

GRASSHOPPER SPARROW ASSESSMENT

March 18, 2009

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TABLE OF CONTENTS

INTRODUCTION.....	3
NATURAL HISTORY.....	4
Description.....	4
Distribution.....	5
Life History.....	7
Habitat and Diet	7
Breeding Ecology.....	9
MANAGEMENT.....	11
Regulatory Authority	11
Stewardship Incentives (nonregulatory programs)	15
Past and Current Management.....	16
HABITAT ASSESSMENT.....	18
Historic Trends	18
Current Assessment.....	21
Kennebunk Plains	22
Wells Barren	23
Brunswick Naval Air Station.....	23
Sanford Airport.....	24
Augusta Airport.....	24
Projections.....	25
Kennebunk Plains	26
Wells Barren	26
Brunswick Naval Air Station.....	26
Sanford Airport.....	26
POPULATION ASSESSMENT.....	27
Historic Trends	27
Current Assessment.....	28
Projections.....	35
Limiting Factors	36
USE AND DEMAND ASSESSMENT	38
Historic Trends	38
Current Assessment.....	38
Projections.....	40
SUMMARY AND CONCLUSIONS	41
LITERATURE CITED	42

INTRODUCTION

Since 1968, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has developed and refined wildlife species assessments to formulate management goals, objectives, and strategic plans. Assessments are based upon available information and the judgments of professional wildlife biologists responsible for individual species or groups of species. This document represents a renewed planning effort undertaken by MDIFW for Grasshopper Sparrows, a species designated as “Endangered” in Maine. Assessments provide the background for species planning initiatives. A “Natural History” section reviews biological characteristics of the species useful to understanding its status. The “Management” section recaps previous actions, strategic plans, relevant rules, and regulatory authority. Historic, current, and projected future conditions for the species are discussed individually for “Habitat,” “Population,” and “Use and Demand” analyses. The major points of an assessment appear in “Summary and Conclusions.”

NATURAL HISTORY

Description

The Grasshopper Sparrow (*Ammodramus savannarum*) is a small bird of open, sparse grasslands. Its plumage is brown and gray streaked with black and buff; its unstreaked throat and breast are buff-colored (Vickery 1996). It measures 11-12 cm (4.5 - 5.5 in.) long, with a flat head and short, pointed tail (Vickery 1996). Its buffy, unstreaked throat and breast distinguish it from Vesper Sparrow (*Pooecetes gramineus*), Savannah Sparrow (*Passerculus sandwichensis*), sharp-tailed sparrows (*A. caudacutus* and *A. nelsoni*) and Song Sparrow (*Melospiza melodia*)(Sibley 2000). It can be easily separated from the Field Sparrow (*Spizella pusilla*) by the latter's pink bill and rusty cap, and from the Chipping Sparrow (*S. passerina*) by its rusty cap and white supercilium (Sibley 2000). A yellowish area at the bend of the wing is visible in hand and accounts for early references to the species as the "Yellow-winged Sparrow".

Grasshopper Sparrows are most readily detected in the field by their vocalizations, characterized by a dry insect-like buzz from which the species derives its name. Three different songs are used by this species. The first or primary song is uttered by males only (Vickery 1996): "pit-tuck-zee-ee-ee-ee" (Smith 1968, Peterson 1980). This three-note song is distinctive from (and yet generally similar to) the four-note, slurred song of the Savannah Sparrow (Vickery 1996), a more abundant and widespread species in Maine. Males also use a "sustained song" of short, buzzy notes, which may follow the primary song (Vickery 1996). A third, less frequently heard song given by both sexes is a long, complicated trill that rises and falls (Vickery 1996) and is unlike that of any other grassland bird or insect. Vocalizations may occur while

sparrows are on the ground, but are often given from elevated perches, such as tall weeds or small shrubs. Grasshopper Sparrows may be detected by song in Maine from mid-May to early August (Vickery 1996).

Distribution

The breeding range of Grasshopper Sparrows spans North America (Smith 1968, Godfrey 1979, DeGraaf and Rudis 1986, Vickery 1996). They nest from the Atlantic Coast west and north through southwestern Quebec, the Great Lakes states, and the southern fringe of the Canadian Prairie provinces. In the Southeast, they breed from the mid-Atlantic states west across the northern portions of most gulf coast states to Texas, then north throughout the Great Plains (Vickery 1996). Smaller, isolated populations occur in the intermountain region of Idaho, Washington, and Oregon, the Pacific coast of California, Central Valley of California, as well as portions of Mexico, Central America, and the Caribbean (Vickery 1996). The Great Plains region is the core of Grasshopper Sparrow breeding range in the U.S.

Although broadly distributed, regional populations are generally disjunct, coincident with the discontinuous nature of suitable habitat. In the East, Grasshopper Sparrows nest sporadically along the Atlantic seaboard from southern Maine to Florida. Breeding abundance peaks in the mid-Atlantic region. It is an uncommon breeding species throughout New England (Figure 1). Nesting records in Maine represent the northeastern limits of its breeding range. Only casual summer observations have been reported in Canada's Maritime Provinces, and none are indicative of breeding residency (Godfrey 1979, Tufts 1986).

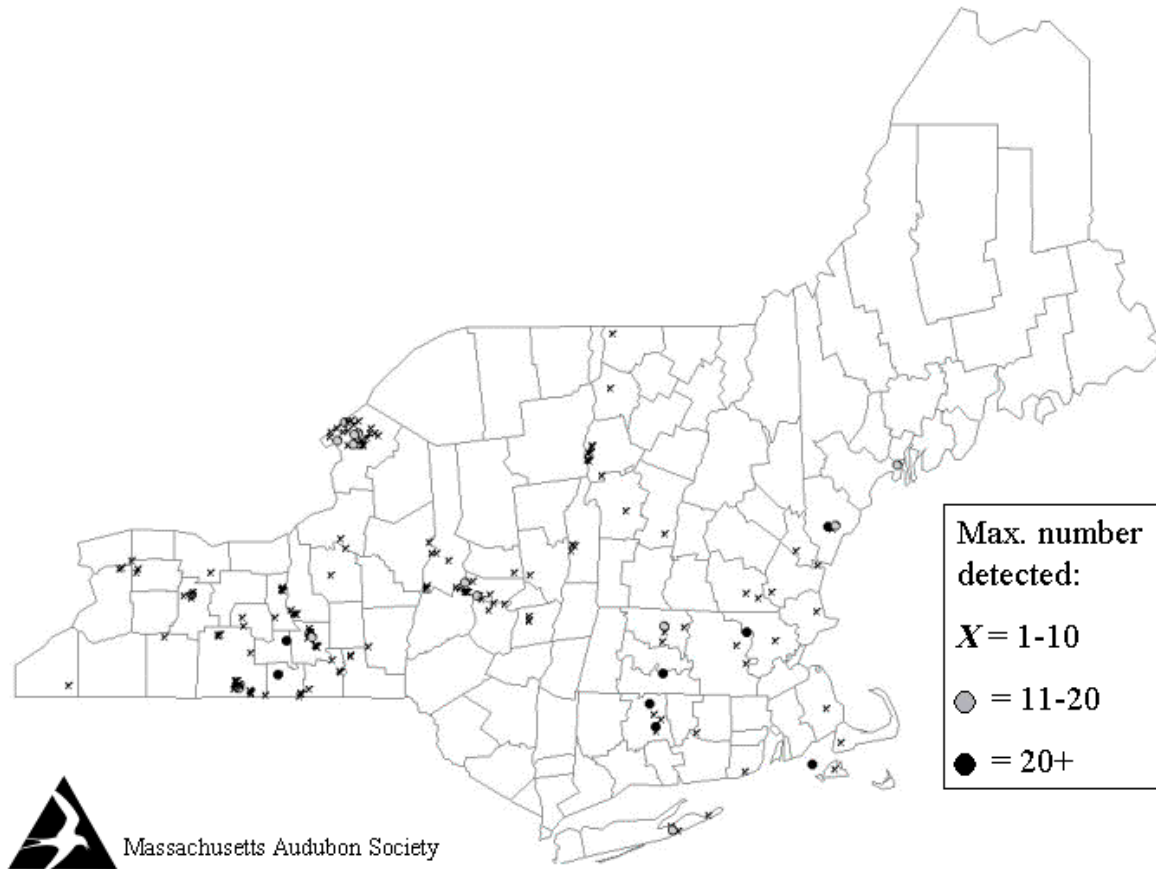


Figure 1. Grasshopper Sparrow distribution and abundance in New England and New York, 1997-2000 (Shriver et al. 2005).

The primary winter range of Grasshopper Sparrows extends from the mid-Atlantic region of Virginia, south to Florida, and west to eastern Texas with a second, larger region extending from extreme southern California eastward to southwestern Texas then southward throughout Mexico and into Central America (Vickery 1996). Wintering populations can be found in Cuba as well (Vickery 1996).

Life History

Habitat and Diet

Grasshopper Sparrow habitat is generally described as large open grasslands where bunchgrasses, rather than sod-forming grasses, predominate. Sod-forming grasses create a dense sward that precludes effective foraging, whereas bunchgrasses are usually interspersed with gaps and patches of bare ground allowing birds to move about freely to forage. Grasshopper Sparrows are area sensitive; despite their relatively small-sized territory, they select grasslands that tend to be large (>50 ha) (Vickery et al. 1994).

In a study of grasslands on reclaimed surface mines in West Virginia, Grasshopper Sparrows selected sites with at least 24% bare ground (Whitmore 1981). Density of breeding pairs decreased with increasing percent cover of litter and grass; density improved with increasing percent cover of bare ground. Mean percent cover of grasses and bare ground within nesting territories was 25.7% and 21.9%, respectively, compared to 84.1% and 3.6% outside territories (Whitmore 1979, 1981). In addition to native grasslands, grazed and cultivated agricultural fields attract breeding Grasshopper Sparrows in the core of their range in the Midwestern U.S. (Graber and Graber 1963,

Renken and Dinsmore 1987, Best et al. 1990), however, in portions of their range, removal of grass by grazing has been detrimental (Saab et al. 1995). In parts of the northeast, Smith (1997) reported that moderate stocking rates, 0.12-0.24 cows/ha provided suitable habitat for Grasshopper Sparrows.

In Maine, breeding Grasshopper Sparrows are restricted to dry sandy grasslands dominated by a few bunch-forming grasses: little bluestem (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*), and sheep fescue (*Festuca ovina*). At Kennebunk Plains in York County (the state's largest nesting area), Grasshopper Sparrows selected sites with 18-33% grass cover and 22-26% bare ground, and did not tolerate shrubs (i.e., *Vaccinium angustifolium*) exceeding 35% ground cover (Vickery 1990a). Furthermore, successful pairs nested in areas with less litter and shrub cover than pairs that nested unsuccessfully (Vickery et al. 1992).

Grasshopper Sparrows forage exclusively on the ground, searching for prey in and around patches of bare ground between grasses (Vickery 1996). Insects, especially grasshoppers, are their primary summer foods, but they also eat beetles, locusts, crickets, spiders, and caterpillars (Wiens 1973). The seeds of grasses and forbs supplement their diet throughout the year and may make up the majority of food items during certain seasons (e.g., Fall) (Martin et al. 1951). The foraging behavior, escape behavior (running along the ground to flee potential threats), and nesting requirements of Grasshopper Sparrows all underscore the importance of vegetative structure of grasslands selected by this species (Vickery 1990a).

Breeding Ecology

Grasshopper Sparrows return to Maine during late May, with females arriving 3 to 10 days after males (Vickery 1996). Males begin singing upon arrival or shortly thereafter; pairs quickly form and nesting is initiated upon arrival of females (Vickery 1996). Grasshopper Sparrows may have 2 broods and will re-nest if a previous nest is unsuccessful (Vickery 1996). Nesting in the northern portion of the species range, including Maine, may continue into mid August (Vickery 1990a). Nests are built on the ground, constructed of grass, and usually well concealed (Vickery 1996). Nests are typically domed, placed at the base of a clump of grass (where they are concealed by overhanging grass); adults often walk (or run) to and from their nest, making it difficult to locate (Vickery 1996).

Grasshopper Sparrows lay from 2 to 6 eggs, with an average clutch size of 4 to 5 eggs (Smith 1963, 1968); second clutches are often smaller (Vickery 1996). The female incubates the clutch for 11-13 days (Smith 1968), and both parents, as well as cooperative nonparents, brood the young and feed the nestlings (Kaspari and O'Leary 1988). Young remain in the nest for about 9 days (Walkinshaw 1940, Smith 1963). After leaving the nest, they run on the ground through the grass, rarely appearing above the vegetation (Smith 1963). Grasshopper Sparrows generally depart their Maine breeding grounds during September (Vickery 1990a) with some individuals present (or perhaps passing through from s. Quebec) into October and mid November (Palmer 1949, Vickery 1978).

Grasshopper Sparrows breed within non-overlapping nesting territories established and defended by males (Vickery 1996). Estimates of territory size may

range from 0.2 to 1.2 pairs/ha (Table 1). Maximum density recorded in Maine has been 0.35 pairs/ha in some portions of the Kennebunk Plains (Vickery 1990a).

Table 1. Estimates of nesting densities (pairs/ha)¹ among selected Grasshopper Sparrow populations in the United States.

Location	Density	Source
North Dakota	0.2	Stewart and Kantrud 1972
	0.6	Arnold and Higgins 1986
	0.2	Renken and Dinsmore 1987
Maine ²	0.35	Vickery 1990a
Maryland	0.8	Stewart and Robbins 1958
Ohio	0.6	Minney 1991
West Virginia	1.2	Whitmore 1979
	0.6	Wray et al. 1982
Wisconsin	0.9	Wiens 1973

¹Published statistics of singing males are restated here as breeding pairs/ha.

²Kennebunk Plains.

MANAGEMENT

Regulatory Authority

Enabling statutes (Title 12 MRSA, 2004) direct MDIFW to "preserve, protect and enhance the inland fisheries and wildlife resources of the state; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for the effective management of these resources" (Chapter 903, §10051). "Wildlife" is defined as "any species of the animal kingdom, except fish, that is wild by nature, whether or not bred or reared in captivity, and includes any part, egg, or offspring of the animal, or the dead body or parts of the animal" (Chapter 901, §10001). In addition, Title 12 Chapter 915 (§12152) states that a permit is required to possess any wildlife species regulated by the state, with some exceptions (§10105).

Additional protection for the Grasshopper Sparrow comes from their designation as "endangered" in Maine (Chapter 925, §12803). Grasshopper Sparrow has been a state endangered species since Maine's inaugural listing of vertebrate wildlife in 1986. Prohibitions for Grasshopper Sparrow and other endangered or threatened wildlife (Chapter 925, §12808) under Maine's Endangered Species Act (1975) and a 1987 amendment include:

- Import into the State or export out of the State any endangered or threatened species.
- Hunt, take, trap or possess any endangered or threatened species within the State.

- Possess, process, sell, offer for sale, deliver, carry, transport or ship any means whatsoever, any endangered or threatened species or any part of an endangered or threatened species.
- Feed, set bait for or harass any endangered or threatened species.

These prohibitions encompass both negligent and intentional acts. “Take” is defined as the act or omission that results in the death of any endangered or threatened species (Chapter 925, §12808). “Harass” means an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns (Chapter 901, §10001).

Incidental take is a provision (Chapter 925, §12808) enacted in 1999 stipulating that lawful activities that do not threaten the recovery of listed species may occur under a plan that minimizes such takings and is approved by the Commissioner. A permit for incidental take is considered if 1) such taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity, 2) the taking will not impair the recovery of any endangered species or threatened species, and 3) the person develops and implements an incidental take plan approved by the Commissioner to take an endangered or threatened species.

A 1988 amendment to Maine’s Endangered Species Act (§12804) created a mechanism for stronger habitat protection. When implemented, special rules enable oversight of state and municipal functions potentially affecting the listed species in designated areas. These “essential habitats” are locales currently or historically providing physical or biological features essential to the conservation of the species and that may require special management considerations. Essential habitats must be

defined and mapped by rule. Protection guidelines are also promulgated according to state rulemaking procedures. These regulations direct that “a state agency or municipal government shall not permit, license, fund, or carry out projects within an essential habitat without review by MDIFW.”

The Natural Resources Protection Act (38 MRSA Article 5-A) is also applicable. Habitats of endangered or threatened wildlife, including Grasshopper Sparrow, may be mapped for designation as "significant wildlife habitats." This statute, administered by Maine's Department of Environmental Protection (MDEP), requires permits for any alteration of soils, waters, vegetation, or permanent structures in a protected natural resource (§480-C). This includes other significant wildlife habitats (§480-B) and threatened or endangered plant habitats (§480-D), pertinent to several sandplain barrens in southern Maine where Grasshopper Sparrows have been documented.

To date, essential habitat and significant wildlife habitat have not been defined or mapped for Grasshopper Sparrow. Both designations provide advance notification of threatened or endangered species issues enabling MDIFW review and consultation with property owners or development interests. Although neither of these avenues have been pursued to date, essential habitat would be the simplest and most effective.

The Site Location of Development Act (38 MRSA Article 6, Chapter 375) (“Site Law”) is among the few laws pertinent to protecting potential Grasshopper Sparrow habitat. Specifically, this act enumerates that “there will be no unreasonable disturbance to” habitat for state or federally listed endangered or threatened species. “Developments of state or regional significance that may substantially affect the environment” (e.g., mineral extraction, most residential subdivisions >15 lots on 30 or more acres, or, for commercial subdivisions >5 lots on 20 or more acres, transmission

lines >100 kV, and several other large-scale projects; §§482, 487-A) require approval by MDEP or certified municipalities. When such projects intersect 1 of the 4 known Grasshopper Sparrow occurrences, MDEP consults with MDIFW for potential management restrictions and conditions associated with the Site Law Permit.

Another relevant statute that assists in habitat protection is the Farmland and Open Space Tax Law (36 MRSA: Part 2, Chapter 105). This law offers incentives to those interested in long-term conservation of farmlands, such as devaluation on property tax liability (§§1105-1106) and easement opportunities (§1111). Maine's Farms for the Future program (7 MRSA, Chapter 10-B), is a business assistance program for farmers that increases the long-term economic viability of their farms. Cash grants are awarded to help implement farm improvements and the farmers sign a five-year, non-development agreement pertaining to their land.

Maine's Comprehensive Growth Management Act (30-A MRSA) lists state goals to guide local comprehensive planning and land use management, which is required in all municipalities (§§4312, 4321). The overall theme is to promote orderly development. Approved plans must include: "protection of the state's other critical natural resources, including without limitation, wetlands, wildlife and fisheries habitat." Strategies that might benefit Grasshopper Sparrow include the maintenance of rural character and a minimization of sprawl in Maine communities. Both issues are currently being addressed as methods of effectively implementing land use plans.

Stewardship Incentives (Non-regulatory Programs)

In addition to the above regulations, there exist additional incentives that promote habitat conservation and management. Two of the most applicable are Beginning with Habitat (BwH) and the Wildlife Habitat Incentive Program (WHIP)

Beginning with Habitat is a habitat-based landscape approach to assessing wildlife and plant conservation needs and opportunities. The goal of the program is to maintain sufficient habitat to support all native plant and animal species currently breeding in Maine by providing each Maine town with a collection of maps and accompanying information depicting and describing various habitats of statewide and national significance found in the town. These maps provide communities with information that can help guide conservation of valuable habitats.

The Wildlife Habitat Incentives Program is another voluntary conservation program administered by the National Resources Conservation Service (NRCS) of the United States Department of Agriculture. This program provides technical and financial assistance to landowners for developing, improving, or managing wildlife habitat or for restoring natural ecosystems on eligible land. Landowners agree to prepare and implement a wildlife habitat conservation plan and NRCS provides technical and financial assistance to implement the wildlife habitat restoration practices. For eligible land, NRCS places primary emphasis on enhancing habitat for fish and wildlife species experiencing declines or those with significantly reduced populations. Other important considerations are those practices beneficial to fish and wildlife that may not otherwise be funded through other conservation programs, and wildlife and fishery habitat enhancement priorities identified by local and State partners and Indian tribes. In

Maine, NRCS priority habitats and species are delineated in the Maine NRCS Fish and Wildlife Action Plan.

Many of these voluntary programs (as well as Farmland and Open Space Tax Law) are often directed at active agricultural sites and because Grasshopper Sparrows occur at so few locations (and in the extreme southern portion of the state), their benefit is not likely to be realized to prevent extirpation of this species. Rather, conservation efforts directed at occupied sites, seems like the most effective strategy.

Past and Current Management

All settings in Maine where Grasshopper Sparrows have recently nested have benefited from some form of inadvertent habitat management. Periodic burning at Kennebunk Plains and Wells Barren to enhance commercial blueberry production has maintained some grassland habitat for Grasshopper Sparrows. Similarly, regular mowing of grasslands abutting Brunswick Naval Air Station (NAS) and Sanford Airport has maintained habitat that, if not optimum, is at least acceptable to breeding Grasshopper Sparrows.

Consultations with the Maine Department of Agriculture's Board of Pesticides Control were initiated in the 1980s to restrict herbicide applications, which altered vegetative cover used by breeding Grasshopper Sparrows at Kennebunk Plains in favor of intensive blueberry cultivation. A portion of the Kennebunk Plains was acquired subsequently by The Nature Conservancy (TNC) in 1987. An experimental burn was prescribed there to enhance breeding habitat for the Grasshopper Sparrow and other rare early successional species. The remainder of the open grasslands at the Kennebunk Plains was acquired in 1990 through a cooperative effort of TNC, Land for

Maine's Future Board, MDIFW, and the Kennebunk Water District. A site management plan was prepared in 1993 and updated in 1996, 2000, and 2006 (MDIFW 2006).

In Maine, research and management efforts for Grasshopper Sparrows have been valuable, but limited. Early studies by Peter Vickery (Vickery 1990b and 1993) and Jeff Wells (Wells 1994a, 1994b) laid the foundation for management of the species in Maine. Following acquisition of the Kennebunk Plains by MDIFW and TNC, habitat management and population monitoring has been the focus of conservation efforts for this species. Management activities include a comprehensive burn rotation at Kennebunk Plains (coordinated by TNC) as well as signage describing periods of access restrictions. No substantive consultations have taken place with landowners regarding long-term management at Brunswick NAS, Sanford Airport, or Wells Barren.

From an agency perspective, responsibility for research and management for many Endangered and Threatened Species has changed. Until 2005, responsibility for Grasshopper Sparrow management within MDIFW (except for regional land management activity) was through the Endangered and Threatened Species Group. Since the reorganization of that group, Grasshopper Sparrow management falls under the purview of the Bird Group. An assessment (i.e., an evaluation of the status and conservation needs of the species) with specific goals and objectives for the management of Grasshopper Sparrows in Maine was prepared in the late 1980s by Scott Melvin and updated in the 1990s by Charlie Todd. A formal management system (i.e., decision matrix for implementing management strategies) was never developed. This updated assessment is intended to stimulate renewed interest in the conservation of this species by creating a public working group to help chart a course for species recovery.

HABITAT ASSESSMENT

Historic Trends

Grasshopper Sparrows breeding in the largely forested regions of eastern North America were restricted originally to disjunct, large natural clearings (Smith 1968). Earlier in the 20th century, they still inhabited remnant tall-grass prairie settings in Minnesota and Michigan, wherever isolated occurrences of this traditional breeding habitat existed (Roberts 1936, Walkinshaw 1940).

In the northeastern U.S., especially in Maine, native grasslands were even more sparsely distributed, likely the result of large disturbances such as fire (Askins et al. 2007). The amount of open habitat most certainly increased during the 18th and 19th centuries as large areas of forest in the east were cleared for agriculture and pasture (Todd 1940). By 1880, one-third of Maine was in farmland (Day 1954). In contrast, suitable grasslands have diminished during the 20th century. Unless external influences (e.g., fire, mowing, etc.) maintain these early seral stages, fallow grassland usually reverts to forest by natural succession. Furthermore, some grasslands have been lost through human activity (e.g., land development, intensive agriculture, tree plantations, etc.) or remained as grassland, but altered structurally (e.g., colonized by dense swards of rhizomatous grasses), thus no longer remaining suitable habitat for Grasshopper Sparrows.

Increasing reforestation of former agricultural areas in Maine (Powell and Dickson 1984) has greatly reduced the overall availability of grassland habitats in the late 20th and early 21st centuries. The amount of farmland has decreased by nearly

80% statewide during the last 100 years (Table 2). In 1880, 34% of Maine's total land area had some form of agricultural use, but only a fraction remained as farmland by 2002. The net loss was even more dramatic in southern Maine, the core range of Grasshopper Sparrows breeding in the state. For example, farmlands comprised 69% of York and Cumberland Counties in 1880, but declined to only 12% by 1982 (NASS 1994).

Agricultural lands are the most prevalent example of grassland communities in Maine, but loss of farmland is not a direct indicator of habitat trend for Grasshopper Sparrow. Farmland acreage may not include "natural" grasslands, and many agricultural practices render habitats unsuitable for the species. However, grasslands subjected to grazing may favor several habitat requisites for Grasshopper Sparrows (Renken and Dinsmore 1987). Indices of the quantity of pasturelands in Maine reveal a remarkable decline of 97% from 1880 to 2002 (Table 2).

A farm area in Berwick (York County) where Grasshopper Sparrows nested for >55 years (Perkins 1935, Palmer 1949) and another historic breeding site in Westbrook (Cumberland County) have since been developed and no longer provide suitable habitat for the species (P.R. Adamus and P.D. Vickery, pers. comm. with C. Todd). Significant human population growth has resulted in greatly accelerated commercial and residential development in these southern Maine counties. It is likely that other, unreported patches of Grasshopper Sparrow habitat in Maine have been lost during this century to not only suburban development, but forest succession and perhaps intensive agricultural practices.

Table 2. Area¹ (in thousands of acres) in selected agricultural land uses (1880-1997) that provide potential habitat for Grasshopper Sparrows in Maine.

Agricultural Use	2002 ¹	1997 ¹	1992 ²	1987 ²	1982 ²	1930 ³	1880
Land in farms	1369.8	1313.1	1258.3	1342.6	1468.7	4639.9	6552.6
Percent of state total	7.0	6.7	6.4	6.9	7.5	23.8	33.7
Cropland used only for pasture	47.9	73.3	73.1	87.5	86.7	499.5	1,620.8
Land in wild and tame hay	153.9	168.2	138.3	161.9	N/A	907.3	N/A
Harvested wild blueberry land ⁴	23.0	25.4	22.2	21.2	N/A	N/A	N/A

¹Data from 2002 Census of Agriculture (National Agricultural Statistics Service 2004).

²Data from 1992 Census of Agriculture (National Agricultural Statistics Service 1994).

³Data from 15th Census of the United States: 1930 Agriculture (U. S. Dept. of Commerce 1932)

⁴As of 2002, 73.2% was in Washington County.

Current Assessment

Territorial Grasshopper Sparrows have been recorded during the breeding season at 5 different locations in Maine since 1984: 2 blueberry barrens (Kennebunk Plains and Wells Barren) and 2 airfields (Brunswick Naval Air Station and Sanford Airport) in southern Maine, as well as a reclaimed gravel pit adjacent to an airfield (Augusta Airport) in central Maine (thought to no longer support this species). All sites possess well-drained sandy soils (or fill) and are vegetated predominantly by bunchgrasses with interspersed forbs, patches of bare ground, and low shrubs. Each has been maintained in an early successional stage by mowing or burning. Maine's current population of Grasshopper Sparrows does not appear tolerant of intensive cultivation such as improved hayfields or blueberry barrens with dense shrub carpets.

Suitable habitats occur as isolated, broadly distributed sites. In the early 1990s, more than 50 grasslands in southern and central Maine considered to be potentially attractive to breeding Grasshopper Sparrows were surveyed without further evidence of occupancy by the species (Vickery 1990a, Pierce and Melvin 1991). Beginning in 1997, MDIFW began additional surveys for grassland birds as well, increasing the number of surveyed sites by several dozen (Weik 1999a). The 4 breeding sites currently documented in the state (excludes Augusta Airport) are limited to southern Maine and strongly suggest a reduced breeding range relative to historic locations of the early 20th century (Palmer 1949)(see Population Assessment).

There are inadequate data to compile a regional or statewide inventory of grasslands suitable for Grasshopper Sparrows. However, Vickery et al. (1994) provide some insight. They found 50% incidence of this species at sites of 100 ha, indicating

this species is one of the more area sensitive species found in Maine. Although their individual territories are smaller, and given the range of sizes of occupied sites, grasslands encompassing 40 ha appears to be the minimum size selected for nesting in Maine. The inability to map suitable habitat features (beyond just size), at large spatial scales, impedes a more meaningful evaluation of Maine's current carrying capacity for Grasshopper Sparrows.

To guide future habitat assessments, Vickery (1990a) reviewed the general characteristics of each breeding site recently inhabited by the species in Maine. The following narratives from that document summarize the qualities of 5 grasslands proven to be attractive to Grasshopper Sparrows as of 1990, and with the exception of Wells Barren and Augusta Airport, likely hold true today.

Kennebunk Plains

This is the largest Grasshopper Sparrow site in Maine at 210 ha (525 acres) and supports the largest breeding population. It is a combination of commercial blueberry barren and sandplain grassland that has been maintained by periodic burning for at least 40 years. During the 1980s, large areas were treated with the herbicide Velpar to favor blueberry production, resulting in a substantial decrease in the percent cover of grasses and forbs over nearly 50% of the site's acreage. Herbicide treatment was terminated in 1989 following interagency consultations. In 1990, the entire Kennebunk Plains were acquired by MDIFW and The Nature Conservancy. Conservation ownership of the Kennebunk Plains provides an ideal opportunity for vegetation management to

optimize habitat conditions for Grasshopper Sparrows and other rare grassland species.

Wells Barren

This is the second largest Grasshopper Sparrow site in Maine (140 ha = 350 acres). It also was intensively treated with the herbicide Velpar to reduce herbaceous vegetation cover and favor growth of blueberries. Wells Barren was purchased for future gravel extraction in 1988, and is thus threatened with severe habitat alteration. Because of its size, soils, and close proximity to the Kennebunk Plains, it is likely that Grasshopper Sparrows could persist at Wells Barren with management that favored bunch grasses as the dominant vegetation. 2009 Note: this site was acquired by The Nature Conservancy in 2007.

Brunswick Naval Air Station

Grasshopper Sparrows nest at this site in approximately 40 ha (100 acres) of grasslands adjacent to runways and in the overflight area at the north end of the airfield. The vegetation is predominantly bunch grasses and forbs, that are maintained by annual mowing. The habitat at the site is likely to remain similar to its present condition as long as Brunswick NAS remains active. It is unclear whether past mowing practices during the breeding season reduced the quality of the habitat below optimum levels or affected nesting success. Guidelines provided to maintain habitats for Grasshopper Sparrows (Nature Conservancy 1988) encourage the suspension of mowing between 1 May and 31 August

each year to allow tall grass to persist through the nesting and brood-rearing periods. Prescribed burns may be required periodically to reduce litter cover and maintain bare ground patches. 2009 Note: Naval Air Station is being closed in 2011 and the future of this site is in question.

Sanford Airport

This location offers limited opportunities for breeding Grasshopper Sparrows within a 50 ha (125 acres) setting within the airfield. Its vegetative structure is unique from that of the sandplain grasslands characteristic of the other sites. Small patches of suitable habitat are interspersed between runways, wet areas, and bulldozed mounds of dirt covered by raspberry shrubs (Rubus sp.). Management to optimize habitats for Grasshopper Sparrows at the Sanford Airport would require additional filling, bulldozing, mowing, and perhaps, periodic burning.

Augusta Airport

One singing male Grasshopper Sparrow has been observed in a reclaimed gravel pit adjacent to the runways at the Augusta Airport annually during the period 1988 through 1990. This site has an apparently suitable vegetation structure: a mixed cover of grasses, forbs, low shrubs, and bare ground. However, the Augusta Airport must be considered marginal because of its geographic isolation from other sites where Grasshopper Sparrows now occur. Habitat quality may also compromise the adequacy of this setting's smaller size

(20 ha = 50 acres) relative to larger grasslands currently inhabited by the species in Maine.

Projections

The availability of suitable grassland habitats for Grasshopper Sparrows can be expected to decrease further without active management intervention. An array of management concerns must be addressed to perpetuate the suitability of current breeding sites in Maine. Conversion of non-traditional settings (dry woodland) to an appropriate vegetation structure is plausible.

Without concerted efforts to maintain or enhance grasslands, the quantity and/or distribution of suitable habitats limit management options for Grasshopper Sparrows in Maine. Both natural loss (e.g., forest succession on abandoned farmlands) and attrition from development or other land use changes are likely to continue. Subtle habitat requisites for the species can be compromised by intensive agricultural practices in settings that may otherwise appear attractive to Grasshopper Sparrows. Alternatively, the use of grassland strips for erosion control in farmlands can enhance habitat values for Grasshopper Sparrows and other wildlife (Bryan and Best 1991), however, in Maine this practice is unlikely to yield significant increases in habitat.

Given renewed interest in management of early successional habitats, habitat management should begin with the 4 sites in southern Maine (excludes Augusta Airport) that have the greatest likelihood of supporting the species.

Kennebunk Plains WMA – There is a growing desire to manage this site for a wide variety of rare fauna (and flora) of both grassland and shrubland affiliation. Discussions towards this end began in earnest in October 2008.

Wells Barren – Recently acquired by The Nature Conservancy, this site will be discussed in detail as described above. Wells Barren is likely to be managed in concert with Kennebunk Plains WMA.

Brunswick Naval Air Station – With decommissioning, this site is undergoing redevelopment. A local committee is seeking to balance natural resource value and local economic growth. However, “take” of this species is possible depending on type and timing of construction activities and must be considered.

Sanford Airport – Management options here have never been numerous and may be even more limited than in the past given hypersensitivity at airports in the post-911 era.

POPULATION ASSESSMENT

Historic Trends

Population trends for Grasshopper Sparrows in Maine are essentially unknown prior to the 1980s. The species apparently has been rare in the state since at least the late 19th century, as indicated by the paucity of observations. Many consider the original reference to its abundance in Maine, "from Maryland to Maine in considerable numbers" (Audubon 1834), to be erroneous. Actual breeding locations are well documented only by recent studies in southern Maine. A broader, historic breeding range in Maine is suggested by reports from widespread, yet sparsely distributed sites. At these, residency was suspected based on observations of territorial behavior during the nesting season.

The species was first collected near Calais in May 1860 (Boardman 1862) and again locally in later years (Smith 1883). At this time, it was characterized as a "rare resident" or "infrequent summer visitant." Knight (1908) indicated that Grasshopper Sparrows likely nested in Maine, although breeding had not been verified by discovery of a nest. Probable nesting was indicated elsewhere by observations of individual singing males on several occasions: in 1901 at Westbrook (Norton 1904) and Pittsfield (Morrell 1902), in 1902 at Unity (Swain 1902), and about 1900 at Lubec (Knight 1908). In a subsequently published report, Perkins (1935) stated that at least 2 pairs of Grasshopper Sparrows had nested at the same location in Berwick for more than 45 years, dating back at least to 1890. The Berwick site was inhabited until at least 1946 (Palmer 1949).

There were no other accounts of Grasshopper Sparrows breeding in the state until observations at the Kennebunk Plains in 1981. However, they are relatively inconspicuous, secretive near their nests, and generally ignored during wildlife inventories until the 1980s. Therefore, considerable uncertainty prevails regarding the historical perspective of Grasshopper Sparrow population status and trends in Maine. Specifically, was the species extirpated for a portion of the 20th century and recolonized suitable habitat a decade or more later, or has it been present all along at low numbers only to be rediscovered in the 1980s?

Historically, significant population fluctuations have been reported in New Hampshire (Griscom 1949), several areas in Massachusetts (Griscom and Folger 1948, Griscom and Snyder 1955, Root 1957), and Pennsylvania (Smith 1963). Declining populations of Grasshopper Sparrows have been widely reported over much of their breeding range during the early years of the Breeding Bird Survey (Eastern BBS Region 1966-1979, -9.9 , $P < 0.01$, $n = 520$; Sauer et al. 2008; Figure 2).

Current Assessment

Grassland bird populations, and Grasshopper Sparrows in particular, have been the focus of several surveys and research studies in Maine for over a quarter century. Vickery (1990a) inventoried habitats potentially attractive to Grasshopper Sparrows in southern Maine (Cumberland and York Counties) during 1984, and later monitored residency and relative abundance of the species during and subsequent to his graduate research at the University of Maine (Vickery 1990b, 1993). Pierce and Melvin (1991) inventoried bird populations at 37 grasslands in central Maine (Hancock, Kennebec,

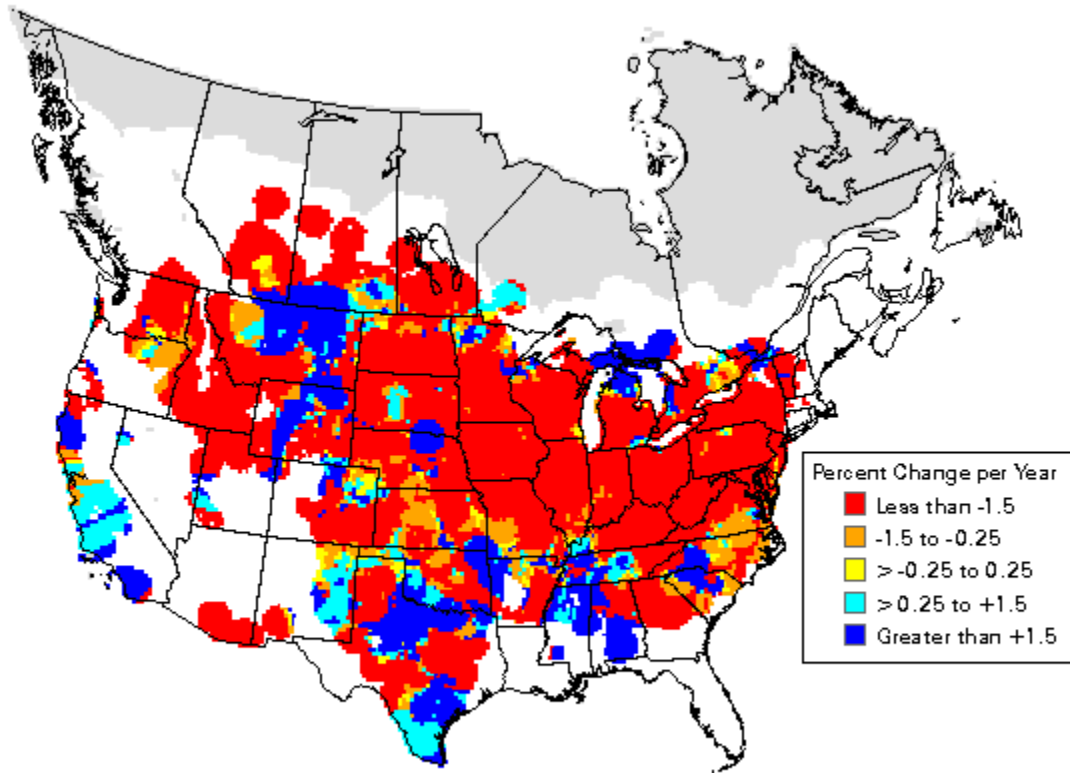


Figure 2. Geographic representation of population trend for Grasshopper Sparrow from North American Breeding Bird Survey, 1966-2003 (Sauer et al. 2008).

Knox, and Penobscot Counties) during 1989. In 1990, Jeff Wells initiated population studies of Grasshopper Sparrows breeding in Maine during graduate research at Cornell University (Wells 1994a). From 1997 to 1998, MDIFW conducted statewide grassland bird surveys (Weik 1999a) as part of a regional effort led by Greg Shriver and others (Shriver et al. 2005). In 2005, 2006, and 2008, staff from MDIFW's Habitat and Bird Groups continued to survey grassland bird populations including revisits to sites inventoried by Weik, as well as at numerous new sites.

A significant breeding population of Grasshopper Sparrows was first documented in Maine at the Kennebunk Plains in 1984 (Table 3). A combined total of 30 singing males was counted there and at nearby Wells Barren. Surveys in 1984 failed to locate additional breeding sites in southern Maine (Vickery 1990a). Territorial Grasshopper Sparrows were subsequently discovered at Brunswick NAS in 1984 (but not enumerated until the following year), and at the Sanford Airport in 1988. A solitary singing male was observed near the Augusta Airport in 1988, 1989, and 1990. Regular monitoring of these 5 sites commenced with the discovery of resident Grasshopper Sparrows at each locality (Table 3).

Breeding abundance has varied somewhat since annual monitoring began. Admittedly, so have the observers and to some extent their methodologies. At Kennebunk Plains, the number of singing males has varied from a high of 49 (2001) to the most recent estimate (2008) of only 10. Only the Kennebunk Plains has been routinely monitored since 2000. However, recent estimates were made at Brunswick NAS (5 singing males in 2005; Seigel and Kaschube 2005) and at Wells Barren (4 singing males in 2002 and 0 in 2008; Schuerman and Kolts 2008). Total number of

Table 3. Numbers of singing male Grasshopper Sparrows recorded at occupied sites in Maine, 1984-1999. Superscripts refer to best source for site-specific estimate for that year. Numbers in parentheses represent a range of estimates found in all available documents. ns=no survey.

Year	Kennebunk Plains	Wells Barren	Brunswick NAS	Sanford Airport	Augusta Airport ³	Statewide Totals
1984	25 ^a (24-25)	5 ^a (5-6)	Present ^b (ns)	ns	ns	30
1985	23 ^c (22-23)	4 ^a	3-4 ^c	ns	ns	31
1986	21 ^d (11?-21)	4 ^a	3-4 ^d	ns	ns	29
1987	11 ^a (11-12)	3 ^a	5 ^a (4-5)	ns	ns	19
1988	15-17 ^e	3-4 ^e	ns ^a	4-5 ^e (4-6)	1 ^f (2?)	27
1989	18 ^a (18-19)	0 ^a	7 ^a	4 ^a	1 ^f	30
1990	25 ^g	0 ⁱ	6 ⁱ	8 ⁱ	1 ^b	40
1991	32 ⁿ	3 ⁱ	5 ⁱ	7 ^k	0 ^b	47
1992	23 ^j (17-23)	3 ^j (3-4)	3 ⁱ	8 ⁱ	0 ^b	37
1993	25 ^l (23-25)	5 ^k	1 ^k (0-1)	6 ^k	1? ^h	38
1994	19 ^h	9 ^h (7-9)	1 ^h	5-6 ^h (9)	2 ^b (1)	37
1995	19 ^o (19-21)	6 ⁱ	ns ⁱ	8 ⁱ	ns	33
1996	17 ^m	7 ⁱ	6 ⁱ (3-6)	15 ⁱ	ns	45
1997	25 ^p	8 ⁱ	15 ⁱ	29 ⁱ	ns	77
1998	18 ⁱ	3 ⁱ	0 ⁱ	9 ⁱ	ns	30
1999	33 ⁱ	6 ⁱ	6 ⁱ	11 ⁱ	ns	56

^a Vickery – Unpublished data (Massachusetts Audubon Society), 9 August 1989.

^b MDIFW – Unpublished data (Maine Natural Heritage Database).

^c Vickery (1986)

^d Vickery (1987)

^e Wells (1988)

^f Todd (1993)

^g Wells (1990)

^h Wells (1994b)

ⁱ Weik (1999b)

^j Wells (1992)

^k Wells (1993a)

^l Wells (1993b)

^m Sferra (1996)

ⁿ Wells (1991)

^o Sferra (1995)

^p Sferra (1997)

singing males across all sites ranged from 19 in 1987 to 77 in 1997. The last year of a complete survey of all sites was 1999 when 56 territorial males were recorded. It's tempting to attribute the spike in abundance at Kennebunk, Sanford, and at Brunswick in 1997 to high survival the previous year, but we have no data to support or refute that speculation. It is clear, however, that at Kennebunk Plains, the number of singing male Grasshopper Sparrows has declined steadily since 1991 (Figure 3). With the 2008 tally of just 10 birds, we have reached the lowest number recorded at this site since monitoring began in 1984.

At a regional scale, Grasshopper Sparrows are not faring well either. First, their rarity is indicated by recognition as "Endangered," "Threatened," or "Special Concern" throughout the northeastern U.S. (Table 4). The Grasshopper Sparrow, an Endangered species in Maine and Connecticut, is listed as a Threatened species in 5 of 8 northeastern states and recognized as a Species of Special Concern in New York. Between 1992 and 2008, 3 southern New England States increased the listing status for this species from Special Concern to Threatened. During this time, no state relaxed its status. Most recent trend data from the BBS describe a species whose population continues to decline across much of North America (Eastern BBS Region 1980-2007, -4.4, $P < 0.01$, $n = 764$; Sauer et al. 2008; Figure 2). Recent communications with officials at Massachusetts Division of Wildlife Resources (S. Melvin pers. comm. with T. Hodgman) indicated that this species is doing well where appropriate habitat management is taking place such as Westover Airbase (200± singing males).

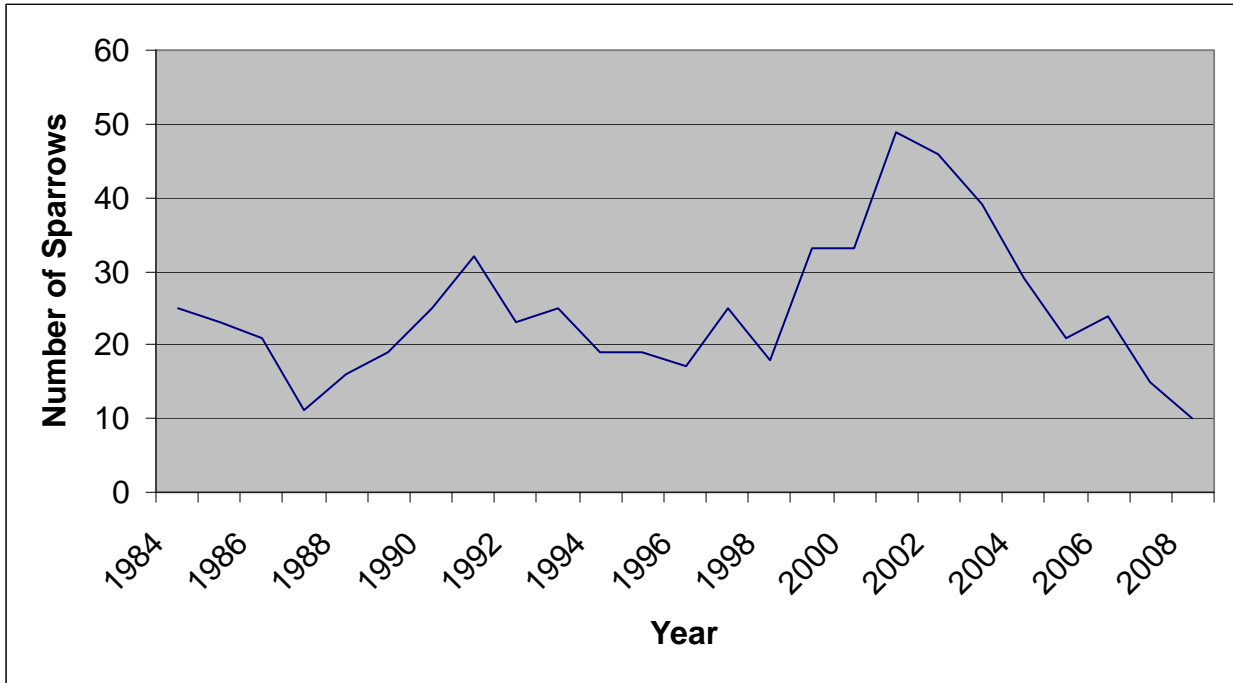


Figure 3. Number of singing male Grasshopper Sparrows at Kennebunk Plains Wildlife Management Area, York County, Maine, 1984-2008.

Table 4. Status of Grasshopper Sparrows in selected states of the northeast region.

State	Status as of 1992	Status as of 2008
Maine	Endangered	Endangered
New Hampshire	Special Concern	Threatened
Vermont	Special Concern	Threatened
Massachusetts	Special Concern	Threatened
Connecticut	No Lists	Endangered
Rhode Island	Threatened	Threatened
New York	Special Concern	Special Concern
New Jersey	Threatened	Threatened

Projections

Studies in New England have reported that local Grasshopper Sparrow populations may fluctuate sharply between years despite continuing presence of seemingly suitable and available habitat (Smith 1963); this is evident in data from Kennebunk Plains for about 1992-2002 (Figure 3). This suggests that in Maine, declines or even extirpations of local breeding populations in the future cannot be ruled out, even if suitable habitat is maintained and indeed may have occurred (or is occurring) at Wells Barren. The likelihood of local extirpations is probably increased by the fact that, at present, Grasshopper Sparrows occur at low densities in Maine and reside at the edge of their breeding range. Furthermore, numbers at Kennebunk are the lowest in 24 years and the Brunswick Naval Air Station is in some form of redevelopment with the military presence there being scaled back significantly.

Wells (1994a) modeled minimum viable population size under various management scenarios for Maine's Grasshopper Sparrow population. He estimated the risk of extinction for the 3 southernmost populations (considered one metapopulation) to be 51% by 2044. Changes in population size among the occupied sites, and variance in population growth rates, strongly influenced viability of Maine's population. Perhaps more importantly, Wells (1994a) demonstrated the importance of immigration from other source populations. He showed that adding just a few immigrants reduced extinction probability to 26%. Although some of the model parameters have changed since 1994, Wells' (1994a) key recommendation is still clear: effective conservation of Grasshopper Sparrows in Maine will require unified efforts with management of other small breeding populations in southern New Hampshire and Massachusetts. This idea acknowledges

the need for further close cooperation of nongovernmental organizations and agencies, as well as for state-state partnerships. Funding may be available for such an effort through a Regional Conservation Needs grant.

Limiting Factors

Historically, Maine has been at the northeastern edge of the breeding range of Grasshopper Sparrow (Smith 1968). The extent to which range limits of this species may be determined by climate, physiology, habitat, or even competition with Savannah Sparrows (Smith 1963) is unknown.

Habitat availability and quality are the primary factors currently limiting the abundance and distribution of Grasshopper Sparrows in Maine. Sandplain grasslands and barrens large enough to support Grasshopper Sparrows are relatively uncommon and are generally restricted to southern and eastern Maine (yet eastern Maine is beyond the current range of the species). If habitat quality is sub-optimal, a site may require larger grassland acreage to support Grasshopper Sparrows, and in Maine, this species is among the more area sensitive grassland birds (Vickery et al. 1994).

Appropriate vegetative cover is a strong determinant of site suitability. Bunchgrasses interspersed with bare ground are invariable traits of breeding habitats for Grasshopper Sparrows in Maine, yet few sites are managed to maintain this condition. Occasional fires are beneficial in preventing litter accumulation and shrub growth while favoring the growth of bunchgrasses and forbs.

Land use changes can influence habitat quality and thus prove to be limiting. Vegetation and habitat quality for Grasshopper Sparrows at both Kennebunk Plains and

Wells Barren was negatively impacted by herbicide use. The construction or expansion of runways, taxiways, or roads at Sanford Airport, or the redevelopment of portions of the Brunswick NAS (or even simply loss of open space via reforestation projects such as was conducted at Bangor International Airport), could reduce the amount of grassland available to Grasshopper Sparrows. Human activities, in lieu of habitat alterations, are potentially disturbing at each of these sites. For instance, despite its conservation ownership, a concern at the Kennebunk Plains is disturbance to nesting birds that might occur if large numbers of ATVs, recreational (or commercial) blueberry pickers, or persons walking dogs off leash visit the site late during the nesting season.

Vickery (1990b) reported that the striped skunk (*Mephitis mephitis*) is the primary nest predator of ground-nesting birds at the Kennebunk Plains. Other potential nest predators or nest parasites, including Blue Jays (*Cyanocitta cristata*), American Crows (*Corvus brachyrhynchus*), Brown-headed Cowbirds (*Molothrus ater*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), snakes (Colubridae), and feral/domestic cats were either not observed or seen infrequently at this study site. The occurrence and relative impacts of nest predators on Grasshopper Sparrows at other breeding sites in Maine are unknown. Also, predator populations could change over time and increases in predator abundance could be locally limiting especially for small populations

USE AND DEMAND ASSESSMENT

Historic Trends

Direct use of and demand for Grasshopper Sparrows have probably always been relatively low. Their small size, drab plumage, secretive habits, and restricted range promote an inconspicuous nature. A lack of any economic incentive for exploitation is also a contributing factor. During the past 25 years, interest in observing Grasshopper Sparrows and preserving the species has undoubtedly increased as the number of birders in Maine has steadily grown.

Current Assessment

Current use of Grasshopper Sparrows is viewing by birders and photographers. The number of individuals that gain enjoyment from actively seeking and observing Grasshopper Sparrows in Maine is unknown, but is probably limited. Although sparse distribution and secretive nesting of this species limit viewing opportunity, demand is apparent: each year from 100 to 200 observers attempt to see Grasshopper Sparrows at the Kennebunk Plains (P.D. Vickery pers. comm. with C. Todd).

In a more general sense, few statistics are available to assess current public use and demand for Grasshopper Sparrows, other endangered species, or even nongame wildlife in general. Recent studies have begun to define current levels of nonconsumptive resource use and demand. Researchers estimated that 56% (U.S. Fish and Wildlife Service 2008) to 91% (Boyle et al. 1990) of the State's adult population are nonconsumptive users of fish and wildlife. Further, of 1 million persons participating

in wildlife-associated recreation in Maine in 2006, 80% participated in wildlife watching compared to 35% for angling and 17% for hunting (U. S. Fish and Wildlife Service 2008). High public demand also is reflected by economic values projected for Maine's wildlife. Boyle et al. (1990) determined that, in 1989, a minimum expenditure of \$50.3 million was made to attract and observe wildlife by in-state residents. The U. S. Fish and Wildlife Service (2008) estimated that total expenditures for wildlife viewing while away from home (by residents + nonresidents) totaled \$865.5 million in 2006.

The demand for conservation of rare flora and fauna, especially those designated as Endangered or Threatened species, is nearly universal, as expressed in Maine's Endangered Species Act:

"The legislature finds that various species of fish or wildlife have been and are in danger of being rendered extinct within the State of Maine, and that these species are of aesthetic, ecological, educational, historical, recreational and scientific value to the people of the State. The Legislature, therefore, declares that it is the policy of the State to conserve, by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend."

Therefore, MDIFW is entrusted to prevent the loss of native wildlife from the state. The use of and demand for rare species is thus a driving force to conservation of Maine's fauna for future generations. These are strongly influenced by public

understanding and sentiment for conservation of endangered species such as the Grasshopper Sparrow.

Projections

Increasing levels of interest in birding, outdoor photography, nature study, etc. are anticipated and should foster an even greater awareness of the diversity of Maine's wildlife resources in the future. Grasshopper Sparrows, and other species for which rarity is likely to prevail for at least another decade, can be expected to receive increased attention. Also, as wildlife managers in Maine address rarity of other grassland species, a growing demand is projected for a conservation strategy focused at this unique natural community to support the assemblage of wildlife dependent on grassland habitats. The Grasshopper Sparrow may well prove to be a species that presents a lasting commitment for an ecosystem approach to management.

SUMMARY AND CONCLUSIONS

Maine's breeding population of Grasshopper Sparrows rose to an estimated 77 nesting pairs (i.e., singing/territorial males) distributed over 5 sites from 1984-1997. In each of those years (except 1997), most singing males were found at the Kennebunk Plains. In Maine, Grasshopper Sparrows reach the northeastern edge of their breeding range. The species is recognized as "Endangered" in Maine. Grasshopper Sparrows are rare in each northeastern state, especially New England, and widespread population declines have been reported across their range for decades.

The distribution of large, sandplain grasslands appears to be fundamentally limiting to the species in Maine. Furthermore, few of these settings are managed to promote maintenance of suitable vegetation structure. Periodic mowing or burning for blueberry cultivation has inadvertently maintained habitat at a few locations. However, habitat quality at 2 sites, Kennebunk Plains and Wells Barren, declined during the mid-1980s as the result of herbicide use. The population at Kennebunk Plains quickly rebounded following changes in ownership and management at the site. Habitat alterations at the hands of man, secondary human disturbances, and losses via natural succession of grasslands are all concerns for the species' future in our state.

Grasshopper Sparrows in Maine may be susceptible to local extirpation because of their limited abundance and sparse distribution. Concerns are mounting for other grassland birds in the Northeast as well.

Many population parameters are undocumented for Grasshopper Sparrows breeding in Maine. Some measure of productivity, and the interchange of individuals among disjunct breeding locations, are crucial to evaluating the self-sustaining potential of these isolated populations and to formulating a regional conservation plan for the species.

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