An Action Plan for the Conservation of State-listed Obligate Grassland Birds in Massachusetts

Grasshopper Sparrow
(*Ammodramus savannarum*)
Photo by: Chris Buelow, NHESP

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

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EXECUTIVE SUMMARY

The purpose of this report is to present a state-wide action plan for two grassland-obligate bird species listed pursuant to the Massachusetts Endangered Species Act (MESA): **Upland Sandpiper** (*Bartramia longicauda*) and **Grasshopper Sparrow** (*Ammodramus savannarum*). The MESA-listed **Vesper Sparrow** (*Pooecetes gramineus*) is included in this plan to a lesser degree but is in need of its own specific action plan. The intention of this plan is to pool the knowledge, resources and management ability of grassland stakeholders in the Commonwealth to initially assess and prioritize conservation needs of these species in the State, and then use these resources to effectively realize specific targeted conservation goals. Although the initial focus of this report is on three MESA-listed species, the greater goal is to eventually develop plans for all grassland-obligate bird species in the State.

In Massachusetts, grassland birds in general and State-listed species in particular have been increasingly confined to a small number of sites, many of which are airports, landfills, and military installations. Notwithstanding the regulatory protections afforded to State-listed species, the long-term prospects for grassland birds at such sites are unclear as airport managers seek to expand/maintain runway safety, and branch out into non-aeronautical uses. Similarly, at military sites, even when habitat needs are taken into account, military uses take precedence over habitat concerns. Recently, a push for solar panel ground installations is putting pressure on grassland bird habitat at a variety of sites including landfills and airfields. Given increasing concerns about the long-term viability of the Commonwealth's grassland bird populations, our purposes here are twofold. First, we identify today's most important breeding sites for State-listed grassland birds and lay the groundwork for long-term action-planning for top-ranking sites in order to ensure the best possible management on an ongoing basis. Second, we identify, and seek to focus additional resources on the restoration and long-term management of State-listed grassland bird habitat on protected open space sites that are (1) large enough to support viable populations in the long-term and (2) where grassland habitat management is the primary goal. Although our present focus is primarily on a state-wide plan for Grasshopper Sparrow and Upland Sandpiper, these species require large patches of suitable habitat for nesting. Conserving adequate habitat for them will benefit the entire suite of grassland birds, as well as other grassland-dependent plants and animals, many of which are also listed pursuant to MESA.

INTRODUCTION

Grassland birds represent one of the fastest declining suites of birds in North America, and for many species, these declines are occurring throughout their range (Askins 1993). Once abundant grasslands associated with the Great Plains and parts of the Midwest have undergone a large-scale transformation to agricultural fields and pasture, and historical disturbances associated with grassland habitat (e.g., fire) have been largely removed from the landscape (Hovick et al 2011). In addition to habitat loss, fragmentation, and degradation, pesticide use has been implicated in playing a leading role in widespread declines of grassland birds in the United States (Mineau and Whiteside 2013). Grassland birds are often found breeding in pastures and hayfields, but these areas are typically composed of cool season grasses inappropriate for some species. Furthermore, heavy grazing or early mowing regimes often result in nest failure for birds nesting in pastures and hayfields.

Although the dominant natural habitat in Massachusetts is forest, grasslands have historically been present, especially along the coastal plain and river valleys where sandy soils have been deposited by glaciers and flooding (Leahy et al. 1996). Following the last glacial period (10,000 years ago), the retreating ice left behind a barren landscape initially colonized by wind dispersed grasses and forbs. This early post-glacial revegetation likely resulted in contiguous grassland from the Great Plains to the New England Coast. Grassland birds would certainly have benefitted from this increase in habitat, and it is thought that they have resided in the region in pockets of habitat since that time (Vickery and Dunwiddie 1997). Support for the concept of a long-term grassland presence in New England is found in the evolution of northeastern endemic grassland dependent birds such as the eastern subspecies of the Henslow's Sparrow (*Ammodramus henslowii susurrans*) and Savannah Sparrow (*Passerculus sandwichensis savanna*).

Although the great majority of New England succeeded to a forested state, some grassland habitat across the landscape has been maintained through periodic disturbance (e.g., natural and anthropogenically induced fire) on coastal and inland areas with dry, sandy soils. Early explorers noted expansive open areas along the northeast coast in Maine, Narragansett Bay, the Hempstead Plains, and Cape Cod (Vickery and Dunwiddie 1997). Many of these large openings

were created and maintained with fire by Native Americans for agriculture and improved hunting opportunities, and small patches of wet grasslands were present following the cyclical abandonment of beaver flowages (Askins 1993).

Habitat for many grassland birds increased following European colonization during the late 18th and early 19th centuries, when approximately 80% of Massachusetts' forests were cleared for agriculture. A century later, as farms in New England were abandoned, the land began to revert back to forest. Massachusetts is currently over 60% forested with many trees now over a hundred years old. The return of the northeastern forest has been a conservation success for many forest-dwelling species but also has resulted in a long term decline of grassland and shrubland birds. While it is often argued that this return to forest reflects a more natural state, this argument overlooks the fact that open, early successional habitats have been an important part of the Massachusetts landscape since the retreat of the Wisconsin Ice Sheet. Many of these grasslands occurred on river flood plains and freshwater tidal zones along coastal rivers and upstream of the salt tide range. The development of coastal and agricultural lands, natural succession, and the reduction of early successional habitats created through disturbance has resulted in a greatly reduced amount of early successional habitats in Massachusetts.

As many native species associated with open habitats continue to decline, their viability in the region has become tenuous. It is now generally recognized by conservation organizations, such as the Massachusetts Division of Fisheries and Wildlife (MADFW), Mass Audubon, The Trustees of Reservation (TTOR), and The Nature Conservancy (TNC), that managing grassland and shrubland habitat in Massachusetts is a conservation priority. Given the ongoing declines of grassland birds in the core of their range (Great Plains and Midwest), managing for these species in the Northeast has increased in importance. Although the ephemeral nature of grasslands makes managing them a challenge, such management is necessary to maintain the Commonwealth's full biodiversity.

WHY THIS PLAN NOW?

In Massachusetts, grassland birds in general and state-listed species in particular are confined to a small number of sites, many of which are airports, landfills, and military installations. Airport managers are increasingly compelled to reduce the amount of grassland habitat on their property

as they seek to expand, maintain runway safety, and branch out into non-aeronautical uses. Similarly, at military sites, even though official policies recognize the need to take habitat needs into account, military uses take precedence over habitat concerns. Recently, efforts to encourage diversity in the energy sector have resulted in a push for solar panel installations in open habitats (e.g., landfills, airfields), which can adversely impact grassland bird habitat at these sites.

Given concerns about the long-term viability of the Commonwealth's grassland bird populations, the primary purposes of this report are to identify the most important breeding sites for state-listed grassland birds today and to initiate a long-term action planning and implementation process for top-ranking sites in order to ensure the best possible management on an ongoing basis. Specifically, we seek to identify, and focus additional resources on the expansion, restoration, and management of state-listed grassland bird habitat on protected open space sites that are large enough to support viable populations in the long-term and where grassland habitat management is a primary goal.

As many grassland birds continue to decline, the Massachusetts Division of Fisheries & Wildlife must make decisions about how best to use grassland bird mitigation funds associated with MESA permitting. These funds must be used exclusively to benefit the state-listed grassland bird species impacted by specific development projects for which a MESA permit was issued. These primarily involved Grasshopper Sparrows and Upland Sandpiper habitat. Off-site mitigation is one option that is generally available to project proponents seeking Conservation & Management Permits (321 CMR 10.23). The site prioritization contained in this report is intended to guide proactive conservation efforts on behalf of state-listed grassland birds including the use of MESA mitigation funds.

GRASSLAND BIRD BIOLOGY

The three species targeted in this report are obligate grassland species with a similar breeding range that extends from Alberta to the northeastern Atlantic Coast. The core of their ranges lies in the Great Plains with sporadic occurrences throughout the majority of their broad breeding distribution. All three species have experienced long term population declines throughout the majority of their range, especially in eastern North America.

Between 1966 and 2010, Grasshopper Sparrows, Upland Sandpipers, and Vesper Sparrows throughout eastern North America experienced annual declines of -4.85%, -3.36%, and -2.58%, respectively, resulting in region-wide population reductions of 89%, 78%, and 68% (Sauer et al. 2011). In Massachusetts, the majority of Upland Sandpipers and Grasshopper Sparrows are found on cultural grasslands at military bases and municipal airports, and the largest population of both species occurs at Westover Air Reserve Base (hereafter referred to as Westover) in Chicopee, MA (Houston et al. 2011). Over the last several decades, Grasshopper Sparrows have been documented during the breeding period at 44 sites in Massachusetts, but almost half of these had only 1-2 singing males. Only a few sites had more than 10 pairs of Grasshopper Sparrows, and sites with fewer than 10 pairs are highly vulnerable and frequently become locally extinct (Jones 2000).

Declines of Upland Sandpiper and Grasshopper Sparrow populations are primarily thought to be a result of habitat loss, fragmentation, and degradation. In general, declines of grassland birds in New England are attributed to agricultural intensification and forest regeneration following farm abandonment (Askins 1993). Both species are considered to be area-sensitive, meaning that they are **only found nesting in large patches of suitable habitat**. Upland Sandpipers are rarely found in grassland patches smaller than 125 acres, and grasslands of this size only support small numbers of Grasshopper Sparrows (Vickery et al. 1997, unpubl. data from Massachusetts in NHESP files).

Suitable habitat can be created for both species, but this requires continued maintenance through prescribed burning, mowing, herbicide application, and/or low intensity grazing. Prescribed fire has been successfully implemented as a management tool in late summer/early fall or late winter/spring but not during the breeding season. Similarly, mowing during the breeding season has been documented to cause large scale nesting failure by grassland birds (Kershner and Bollinger 1996, Perlut et al. 2006), and a deferred mowing regime (after August 1) is recommended if managing for grassland birds. One way to promote late-season mowing is to encourage the growth of native warm season grasses (e.g., Little Blue Stem, Indian Grass), which mature later than the cool-season grasses allowing for mowing to be delayed until after the peak nesting period. Mowing height may also be a determinant on how detrimental it is to nesting birds. Preliminary results from research at Westover by the New Jersey Audubon

Society documented lower than expected nesting failure of grassland birds caused by their mowing regime of maintaining grass height between 7-14 inches. The relatively high mowing height was found to leave many nests unharmed. Although encouraging, the Westover results are compromised by small sample sizes and should be interpreted with caution (Peters and Allen 2011).

UPLAND SANDPIPER: The Upland Sandpiper, once a common breeding bird in North America, is a terrestrial shorebird of grassland mosaics using tall, dense vegetation for nesting and more open areas with shorter grass for foraging. In the 1800s and early 1900s, habitat loss and overexploitation from market hunting in both North and South America drove this species to the brink of extinction (Dettmers and Rosenberg 2000). Current declines are primarily caused by the loss of extensive patches of suitable breeding habitat, and the Upland Sandpiper is classified as state endangered, only known to breed at a handful of sites in Massachusetts (Table 1). Breeding birds begin arriving in Massachusetts by mid April and depart in July and August for their wintering grounds in the Pampas of South America. Upland Sandpipers lay an average of 4 eggs (range 2-7; Houston et al. 2011) and are a single brooded species, though they may re-nest following an initial failed nesting attempt. Eggs are incubated by both sexes for approximately 24 days, and the young are precocious and gain flight and independence from adults approximately 30 days following fledging (Houston et al. 2011).

GRASSHOPPER SPARROW: The Grasshopper Sparrow is a migratory species that winters in the southern United States, Mexico, and the Caribbean. Like the Upland Sandpiper, the Grasshopper Sparrow prefers large patches of habitat for nesting and is generally absent from small patches (< 75 acres, Vickery 1996) of otherwise suitable habitat (see Table 1 for range of habitat sizes with Grasshopper Sparrows in Massachusetts). In Massachusetts, grasshopper sparrows are found almost exclusively in grassland dominated by warm season bunch grasses. Although the Grasshopper Sparrow is subject to brood parasitism by the Brown-headed Cowbird, such parasitism levels are generally low and probably have little effect on the population. The species lays an average of 4.3 eggs (range = 3-6) per nest and is capable of double brooding, i.e. producing 2 sets of young in a single breeding season (Vickery 1996). The female incubates eggs for 11-13 days and altricial young are fed in the nest for 9 days before

fledging. Upon leaving the nest, fledglings are initially flightless and for 3-4 weeks remain dependent on their parents before dispersing away from their natal territory (Vickery 1996).

VESPER SPARROW: The Vesper Sparrow breeds in open habitats characterized by areas with some shrub cover, bare ground, and patchy herbaceous cover (Jones and Cornely 2002). Like the Grasshopper Sparrow, this species can produce multiple broods in a given breeding season, has a mean clutch size of 4 eggs (range 1-6), and is subject to parasitism by the Brown-headed Cowbird (Jones and Cornely 2002). The female incubates eggs for 12-13 days. Nestlings leave the nest approximately 9 days after hatching, and fledglings continue to be dependent on parents for another 3-4 weeks. The Vesper Sparrow commonly breeds in agricultural areas and can be found in potato and soybean fields in the Connecticut River Valley in Massachusetts (Buelow pers. comm.). A primary reason for nest loss in agricultural habitat is from mechanical field operations. For example, one study showed that only 2% of nests successfully fledged young in crop fields in Iowa (Stallman and Best 1996). Utilizing agricultural fields for breeding also makes Vesper Sparrows vulnerable to agricultural chemicals, and their decline has been partially attributed to pesticide exposure (Jones and Cornely 2002). Vesper Sparrows breeding in agricultural areas would benefit from reduced pesticide use and tillage operations during the breeding period (Rodenhouse and Best 1983). Unlike Grasshopper Sparrows and Upland Sandpipers, Vesper Sparrows can be found in small habitat patches (< 25 acres, Jones and Cornely 2002), and this may be related to their propensity to use woody vegetation within grasslands and forest edges (Bent 1968).

In addition to our three target species, nearly the entire suite of grassland birds is undergoing range-wide population declines, and this is especially noticeable in Massachusetts. According to the North American Breeding Bird Survey (United States Geological Survey), annual declines for species in this group are 9.6% for Eastern Meadowlark (*Sturnella magna*), 6.2% for American Kestrel (*Falco sparverius*), 4.9% for Field Sparrow (*Spizella pusilla*), and 3.1% for Savannah Sparrow (*Passerculus sandwichensis*) in Massachusetts between 1966 and 2010 (Sauer et al. 2011). These species, once common in Massachusetts, are becoming increasingly uncommon and have become focal species in the State Wildlife Action Plan (SWAP) and MassAudubon's State of the Birds Report. Reasons for declines of these species are likely multifaceted, but habitat loss certainly plays a role.

How Was This Report Developed?

The project team consisted of an inter-organizational partnership that included experts in avian ecology and habitat management from the Massachusetts Division of Fisheries & Wildlife, Mass Audubon, The Trustees of Reservations, The Nature Conservancy, and other organizations. We employed a two-step process for ranking all known Upland Sandpiper and Grasshopper Sparrow breeding sites in Massachusetts (Figure 1).

First, sites were ranked for their current contribution to Grasshopper Sparrow and Upland Sandpiper conservation in Massachusetts based on their relative abundance of these two species during the breeding period. Vesper Sparrow distribution is far less predictable and they tend to occupy field edges and recently disturbed areas. Therefore, Vesper Sparrow distribution did not factor directly into site ranking. Site ranking was based on a simple categorization of the putative number of singing male Grasshopper Sparrows and total abundance of Upland Sandpipers at each site during the breeding season (May-July), with both species given equal weight (Table 1). The numbers of birds at each site were determined after reviewing bird surveys and reports submitted to the Massachusetts Natural Heritage and Endangered Species Program. We considered including site acreage in the ranking system, but area was dropped because of its close correlation with abundance of both Grasshopper Sparrows and Upland Sandpipers.

The second step was to determine which sites, through active conservation, should be focused upon for their long-term *potential* to maintain regionally sustainable populations for Grasshopper Sparrow and Upland Sandpiper. The intention of this exercise was to identify the State's top priority sites for restoration, expansion and/or acquisition in order to maximize the relevance of conservation efforts for the two focal species, and to help clearly define and prioritize conservation actions. Sites were prioritized through a process of assessing their "Long-term Management Potential". This included taking into account the current and potential size of each site, its protected status, and likelihood for continued management. This was accomplished by employing a suite of criteria designed to capture a site's "Long-term Management Potential" (Table 2). These criteria were:

Current Area: The area of functioning Grasshopper Sparrow and Upland Sandpiper habitat currently at each site.

Potential Area: The maximum amount of habitat that a site could support if conservation actions such as grassland expansion, restoration and/or the acquisition of adjacent parcels were to be fully realized. This accounted only for the *physical* potential of a site, not economic or political limitations, and we considered such factors as topography, soil composition, and hydrology.

Ownership: This took into consideration whether the parcels were owned by DFW, the U.S. Military, Federal, State or local government, non-profit conservation organizations, or individual landowners. Long-term ownership is a primary factor in estimating the feasibility of managing a site into the future.

Protected: The legal status of a site in terms conservation protection (e.g. state-owned conservation land, non-profit conservation land, land protected by a conservation restriction). Land under a management plan resulting from required mitigation under a MESA permit was *not* considered to be protected.

Current Management: Whether or not a site is currently receiving active management specifically for the benefit of grasshopper sparrow and upland sandpiper habitat. Land under a management plan resulting from MESA mitigation *was* considered to be under active management.

Future Management Likelihood: This considers both the current owner's willingness and ability to manage for grassland habitat, as well as factors affecting future ownership. Land under a management plan resulting from MESA mitigation is assumed to only be under active management for the duration of the management plan.

The management potential of each site was evaluated based upon a qualitative, expert assessment of multiple criteria and scored on a scale from 0-5. Ultimately, *Potential Size* and *Likelihood for Future Management* became the two most important criteria in the evaluation. This is not surprising; larger sites generally support larger populations, and sites where managers can have confidence that their short-term investments will return long-term productivity are attractive for obvious reasons. By selecting large sites that are protected for conservation and have a

demonstrated likelihood to be managed indefinitely, the project group identified what should be the most logical sites to invest resources for proactive management.

RESULTS

The results of the analyses of (1) current importance and (2) long-term management potential of all known, extant Massachusetts Grasshopper Sparrow and Upland Sandpiper breeding sites are shown in Tables 1 and 2. As can be seen from the rank scores in Table 1, sites can be grouped into tiers of importance, with the especially large populations of Grasshopper Sparrow and Upland Sandpiper at Westover Air Reserve Base standing alone in terms of its significance. A second tier of sites that make an important contribution to the Massachusetts population include the Massachusetts Military Reservation (MMR), Nashawena Island, Westfield-Barnes Airport, Fort Devens, Hanscom Field, Plymouth Airport, and Logan Airport (Composite Rank 2-7, Table 1). A third tier of sites that also are important include smaller airports, Wildlife Management Areas (Frances Crane and Southwick) and capped landfills (Composite Rank 9-12, Table 1).

The potential of each site for supporting breeding Upland Sandpipers and Grasshopper Sparrows and for ongoing restoration is displayed in Table 2. Sites that are owned by a conservation organization (e.g., Mass. Division of Fisheries and Wildlife) that has the intent to specifically manage for these species for posterity were given high priority.

Top Priority Restoration Sites: Frances Crane and Southwick Wildlife Management Areas (WMAs) ranked as having the highest restoration potential, based on State ownership and their potential for substantial grassland expansion, thereby providing habitat for both Upland Sandpiper and Grasshopper Sparrow. Specifically, Southwick WMA currently supports a moderate population of grasshopper sparrows and includes 163 acres of contiguous grassland habitat. Furthermore, Southwick directly abuts an additional 196 acres of grassland owned by the Connecticut Department of Environmental Protection (DEP) and managed for grassland birds. Frances Crane WMA in Falmouth also currently supports a moderate Grasshopper Sparrow population, occasionally Upland Sandpipers, and its 175 acres of contiguous grassland is likely to be doubled through standard grassland restoration. Frances Crane is adjacent to the ~2,000 acre MMR, offering a very large area of habitat for grassland birds.

Nashawena Island and Bolton Flats WMA also are considered sites with high restoration potential but rank slightly below Southwick and Frances Crane WMAs, due to ownership (Nashawena) and size (Bolton Flats) constraints. Nashawena hosts the second largest population of Grasshopper Sparrows in the State and likely represents a source population for the coastal region. Past management practices on the Island have greatly benefitted this population and working with landowners on the Island to develop a management plan that simultaneously meets their goals while continuing to support a significant grassland bird population is a high priority. Bolton Flats WMA is owned by DFW, supports modest Grasshopper and Vesper Sparrow populations, and has the potential to expand to 150 acres of grassland habitat.

While the above four sites hold the greatest potential for active, long-term restoration of sandplain grassland habitat, this is but one avenue of rare grassland bird conservation. Management of priority habitat on airfields, landfills, and other similar properties remains one of the most important tools in continuing the viability of rare grassland birds in the State. This, complimented by land protection/acquisition, outreach (the development and dissemination of best management practices for grasslands), and active monitoring and research are the components of developing a comprehensive strategy for grassland bird conservation in Massachusetts.

DISCUSSION

Maintaining a healthy and sustainable population of the state-listed Upland Sandpiper and Grasshopper Sparrow will largely depend on the future conservation and management efforts at sites currently identified in the top two tiers of sites that make the highest current contribution to the Massachusetts populations. These sites are effectively captured in Table 1 as those with a Composite Rank $\leq$ 12.

Rankings Based on Current Abundance

Tier I

Westover offers an extensive area of grassland habitat and hosts the highest breeding populations of Grasshopper Sparrows and Upland Sandpipers in New England (Jones et al. 2001, Melvin 2012). Westover is thought to represent a source population that, through emigration, plays a critical role in supporting smaller populations of these species at other sites throughout the region (Jones 2000). Because a crash of the Westover population could result in regional extirpation, it is important to work with airfield managers to identify a mowing regime that is conducive to both aircraft safety and grassland bird viability, and to refine habitat management practices (e.g. prescribed fire, invasive plant control) to ensure that suitable grassland continues to support rare grassland birds. Because Westover currently plays such a vital role for both Upland Sandpiper and Grasshopper Sparrow in the Northeast, it is important to continue to monitor the population status and nesting success of these species at the site in relation to grassland management.

Tier II

There are 18 sites that support a variable number of Upland Sandpipers and/or Grasshopper Sparrows (Composite Rank = 2-12, Table 1). These sites are quite diverse in their size and management strategies and can be grouped into municipal airfields (8 active and 1 abandoned), military bases (2, with 1 containing an airfield), Wildlife Management Areas (2), landfills (1), and several miscellaneous sites (Table 1). Sustaining populations of Uplands Sandpipers and Grasshopper Sparrows at these sites is key to implementing a successful state-wide conservation plan for these species. At many of these sites MESA has become a critical conservation tool.

Extensive patches of continuous grassland habitat are common at municipal airports and military reserves, and the grassland mowing regime employed is going to largely dictate what species use the habitat and whether it can support sustainable populations of grassland birds of conservation concern. Together, these Second Tier sites represent a vital contribution to the State's grassland bird population in terms of both number of birds and acres of habitat. Although the primary directive for most of these Second Tier sites is for resources other than grassland bird conservation (e.g. aircraft safety, landfill operation), many of these sites have continued to function as important habitat, particularly due to MESA involvement. Examples of mutually beneficial resource management at Second Tire sites through MESA involvement have resulted in key populations at MMR, Westfield-Barnes Airport, Plymouth Airport, Hanscom Field, Ft. Devens, Turners Falls Airport, Worcester Landfill, Clinton Landfill, and Orange Airport.

Continuing to work with managers at these sites to protect key breeding areas, identify appropriate mowing regimes, and manage habitat for sandplain grassland bird species is critical for the continued presence of these species in the Commonwealth.

Ranking for Proactive Restoration

In most cases, grassland birds will need to be managed at sites such as airfields, where the primary function is not bird conservation. However, the management of sites where ownership is committed to supporting long-term grassland bird conservation provides an important complimentary piece to the overall grassland conversation strategy in Massachusetts. Though the number of sites dedicated to grassland bird management are somewhat limited by site ownership, size and available resources, several important opportunities for relevant conservation actions exist. In general, using resources to fund habitat management/restoration (e.g. prescribed fire, woodland conversion, invasive plant control), grassland protection/acquisition, the development of best management practices, the purchase of management equipment, and landowner outreach (e.g., NRCS) should play a significant role in future planning. Specifically, through this exercise, we have identified four sites where ongoing management could result in the long-term viability of key grassland bird sites. These are Frances Crane WMA, Southwick WMA, Nashawena Island, and Bolton Flats WMA.

Both Frances Crane and Southwick Wildlife Management Areas are currently being managed for grassland birds, support moderate Grasshopper Sparrow populations, and are large enough to attract the entire suite of grassland birds. They each have a detailed management plan that includes a combination of grassland expansion, prescribed burning, mowing, invasive plant control, tree harvesting, and controlling illegal ATV activity. At both sites, there is a realistic potential, through a combination of grassland expansion and restoration, to significantly increase breeding habitat for grassland birds from 163 to 363 acres at Southwick and 175 to 325 acres at Frances Crane.

Through a multi-state partnership between the Massachusetts Division of Fisheries and Wildlife and the Connecticut Department of Environmental Protection the Southwick WMA was purchased in 2008, specifically for the conservation of grassland birds. The land, a former tobacco farm, included 254 acres in Massachusetts and 196 acres in Connecticut. Both states

manage the land for Upland Sandpipers and Grasshopper Sparrows, and, if its full grassland potential is realized, it could become one of the more important populations of rare grassland birds in the State's interior.

The northern portion of the Frances Crane WMA represents a large sandplain grassland that has benefitted from an active management program since 2000 (Buelow 2005). This has revived the grassland community and resulted in an increase of many state-listed species, including a tripling of Grasshopper Sparrow numbers. In total, 19 state-listed species have been documented on this WMA including Grasshopper Sparrow, Upland Sandpiper, Vesper Sparrow, plants, butterflies, moths, beetles, and reptiles. Doubling the size of this already important grassland, especially considering its close proximity to MMR, could result in the development of a significant site for grassland birds along the coast.

Nashawena Island is privately owned and is under a Conservation Restriction held by The Trustees of Reservations. The island has approximately 600 acres of grassland habitat that supports the second largest grasshopper sparrow population in the State. This population is largely the result of management employed by the landowner, which consisted of a combination of prescribed fire and controlled grazing. Working with the landowner to enable this type of management on the Island to continue is a key step in sustaining this population.

Bolton Flats WMA is state owned property that holds promise for grassland bird conservation. Although grassland habitat at this site is currently limited in size (31 acres), there is potential to expand the area to include ~150 acres of suitable habitat for grassland birds. The next steps to be taken at Bolton Flats are to develop a site specific management plan for grassland birds, followed by grassland restoration (seeding and prescribed fire) and expansion.

Grassland Birds

Monitoring Grasshopper Sparrow and Upland Sandpiper breeding populations at the remaining grassland habitat across the commonwealth will be important not only to generate estimates of overall population totals, but also to evaluate the success of grassland management allowing an adaptive management approach to support the continued existence of these species in Massachusetts. Adaptive management is the iterative process of using the most current knowledge to design future management, and it will allow us to implement our short-term

objectives while simultaneously planning for the future. In a best case scenario, we would like to undertake future surveys to estimate the numbers of breeding birds at all known nesting locations of Upland Sandpipers and Grasshopper Sparrow and evaluate reproductive success at select sites (e.g., Westover, Southwick, Frances Crane). Evaluating nesting success is important because it is a better indicator of habitat quality than species abundance. Some habitats act as ecological traps where species are attracted to a particular area despite negative aspects associated with that habitat patch (e.g., early mowing), causing reduced survival or breeding success. Because the current population of Upland Sandpipers and Grasshopper Sparrows are concentrated at Westover, it is important to have a continued monitoring effort there, and this is especially the case if the grassland management regime is modified in the future. It also would be beneficial for managers to implement controlled experiments at Westover and other high-priority sites to isolate and directly assess the effects of management actions. We suggest that a state-wide monitoring protocol be developed to determine the frequency, comprehensiveness, and types of surveys to be conducted. We recognize that conducting surveys can be costly, and it is possible that mitigation funds could be used for this purpose.

This plan focuses on Upland Sandpipers and Grasshopper Sparrows because they are state-listed grassland obligate species, and mitigation funding has been acquired to support these species in Massachusetts. However, the Vesper Sparrow, listed as threatened under MESA, should also benefit from this plan as they are documented at 9 of the top 18 sites (Table 1). In addition to those sites, Vesper Sparrows are also known to nest in the dunes of Cape Cod National Seashore and throughout the tilled agricultural fields of the Connecticut River Valley. The aggregation of these fields supports the primary Vesper Sparrow population in Massachusetts. As part of a separate process, we plan on discussing how to best move forward with Vesper Sparrow conservation in Massachusetts.

Although this plan doesn't directly address all grassland birds, the large grasslands being targeted for the conservation of Upland Sandpipers and Grasshopper Sparrows will benefit the entire suite of grassland birds (e.g., Eastern Meadowlark, Bobolink) as well as species of concern in other taxonomic groups (e.g., reptiles, invertebrates, plants). Additionally, there are other grasslands in Massachusetts that support important populations of non-listed grassland birds including agricultural lands, landfills, utility rights-of-way, and airfields. Such sites include the

Conte National Wildlife Refuge, the Common Pasture in Newburyport, Woodsom Farm in Amesbury, and Mass Audubon's Daniel Webster Wildlife Sanctuary. Although it is not within the scope of this report, we recognize the need to directly address the conservation of all grassland birds by developing best management practices for grassland habitats throughout the Commonwealth.

Climate Change

Although climate change is projected to have profound impacts on some ecosystems in Massachusetts over the next 100 years, it is not predicted to have a drastic effect on the amount of upland grassland habitat in the northeast. Although future changes and their effects remain uncertain, an increasingly unstable climate is forecasted in the northeast, resulting in both more precipitation in winter and drought in summer (Rustad et al. 2012). Because many species of grasses are drought tolerant, grasslands are largely thought to be resilient to these projected changes (Craine et al. 2013). Still, relative stability is predicted for the eastern North American biome with the majority of habitat remaining in a forested state (Rehfeldt et al. 2012). Although, rising ocean levels pose a clear threat to coastal estuaries and wetlands, the upland grasslands that host Grasshopper Sparrows and Upland Sandpipers are not subject to this same risk. As a result of this, and because current grassland habitat in the state is anthropogenically maintained, climate change was not directly incorporated into this action plan.

Next Steps

This document provides the foundation for instituting a state-wide grassland bird conservation plan in Massachusetts. There remains a need to develop a long-term monitoring plan and action list for all sites and to refine the management plans for the top ranked restoration sites. To evaluate progress and ensure all of the partners continue to be engaged in this process, we would like to have annual meetings involving all organizations interested in grassland bird conservation in the State. Also, because nearly the entire suite of grassland birds is in decline in Massachusetts, we would like to expand on this plan to develop strategies focused on conserving the full complement of grassland birds.

CONCLUSION

The Massachusetts Endangered Species Act lists the Upland Sandpiper as endangered and the Grasshopper Sparrow as threatened, and both are part of our natural heritage and in urgent need of conservation. This plan identifies all known sites where these species have been documented during the breeding period, and an expert panel from several organizations ranked the sites in terms of their current importance and long-term restoration potential. Four sites were identified as the highest priority for use of the MESA mitigation funding. This report represents an early phase of establishing a multi-organizational partnership aimed at conserving grassland birds in Massachusetts. Without actively restoring large expanses of grassland habitat, the future of Upland Sandpipers and Grasshopper Sparrows in Massachusetts is tenuous. This plan lays the groundwork to maintain sustainable populations for these species and, ultimately, the entire suite of grassland birds in Massachusetts.

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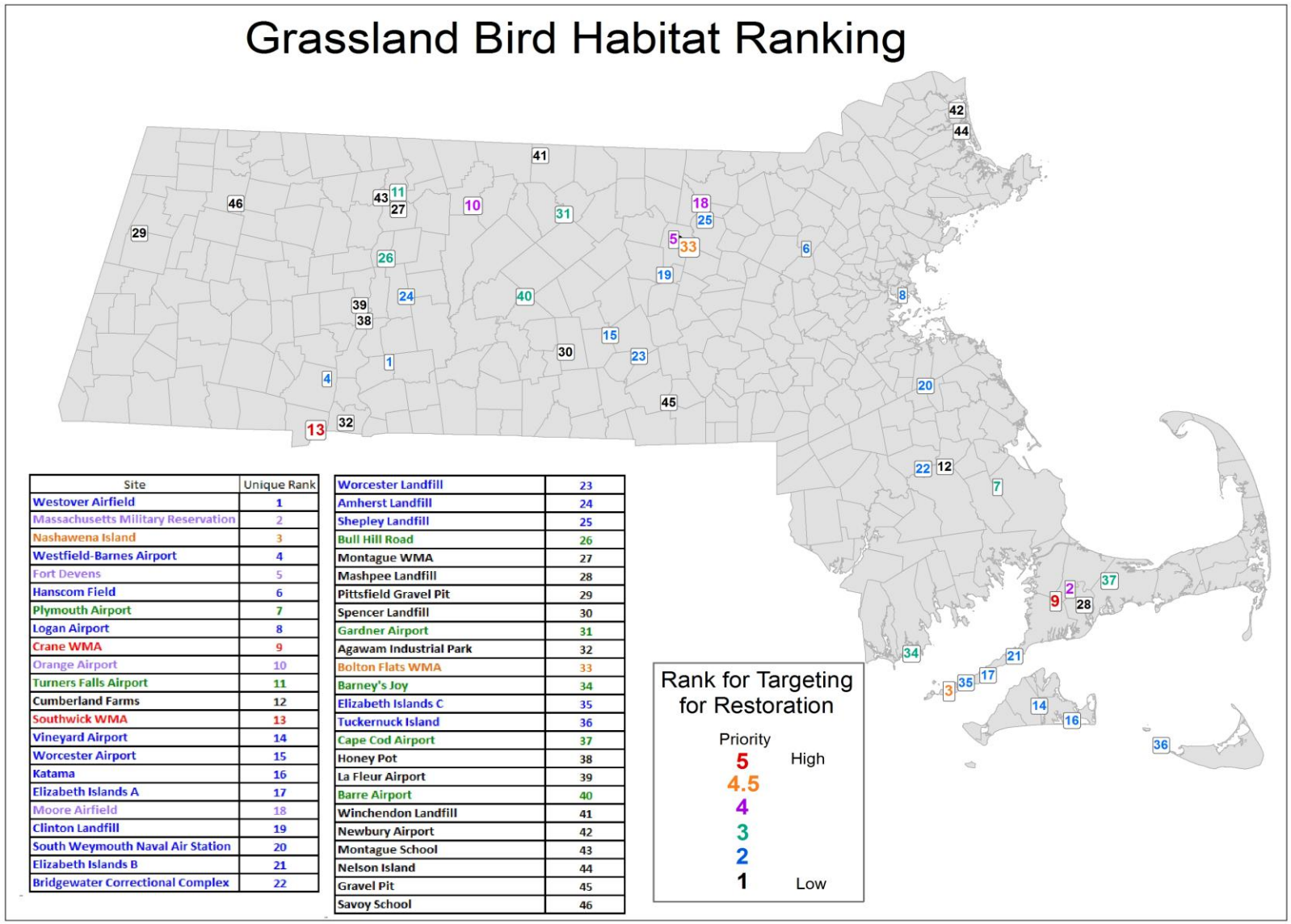
Figure 1. Locations and rankings of all sites in Massachusetts known to have Upland Sandpipers or Grasshopper Sparrows since 1990.



Site	Unique Rank
Westover Airfield	1
Massachusetts Military Reservation	2
Nashawena Island	3
Westfield-Barnes Airport	4
Fort Devens	5
Hanscom Field	6
Plymouth Airport	7
Logan Airport	8
Crane WMA	9
Orange Airport	10
Turners Falls Airport	11
Cumberland Farms	12
Southwick WMA	13
Vineyard Airport	14
Worcester Airport	15
Katama	16
Elizabeth Islands A	17
Moore Airfield	18
Clinton Landfill	19
South Weymouth Naval Air Station	20
Elizabeth Islands B	21
Bridgewater Correctional Complex	22
Worcester Landfill	23
Amherst Landfill	24
Shepley Landfill	25
Bull Hill Road	26
Montague WMA	27
Mashpee Landfill	28
Pittsfield Gravel Pit	29
Spencer Landfill	30
Gardner Airport	31
Agawam Industrial Park	32
Bolton Flats WMA	33
Barney's Joy	34
Elizabeth Islands C	35
Tuckernuck Island	36
Cape Cod Airport	37
Honey Pot	38
La Fleur Airport	39
Barre Airport	40
Winchendon Landfill	41
Newbury Airport	42
Montague School	43
Nelson Island	44
Gravel Pit	45
Savoy School	46

Table 1. A ranking of all sites in Massachusetts known to have Upland Sandpipers and/or Grasshopper Sparrows during the breeding season. The rank scores are on a range of 0-10 and are based on the numbers of birds present during the breeding season and include data collected since 1990. Vesper Sparrows were not documented in high numbers at any of the sites, and their presence (y=yes, n=no) or absence was not directly incorporated in to the composite rank, but this criterion can be used to order sites with an identical ranking. The rank score is the summation of the scores for GRSP rank and UPSA rank, and the composite rank orders the sites from best to worst, given the numbers of birds detected at sites. Colored text refers to a site restoration rank score (red = 5, orange = 4.5, purple = 4, green = 3, light blue = 2, black = 1).

Site	Town	Area (acres)	GRSP Rank	UPSA Rank	VESP Presence	Rank Score	Composite Rank
Westover Airfield	Chicopee	1539	10	9	y	19	1
Massachusetts Military Reservation	Sandwich; Mashpee; Bourne	1872	7	3	y	10	2
Nashawena Island	Gosnold	600	9	0	n	9	3
Westfield-Barnes Airport	Westfield	645	6	2	y	8	4
Fort Devens	Lancaster	207	6	1	y	7	5
Hanscom Field	Bedford; Lincoln; Concord	599	3	4	n	7	5
Plymouth Airport	Plymouth; Carver	337	3	3	y	6	7
Logan Airport	Boston; Winthrop	970	2	4	n	6	7
Crane WMA*	Falmouth; Sandwich	175	3	1	y	4	9
Orange Airport	Orange	398	4	0	y	4	9
Turners Falls Airport	Montague	120	4	0	y	4	9
Cumberland Farms	Middleborough	722	0	3	y	3	12
Southwick WMA*	Southwick	163	3	0	n	3	12
Vineyard Airport	Edgartown	409	3	0	n	3	12
Worcester Airport	Leicester; Worcester	364	3	0	n	3	12
Katama	West Tisbury; Edgartown	286	3	0	n	3	12
Elizabeth Islands A	Gosnold	169	3	0	n	3	12
Moore Airfield	Ayer	166	3	0	n	3	12
Clinton Landfill	Clinton	47	3	0	n	3	12
South Weymouth Naval Air Station	Rockland; Abington	539	1	1	n	2	20
Elizabeth Islands B	Gosnold	216	2	0	n	2	20
Bridgewater Correctional Complex	Bridgewater	301	2	0	n	2	20

Worcester Landfill	Worcester	83	2	0	n	2	20
Amherst Landfill	Amherst	79	2	0	n	2	20
Shepley Landfill	Ayer	93	1	1	n	2	20
Bull Hill Road	Sunderland	77	2	0	n	2	20
Montague WMA*	Montague	22	2	0	n	2	20
Mashpee Landfill	Mashpee	18	2	0	n	2	20
Pittsfield Gravel Pit	Pittsfield	25	2	0	n	2	20
Spencer Landfill	Spencer	25	2	0	n	2	20
Gardner Airport	Templeton	80	1	0	y	1	31
Agawam Industrial Park	Agawam	13	1	0	y	1	31
Bolton Flats WMA*	Stow; Bolton; Harvard	31	1	0	y	1	31
Barney's Joy	Dartmouth	73	1	0	y	1	31
Elizabeth Islands C	Gosnold	723	1	0	n	1	31
Tuckernuck Island	Nantucket	213	1	0	n	1	31
Cape Cod Airport	Barnstable	96	1	0	n	1	31
Honey Pot	Northampton	61	1	0	n	1	31
La Fleur Airport	Northampton	41	1	0	n	1	31
Barre Airport	New Braintree	40	1	0	n	1	31
Winchendon Landfill	Winchendon	38	1	0	n	1	31
Newbury Airport	Newbury	58	0	1	n	1	31
Montague School	Montague	15	1	0	n	1	31
Nelson Island	Rowley	17	1	0	n	1	31
Gravel Pit	Sutton; Northbridge	25	1	0	n	1	31
Savoy School	Savoy	9	1	0	n	1	31

*WMA = Wildlife Management Area

Table 2. A ranking of all of the sites known to have Upland Sandpipers and Grasshopper Sparrows during the breeding season based on the potential for restoration activities. Restoration Rank was scored from 0-5, with 5 indicating the highest priority to focus future management and restoration.

Site	Current Area (acres)	Potential Area (acres)	Ownership	Protected	Current Management	Future Management Likelihood	Restoration Rank
Crane WMA*	175	325	DFW	Yes	Yes	Very Likely	5
Southwick WMA*	163	363	DFW	Yes	Yes	Very Likely	5
Nashawena Island	1,360	1,360	Private	Yes (CR)	No	Possible	4.5
Bolton Flats WMA*	31	150	DFW	Yes	Yes	Very Likely	4.5
Fort Devens	207	460	Military	No	No	Unlikely	4
Orange Airport	398	423	Government	No	Yes	Likely	4
Massachusetts Military Reservation	1,872	2,200	Military	No	Yes	Certain	4
Moore Airfield	166	230	Private	Some	No	Possible	4
Plymouth Airport	337	440	Government	No	Yes	Likely	3
Turners Falls Airport	120	150	Government	No	Yes	Likely	3
Bull Hill Road	77	120	Private	No	Yes	Likely	3
Barney's Joy	73	110	Private	Yes (CR)	No	Possible	3
Gardner Airport	80	170	Government	No	No	Unlikely	3
Cape Cod Airport	96	155	Government	Yes	No	Possible	3
Barre Airport	40	90	Private	No	No	Unlikely	3
Westover Airfield	1,539	1,750	Military	No	Yes	Uncertain	2
Hanscom Field	599	599	Military	No	Yes	Likely	2
Logan Airport	970	970	Government	No	Yes	Likely	2
Vineyard Airport	409	430	Government	No	Yes	Likely	2
Westfield-Barnes Airport	645	745	Government	No	Yes	Likely	2
Elizabeth Islands A	169	200	Private	No	No	Possible	2
Katama	286	300	Government	Yes (CR)	Yes	Likely	2
Bridgewater Correctional Complex	301	301	Government	No	No	Unlikely	2

South Weymouth Naval Air Station	539	539	Private	No	Yes	Likely	2
Worcester Airport	364	364	Government	No	Yes	Likely	2
Elizabeth Islands C	723	723	Private	No	No	Unlikely	2
Elizabeth Islands B	216	216	Private	No	No	Possible	2
Tuckernuck Island	213	213	Private	Yes (CR)	No	Possible	2
Clinton Landfill	47	47	Private	No	Yes	Likely	2
Amherst Landfill	79	79	Government	No	Yes	Likely	2
Worcester Landfill	83	100	Private	No	Yes	Likely	2
Shepley Landfill	93	93	Military	No	Yes	Likely	2
Cumberland Farms	722	722	Private	No	No	Possible	1
Honey Pot	61	61	Private	Yes (MAS)	No	Unlikely	1
Pittsfield Gravel Pit	25	25	Private	No	No	Unlikely	1
Winchendon Landfill	38	90	Private	No	No	Unlikely	1
La Fleur Airport	41	41	Private	No	No	Unlikely	1
Mashpee Landfill	18	18	Government	No	No	None	1
Montague WMA*	22	22	DFW	Yes	No	-	1
Spencer Landfill	25	29	Private	No	No	Unlikely	1
Newbury Airport	58	58	Private	No	No	Unlikely	1
Agawam Industrial Park	13	13	Private	No	No	None	1
Montague School	15	15	Government	No	No	-	1
Nelson Island	17	17	NWR	Yes	No	Possible	1
Gravel Pit	25	25	Private	No	No	Unlikely	1
Savoy School	9	9	Private	No	No	Unlikely	1

*WMA = Wildlife Management Are