	1			Determine influence of exotic vegetation and confirm whether suitable habitat includes only native vegetation on the breeding range.	SKD				
	2			Determine influence of wetlands and topography on density and reproductive success. Determine whether high-density wetland landscapes are source SPPI habitat.	NK				
	1.C.w		*Wintering and Migration*						
	1			Determine the extent of SPPI use of grazed rangelands on the wintering range, and how SPPI respond to various grazing regimes.				MD	
	2			Determine habitat needs on wintering range, including influence of non-native vegetation, precipitation, and diet and seed resources.				MD	SPPI seem to use non-native quite readily in some locations, on the wintering range.
	3			Determine influence of exotic vegetation and confirm suitable habitat types on the wintering range.					
2		**Management**							
	1			Implement best management practices, and determine whether current recommendations are valid, for different geographic areas and seasons.				FWS, USFS, USBLM	

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	2			Identify and implement appropriate restoration and management tools to improve and maintain the quality of habitat used by SPPI in all seasons.				FWS, USFS, USBLM	
	3			Determine how various habitat management practices for grasslands in different regions of the range effect this species. Test and monitor a variety of existing grassland restoration projects within the range of this species for its benefits to SPPI.	NK			FWS, USFS, USBLM	
	4			Implement techniques to recover SPPI populations in areas that have experienced declines and range contractions.				CWS, FWS, JV-LCC	
	5			Remove woody vegetation from existing open grasslands. Identify geographic regions where woody vegetation encroachment is prevalent and the relative importance of woody vegetation to SPPI during breeding.	NK				
	6			Convert shrub-encroached grasslands back to more open grasslands (e.g., removal of mesquite) on the wintering grounds.				JV-LCC, USBLM, TNC, ProNatura	
	7			Identify areas where haying of SPPI habitat is common; establish and implement guidelines for haying during the breeding season. Determine whether incentives are required to offset costs to producers.	NK				Probably an issue in sw. Manitoba more than the other areas of Canada; not known to be an big issue in other portions of the range.
3		**Inventory, Monitoring and Assessment**							
	1			Increase grassland bird monitoring using the Grassland Bird Monitoring programs in Canada and the U.S.	CWS	FWS-MBNG, FWS-HAPET			
	2			Encourage and solicit increased participation in the BBS and increase the number of trained observers and routes in grassland habitat.	CWS	FWS-MBNG, FWS-HAPET	USGS	USGS	
	3			Evaluate the existing inventory and monitoring data for both populations and habitat to identify data gaps, particularly on the wintering range.				USGS	

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	4			Determine the quantity and quality of grassland habitat, and monitor changes in quantity and quality over time.	CWS	FWS-HAPET, FWS-ES, PPJV		PPP-LCC, TNC, JV-LCC	Targeting grassland conservation: an estimate of land–use conversion risk in the Northern Great Plains (parts of ND, SD, and MT).
	5			Inventory and monitor the distribution and habitat use for SPPI on the wintering grounds.		FWS-R2	RMBO,TNC		
	6			Collect location and abundance information and establish a database with this data. Create maps showing locations of SPPI and areas of high density and persistence.	CRT	RMBO			
	7			Use existing programs (e.g., avian checklist, bird atlas, e-Bird, Natural Heritage programs), and collated sightings from bird enthusiasts, to refining the extent distribution in all seasons, particularly on the winter range and during migration.					
	8			Establish long-term study plots throughout the breeding range to monitor demographic parameters.	NK, SKD	SLJ			
4		**Research**							
	4.A		*Demographics*						
	1			Increase demographic information for SPPI throughout different geographic areas; conduct studies to target unknown aspects of basic biology for SPPI.	NK, SKD	SLJ			
	2			Conduct analysis on the extent and direction of road bias in surveys and on nest survival for SPPI.		SLJ			
	3			Conduct an analysis on changes in arrival dates due to changes in weather on survivorship.		SLJ			
	4			Develop and assess techniques to recover SPPI populations in areas that have experienced declines and range contractions.					
	5			Do a population viability analysis.		SLJ			

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	2			Conduct analysis on the extent and direction of road bias in surveys and on nest survival for SPPI.		SLJ			
	3			Conduct an analysis on changes in arrival dates due to changes in weather on survivorship.		SLJ			
	4			Develop and assess techniques to recover SPPI populations in areas that have experienced declines and range contractions.					
	5			Do a population viability analysis.		SLJ			
	6			Conduct research to determine site fidelity, return rates and survivorship.					
	4.B			*Habitat and Management*					
	1			Increase basic knowledge on the effects of haying, grazing, burning and brush control, and other management actions on demographic parameters, e.g., parasitism rates, survivorship. Make recommendations for management.	NK				
	2			Determine the fire regimes that create suitable SPPI habitat in different geographic areas. Determine at what levels fire may be a threat to SPPI habitat, if any.	NK				
	3			Determine the grazing levels and seasons that create suitable SPPI habitat in different geographic areas and seasons. Determine what levels grazing becomes a threat to SPPI habitat.					
	4			Determine the impact of cattle grazing on Brown-headed Cowbird parasitism rates.					
	5			Determine the relative effects of threats, including habitat loss and degradation, pesticide exposure, predation, etc. on continuing declines.	NK				

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	6			Determine whether non-native grassland habitats act as ecological sources or sinks and whether management (and if so, what type of management) improves habitat suitability, reproductive success, and survival of SPPI, in all seasons.	SKD				
	4.C		*Wintering and Migration*						
	1			Describe migration and wintering distribution, habitats, and abundance.					
	2			Conduct research to determine wintering habitat components that are important, including distribution, amount, and protection status of nonbreeding habitat.					
	3			Determine degree of wintering habitat threats, and limiting factors.					
	4			Determine site fidelity on wintering range.					
	4.D.		*Threats*						
	1			Determine the relative level of the threats identified, on both breeding and wintering ranges, and their relative importance to continuing declines and range contractions.	NK		WWF, TNC		
	2			Effects of tall structures (e.g., buildings, towers, wind developments) on both habitat components (e.g., invasive plant species, fragmentation) and on mortality and survivorship rates.					
	3			Energy Development. Determine the direct and indirect effects oil and gas, solar, and wind energy development have on presence, abundance, survival, and productivity of SPPI. Establish appropriate guidelines to mitigate these effects. These issues will apply to all geographic area in SPPI's range, and to all seasons.					

Table 2, continued

Priority	Sub-priority	Section	Sub-section	Description	Lead for current work: Canada	Lead for current work: United States	Lead for current work: México	Potential	Comments
	4			Climate Change. Gain an understanding of the consequences of changing weather patterns, including annual variation in population size and resiliency of SPPI to climate change. Use existing climate change models to evaluate possible changes in grassland habitats.		SLJ			
	4.E		*Area-sensitive*						
	1			Determine the suitability of small grassland patches as SPPI breeding habitat, including variability of SPPI responses temporally and spatially.	NK, SKD	USGS			
	2			Determine the functionality of small grassland patches, and the effects of the surrounding landscape.	SKD				
5		**Education and Outreach**							
	1			Publish and distribute land use guidelines and practices that benefit SPPI, in different geographic areas. Where BMPs for SPPI already exist, make them readily available.	NK	FWS-MBNG			
	2			Outreach to Mexican NGOs and government agencies to work on SPPI populations and habitats.		TNC, ProNatura, JV-LCC			
	3			Develop of education and outreach tools for SPPI to for public and landowner education and outreach on the value of conserving intact native prairie. Develop education and communication programs targeted at youth, land managers, and the general public increasing awareness of SPPI and their habitat requirements.					
	4			Integrate Sprague's Pipit recovery needs into land management programs and grassland conservation initiatives.		JVs			
	5			Produce outreach documents to inform and influence land use decisions and policies that affect grassland habitat.		JVs			

on Sprague's Pipits are not fully understood, but any prairie conversion and fragmentation of suitable habitats will further decrease their breeding populations. Pre-project investigations should be made a priority in areas suggested for wind power or oil and gas development.

Recommended conservation actions are prioritized as follows:

1. Identify essential habitat throughout Sprague's Pipits' range.

2. Identify essential winter areas and Sprague's Pipits distributions throughout their wintering range.

3. Identify the types and intensity of current threats during the breeding, migration, and wintering seasons.

4. Determine factors limiting Sprague's Pipit populations, and the causes of breeding range contractions. Identify the relative importance of factors during the breeding, and wintering seasons to limit populations. Assess which environmental factors could be limiting Sprague's Pipits population growth, during all seasons.

5. Determine if Sprague's Pipits are positively responding to management actions designed for their conservation in local areas.

Conservation Strategies

The conservation action plan is divided into major sections, addressing priority actions that contribute and enhance this Plan. The specific actions are prioritized and described in Table 2.

1. Habitat Protection and Restoration

The primary cause of Sprague's Pipits historical declines are the loss, conversion, degradation, and fragmentation of native grasslands.

1A. *Protect and restore larger tracts of native grasslands.*—The 1st priority action to stem these declines is to protect and restore the remaining native prairie and grasslands.

1B. *Identify important source habitat.*—Identify geographic areas that are important as source habitat for pipit populations. Identify those priority areas and essential habitats to preserve.

2. Management

Recommendations for management actions should be primarily designed to improve and restore grasslands for Sprague's Pipit nesting and wintering populations. These recommendations should be evaluated and refined to create habitat in specific geographic area.

3. Monitoring, Surveys and Assessment

Monitoring and assessment will play important roles in the adaptive management process by ensuring that critical information gaps are filled and enabling recovery activities and goals to be evaluated. On the breeding grounds, Sprague's Pipit populations seem to be adequately monitored for trends by the BBS, but no large-scale program monitors native grassland habitat. Determining the quantity and quality of grassland habitat and monitoring changes in quantity and quality over time are required to assess whether recovery efforts are successful.

4. Research

Sprague's Pipits are one of the least studied avian species (Robbins and Dale 1999), and past research has focused primarily on distribution, habitat use, area requirements, demographics, and productivity. Currently, ongoing research is focusing on demographics and management.

4A. *Demographics.*—The primary factors causing population declines and range contractions in different regions are unknown. Demographic data throughout the range and across the full annual cycle are necessary to determine potential source and sinks areas. Complete a population viability assessment across the range of breeding demographic data

4B. *Habitat.*—Although pipits are most abundant on native grassland, they will breed in planted pastures in some regions; however, the conditions under which this occurs are unknown. Further work is needed on whether these anthropogenic habitats act as an ecological source or sink or whether management can improve habitat suitability, reproductive success, and survival of pipits.

4C. *Wintering and Migration.*—The current status of migration and wintering distribution and habitats are unknown, along with the factors that threaten the quantity and quality of these habitats.

4D. *Threats.*—A priority is to identify of degree and intensity of current threats on breeding, migration, and wintering grounds. It will be necessary to identify exactly where and what level of risk perceived threats pose to Sprague's Pipit populations.

5. Education and Outreach

Development of education and outreach tools were recurring themes in every category of the recommended conservation actions. Sprague's Pipit conservation will require public and landowner education and outreach on the value of conserving intact native prairie. In addition, education and communication programs targeted at youth, land managers, and the general public are needed to increase awareness of pipits and their habitat requirements. Education and outreach activities will enhance, and explain many of the actions above. Integrating Sprague's Pipit recovery needs into land management programs, and getting recommendations included in local, state, provincial, NGO and federal agency plans is crucial to success.

Completed and Ongoing Conservation Actions

Completed actions

• Completion of conservation action plan by the Region 6 Migratory Bird Office, Nongame (this document).

• Publication of results of demographic studies in Saskatchewan (Davis 2003, 2004, 2005, 2009; Davis et al. 2006; Davis and Fisher 2009; Dohms and Davis 2010) and Montana (Dieni and Jones 2003, Jones and Dieni 2007, Jones et al. 2007, Jones et al. 2010).

• Publication of the results of management studies in Canada (Koper and Schmiegelow 2006a, 2006b; Koper et al. 2009).

• Increased monitoring and evaluation of Sprague's Pipits using the GBM-Canada (Dale et al. 2003) and GBM-US (Jones and Niemuth 2009) programs.

• Evaluation of Sprague's Pipits populations and habitats for current listing actions from Canada (Environment Canada 2008) and the United States (U. S. Fish and Wildlife Service 2010).

Current and Ongoing Actions

Current and ongoing actions are focusing on landscape composition, habitat, and population densities for Sprague's Pipit in all three countries. However, much research is still needed. Some of the ongoing programs include:

• Demographic information, including nesting success, juvenile and adult survival, and other parameters are being conducted on native (Davis et al. in prep., SLJ) and non-native grasslands, along with effects of management actions on demographic parameters.

• Identification of predators over a larger geographic area using camera data (Davis et al. in prep.), along with demographic parameters from cameras (SLJ).

• Research using stable isotope analyses is being conducted to identify connectivity to Sprague's Pipit wintering grounds, determine its molting patterns, and assess levels of dispersal and recruitment in grassland- and cropland-dominated landscapes in central Saskatchewan (Crawford et al. 2009).

• Research in Grasslands National Park, Saskatchewan is determining the effect of grazing on pipit abundance and reproductive success (Koper et al. 2009; Koper et al. *in prep.*).

• Surveys in northern México are ongoing, determining distribution, habitat and densities (Levandoski et al. 2008, Panjabi et al. 2010).

• The Bureau of Land Management and Montana Natural Heritage Program have been conducting surveys of breeding birds in north Valley County, Montana from 2001-2007 (n=1410 point counts) and these are continuing (C. Wightman, pers. comm.).

• Montana Fish, Wildlife and Parks are funding a monitoring program in the Montana portions of Sprague's Pipit's range. The program began in 2009, and involves point count and vegetation surveys. Surveys are continuing (C. Wightman, pers. comm.).

Conclusion

Developing a specific Action Plan by a coalition of partners is necessary to implement the conservation strategies recommended here. The Action Plan should relate to a sub-portion of each strategy and should include the identification of the partners that might undertake each sub-strategy. However, there are currently no specific funding sources available for Sprague's Pipit conservation in the United States and México. Therefore, implementing effective conservation measures will require the cooperation of a coalition of local, regional, national, and international partners. In addition to this Action Plan, several states and provinces have developed objectives and actions designed to address conservation of Sprague's Pipits, and many states and provinces have developed actions as part of their wildlife programs (e. g., Hagen et al. 2005, Environment Canada 2008). The conservation of Sprague's Pipits will be an action for a wide group of partners, and will require implementation in three countries, three provinces, many U. S. and Mexican states, and by public and private organizations.

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