

Historical Description of the Vegetation of the Boston Harbor Islands: 1600–2000

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Abstract - Historical accounts and descriptions of the Boston Harbor Islands were searched for references to the islands' vegetation. They indicate dramatic changes in vegetation structure and composition since 1600. Many of the islands were wooded prior to European settlement, although Native American use is evident before 1600. Forests were cleared for agriculture, building materials, and firewood. Through the centuries since European settlement, the islands have variously supported municipal and military facilities, some of which have since been abandoned. As use of the islands changed, the vegetation of the islands also changed; in some cases native trees and other species returned to abandoned areas, while in others new, exotic species became established or were planted. By the end of the 20th century the vegetation had become a mixture of woodlands (roughly 25% of the islands as a whole), shrub thickets, open lands, and manicured landscapes, all of which include a large component of non-native species.

Introduction

Being a focal point for the early history of the United States, Boston and its people have been studied for centuries. From the establishment of the Massachusetts Bay Colony to the Tea Party and the lives of early presidents, Boston holds a special place in the history of Massachusetts, New England, and the United States. The islands of Boston Harbor have also been studied for their role in protecting the new colony via forts and lighthouses, in commerce and fishing, and in social services. The islands, with their connection to the land and sea around them, have captured the imagination of people for centuries, if not millennia.

Although much is known of the cultural history of the Boston Harbor Islands, there has been little exploration of the islands' vegetation. Unlike the White Mountains of Maine and New Hampshire and the off-shore islands of Nantucket and Martha's Vineyard, the Harbor islands were not valued for their plant life, but rather for how the islands themselves could be used to support the growing population of Boston and its environs. This paper describes the history of the vegetation of the

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Boston Harbor Islands and how it has changed based on written accounts of early explorers, colonists, and others.

Vegetation, as a component of a functioning ecosystem, is dynamic and constantly changing in response to factors as varied as damaging windstorms, wildfire, and long-term climate change. It is possible, however, through historical analyses, to understand what vegetation was like in the past and how it was and is being altered by human activity. With this information, we can project how the vegetation may change in the future in response to changing environmental and social factors. In the northeastern US, such analyses often involve investigations of how Native American Indian populations used natural resources, and how nearly 400 years of “European” land use has changed the vegetation that was observed by the first European explorers of the North Atlantic coast. In this study, our goal is to understand the character of the vegetation of the islands at the time of “first contact” with Europeans, the factors influencing vegetation dynamics at that time, and how land-use activities during the past 400 years have influenced the vegetation on the Boston Harbor Islands today. A consideration of the prehistoric vegetation of one island—Calf, in the outer Brewster group—is presented elsewhere in this issue (Patterson et al. 2005).

Boston Harbor Islands Recreation Area

The Boston Harbor Islands range in size from less than 0.4 to 105 hectares (< 1 to 259 acres) and have had similar variations in the sizes of the settlements on them. Some islands have been permanently connected to the mainland via causeways, whereas others are as much as 16 kilometers (10 mi) offshore. All were formed or influenced by glacial activity in what has become Massachusetts Bay. Most are partially drowned drumlins, part of the only drumlin field that intersects the Atlantic Ocean (Crosby 1928). Several of the islands (e.g., The Graves and Slate Island) are glacially scoured bedrock outcroppings. Many are underlain by granite, slate, or puddingstone bedrock, all of which have been quarried to some extent. The islands have elevations of less than 30 meters (110 ft) above mean sea level with flat to gently rolling topography (Better Boating Association 1994). Soils of the islands are excessively well-drained to well-drained sandy loams formed from glacial till or outwash deposits (Peragallo 1990). Water depths immediately surrounding the islands vary from 1 to 10 meters (3 to 30 ft) with a few channels of up to 18 meters (60 ft) depth (Better Boating Association 1994).

Human use of the islands started with seasonal use by Native Americans long before the arrival of Europeans (Luedtke 1996). With the arrival of Europeans in the Boston area, the islands served as farms,

fishing villages, military outposts, summer colonies, and public institutions (e.g., prisons, hospitals, quarantine facilities, schools). Each use impacted the vegetation of the islands through a combination of activities: timber harvesting, land clearing, plowing, and introducing non-native plant and animal species.

The varied topography, soils, and bedrock characteristics of each island as well as their varied flora and historic land uses, have resulted in a mosaic of modern vegetation types and wildlife habitats. Early successional habitats, including old fields and shrub-dominated communities, are not as common now as they were in the past. Other habitats present include woodlands, salt marshes, freshwater wetlands, rocky beaches and cliffs, and manicured landscapes. Many of these are dominated by non-native species (Elliman 2005). Originally brought to the islands for uses ranging from soil stabilization to ornamental plantings and also via accidental introductions through livestock feed, many of these “exotics” have become naturalized. Management of the islands’ vegetation is done by the agencies and organizations that own the islands in coordination with the Boston Harbor Islands Partnership.

Sources of Information

Reference materials including writings by early explorers and colonists, published and unpublished histories of the region, maps, manuscripts dealing with the archaeology and paleoecology of the islands, photographs, and artwork were collected and reviewed for information on past vegetation composition and land-use activities that would have affected vegetation patterns. The collections of the leading repositories of Boston’s historical information were searched (e.g., Boston Public Library, Massachusetts State Archives, Massachusetts Historical Commission, Massachusetts Historical Society, the University of Massachusetts library system [at Boston and Amherst], Harvard University’s map collection, Harvard University Herbarium library, Harvard University’s library system, and the New England Botanical Club library). Previous analyses of the islands’ history (Connelly 1933, Shurtleff 1891, Snow 1971, Stark 1880, Sweetser 1888) were reviewed as well.

Vegetation and Land Use by Time Period

Following is a discussion of the general vegetation patterns on the islands as described in historical documents and reference materials. Five broad periods are described: pre-European settlement (before 1621), early European settlement (1600s), Colonial era (1700s), and the 19th and 20th centuries.

Pre-European settlement (before 1621)

Vegetation patterns have been influenced for millennia by climatic warming and cooling since the glaciers retreated from New England 12,000–15,000 years before present (B.P.). Initial tundra vegetation was replaced by spruce/fir forests, then by pine and birch forests, and eventually by oaks and hickories (Davis 1983). Chestnut dominated southern New England forests from ca. 7500 B.P. to the early 20th century, when an introduced blight destroyed all mature stems and converted the species to a stump-sprouting shrub (Anagnostakis and Hillman 1992). Locally, vegetation patterns have been influenced not only by a changing climate, but also by wind (e.g., hurricanes), fire, and other exogenous disturbances (e.g., ice storms, insect pests, flooding).

The arrival of paleo-indians (12,000–8000 B.P.) and their successors influenced vegetation patterns through the establishment of hunting grounds and settlements (Luedtke 1996, Robinson 1996, Russell 1980). At the time of their arrival in the early Holocene (i.e., earlier than about 9000 B.P.), lower sea levels meant that the Boston Harbor Islands were part of the mainland (Casjens 1976; Luedtke 1975, 1996). Although no evidence of paleo-indian activity has been found on the islands themselves, a paleo-indian site is documented along the Neponset River just 25 km (15.5 mi) from the Harbor (Luedtke 1996). Archaeological evidence (including several human bone artifacts) locates subsequent native peoples on many of the “islands” including Bumpkin, Gallops, Grape, and Thompson Islands through the Archaic and Woodland prehistoric periods (8000 B.P.–1500 A.D.) (Casjens 1976; Dudek 2000; Luedtke 1975, 1996). These populations used the lands of Massachusetts Bay (eventually the Boston Harbor Islands) for fishing and gathering other marine food resources, as sources of materials (e.g., clay, rock, shell), and eventually for agricultural use (Braun 1974, Luedtke 1996). Nutshell fragments of shagbark and possibly bitternut hickory, kernels of corn, and charred oak, birch, maple, hickory, ash, and conifer wood fragments were found in cooking pits and middens on Calf, Bumpkin, Gallops, Grape, Thompson, and Spectacle Islands and at Worlds End (Luedtke 1975, 1980, 1990, 1996; McHargue 1996). Although some of the species indicated by these fragments may have grown on the islands, they may also have been brought to the islands by humans or ocean currents (i.e., as driftwood). The inner harbor islands were likely more heavily used than the outer islands due to their proximity to the mainland and their larger sizes, but even Calf Island, one of the outermost islands, was used by native peoples prior to European settlement (Luedtke 1980).

Around the time that Columbus and other early explorers were making their way to the western hemisphere, Indian use of the Boston Harbor Islands was generally limited to seasonal occupation

(most likely autumn) (Luedtke 1975, 1980, 1996). Luedtke (1980) hypothesizes that through most of prehistory, the Boston Harbor Islands were used as bases for acquisition and processing of coastal resources (including fish and shellfish) and not for long-term habitation. Although many of the islands were apparently forested, some of the smaller islands and those composed mostly of exposed bedrock may never have supported large stands of trees. Trees likely to have occurred on the islands as indicated by soil-borne wood macrofossils (Luedtke 1975) include birch, oak, ash, maple, pine, and cedar. Pollen analyses of sediment cores from the islands suggest that walnut, hickory, linden, and sassafras were also present (Luedtke 1980), though the role of pollen blown from the mainland makes it hard to interpret their relative importance. Many of the islands of the outer harbor have shallow soils (Luedtke 1975) and experience heavy winds, suggesting that any trees would have been short. These islands likely supported low, shrubby stems with espalier forms, a variety of graminoid and herbaceous species, and wetland species in lowlands.

Mann (2002) and others describe an eastern North American landscape that was changing rapidly during the 1500s and early 1600s as native populations died of diseases brought by early European explorers (Bragdon 1996, Dacey 1995, Robinson 1996). Native populations affected the landscape by clearing areas and planting crops, setting fires (on purpose and accidentally), and clearing the woods of downed wood for fuels necessary for cooking and warmth. These impacted habitats, once abandoned, began to revegetate with early successional species and eventually with oak-dominated woodlands. Thus, dramatic changes in the vegetation of the Harbor Islands may have begun before the arrival of European settlers on the islands.

Early European settlement (1600s)

Island forests changed dramatically during the 1600s. Early colonists arriving in Massachusetts Bay established trading posts, farmsteads, and towns. Many of the islands were purchased or taken from Native Americans, who were cultivating land on some islands. Thompson Island, where the first trading post is believed to have been established by David Thompson in 1625, was probably being farmed when John Smith entered Boston Harbor in 1614 (Luedtke 1996).

Many writers during this period were either explorers interested in economic gains or colonists interested in encouraging others to come to the new settlements. Modern historians and ecologists, therefore, often interpret early-17th-century descriptions of the landscape with caution (Cronon 1983, Russell 1983, Whitney 1994). Descriptions of open, pastoral landscapes seem too reminiscent of the 17th-century English countryside, from which settlers were being encouraged to emigrate, to

be completely trustworthy. Nonetheless, descriptions of the islands and surrounding areas suggest a mix of wooded and open habitats, with extensive use by Native Americans. In 1616, Smith writes of “many Iles all planted with corne; groves, mulberries, salvage gardens” (Barbour 1986). Although likely not describing the islands of Boston Harbor specifically, Samuel de Champlain in 1605 relates a similar scene with this description: “All along the shore there is a great deal of land cleared up and planted with Indian corn. The country is very pleasant and agreeable; and there is not lack of fine trees” (Russell 1980:10, Winship 1968). In his 1635 account, William Wood ([1635] 1993:61) describes the islands as “abound[ing] with woods and water and meadow ground,” while Shurtleff (1891:439) notes “history, as well as tradition, tells that these islands were mostly well wooded in the earlier days of the New England settlement, and that they had been inhabited before the arrival of the forefathers.” Mourt’s Relation from 1621 states “At the entrance of the Bay are many Rockes; and in all likelihood very good fishing ground. Many, yea, most of the Ilands have been inhabited, some being cleared from end to end, but the people are all dead, or removed” (Shurtleff 1891:434).

By this time, native populations had likely been decimated by disease brought by early European explorers (Dacey 1995, Robinson 1996). Mann (2002) concludes that the areas first settled by Europeans may already have undergone drastic changes in the vegetation in the years prior to settlement due to abandonment following decimation of whole populations by disease.

In 1616, Smith identifies some of the tree species observed on the islands and coastal mainland including “Firre, pyne, walnut, chestnut, birch, ash, elme, cypresse, ceder, mulberrie, plumtree, hazell, saxefrage, and many other sorts” (Barbour 1986; Table 1). In 1603, Martin Pring was especially interested in sassafras, due to its medicinal uses, and found this species in abundance along the coast as well as “vines, cedars, okes, ashes, beeches, birch trees, cherie trees bearing fruit ..., hasels, wich-hasels, ... walnut-trees, maples ... with divers other sorts of trees to us unknowne” (Winship 1968). In addition to species which naturally occurred on the islands, by 1635 European settlers had begun planting orchards and vineyards (Wood [1635] 1993), the first of which was reportedly on Governors Island (Josselyn 1833). This introduction of species not native to coastal Massachusetts, and indeed some not native to the continent, was the beginning of a shift in the composition of the islands’ vegetation.

Early in the 17th century, farms and small homesteads were established on several of the islands including Bumpkin, Gallops, Grape, and Long (Luedtke 1975, Ritchie et al. 1984). Along with the establishment of these island farms and homesteads, there was an increased harvest of

wood for building materials and firewood. Carroll (1973:28) writes of this period that almost all of the islands in Boston Harbor “that are now completely denuded of trees nurtured valuable timber” for fuel and construction material. As wood was initially plentiful on the islands, it was also gathered for use on the mainland, especially for the treeless peninsula of Boston, in spite of the difficulty in doing so (Carroll 1973). In Colonial greater Boston, all timber was often cut down within a decade of a new town’s establishment, leaving no material for building, heating, etc. (Carroll 1973, McManis 1975). As early as 1635, there were wood shortages on the mainland. William Wood ([1635] 1993:58) refers to Boston’s plight when he notes that “their greatest wants be wood and meadow ground, which never were in that place, being constrained to fetch their building timber and fire wood from the islands in boats. ...” The town of Boston was built on a small peninsula surrounded by other developing settlements including Charlestown and Dorchester (Shurtleff 1871). Therefore, wood for Boston was removed from the peninsula in the earliest years of the settlement. The nearest mainland supplies of wood were likely used by the other settlements, so the most readily accessible wood supply was on the Harbor Islands.

Table 1. Woody plants listed in early accounts and their modern Latin names.

Historic citation	Scientific name (inferred)	Reference *
Ash	<i>Fraxinus</i> spp.	1, 2
Beech	<i>Fagus grandifolia</i> Ehrh.	1
Birch	<i>Betula</i> spp.	1, 2
Ceder, cedar	<i>Thuja occidentalis</i> L., <i>Juniperus virginiana</i> L. or <i>Chamaecyparis thyoides</i> (L.) B.S.P.	1, 2
Cherie	<i>Prunus</i> spp.	1
Chestnut	<i>Castanea dentata</i> (Marsh.) Borkh.	2
Cypresse	<i>Chamaecyparis thyoides</i> (L.) B.S.P.	2
Elme	<i>Ulmus</i> spp.	2
Firre	<i>Abies balsamea</i> (L.) P. Mill., <i>Picea</i> spp., or <i>Tsuga canadensis</i> (L.) Carr.	2
Hazell, hasel	<i>Ostrya virginiana</i> (Mill.) K. Koch, <i>Hamamelis virginiana</i> L., <i>Corylus americana</i> Walt.	1, 2
Maple	<i>Acer</i> spp.	1
Mulberrie	<i>Morus rubra</i> L.	2
Oke	<i>Quercus</i> spp.	1, 2
Plumtree	<i>Prunus (pennsylvanica</i> L. f.), <i>Amelanchier</i> spp.	2
Pyne	<i>Pinus</i> spp. (probably <i>P. strobus</i> L.)	2
Sassafras, saxefrage	<i>Sassafras albidum</i> (Nutt.) Nees	2
Walnut	<i>Carya</i> spp.	1, 2
Wich-hasel	<i>Hamamelis virginiana</i> L., <i>Ostrya virginiana</i> (Mill.) K. Koch	1

* 1 - Pring in 1603 from Winship (1968); 2 - Smith in 1616 from Barbour (1986).

Governor Winthrop wrote on January 13, 1638 that “about thirty persons of Boston went out on a fair day to Spectacle Island to cut wood (the town being in great want thereof). ...” (Hosmer 1908:258).

Consumption of wood from the islands was so rapid that laws were enacted to control the harvest of any remaining stands. Stark (1880) and Shurtleff (1891) list several examples, including Noddles Island where “as far back as 1631, an order was passed by the Court of Assistants, restraining persons from putting cattle, felling wood, or taking slate from Noddle’s Island.” But by 1633, the island was granted to Mr. Samuel Maverick on the condition that he allow Boston and Charlestown to “fetch wood continually as their needs requires.” “Either the island was extremely well wooded at the time the order was passed, or the towns of Boston and Charlestown were very sparsely inhabited” (Stark 1880:2). Deer Island provides another example where “at this time the island appears to have been of no special use to the inhabitants except to procure fire-wood from; for an order was passed in 1636, as follows: “Also it is agreed yt ye Inhabitants who doe want wood, shall have liberty to get for their vse at Deare Island, so as yt they psently take & carrye away what they doe get, & whatsoeuer they have felled there to be at liberty for others to take away.” This use of Deer Island for wood was continued through the 1600s with references to the wood on the island made in transfer documents through 1662 (Shurtleff 1891, Stark 1880:32).

By the end of the 17th century, most of the islands were inhabited, cultivated, and likely totally deforested. Shurtleff (1891:47) quotes an unknown author from around 1687: “... we arrived at Boston, after having fallen in with a Number of very pretty Islands that lie in Front of Boston, most of them cultivated and inhabited by Peasants, which form a very fine view.” European weeds (e.g., sheep sorrel, plantain), often introduced accidentally, quickly became naturalized as the islands were deforested and cultivated (Gray 1880). In addition to the agricultural use of the islands, a few were used for temporary internment camps, military forts, and the quarrying of slate. A fort was constructed on Castle Island, the closest to mainland Boston, beginning in 1634 and completed in 1654 (Shurtleff 1891, Snow 1971). With the removal of the trees that once dominated these islands, and with the planting of crops and introduction of grazing animals, the islands’ vegetation was transformed.

Colonial era (1700s)

During the 1700s, the islands were primarily used for agricultural activities producing “grain and hay, the latter sufficient to export from some of them,” and pasture for sheep, cattle, and horses (Kales and Kales 1983, MA Historical Society Collections 1794:241). In

addition, there was expanding use for forts and batteries in defense of the Harbor and the colony. Shurtleff (1891:60) quotes Daniel Neal in an excerpt written in 1719 that Boston is “guarded from the Roughness of the Ocean by several Rocks appearing above Water; and by above a Dozen Islands, many of which are inhabited. ... The most remarkable of these Islands, is called Castle-Island, from the Castle that is built in it.” In the 1770s, French troops dug earthen batteries on Gallops Island to protect Boston Harbor. Peddocks, Long, and Thompson Islands were used by British troops (and their cattle and sheep) in 1775, until the colonial militia took over the islands in 1776. At this point, 600 men were stationed on Peddocks Island to guard the Harbor (Connelly 1933), and earthen batteries were built on the eastern end of the island. Other islands were acquired by the city of Boston to erect quarantine hospitals (Rainsford and Spectacle Islands) and a cemetery (Rainsford Island).

The vegetation of the Harbor Islands, as well as that of the expanding colony on the mainland, continued to be heavily influenced by the colonists’ intense use of the land. Carroll (1973:25) states that “devastation of flora and fauna proceeded at such a rapid pace that as early as the eighteenth century, much of eastern Massachusetts, with its gently rolling hills, looked like the tame and treeless English countryside.” The cleared and plowed islands presented a striking change from the wooded islands observed by the first European settlers a century before. In addition, lands that were heavily disturbed, such as those where batteries were built, provided an excellent opportunity for exotic invasive species to grow and spread.

The 1800s

During the 19th century there was a shift from using the islands primarily for agriculture, to using them for recreation, defense, mariner safety (lighthouses), and public facilities such as hospitals, sewage treatment and garbage reclamation facilities, and schools (including the Thompson Island Farm School). Hospitals were located on Deer, Gallops, Long, and Rainsford Islands for at least a portion of the 19th century, and in most cases these were converted into almshouses or prisons by the end of the century. Each of these uses impacted the vegetation on the islands. Management ranged from highly manicured lawns to complete neglect, and from large-scale topographical alteration, like the elimination of cliffs on Gallops Island, to being left topographically largely untouched (Snow 1971). Some of the smaller or more rocky islands were uninhabited or had small fishing colonies and lighthouses. Many of the islands supported military facilities during the Civil War. Others, such as Gallops, Long, Peddocks, Rainsford, Ragged, and Spectacle, had hotels, inns, or summer cottages. With the

increased use of the islands as a recreational destination, writers and visitors began to lament the lack of trees. Emerson (1878:9) wrote of the greater Boston area including the islands:

The northern and southern sides of Boston are not essentially unlike in their natural features; yet the hills of Brookline and Roxbury, capped with hickory and chestnut, whose sides are clothed with oaks and pines, give the impression of a rich and happy country, of which only pleasant memories are carried away, while the bare hills of Chelsea suggest images of bleak and barren desolation. Three or four trees upon Apple Island make it a gem among the islands in Boston Harbor. What a scene would the Bay present, if all the islands were so covered! ... The happy effect of three or four trees on an island in Boston harbor has been already mentioned; a single one on Pettick's Island gives an agreeable relief to the eye.

Frederick Law Olmsted (reprinted in 1988) echoes Emerson's comments in his 1887 proposal to reforest the islands with his own opinion that "let any one, passing through the harbor, imagine [the islands] clothed with foliage of any kind, and it will be felt how much more agreeable its character would be if they were generally wooded."

Stark (1880:2) further laments how "nowadays very little wood except chips from the shipyards can be obtained from Noddle's Island, for the oldest inhabitant can only remember two trees growing upon the island previous to its purchase by the East Boston Co. in 1833. At that time the island did not contain one-tenth as many inhabitants as at the present time." Bouve (1893:178) comments on the islands within Hingham Harbor, writing that Ragged and Sarahs Islands are rocky islands covered with sumacs and other wild shrubs, while Button Island is a "little heap of rock and gravel, bearing no trees nor shrubs and but little grass." He also describes Langlees Island as one with steep ledges and gravelly beaches with shrubs in the uplands and "a fine linden." The owner of this island "has planted many small trees, which will eventually cover it with forest growth, as was originally the case when the country was settled, and restore it to the condition in which all the islands of Boston Harbor should be" (Bouve 1893:178). Deer Island also had trees planted on it during this time period, although environmental factors hampered their growth. Stark (1880:32) describes Deer Island: "for now it is with the greatest difficulty that trees can be made to grow upon the island, on account of the easterly sea-winds which are so unpropitious to their cultivation. A few willows and silver-leaf poplars of quite recent planting are now the only trees on the island." Gray (1880) attributes the difficulty in reforesting the islands following agricultural abandonment to poor soils.

With the use of the islands for other than agricultural uses and the increased desire for a more commodious appearance, there was an increase in the maintenance of the grounds of island facilities, including the planting of trees on some. Thompson Island's farm school planted trees, and in their annual report the Board of Metropolitan Parks Commissioners (1893:27) stated, "The well-grown plantations of trees, both deciduous and evergreen, that mark this island, add greatly to its beauty and attractiveness." In their 1893 annual report, the Board considered the economic value of the islands, noting that if the islands could be made to be more attractive, they might bring tourist money to the area. The Board further comments on other islands in the Harbor:

[Apple Island, near East Boston and Winthrop] is given an exceptional prominence and attractiveness by a group of handsome elm trees. [Bumpkin Island is owned by Harvard University] and as it is at present barren and unimproved, the idea naturally suggests itself that an admirable use of it would be for the University to give it in charge of its important department, the Arnold Arboretum, which might put it to good service as an experiment station for arboriculture under maritime conditions. ... The great fault of the bay, from a landscape point of view, lies in the barren aspect of its islands and shores, the hard naked lines of their thin slopes covered only with turf, and unrelieved, except in rare instances, by any trees, or even shrubbery. These islands and shores were formerly well clothed with woods, which were cut away in the colonial days.... In this connection attention may be called to the small rocky islands in Hingham harbor. The work of Mr. Brewer, their owner, in planting them with trees and shrubs and caring for them in a way that enhances their natural beauty, is worthy of all praise. ... and care should be taken to see that their present character is permanently preserved. (Board of Metropolitan Parks Commissioners 1893:27-31)

Stark (1880:15) also commented on Thompson Island: "This is one of the best-cultivated and most fruitful islands in the harbor, and one thing that distinguishes it from all others is the growth of trees which is now beginning to make quite a show on the island, and which all the other islands are so sadly deficient in." This fine growth of trees was only about 50 years old when Stark wrote that description, as Luedtke (1996) reports that there were "no trees on the island when it was purchased in 1833, and most of the existing trees were planted by the Farm School over the next century." Manicured lawns and tree and shrub plantings often occurred on the grounds of recreational facilities like the Long Island House, a large hotel located on the center part of that island (Stark 1880:27).

While restoration of the forests on the islands began to occur during the 19th century, some of the islands continued to see alteration of natural resources for utilitarian uses. The creek and pond

located between the two heads of Thompson Island were diked and drained, respectively, to produce “meadow-land” for growing crops (Stark 1880). Castle Island was connected to the mainland to improve access for waterside recreation (Board of Metropolitan Parks Commissioners 1893). The landscaping of facilities, as well as attempts to revegetate the islands, brought more new and often exotic species to the islands, some of which escaped cultivation and have become dominant in some areas.

The 1900s

The 20th century saw a dramatic increase in the height of the vegetation on the Boston Harbor Islands. Several islands and their facilities were abandoned, while the early successional trees and shrubs (e.g., quaking aspen, gray birch, black cherry) that had invaded previously abandoned areas grew taller. Woody species invaded areas previously dominated by low-growing herbaceous species and grasses (Levering 1988). Planting continued with the efforts of Civilian Conservation Corps crews in the 1930s and efforts by the Arnold Arboretum throughout the early part of the century (Anderson 1988). Groups such as the Friends of the Boston Harbor Islands continue that tradition today. The islands were increasingly acquired and developed as park land, and fewer areas were being farmed or maintained as open land. Many of the buildings on the islands were abandoned or removed by the end of the 20th century. Exceptions include one island that still has summer cottages (Peddocks Island), the City of Boston public health campus (Long Island), and sewage treatment facilities (Deer Island, Nut Island).

Synthesis and Commentary

The vegetation of the Boston Harbor Islands, and the northeastern US in general, has been continually changing since the glaciers retreated more than 12,000 years ago. The landscape that early European settlers found had been altered by a changing climate and by human use. Native American use of the islands dates to early post-glacial time when the islands were part of the mainland. Later, in the period before European exploration of the coast, the islands were most likely used seasonally by Indians as ports for fishing, places to gather specialized materials, and for agriculture (Luedtke 1996 and others). Native Americans probably set fires, which they used for a variety of purposes including improving game habitat, controlling pests (e.g., mosquitoes), and signaling among members of their tribe (Day 1953, Patterson and Sassaman 1988). In addition to intentionally setting fires, campfires were used for cooking and warmth, and some of these undoubtedly escaped from time to time to burn the

islands' vegetation. Evidence of (presumably) Indian burning activity is found in the abundant charcoal in pre-European peat from Calf Island (Patterson et al. 2005). Natural disturbance processes including wind storms, salt-spray, and erosion influenced the islands' vegetation, resulting in short stature forests. The islands experienced a generally harsh maritime environment. This is probably especially true of the small, outer islands, like Calf, which were continually exposed to wind and salt-spray. On the larger islands and those near shore, early successional communities, such as open fields and shrub-dominated lands, may have been interspersed among more wooded areas and low, open wetlands (including salt marshes). Open communities may have been maintained by the natural processes mentioned above, or by early Indian burning and clearing for camps or cultivation of crops.

During the past four centuries, humans (European settlers, initially, and more recently the expanding population of the City of Boston) have become important agents for vegetation change on the Boston Harbor Islands. The proximity of the islands to the mainland, their exposure to wind and salt-spray, and the resources found on them influenced how they were used by humans and how well they were able to recover after those disturbances. The earliest colonists probably used the islands' resources as had the Indians who preceded them, but the Colonial era need for lumber and fuel wood soon exceeded that of the native peoples as permanent settlements were established. This resulted in nearly complete deforestation of greater Boston and the islands, and the use of this cleared land for pasture and agriculture. This regional deforestation is detected in the decline in pine and oak pollen in the Calf Island peat core (Patterson et al. 2005). Europeans also introduced many exotic species both intentionally by planting agricultural crops (including fruit trees) and unintentionally through feed and hitchhikers on other plantings. Exotic species initially established on the mainland were carried to the islands by birds, animals, the wind, and tidal currents.

By the 19th century, Bostonians were attempting to reforest many of the islands by planting hearty European species such as English oak. Throughout the 20th century, there has been abandonment of many of the facilities on the islands and a return of early successional shrubby habitats. The islands are characterized by shrubby and woodland vegetation to a greater degree today than at any time during the past 200 years, with most of the growth occurring during the past 50 years (Richburg and Patterson, in prep.). However, many of these woody species are not native to the New England area (Elliman 2005).

Although we can describe the general character of the early vegetation of the islands and list some of the more important species, we

cannot reconstruct the past vegetation of the islands with the great detail necessary to identify all or even most species present during any given time period (Tolonen 1983). We can, however, derive an understanding of some of the natural and anthropogenic processes that influenced the vegetation. More important than identifying which species occurred where and at what time, is knowing that the vegetation of the islands (and of the Northeast in general) has been continually changing. Future management of the islands should focus on perpetuating or mitigating (or in some cases excluding) natural and anthropogenic influences on vegetation, rather than on trying to re-create a static landscape from the past. Eliminating undesirable species and conditions (e.g., exotic invasive species, erosion, grazing, etc.) and reintroducing species and processes that may have been important in the past (e.g., native tree species now eradicated, or the controlled use of fire) might be useful land management goals. In some instances, there may be specific types of vegetation that would capture the historical significance of past landscapes, but re-creating these landscapes may be difficult as a changing environment may interfere (e.g., climate warming may preclude the reestablishment of red and/or white spruce, which occur on islands north along the coast and may have occurred on at least some of the Boston Harbor Islands [Argus and Davis 1962]).

Our work and that of others clearly identifies the important role that invasion by exotic species has played in the development of the modern vegetation. In his 17th-century survey of New England, Josselyn (1672) reported the presence of many European species (e.g., sorrel, purslane, ground-ivy, and tansy). At Calf Island more than half of the current flora is exotic species (Elliman 2005). Deliberate and accidental introductions of plant species have altered the composition and structure of many of the islands. Our analysis of the peat core from the Calf Island wetland suggests that exotics have been present since at least the 19th century. In some instances, these exotic species have not expanded beyond the local areas where they were planted, but elsewhere they have taken over large portions of the landscape and have crowded out native species. Any attempt to return the islands' flora to pre-European conditions will require efforts targeted at eliminating these species. But in certain instances, it may be desirable to keep the species as examples of historic vegetation.

Defining historic vegetation composition is limited by the types and sources of information available about conditions hundreds or even thousands of years ago. The concept of a single, original, pristine landscape present prior to European settlement is now understood to be overly simplistic (Foster 2000). Natural and anthropogenic disturbance of landscapes has always occurred, and will so in the future. In many cases it is difficult to separate "natural" from anthropogenic disturbance

histories when interpreting past vegetation composition and change. The vegetation of the Boston Harbor Islands is no exception.

Clearly humans have had a large impact on the vegetation of the Harbor Islands over the past 300–400 years, and probably longer. Many islands were wooded, at least in part, when the first European settlers arrived in the early 17th century, yet most had been the location of Indian encampments prior to arrival of the colonists. The islands were subsequently deforested, and the removal of trees from the islands had an impact not only on the vegetation of the islands as a whole, but also on the character of individual islands. Loss of vegetative cover and the new uses to which the islands were put (e.g., pasture, quarrying, farmland), increased erosion rates. With demand for firewood and locally produced crops in decline, forest returned to the islands, though with the inclusion of new exotic species. The current vegetation, nearly 400 years after initial settlement of the islands by Europeans, includes a mixture of woodlands, shrub thickets, open lands, and manicured landscapes, all of which include a large component of non-native species (Elliman 2005).

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