

II. Regional History of Research and Conservation

Massachusetts

In Massachusetts, where the majority of sandplain grasslands now exist, early work focused on protecting key land parcels, starting in the 1960s. The major players in land protection and subsequent management included the Massachusetts Audubon Society (now Mass Audubon), Massachusetts Division of Fisheries and Wildlife, the Nantucket Conservation Foundation, the Nantucket Land Bank, The Nature Conservancy, The Trustees of Reservations, the Sheriff's Meadow Foundation, and the Martha's Vineyard Land Bank.

By the 1980s many of the key sandplain grassland and heathland parcels had been protected and the focus of conservation groups shifted to management. This change in focus was caused by concerns that sandplain grasslands were gradually succeeding to other community types in absence of the large-scale disturbances, such as fires and grazing, that had occurred in the past (Godfrey and Alpert 1985, Barbour et al. 1998). Shrub encroachment was identified as a major concern (Dunwiddie 1998, Dunwiddie et al. 1995, Dunwiddie and Caljouw 1990, Dunwiddie 1990). Early management efforts throughout the 1980s and early 1990s tested multiple potential techniques to determine their effectiveness at reducing shrub cover and promoting grassland diversity. Techniques tested included prescribed fire, mowing, grazing and herbicide applications.

Mass Audubon, the University of Massachusetts at Amherst, and William Patterson III started studies in 1981 on Nantucket to understand the composition, origins, extent and dynamics of sandplain grassland vegetation communities to develop methods for grassland maintenance and restoration. Fourteen test sites were established in six locations on Nantucket, Martha's Vineyard, and Cape Cod including Tom Nevers, Wellfleet Heathland, Sesachacha Heathlands, Ram Pasture, Wellfleet Grassland, Sanford Farm and Katama Plains (Dunwiddie 1998). By the late 1980s, results showed that merely maintaining present acreage of sandplain grasslands would be a challenge. Summer burning had logistical challenges and woody plants increased in cover with just only dormant season treatments. Recommendations were to explore management methods that more effectively limit shrub encroachment, including herbicide use, disk harrowing and spring burning followed by summer mowing (Dunwiddie 1998).

In 1982, four 0.25-ha permanent plots were established in Ram Pasture on Nantucket to measure cover and frequency before and after biennial treatments that included mowing, spring burning and summer burning. These studies continued for 13 years (P. Dunwiddie, W. Patterson III, Interviews.). The results showed that in untreated plots, the vegetation trended toward heathland species. Summer treatments were most successful at increasing herbaceous species and reducing shrubs (Dunwiddie et al. 1995, Dunwiddie et al. 1997).

On Nantucket, additional studies in the late 1980s and 1990 focused on sheep grazing. Twenty sheep were grazed in four areas in vegetation that ranged from scrub oak-dominated heath at Tom Nevers, to low shrub heath at Shawkemo, to grassy heath at Ram Pasture, and agricultural pasture at Squam. The results showed that heathland vegetation was adapted to moderate grazing pressure. Tall shrubs were not favored by sheep for grazing and it was

challenging to predict the ideal balance of grasses, forbs and shrubs (Dunwiddie 1986). A study conducted in 1990 that compared un-grazed grasslands to adjacent sites grazed prior to 1948 showed that compositional differences were evident even 50 years after grazing. For example, shrubs were the dominant plant form in un-grazed areas while grazed areas had more bare soil patches and more of certain grassland-associated species (Dunwiddie 1997). The Nantucket Conservation Foundation compared the effects of growing season prescribed sheep grazing and mowing on promoting grassland habitat on former agricultural land at Squam Farm. This project from 2005-2008 documented that mowing and grazing were both effective at reducing shrub cover and increasing graminoid cover to some extent, but sheep grazing was more effective at creating patches of bare ground (Beattie et al. 2017).

In summary, this early research determined that various management techniques including burning, mowing, and grazing could be effective at maintaining sandplain grasslands. However, without implementation of aggressive management methods during the right season, shrub encroachment and loss of grass and forb diversity would be ongoing issues.

As a result of the above research, many organizations by the late 1990's attempted to initiate management techniques and particularly prescribed fire at a larger landscape scale. This goal was made challenging by a profession-wide trend towards requirements for increased training and certifications as well as concerns about liability associated with implementing prescribed fire. These challenges drove the formation of partnerships to share both information and fire professionals, with the goal of effectively applying prescribed fire to a larger landscape.

On Nantucket, the Partnership for Harrier Habitat Preservation (PHHP) was formed in 1997, in response to the issuing of the first Massachusetts Endangered Species Act (MESA) conservation permit, which required a partnership to fund more than 405 ha (1,000 acres) of habitat management for mitigation of development of a golf course. The PHHP provided funding for and oversaw the management of large-scale acreages of grassland, heathland and scrub oak barren on protected conservation land using prescribed fire and brush cutting to promote habitat for northern harriers, a species that was impacted by the development of the golf course. Most of the funding provided was spent during the first 10 to 15 years of the project and the management of these sites is now being undertaken by the landowners (the Nantucket Conservation Foundation and Mass Audubon).

On Martha's Vineyard, the premiere sandplain grassland site, Katama Plains, was protected in 1985 by the Town of Edgartown and The Nature Conservancy. Management at Katama started in 1986 and has continued to the present. In 1991, several conservation groups on Martha's Vineyard started a coalition called the Sandplain Restoration Project. The Project had wide ranging goals from inventory, research and prioritization, to mutual assistance during restoration, as well as public outreach and regulation change. The project ended when the main goal was achieved: making prescribed burning a publicly accepted, professionally delivered, and well-established practice. During the same time period, several conferences focused on sandplain habitat management and in conjunction, organizations and agencies on the Vineyard worked together to apply prescribed fire. Since 2010, fire management has once again shifted from staff and volunteers to the increased use of professional crews and contractors because of the challenges and costs of maintaining individual fire programs.

Despite these partnerships and an increased capacity to conduct management, and despite early research-based management recommendations for summer (growing season) prescribed fire, these recommendations have not been realized in part because greater development and tourism across Southeastern Massachusetts and the Islands has limited the seasons when managers can apply prescribed fire without large summer public impacts. Additionally, further research examining the influence of fire on sandplain grasslands indicated that fire alone may not be effective at maintaining many sandplain grassland sites (Motzkin and Foster 2002, Dunwiddie 1998, Niering and Dryer 1989) particularly if summer fire cannot be applied. Because these natural communities were likely created by a combination of plowing, harrowing and grazing, incorporating these techniques in rotation with prescribed fire may be helpful (Motzkin and Foster 2002). Staff at conservation organizations continue to experiment with these additional grassland management techniques. One of the goals of this guidance document is to capture lessons learned in those management actions.

In addition to the continued use of such management techniques as burning, mowing, and grazing to maintain existing grasslands, several new management projects and research experiments have focused on the creation of grasslands in Massachusetts since 2000. For example, from 2008 to 2013, methods of removing non-native species, soil alterations, tilling, and seeding were tested at Bamford Preserve, Martha's Vineyard to convert a non-native species-dominated agricultural grassland to a more native species-rich sandplain grassland community (Wheeler et al. 2015, Neill et al. 2015). Also, during 2001 at Job's Neck on Martha's Vineyard, about 20 hectares of oak forest were cut, mowed and seeded with grassland plant seeds to test methods for establishing native species-rich grassland (Lezberg et al. 2006, Chris Neill Interview). Since 2006, cattle grazing has been used on Naushon Island to restore coastal grasslands in former pastures that had been taken over by catbrier (*Smilax rotundifolia*)- and black huckleberry (*Gaylussacia baccata*)-dominated shrublands (C. Neill, Interview). Additionally, at the Truro and Marconi sites of Cape Cod National Seashore, burning and cutting of second growth pitch pine forest has been implemented to open the landscape and create a more diverse understory that includes grasses (D. Crary, Interview). Harrowing has also been used to encourage greater grass cover within previously managed scrub oak shrubland at the "Serengeti" on Nantucket (Omand et al. 2014). At the Francis Crane Wildlife Management Area, 138 hectares (341 acres) of second growth post-agricultural forest have been converted to grassland through mechanical tree removal, harrowing, and seeding since 1998 (J. Scanlon and C. Buelow, Interviews). Current management efforts focus both on refining the above techniques to maintain existing grassland diversity as well as to reclaim grasslands from agriculture, shrublands, or forest.

Maine

Kennebunk Plains in Maine has been conserved since the late 1980s and Wells Barrens has been conserved since 2000. In 1989 Kennebunk Plains was protected by the Land for Maine's Future Project by the State of Maine. A total of 421 hectares (1,041 acres) were initially purchased to protect sandplain grassland species. The Nature Conservancy bought an additional 50 hectares (123 acres) in the southeast corner of the Plains. Prior to being conserved, Kennebunk Plains and Wells Barrens were in blueberry production until the late

1980s. Prescribed fire was used until the mid-1980s to control woody vegetation and promote blueberries. For several years starting in 1985, the herbicide Velpar was employed to reduce species other than blueberries. The use of Velpar ceased when the property was purchased for conservation.

The Nature Conservancy re-implemented prescribed burning at Kennebunk Plains in 1990 (N. Sferra, Interview). Controlled burning occurs on 243 hectares (600 acres) in 16 units ranging from 13 to 20 hectares (32 to 49 acres) that are burned in the spring just after leaf-out or late summer to fall following the conclusion of bird nesting season. After fire management began, Peter Vickery initiated research at Kennebunk Plains, which was continued by Jeff Wells. This research focused on the frequency of controlled burning to maximize habitat for grassland nesting birds and promote rare plants such as northern blazing star (*Liatris novae-angliae*). He found that burning increased rare northern blazing star seed production and reduced seed predation by microlepidoptera (Vickery 2002a, Vickery 2002b). To date, the burn program continues and is supplemented with periodic mowing to reduce shrub invasion on the grassland.

In 2007, 367 acres at the adjacent Wells Barrens was purchased by The Nature Conservancy for conservation. That site had not been actively managed since the late 1980s. In 2015, The Nature Conservancy cut the majority of the woody vegetation on the former grassland to prepare for restoration. In addition, The Nature Conservancy cut several stands of pitch pine woodland to create early successional habitat and plans to start implementing prescribed fire at the site.

New York Islands

Similar to other regions of the Northeastern Atlantic Coastal plain, a majority of the sandplain grasslands on Long Island either have been protected from development by land preservation, or are managed in association with commercial use (airports, roadways, communication towers, golf courses and agriculture). On Long Island, urbanization and population growth expanding east from New York City has increased grassland isolation, reduces connectivity and introduced non-native species. As a result, non-commercial grasslands are generally small remnants and relics of less than approximately 12 hectares (30 acres). Commercial or Native American-associated grasslands (Shinnecock and Montaukett Nations) are larger and range between 20 to 60 hectares (29 to 148 acres) (Weigand et al. 2017). A roughly equal portion of Long Island's grasslands are remnants of conventional agriculture that have converted to old fields since the 1950s. Regardless of past or current land use, grasslands of the New York Atlantic Coastal Plain are fragmented, and isolated and occur in a highly urban, agricultural and forested matrix. Like in the grasslands of Massachusetts and Maine, even when the boundaries of many of these grasslands are preserved, persistence of these disturbance-dependent ecosystems is not guaranteed because of woody succession and invasive species encroachment. On the New York islands, invasive species and increased woody succession are generally not being suppressed by mowing and/or burning at current return intervals. In addition, the high degree of fragmentation and high proximity to urban areas results in a large number of non-native and invasive species invading grasslands that must be managed.

In the New York region, the major land holders of grasslands include the U.S. Fish and Wildlife Service (Sayville and Conscience Point Grasslands), The Nature Conservancy (Shinnecock Hills, Mashomack), Suffolk County (Montauk County Park, Gabreski Airport), Nassau County (Hempstead Plains), Town of Riverhead (Enterprise Park at Calverton), New York State Office of Parks, Recreation and Historic Preservation (Montauk Downs), New York State Department of Environmental Conservation (Underhill), Green Tree Foundation, Henry Ferguson Museum and Land Trust (Middle Island Farms, Fishers Island), National Parks Service-Gateway (Floyd Bennett Field) and the Town of Easthampton (Easthampton Airport). Golf courses have also played an important role in maintaining and creating sandplain grassland habitat on Long Island. The National Links of America (Shinnecock Nation Historic Grassland) and Shinnecock Golf Course (Shinnecock Nation Historic Grassland) are adjacent golf courses in Southampton that were created on what was the historic Shinnecock Native American Nation's home range in the early 1900s (W. Salinetti, Interview). A majority of the holdings of the New York State Department of Environmental Conservation and the Town of Southampton are old-field grasslands. Unfortunately, however, not all these grasslands have been preserved and thus remain threatened by development. For example, Enterprise Park at Calverton (EPCAL) in Riverhead, the region's largest grassland, is slated for development, while the grasslands at Gabreski and Easthampton airports, which support a number of rare and unique flora, are being considered for solar array installations. Gardiners and Robin's Island grasslands, while owned privately, have the potential for development if the current owners develop or sell these properties.

Sandplain grasslands on Long Island share many aspects of their historical origin with those of Massachusetts. Fire has long been associated with grassland management on Long Island. Grasslands were maintained by Native Americans prior to European colonization, and the earliest evidence of the use of prescribed fire was by the Montaukett Native American tribe during the 1600s (Taylor 1923). Clear-cutting and deforestation increased the range of these grasslands to such an extent that Taylor (1923) in his Montauk Memoirs described a "sea of pink created by vast swaths of blooming sandplain gerardia (*Agalinus acuta*)." As in sandplain grasslands in coastal Massachusetts, grazing increased following colonization, especially in Montauk and associated coastal islands, through the end of the 1900s when it declined rapidly because of poor soils and pressures of residential development (Foster and Motzkin 2003). Early successional pitch pine stands established following the abandonment of grazing. Wildfires ignited in these sites resulted in many large and uncontrolled wildfires, which left a lasting legacy of fire suppression. As a result, applying prescribed fire has been and remains very challenging on many fronts and continues to be limited by the negative public perception of fire, lack of understanding of the ecological importance of fire, a high amount of grassland habitat directly adjacent to urban areas, and lack of regional experience in developing burn plans and allocating resources to conduct prescribed fires (Stack 1989).

Like in Massachusetts and Maine, prescribed fire has been and continues to be used in grassland management. Its use has been supported by the New York State Wildfire and Incident Management Academy, The Nature Conservancy, and New York State Department of Environmental Conservation since the late 1990s. Fire is most commonly used in the Town of

Southampton to manage grasslands at Shinnecock Golf Course, Shinnecock Hills and the Montauk grasslands. It continues to be used at National Links of America just to the north of Shinnecock golf course (W. Sallinetti, Interview).

The use of fire in grassland management was strongly encouraged in the 1990s by The Nature Conservancy. The Nature Conservancy developed numerous Fire Management Plans for Hempstead Plains, Big Reed, and Oyster Ponds Complex (Montauk), as well as monitoring and management plans for the endangered *Agalinis acuta* (Jordan and Parrish 2007, Kurtz 2008a, Kurtz 2008b, Horwith et al. 2009). The cancellation of The Nature Conservancy's prescribed fire programs in 2007 because of funding constraints resulted in the loss of specialized monitoring and management on upwards of 50 percent of the region's grasslands.

Across the region, the time between burns varies widely from 1 year (National Golf Links of America) to 50 years (Shinnecock Hills Preserve) with an average return interval of 8 years (Weigand et al. 2017). The New York State Department of Environmental Conservation plans to burn their grasslands on a three-year rotational basis, ideally in the spring to reduce cool season grasses and maximize impact on woody species, while the Henry Ferguson Museum and Land Trust burns on a biennial basis during the dormant season. Conversely, the U.S. Fish and Wildlife Service's Sayville grassland was burned for the first time in 2016 but previously had experienced small-scale arson fires in 1997, 2002, and 2007. Currently, old fields owned by the New York State Department of Environmental Conservation, Henry Ferguson Museum and Land Trust and National Links Golf Course frequently receive prescribed fire.

Land managers are currently attempting to maintain some capacity to conduct prescribed fires through contracted fire professionals. The Greentree Foundation successfully conducted its first grassland prescribed fire using a contracted burn boss in 2017. The Central Pine Barrens Joint Planning and Policy Commission also contracted the development of a prescribed burn plan for Pine Meadows County Park grassland and will implement the prescription using a contracted burn boss in partnership with Suffolk County Department of Parks and Recreation and NYS Department of Environmental Conservation. The U.S. Fish and Wildlife Service also re-initiated a burn program at Sayville in 2016.

Across Long Island, mowing is commonly utilized in place of fire when weather conditions or proximity to the urban interface prevents the use of fire. Mowing is most commonly conducted in the spring or dormant season. Mowing is also prescribed on a 3-year rotation but is utilized on average every 2.2 years (Weigand et al. 2017). Mowing frequency ranges from annually at airports, while the Shinnecock Hills Preserve has not been activity managed or mowed for the last 17 years.

The use of herbicides is not readily utilized or considered a management practice on Long Island because of concerns with non-target impacts to water quality, flora, fauna and soil.

Long Island lacks the diversity and history of sandplain grassland management research that occurs and has occurred in Massachusetts. Research focused predominantly on the iconic Hempstead Plains and within grasslands in Montauk, Conscience Point and Sayville because of the presence of the federally listed *Agalinus acuta* (Lamont and Fitzgerald 2000, Jordan and Parrish 2007, Edinger et al. 2014). This endemic species has a highly restricted range and only

occurs in New York within Nassau and Suffolk Counties as well as Rhode Island, Connecticut, Massachusetts, and Maryland, with the largest population occurring in Suffolk County (New York Natural Heritage Program 2015).

The flora and fauna of the Hempstead Plains have been well studied, with floristic inventories conducted from the late 1800s nearly to the present (Hicks 1892, Harper 1911, Harper 1918, Ferguson 1925, Cain et al. 1937, Statler and Lamont 1987, Statler and Seyfert 1989, Statler et al. 1991). A recent study by Gulotta (2005) revealed that 54 percent of the flowering plants inventoried were native, providing an indication of the degree of non-native species encroachment on this grassland. Studies have been conducted on the control of mugwort (*Artemisia vulgaris*) using burning, mowing and herbicide treatments (Jordan et al. 2002). Lastly, in the 1990s The Nature Conservancy conducted monitoring on an *Agalinis acuta* population that was transplanted to a small section of the Hempstead Plains (Gulotta 2005, Jordan and Parrish 2007). The Friends of Hempstead Plains continue to monitor this population with support from the U.S. Fish and Wildlife Service and volunteers.

In addition to being an important research site, the Hempstead Plains provides an excellent example of the challenges the region faces. At its greatest extent, this site was estimated to cover upwards of 16,188 hectares (39,984 acres) of central Nassau County (Gulotta 2005, Neidich-Ryder and Kennelly 2014). The deep, well-drained soils of the plains are commonly thought to be a leading reason for the wide extent and long-term persistence of grasslands. The Hempstead Plains also has a long history of cultural use, including sheep grazing, home sites, and as the “Cradle of Aviation” that hosted airfields and flying schools that occurred during the early 1900s. While one of the most historically iconic and ecologically rich of the region’s grasslands, massive development extending eastward across Long Island from the boroughs of New York City has severely fragmented and reduced the Hempstead Plains to less than 2 percent of its historical range and less than 20 hectares (49 acres). The largest section of 7 hectares (17 acres) is preserved and managed by the Friends of Hempstead Plains at Nassau Community College (Gulotta 2005), while other, smaller fragments exist in isolated patches within an urban matrix in locations such as transportation rights of way, drainage retention basins, parklands, cemeteries and parks. The remaining grasslands contain many invasive species including sericea lespedeza (*Lespedeza cuneata*), cypress-spurge (*Euphorbia cyparissias*), mugwort (*Artemisia vulgaris*), and native and non-native species including apple species (*Malus* spp.), sumac species (*Rhus* spp.), small bayberry (*Morella caroliniensis*), autumn olive *E. umbellata*, and honeysuckle species (*Lonicera* spp.).

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