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Identity Behind Glass: The Second Gore Place Greenhouse

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IDENTITY BEHIND GLASS: THE SECOND GORE PLACE GREENHOUSE

A Thesis Presented

by

SEAN P. ROMO

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ABSTRACT

IDENTITY BEHIND GLASS: THE SECOND GORE PLACE GREENHOUSE

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This thesis examines the second greenhouse at Gore Place, a historic country estate in Waltham, Massachusetts. Gore Place was owned by and named for Christopher and Rebecca Gore, members of the 18th- and 19th-century political and economic elite in New England. The greenhouse was constructed in 1806, and excavation at the site took place in 2004, 2008, and 2012. The latter two projects were data recovery excavations, which exposed portions of the greenhouse's foundations and interior, as well as several features in the yard surrounding the building. Historic greenhouses were prestigious structures, financially accessible only to institutions, governments, and the wealthy elite. How a greenhouse was built and organized and what plants it contained can yield information on the motivations behind its construction. To that end, this thesis analyzed the history of the Gores and their country estate, the culture of the 18th- and 19th-century

New England elite, the methods and reasons for greenhouse construction, and the archaeological results from the 2004-2011 excavations.

This analysis indicates that the Gores built their greenhouse in the efficient "Lean-to" style, which is characterized by a sloped front wall made almost entirely of glass. The building was heated via a furnace and flue system, and grew grapes in beds and other potted plants on shelves or platforms. The greenhouse yard was explicitly arranged to support the building. The Gores were motivated to build the 1806 greenhouse as part of an expression of Christopher's aristocratic identity and the pair's commitment to scientific agriculture and horticulture.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

Gore Place is a National Historic Landmark located at 52 Gore Street in Waltham, Massachusetts, only about 10 miles west of Boston. The property's namesakes were Christopher and Rebecca Gore, who owned this country estate from 1786 until 1834 (Beranek et al. 2011:11). Today managed by the Gore Place Society, the site is famous for its association with the Gores, who were members of the New England elite, and with their servant Robert Roberts, one of the earliest published African-American writers and the author of *The House Servant's Directory* (Gore Place Society 2012b). In 1806, the Gores built a large mansion on the property, which was designed with help from noted French architect Jacques-Guillaume Legrand and still stands as an impressive example of Federal-style architecture (Field 1999; Gore Place Society 2017). Open to the public, the Gore Place Society has maintained the property as "a unique educational resource to inspire an appreciation of early 19th century America" (Gore Place Society 2012a). Though any one of these attributes would be impressive on its own, taken together they make Gore Place a unique and important cultural resource for eastern Massachusetts.

Although less well-known, one other feature makes Gore Place important for historical archaeology: the presence of an archaeologically excavated 19th-century

greenhouse. At its most basic, a greenhouse is a specialized structure within which plants are grown and kept protected from the vagaries of weather. Today they are a common sight on farms and tend to be utilitarian structures few people would give more than a passing thought. This was not the case in the past. Historic European and North American greenhouses were multifaceted structures, which could be used simultaneously as practical agricultural buildings, botanical laboratories, political statements, and expensive prestige items. Predominantly the purview of the wealthy, greenhouses encoded information about their owners' power, status, and identity, both purposefully and incidentally. Thus, greenhouses, like the gardens they were often a part of, can contain a great deal of information about the social and political life of the people who owned them.

Unfortunately, relatively few of these buildings have been examined archaeologically, and still fewer remain standing, to provide analogues for archaeological interpretation (Pogue 2003; Beranek et al. 2011:39-41). As a result, our understanding of these buildings is far from complete, and the examination of any historic greenhouse is an important step in rectifying this situation. The focus of this thesis is the greenhouse at Gore Place, which is important not only for simply having been examined archaeologically, but also because of the insight it can provide into the estate as a whole and its various owners.

This greenhouse, which was constructed in 1806, was actually the second one to have been built at Gore Place (Beranek et al. 2011:9, 98). For simplicity, this structure will be referred to as the "1806 greenhouse" or "the second greenhouse" in this thesis.

Historic maps of the property indicated it was situated near the west end of the "mansion house lot," the core of Gore Place which included the Federal-style mansion, 1793 carriage house, a fruit wall, flower and vegetable gardens, and several other features (Figures 1 and 2).

In 2000, the Gore Place Society began an ambitious plan to document and recreate the late 18th- and early 19th-century landscape at Gore Place. This plan called for archaeological excavations at Gore Place to determine the locations and layouts of several no-longer-extant structures and landscape features, including the 1806 greenhouse. To that end, the Fiske Center for Archaeological Research at the University of Massachusetts Boston carried out three archaeological investigations of the 1806 greenhouse. These excavations exposed significant portions of the 1806 greenhouse, as well as features from the surrounding yard (Smith and Dubell 2006; Beranek et al. 2011; Romo et al. 2014).

By combining data accumulated during these projects with contextual information about Christopher and Rebecca Gore, their estate, and historic greenhouses in general, this thesis will aim to answer two research questions. First, what did the greenhouse look like? Contemporary examples and historic greenhouse manuals offer different templates for the overall layout of the building, the organization of the interior, the structure of the heating system, and the types of plants grown within. The historic maps of Gore Place offer little in the way of detail when it comes to the greenhouse; as such, the physical attributes of the building must be reconstructed from archaeology.

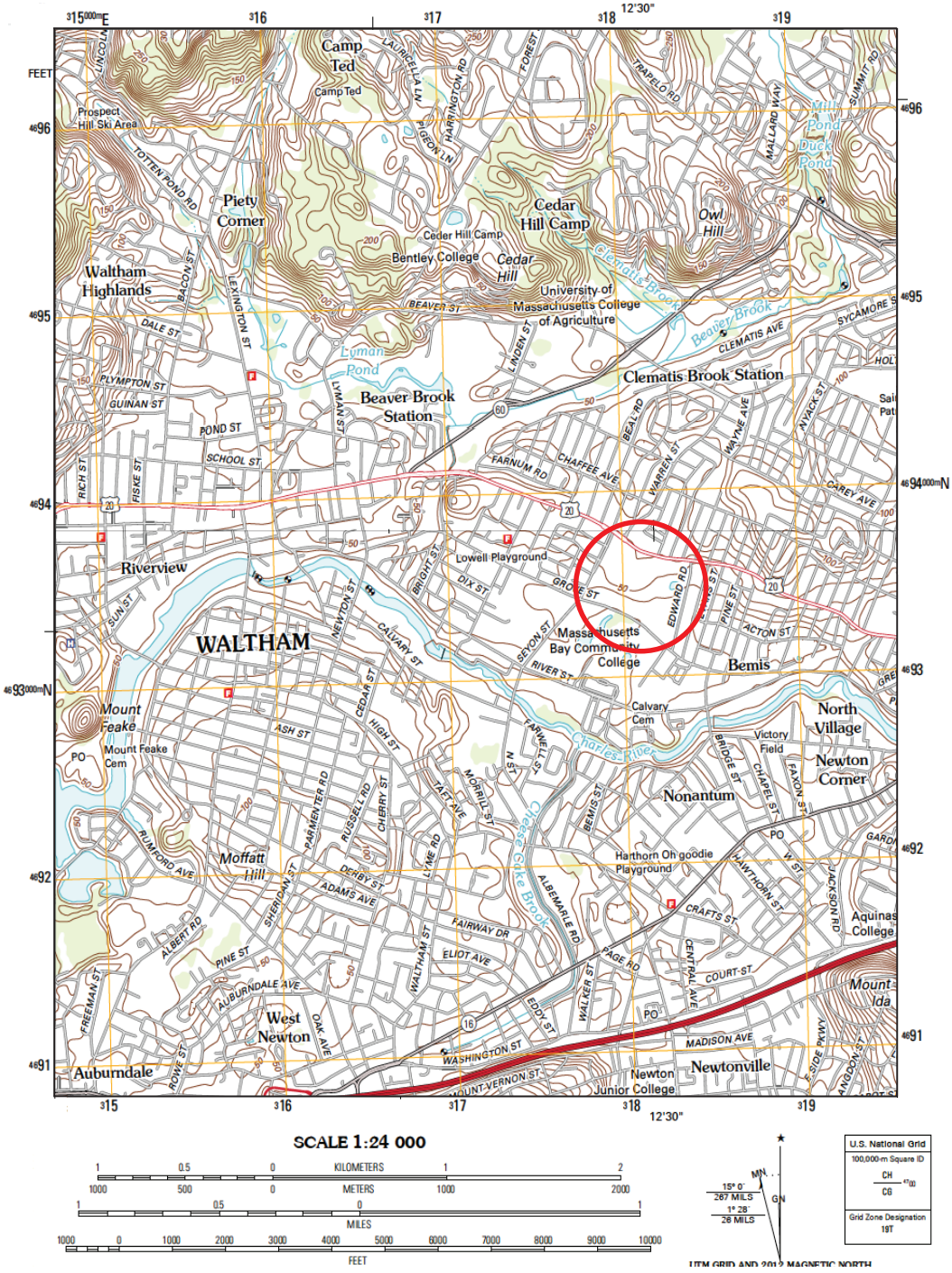

Figure 1. Detail of the combined Lexington and Newton USGS quadrangle maps, showing the modern-day limits of Gore Place, which correspond to the historical "mansion house lot" boundaries (USGS 2012a, 2012b).

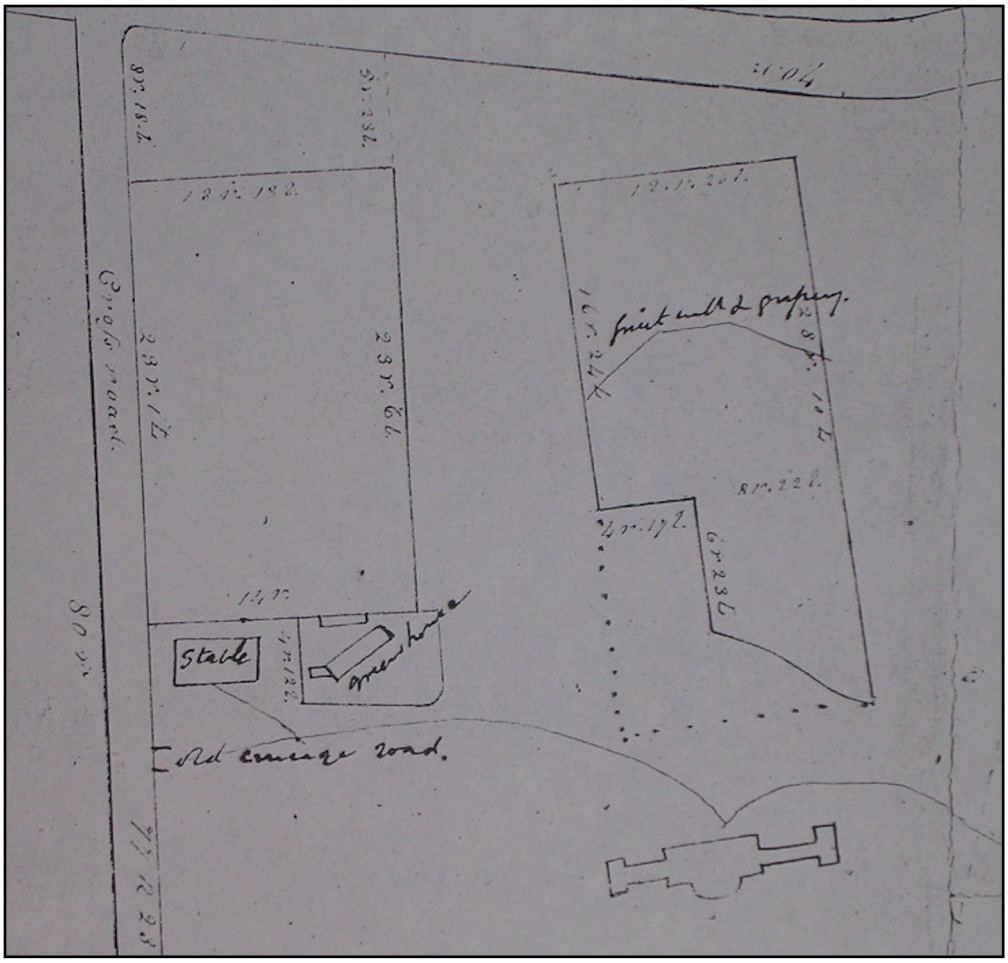

Figure 2. Map of the mansion house lot drawn in 1834. The mansion is in the lower right, and the greenhouse and stable are in the lower left. North is toward the top of the image. Original on file at Gore Place.

Second, why did the Gores build a greenhouse at all? All private greenhouses built in the late 18th and early 19th centuries were elite structures, popular on—and limited to—the villas and estates of wealthy individuals. Christopher Gore was well known for his aristocratic airs, and a greenhouse would have been a natural addition to Gore Place. But greenhouses manifested differently depending on what type of elite

identity an owner was trying to project. Some members of the 19th-century New England elite built greenhouses to show their passions for gardening and botany. Others gained political capital by becoming gentlemen farmers who practiced scientific agriculture. Still others wanted to show off to their peers, gaining prestige by owning expensive foreign plants. These identities—gardener, gentleman farmer, and collector—were not mutually exclusive, and each could influence how a greenhouse was built and used.

This thesis posits that the 1806 greenhouse was built in a "Lean-to" style to hold grapevines and other plants. This style of building was characterized primarily by the presence of a sloped, south-facing wall comprised almost entirely of glass, and was the most efficient type of greenhouse available in the early 19th century. Furthermore, the 1806 greenhouse was built because of both Gores' strong interests in agriculture and horticulture, as well as Christopher's identity as an aristocratic gentleman farmer. Gentlemen farmers were expected to practice scientific agriculture, experimenting with new crop varieties and farming techniques for the betterment of their countrymen. One of the great agricultural challenges of the 18th and 19th centuries was adapting prestigious European grapes to North America—a challenge tailor made for horticulturalists and scientific agriculturalists like the Gores. The 1806 greenhouse was built, in part, to take up this task.

These arguments are based on an understanding of the historical and archaeological context of the 1806 Gore Place greenhouse. As a result, Chapter 2 will examine who Christopher and Rebecca Gore were, how their estate evolved, and what and what it meant to be a member of the 18th- and 19th-century New England elite.

Chapter 3 will provide a history of greenhouses in general, as well as a more specific discussion of the 18th- and 19th-century versions of these buildings. Chapter 4 will examine the motivations that the elite had for building greenhouses. Finally, Chapter 5 will describe the archaeological finds at the site of the 1806 greenhouse. The information contained in these three chapters will provide the background necessary to answer the what and why of the 1806 greenhouse, which will be discussed in Chapter 6.

Throughout these chapters, historical and modern prices for goods and services appear. The modern prices were calculated using the MeasuringWorth (2015) website. That site provides a variety of methods to convert between historical and modern monetary values, and the modern dollar amounts quoted in this paper are based on approximate purchasing power, which is derived from historical changes in the consumer price index.

CHAPTER 2

PLANTING POWER: THE GORES AND THEIR COUNTRY ESTATE

Gore Place as a Country Estate

Christopher and Rebecca Gore purchased the estate that bears their name in 1786. The previous owner, Aaron Dexter, sold the Gores a 33-acre parcel with a mansion, barn, and other outbuildings, called the "mansion house lot," as well as an empty 18-acre parcel (Smith 2007:10). At that time, Christopher was a lawyer with a thriving practice and a growing interest in politics (Pinkney 1969:16-22). Rebecca hailed from the wealthy, well-connected Payne family, and was known as an intelligent, kind woman of actions, not words. By all accounts, the marriage was a happy one (Whitmore 1875:23; Pinkney 1969:18). In addition to Gore Place, in Waltham, the Gores owned a house in Boston on Bowdoin Square, and Christopher maintained an office on State Street (Pinkney 1969:75).

Christopher was an ambitious young man, anxious to be wealthy; a later biographer wrote Gore strove to be rich "not because he enjoyed the acquisition of wealth but because he coveted its attributes of esteem, leisure, elegance, and power" (Pinkney 1969:33). This statement is certainly true, but perhaps not the entire story. Christopher Gore's life was marked by strong commitments to public service—mainly through

politics—and agriculture. Gore was always busy with these activities; at least until illness left him largely unable to do either.

Christopher had earned his wealth by 1790, making a fortune speculating on government debt (Pinkney 1969:33-38). The next year, the Gores expanded their estate, purchasing the 34-acre "homestead lot" to the north and the 75-acre "Ward Farm" to the south (Smith 2007:10). In line with this expansion, the Gores built a new house on the mansion house lot in 1793. The mansion was comprised of a central-block house with wings on the east and west sides, and a connected greenhouse off the east end (Whitmore 1875:22; Brockway 2001:23). A carriage house was also constructed on the property in that year (Beranek et al. 2011:9).

From its inception, Gore Place was intended as a country estate. In Great Britain, the nobility had long drawn their wealth, power, and status from massive rural landholdings (McCracken 1988:11-16; Thornton 1989:22). The classic layout of the English country estate developed in the 16th century, and remained relatively unchanged into the 19th century. Typically, it included acres upon acres of rented-out farmland, arrayed around a central core. This core consisted of the landlord's mansion and the surrounding parkland, which could include enclosed woodlands for hunting, formal gardens, and even artificial lakes (Hoskins 1988:130-138; Williamson 1999). These parks were intended to set a landlord's home apart from his farmland and its tenants, as well as to flaunt his ability to maintain "square miles of conspicuous waste," as one landscape historian put it (Hoskins 1988:134). The total acreage for British country estates could run into the tens or hundreds of thousands; the parks alone could reach up to 2500 acres

in area. The mansions were no less impressive: most were elaborately decorated, and some reached truly palatial sizes (Hoskins 1988:130-138; Williamson 1999).

The situation differed in New England. Boston-area estates were at most several hundred acres in area, and they brought in nowhere near the income that the English lords reaped from their properties. At its largest, in 1834, Gore Place was only 197 acres, the average size for a New England farm, though far smaller than many British parks. The houses were similarly modest and were overall much smaller and far less ornate than the mansions of the English aristocracy (Thornton 1989:22; Brockway 2001:22; Viens 2010:2). However, the English and American country estates were similar in one key respect: they were both used for social signaling. The mere presence of these properties set their owners apart from their poorer neighbors, and the various accouterments present on an estate—mansions, gardens, greenhouses, and beautiful landscapes—communicated information about their owner's self-image and status to other elites (Williamson 1999:43-44, 49; Emmet 1996:1-12).

The construction of country estates around Boston was also a relatively new affair, with the earliest known built around 1736 (Hammond 1982:22-23, 27). Even so, by the late 18th and early 19th centuries Christopher Gore and many other wealthy, politically active New Englanders owned country estates. The Boston-area alone boasted at least 13 of these properties. For example, John Adams owned 294 acres in Braintree; Theodore Lyman Sr., the Gores' neighbor and friend in Waltham, had a large, 517-acre property; and John Brooks, who would be the Governor of Massachusetts from 1816 to 1823, owned a modest 58-acre estate (Hammond 1982:v; Thornton 1989:1; Brockway

2001:18; Parson 2009:104). Most, if not all, of the owners of these estates were lawyers, merchants, doctors, and politicians (Hammond 1982:73).

So why did these men bother with outlying rural estates, when the center of political and commercial life in 18th- and 19th-century Massachusetts was undoubtedly urban Boston? There seem to have been two primary reasons. The first was social: it was simply what the wealthy, political elite did. For the English aristocracy, country estates were a means to an end, namely providing income and augmenting social status; in New England, they were often the end itself. "Land was a trapping of power, prestige, and wealth acquired elsewhere" (Thornton 1989:22). Though the United States was an independent nation, in the late 18th and early 19th centuries it was still very English culturally. The powerful men of Boston viewed themselves as improved, republican versions of the British nobility; as such, it is unsurprising that they attempted to emulate, in a more modest way, the patterns and practices of their English counterparts (Thornton 1989:16-18; Deetz 1996:60-64).

The second reason was political. In the early United States, "work" was viewed through a moralistic lens, especially in New England. Professions that encouraged hard-work and productivity, such as agriculture, were regarded highly. Farmers were also seen as frugal and self-sufficient, and thus in control over their "own economic destiny." This financial independence was supposed to guarantee that farmers would be incorruptible politically (Thornton 1989:4).

In contrast stood commercial professions such as banking, trading, or speculating, which produced no tangible goods and required little physical labor, and thus seemed to

encourage laziness. These types of jobs were also associated with the rapid accumulation of wealth and luxury, which, to post-Revolution Americans, were closely tied to vice, immorality, and overall corruption. While banking and other commercial activities could be very profitable, they were seen as being entirely dependent on the market, and not on an individual's hard work or skill. As such, workers in the commercial establishment were believed to focus only on their own narrow self-interest, and could not be trusted to look out for the common good.

This type of thinking was a problem for many of the wealthy, politically-minded men of New England. Most had built their fortunes on commercial activities, lending them an air of disreputableness despite their obvious economic success. To counter this negative perception, some of the New England elite attempted to rebrand commerce as a misunderstood activity, one that supposedly helped spread prosperity, morality, knowledge, and peace across the world. Others sought to redefine themselves as hardworking, honorable, gentlemen farmers, purchasing country estates and taking up "experimental" or "scientific" agriculture (Thornton 1989:1-25; Emmet 1996:3-4).

Christopher Gore was in the latter group. He was certainly keen on politics, and was acutely aware of "what important people thought of him," especially his fellows in the Federalist party (Pinkney 1969:55). His first official foray into the political sphere came in 1788, when he was elected to serve as a member of the state convention to vote on the United States Constitution. Gore was strongly for the ratification of the new federal system, and his participation in the convention propelled him into an election to the Massachusetts legislature that same year. The following year, Gore was appointed

District Attorney for Massachusetts (Pinkney 1969:22-31). After serving ably in that role for several years, Christopher agitated for a more impressive position in the government. By 1796, Gore's loyalty to the Federalist party and political skill secured him a job more suited to his tastes: as a commissioner under the 1795 Treaty of Amity, Commerce, and Navigation—also known as the Jay Treaty—with Great Britain. The new office required Christopher and Rebecca to relocate to London, and in May of 1796 they set sail for England (Pinkney 1969:65-67).

Scientific Agriculture in England and New England

Except for a brief return to Boston in 1800, the Gores lived abroad for eight years. Most of that time was spent in Great Britain, though the couple traveled to continental Europe as well. While in England, Christopher and Rebecca traveled the county and were able to make the acquaintance of several influential, upper-class families. Thomas Coke of Holkam Hall in Norfolk was one such acquaintance, who impressed Christopher with his agricultural experiments (Ripley 1833:7; Pinkney 1969:78). Coke was famous for converting barren land that could barely support agriculture into rich, productive farmlands, as well as for maintaining an expansive, beautiful estate (Hoskins 1988:154; Thornton 1989:29; Williamson 1999:43).

Thomas Coke was one of a number of English gentlemen who took up scientific agriculture in the 18th and 19th centuries. These men were focused on the idea that contemporary farming practices could be improved through experimentation and scientific study and that as patriotic aristocrats it was their duty to "set an example for the

farmers of Britain" (Thornton 1989:25-29). Farming was viewed as a moral activity in England and was considered "a respectable interest for even the highest born members of society," adding an additional impetus for wealthy landowners to attempt agricultural reforms (Tarlow 2007:40-41). Of course, these gentlemen also knew that improving agricultural practices would increase crop yields, thereby increasing the profits they reaped from their vast landholdings (Thornton 1989:26)

The New England elite found scientific agriculture a fashionable, politically expedient pursuit. The practice allowed wealthy landowners to define themselves not as untrustworthy merchants, bankers, or traders, but as gentlemen farmers, whose only goal was to serve their neighbors and the nation as a whole by improving agricultural practices. As far as they were concerned, scientific agriculture was a benevolent, patriotic practice (Thornton 1989:29-71; Emmet 1996:3) that "their station obligated them to perform" (Viens 2010:3). To spread the word about their innovations a group of 28 scientific agriculturalists, including Samuel Adams, Aaron Dexter, and Theodore Lyman Sr., founded the Massachusetts Society for Promoting Agriculture (MSPA) in 1792 (Secretary of the Commonwealth 1895:333-334; Hammond 1982:75; Beranek et al. 2011:9, 29). The stated goal of the MSPA members was "promoting useful improvements in Agriculture" (Secretary of the Commonwealth 1895:334); for many, membership was also a "highly self-conscious," public act of political symbolism (Thornton 1989:68).

That is not to say that membership in the MSPA or the adoption of scientific agriculture were solely political acts. Founding member Joseph Barrell, who owned the Pleasant Hill estate in Charlestown, was well known for his commitment to agricultural

study and experimentation, and his overall love of farming (Hammond 1982:139-143; Thornton 1989:39-43; Brockway 2001:19). Christopher Gore, also a charter member, was similarly enthralled. While in Great Britain, Gore met with Thomas Coke and other scientific agriculturalists and kept up with the latest agricultural practices from overseas even after he and Rebecca returned to the United States (Thornton 1989:29; Viens 2010:3).

Gore Place was run as an experimental farm, where new tools, crop varieties, farming practices, and livestock breeds were constantly tested (Hammond 1982:145-149, 224; Viens 2010). Christopher's commitment to his country estate and farming was such that in 1800, when he and Rebecca were low on funds, he sold his office and the family's house in Boston, but retained Gore Place. Theodore Lyman Sr. a wealthy merchant and friend to the Gores who owned a country estate called the Vale a short distance from Gore Place in Waltham, purchased the family's Boston home (Pinkney 1969:75; Parson 2009:102-104).

While the Gores were abroad, Rebecca's brother William Payne managed Gore Place. William apparently landscaped the grounds on the mansion house lot, writing that he "raised and planted Trees, and, formed most of the present walks" while his relatives were away (Whitmore 1875:22). In 1799, a fire started in the estate's greenhouse that spread to the adjoining mansion, destroying both structures. William had been living in the mansion; it is unclear where he resided afterward (Whitmore 1875:22; Beranek et al. 2011:9).

Redesigning Gore Place

Christopher and Rebecca returned to the United States in 1804, and set about constructing a new home for themselves at Gore Place in 1805. The new mansion, which was completed in 1806 and still stands, is comprised of a central two-story section with flanking one-story wings. All three sections are brick. The north side of the central section of the mansion has a projecting, curved outer wall, a consequence of the oval reception room on that side of the building. This oval room, and other attributes of the mansion, such as arched windows, fan- and sidelights around the entrance door, and relatively unornamented walls, are features typical of Federal-styles houses in New England (Field 1999:8, 16-17).

Charles Bulfinch popularized the Federal style in New England, and it is likely that the Gores took their cues from builder's handbooks and other mansions in the area, given their new house's similarity to nearby examples (Field 1999:9-10, 17, 20). Letters from Christopher Gore to his friend Rufus King indicate that the Gores consulted with French architect Jacques-Guillaume Legrand during the designing of the mansion. However, the mansion is quite unlike other buildings designed by Legrand (Field 1999:16-24). Although it shares some architectural elements with contemporary English and French buildings, the mansion far more closely resembles neighboring New England homes. As such, it seems likely that Legrand merely advised the Gores on their design choices and did not develop the plan for the mansion himself. Instead, Rebecca Gore appears to have been the primary architect of the house (Field 1999:13-34).

Rebecca was known to have an interest in architecture: for example, in 1800 she assisted John and Catherine Codman, the latter of whom was Rebecca's cousin, in redesigning their Lincoln, Massachusetts house and the surrounding landscape to more closely match contemporary English fashions (Field 1999:8-20). Christopher's letters also support the idea that Rebecca was the prime mover for the new mansion. In 1801, he wrote that Rebecca and Legrand were "in the adjoining parlour building houses" (Field 1999:13). The following year, Christopher sent a letter with sketches of the new mansion's designs to Rufus King, but wrote that "Mrs. G. has sent the plan of our intended house," clearly giving Rebecca credit for the blueprints (Field 1999:14). The plan for the mansion seems to have been completed by the end of 1802, but construction did not begin until 1805, and the house was completed the following year (Field 1999:15-16; Beranek et al. 2011:9).

The new mansion was built with an eye toward both comfort and convenience, and included several innovations:

> Brass rollers assured the smooth gliding of drawers in the pantry and bedroom cupboards, specially designed hinges raised the doors to clear the carpets. The louvre boards in the door of Gore's bed chamber provided good ventilation, and in the entrance hall a layer of goat hair under the floor lessened the chill of the marble squares. The plumbing facilities included a water closet and a "bathing tub," with a hole in the ceiling above the tub to improvise a shower (Pinkney 1969:87-88).

Despite these amenities, the mansion was not initially used as a year-round residence by the Gores. Rather, from their return to the United States until 1816, the Gores rented, and later purchased, various properties in Boston to serve as their primary residence. The mansion in Waltham was used only during the summer and fall, from about June to November (Pinkney 1969:88-89). This arrangement was necessitated in part by Christopher's work, as his newly reopened law office was located in Boston. Another factor was Christopher's continued interest in politics: he was a state senator from 1806 to 1808, and a state representative in 1809. That same year, Gore was elected Governor of Massachusetts (Bradford 1942:206; Pinkney 1969:100-101). He served in that role for only a year, before being defeated in the 1810 election by Elbridge Gerry, of "gerrymandering" fame (Pinkney 1969:117-119). Christopher's final political appointment was as a United States Senator for Massachusetts. He served in that office from 1813 until 1816, when disillusionment with politics and growing physical discomfort from rheumatism prompted him to resign (Pinkney 1969:122, 137).

In addition to his political career, Christopher was also a member of various organizations and boards. For example, he was elected to the Massachusetts Historical Society in 1798, and became its president from 1806 to 1818. In 1802 he joined the American Academy of Arts and Sciences, and in 1804 he helped found the Social Law Library. Gore also served as an Overseer and then Fellow of Harvard College (Pinkney 1969:92-93). It is worth noting that Christopher also took an interest in medical innovations, paying close attention to an 1809 test of a smallpox vaccine (Ripley 1833:18-19). Christopher's association with these particular organizations suggest that he

saw himself as a learned, scientifically-minded man, an opinion shared by his peers (Ripley 1833; Wilder 1881:57).

In spite of all of these distractions, Christopher never lost interest in his country estate or farming in general. One author wrote that "after his return to Massachusetts, [Christopher Gore] engaged in the practice of the law, and at the same time cultivated and embellished his farm at Waltham, which was one of the best in the State" (Bradford 1842:205-206). One of these "embellishments" was the construction of a new greenhouse on the property, built at the same time as the new mansion. Although the mansion had been constructed where its flammable predecessor had once stood, the 1806 greenhouse was built a short distance to the northwest, near the 1793 carriage house (see Figure 2).

Greenhouses—specialized structures used to protect plants from the vagaries of weather, maintain exotic plants outside of their native climate, and to produce vegetables and flowers year-round—were relatively uncommon buildings in the 18th and 19th centuries (Pogue 2003). This was primarily due to their expense; as a result, only governments, institutions, and wealthy individuals could own these buildings (Woods and Warren 1988; Hix 2005). Greenhouses were popular among elites like Christopher and Rebecca Gore for a variety of reasons. Some enjoyed gardening, agriculture, or botany, and built greenhouses to facilitate those pursuits. Others used them as showpieces and homes for prestigious collections of exotic plants. The buildings also visually conveyed the wealth of their owners, and could symbolize their dominant societal position (Woods and Warren 1988; Cooperman 1993; Yentsch 1994; Chesney 2009; Hix 2005).

Although wealthy men and women built and managed greenhouses, the actual day-to-day work was carried out by professional gardeners and laborers (Beranek et al. 2011:38). As early as 1796, when he first arrived in London, Christopher had sought to hire a gardener for Gore Place. He contracted Scotsman William Hay, though it is unclear if he ever arrived in Waltham (Pinkney 1969:88).

The Gores are known to have employed at least two other professional gardeners at their estate, Robert Toohey and William Heathcot (also spelled Heathcoat), the latter of which developed the Heathcot Pear while working on the property (Beranek et al. 2011:33, 101). Jacob Farwell was hired as a farm manager in 1810, and worked at Gore Place until 1830 (Viens 2010:6). A variety of other farmhands were also employed on the estate (Viens 2010:2). Farwell's notes refer to helping Heathcot at the "hothouse," which may be a reference to the 1806 greenhouse (Beranek et al. 2011:36).

In 1816, the Gores moved their permanent residence to Gore Place. As part of this process, the mansion house was renovated and winterized so that it could be used year round (Beranek et al. 2011:9). Although they would eventually buy a winter home in Boston in 1822, to be closer to their friends, the mansion in Waltham remained the family's primary abode until Christopher's death in 1827 (Pinkney 1969:139). Rebecca inherited the property after her husband's passing, but it is not clear how much time she spent on the estate afterward. By the time of her death in 1834, the property was being rented to Judge Charles Jackson. Later that year, the mansion house lot was purchased by Theodore Lyman Jr. and his wife Mary (Beranek et al. 2011:9).

Gardens, Buildings, and Crops at Gore Place

A map of Gore Place drawn between 1834 and 1838 shows how the mansion house lot was laid out at the time of Rebecca's death (see Figure 2). The 1806 mansion stood just west of the center of the lot. A formal entrance drive connected the mansion with Cross (now Gore) Street to the west. The 1793 carriage house, marked as "stable" on the map, sat just east of Cross Street and north of the entrance drive, and was connected to the latter by a driveway. The 1806 greenhouse was a short distance east of the carriage house, while a large rectangular vegetable garden, measuring about 380 feet north-south by 230 feet east-west, was situated to the north of both buildings. A similarly large flower garden was located north of the mansion, which contained a large fruit wall, noted as "fruit walls & grapery" on the map.

Fruit walls were large brick walls against which grapevines and cherry, plum, peach, and other fruit trees were planted. The walls would passively absorb solar heat, helping to keep the vines and trees warm. Occasionally, these features would also incorporate furnace and flue systems for additional heat (Hammond 1982:225-226). The fruit wall at Gore Place was comprised of a central east-west span flanked by two angled walls. The fact that the fruit wall is not aligned with the Gore Place mansion may suggest that it predates 1806, or that it was angled to better absorb the sun's rays (Hammond 1982:225-226; Beranek et al. 2011:99). The fact that the fruit wall was also marked as a "grapery" indicates that grapevines were grown against it. An 1824 letter penned by Christopher Gore notes that a frost decimated his grapevines and damaged his peach,

cherry, and pear trees (Viens 2010:47), indicating they had been planted outside, probably against the fruit wall.

A subsequent plan, drawn in 1841, indicates that the fruit wall was eventually expanded into two adjoining greenhouses (Figure 3). The 1806 greenhouse was still standing by that point, and a path connected to the east wall of the building, suggesting that the structure was entered from that end.

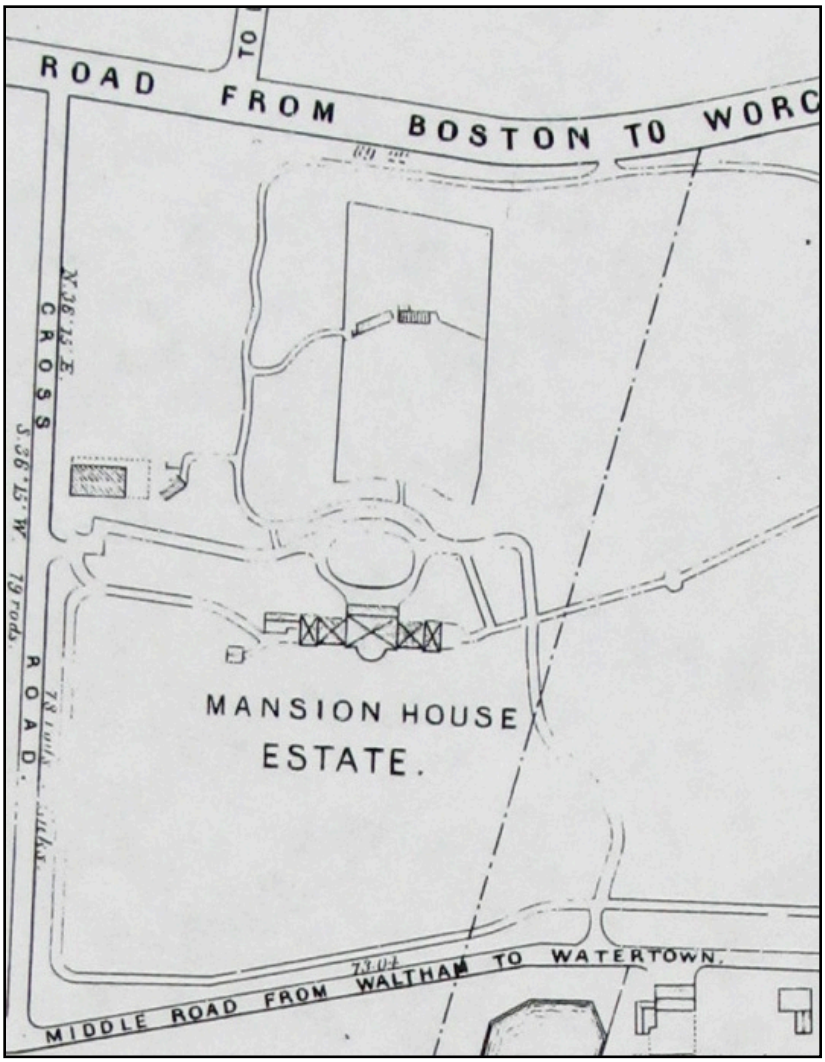

Figure 3. Plan of the mansion house lot drawn in 1841. The mansion, greenhouse, and carriage house appear the same, but the fruit wall north of the mansion has been expanded into adjoining greenhouses. North is toward the top of the image. Original on file at Gore Place.

A later sketch plan, drawn in 1881 by Colonel Henry Lee but depicting the property as it looked in 1834, adds a few more details (Figure 4). The vegetable garden and flower garden are both crossed by a pair of perpendicular pathways, which connect to rectangular perimeter walks. This rectilinear garden pattern was typical of 18th-century vegetable and flower gardens (Brockway 2001:32). Both gardens are also surrounded by fence lines.

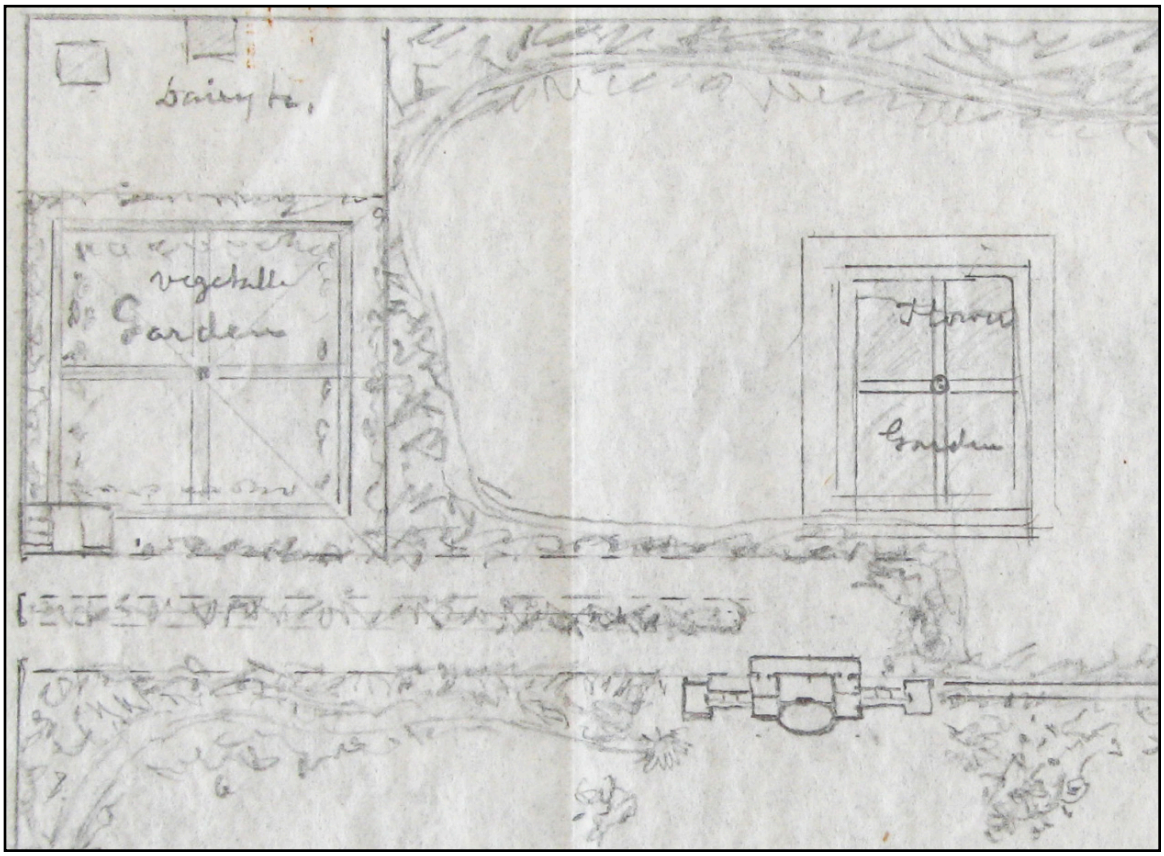

Figure 4. Sketch map of the mansion house lot, drawn in 1881 but depicting the property as Colonel Henry Lee remembered it from an 1834 visit. The 1806 greenhouse is not depicted. North is toward the top of the image. Original on file at Gore Place.

The fence around the vegetable garden seems to link up with the carriage house, and to enclose a dairy to the north of the garden. A path is shown extending off the east end of the mansion, while another loops from the flower garden, west to the vegetable garden, north to the edge of the lot, and then back east, encircling a large open field north and east of the mansion. The former path is presumably the Straight Walk, one of the only landscape features referenced in Christopher Gore's writings (Smith et al. 2010:16). Another path meanders west and south from the west end of the mansion. Most or all of these paths would have been tree-lined. The Straight Walk was perhaps the most important and was used by the Gores to observe the farm fields east of the flower garden and mansion (Brockway 2001:21, 24; Viens 2010:6).

Other documentary sources, such as Jacob Farwell's farm journal and Christopher Gore's letters, describe more features of the mansion house lot. A gated cartway ran north-south between the greenhouse and the carriage house, connecting the entrance drive with the vegetable garden. At one point, a smaller vegetable garden was located south of the entrance drive and carriage house. This second garden grew mangelwurzel, corn, beans, and turnips and was in use as late as 1821. Manglewurzel is a root vegetable used as livestock feed (Beranek et al. 2011:11-14).

Christopher wrote often of his experiments with farming, telling his friends about harvests and sales (Brockway 2001:26; Beranek et al. 2011:31). This was not idle boasting: Christopher's letters reveal that he carefully measured crop yields, experimented with new varieties of crops and animal feeds, and kept abreast of the latest agricultural developments in England (Beranek et al. 2011:31). In the 1830s, American

farmers began sheltering their hogs in barn cellars; the Gores were ahead of their contemporaries, having taken up this practice by 1824 (Viens 2010:35-36). Christopher often tested new crops, growing experimental batches of rhubarb, salsify, asparagus, and sea kale before they became popular or common (Viens 2010:42). In the 1800s, scientific farmers were also experimenting with additives to improve the fertilizing power of manure. Gore himself tried using fish, wood ash, lime, and ground bone at various times to enhance his manure fertilizer (Viens 2010:43-45).

Christopher also embraced new farming technologies. For example, he purchased a horse-drawn hay rake several years before it was in common use, and adopted the use of cast iron plows at a time when many farmers were still using wooden implements. As early as 1822, farmers at Gore Place were using a heavy roller to deposit grass seed and compact soil, which was notable since as late as 1839 this type of roller was still considered an innovative new tool (Viens 2010:12-15).

Gore Place appears to have been relatively successful as a farm: the aforementioned Heathcot pear was developed on the property, as was a cattle breed that became "widely known as the Gore breed" (Viens 2010:26). In 1816, Christopher Gore wrote to his close friend Rufus King that he had harvested 1600 bunches of grapes from his grapery (Beranek et al. 2011:31). Other crops grown in the farm fields and gardens included apples, beans, beets, cabbages, carrots, celery, cherries, corn, cucumbers, hay, horseradish, mangelwuzel, melons, nectarines, onions, parsnips, peaches, peas, potatoes, pumpkins, radishes, rutabagas, strawberries, squash, turnips, and several types of grains. Cattle, pigs, sheep, and chickens were also kept on the property (Viens 2010:6, 41, 47).

The crops that the Gores grew hint at their goals for Gore Place. Take, for example, apples, pears, and grapes, all of which were imports to North America. Apple trees were used to produce hard cider, which was ubiquitous in the 18th- and 19th-century United States (Pauly 2007:67; Kerrigan 2012:10, 19-20). Cider was so popular, in fact, that farm owners "were expected to provide their workers with a ready supply of hard cider" during harvest season (Kerrigan 2012:144). The Gores were known to have produced cider and sold some 48 barrels at the market in 1817, indicating they took economics into consideration when choosing crops (Brockway 2001:26; Viens 2010:1, 6), and possibly that they were not immune from the "national thirst" for the drink (Pauly 2007:67).

Unlike apples, which were the fruit of the average American, pears were "the perfect upper-class fruit" (Pauly 2007:68). Pear trees grew slowly, had great difficulty adapting to the changeable American climate, and required extra work to produce ripe fruit. As early as the 1600s pears were associated with the aristocracy, and they were a favorite plant among horticultural enthusiasts (Pauly 2007:68-69). The aristocratic association of pears, and the complexity inherent in their successful production, would certainly have appealed to Christopher Gore's image of himself as a member of the elite, and as a scientific agriculturalist. A craze for pear cultivation would take hold of Boston beginning around 1830 (Thornton 1984:3); here, too, the Gores were ahead of their contemporaries, having planted pear trees by 1812 (Hammond 1982:223).

Grapes were another challenge, one almost tailor-made for gentlemen farmers. Since the 17th century, Americans had attempted to grow European wine grapes in the

New World (Pauly 2007:23-32, 73). Wine grapes were viewed, in the Western world, as "the indicator species for culture" (Pauly 2007:29). Further, knowledge of wine itself, "its proper care and handling," and the culture surrounding its imbibing, was part of how gentlemen demonstrated their elite status (Thomas 2007:46-47). Unfortunately, cold snaps, bacteria, and fungi consistently destroyed grapevines, with most, even those managed by experienced gardeners, surviving only a year or two at maximum (Pauly 2007:26). In fact, it was not until the 1840s that an American gardener developed a grape that would thrive in the United States: the Concord grape (Pauly 2007:75). Prior to this, the failures of American grape-growers were blamed on incompetence or the distressing idea that North America was a "degenerate" place that destroyed "refined European" plants, animals, and people (Pauly 2007:20-23, 73).

The idea that North America as a whole was inherently inferior to Europe and had a corrosive effect on people, plants, and animals was a source of anxiety for many in the early United States (Pauly 2007:9-32). Figuring out a way to grow wine grapes and thus prove that North America was as civilized and refined as Europe would have been the ultimate act of patriotism for a farmer or horticulturalist. The nigh inexplicable withering of European grapevines was a problem whose solution demanded experimentation with different plant varieties and growing techniques, and a deep understanding of gardening. A gentlemen farmer would likely have seen solving the grape problem as a patriotic duty that they were uniquely suited for. However, it was not a task for the faint of heart, as even luminaries such as Thomas Jefferson had been met with consistent failure when attempting to cultivate wine grapes (Pauly 2007:12, 23-32). The fact that the Gores grew

grapes indicates that they were serious about scientific agriculture—they did not simply dabble as gentlemanly farmers.

Christopher Gore's letters and his management of the Waltham farm paint a picture of a man fully committed to scientific agriculture and his chosen role as a gentleman farmer. Visitors to the estate clearly picked up on this: Dr. Samuel Ripley described the estate in 1815 as "pleasant" and "tastefully laid out" but noted that:

> The grounds are not improved merely to gratify personal feelings or… receive applause; but they are devoted to raising of every variety of horticulture, grass, corn, wheat, barley, etc.: - and while this variety itself delights the eye of the beholder, it makes him feel that utility is the main design of the exertions there displayed… to study the convenience or supply the wants of society. Mr. Gore has paid considerable attention to the cultivation of wheat, and has sometimes raised good crops (Brockway 2001:24).

Unfortunately, no letters or other writings by Rebecca Gore exist, and it is not clear what the extent of her involvement with the agricultural activities at Gore Place was. However, circumstantial evidence indicates that she may have operated the estate's greenhouses, at least in part. In 1829, two years after her husband had died, "forced vegetables"—grown in a greenhouse or hot bed—"were shown by Mrs. Gore's gardener" at an early exhibition of the Massachusetts Horticultural Society (MHS) (Wilder 1879:6-7). The next year, Rebecca was one of "only three women elected as honorary members"

of that society (Wilder 1879:9). Rebecca's interactions with the MHS after her husband's death make it clear that she maintained an active interest in horticulture. Rebecca was also known to have purchased plants from the Cambridge Botanical Garden, which would likely have been housed in a greenhouse. At the time of her death, seven years after Christopher Gore had died, orange and variegated orange trees, lime trees, roses, and geraniums were known to have been grown "in the vinery"—possibly the 1806 greenhouse or the "grapery" at the fruit wall referenced on the 1834 map (Brockway 2001:26-28; Beranek et al. 2011:102). This indicates that either Rebecca or a tenant was maintaining the plants.

Other contemporary English and American women were known to have managed greenhouses and gardens: Margaret Carroll, for example, was a late 18th-century horticulturalist who ran her own greenhouse and advised George Washington on how to construct and maintain one of his own (Weber 1996:34-36). By the mid-19th century, at least one gardening manual was directed solely at women: *Gardening for Ladies*, written by Jane Loudon, which had an entire chapter dedicated to managing a greenhouse (1851). As such, it would not have been unusual for Rebecca to have been entirely in charge of the 1806 greenhouse and grapery, or to have taken over their management after Christopher died (DeForest 2010:115-121).

Gore Place after the Gores

After Rebecca's death in 1834, the mansion house lot was purchased by Theodore Lyman Jr. and his wife Mary (Smith and Dubell 2006:12). Lyman Jr.'s purchase included "33 acres with mansion house, stable, vinery and sheds" (Brockway 2001:31). The other parts of the estate were split up and sold off to various other people (Brockway 2001:30). Theodore Lyman Sr. was an old acquaintance of the Gores, and a fellow member of the wealthy New England elite. The elder Lyman is known to have entertained many of "Boston's most distinguished citizens, including the Adamses, Hamiltons, Gores, Otises, Hancocks, Bootts, and others" (Parson 2009:102). He made his fortune in the late 1700s through shipping and shipbuilding, and purchased the Vale, a country estate less than a mile north of Gore Place in Waltham, in 1793 (Parson 2009:4, 100-102, 104). One visitor to the Vale noted that the grounds were "in a good taste" and had been "embellished… at a very large expense" (Kendall 1809:10). Lyman Sr. was a fellow gentleman farmer and cofounder of the MSPA, and had a keen interest in horticulture. By 1804, Lyman Sr. had built two greenhouses and a fruit wall at the Vale, within which grew a variety of plants, including camellias, mimosas, bananas, figs, and pineapples (Parson 2009:104, 106). A visitor to the area in the early 19th century remarked that the Vale held "a handsome collection of exotics," but made no mention of a similar collection at Gore Place, perhaps indicating that the Gores grew more local or less impressive plants in their greenhouse (Kendall 1809:10).

Theodore Lyman Jr. was the second son of Theodore Sr., and became active in politics in the early 19th century. By 1834, when he purchased Gore Place, he was

serving as mayor of Boston, the zenith of his political career. Lyman Jr. only owned Gore Place for four years. In 1835, his oldest daughter died, and the following year his wife Mary passed away. Lyman Jr. had apparently purchased Gore Place for his wife, and found it too painful a place to stay after her death. As a result, he moved his primary residence to Brookline and sold Gore Place a few years later in 1838 (Brockway 2001:32-33).

While he owned the estate, Lyman Jr. was known to have painted the mansion white, and to have planted "a garden laid out in a modern fashion" (Brockway 2001:29). This "modern" garden contained curvilinear paths and circular planting beds in a pattern based on contemporary European designs. The new garden was laid out over and replaced the Gore-era rectilinear flower garden (Brockway 2001:31-32). Lyman Jr. also put the 1806 greenhouse and/or grapery greenhouse to use, asking his brother to send him small pineapple plants and to advise on the appropriate climate for growing them (Brockway 2001:32).

John Singleton (J.S.) Copley Greene purchased the mansion house lot at auction for $24,000—approximately $631,000 in modern American dollars—and dwelt with his family on the property until 1856 (Brockway 2001:34-38). John came from a family with a strong tradition of horticulture: his father, Gardiner Greene, was known for his Boston home and its terraced gardens and greenhouse. With the aid of gardener Robert Murray, Gardiner Greene grew rare trees and flowers (Emmet 1996:34), and his property was described as having "the most conspicuous and extensive, and elegant garden" of its day (Wilder 1881:12). Robert Murray was subsequently hired by Theodore Lyman Jr. to

improve and manage the Gore Place grounds, and stayed on through J.S. Copley Greene's tenure at the estate (Brockway 2001:31). Greene made at least one change to Gore Place during his tenure, excavating a large pond in 1846 (Brockway 2001:25). The fruit wall had also been expanded into two adjoining greenhouses by 1841, though it is not clear when exactly the expansion took place.

Theophilus Walker purchased the mansion house lot from J.S. Copley Greene in 1856, and his family owned the property until 1907. A sketch map of the estate grounds, produced in 1889, indicates that the 1806 greenhouse had been demolished by that point, though the fruit wall greenhouses were still in use. As there are no detailed maps of the estate from between 1841 and 1889, it is not clear from the documentary record when the 1806 greenhouse was demolished.

The fact that the Lymans, Greenes and Walkers all managed at least one greenhouse on the property indicates that all three families had an interest in horticulture. However, none of the owners after the Gores appear to have had strong interests in agriculture. This is perhaps most clearly shown by the fact that none of the later owners purchased any of the outer farm fields; they only ever owned the core of the estate, with the mansion and pleasure grounds and only limited agricultural fields. Although the plot was farmed into the 19th century, owners after the Gores seemed to appreciate the estate primarily for its aesthetics, and not for its productivity (Brockway 2001:34, 38).

CHAPTER 3

LIGHT AND HEAT: HISTORIC GREENHOUSES

Orangeries and Early Greenhouse Development

The earliest European greenhouses were built by the Roman Empire. Roman gardeners developed greenhouses in order to "force" plants—artificially heating them to produce crops of fruits and vegetables out of season—and to keep exotic imported plants alive. Greenhouses disappeared from use and memory with the dissolution of the Roman Empire, but the exotic plants they had housed remained popular. Oleanders, pomegranates, lemons, limes, oranges, and myrtles were all imports to Europe that arrived in Roman times, and these plants were still garden staples well into the 15th century. Citrus trees, especially oranges, were particularly treasured, and by the 16th century were found even in England and Northern Europe (Woods and Warren 1988:3-10; Yentsch 1994:117; Hix 2005:10-11).

Growing citrus trees outside of the Mediterranean basin, even in northern Italy, proved difficult. The plants are sensitive to low temperatures, especially long-term, and cannot survive outside during the chilly winters seen in central and northern Europe. Fifteenth- and 16th-century gardeners settled on two solutions to this problem: first, citrus trees could be grown in pots and carried indoors during the winter. This method of

cultivation had the added benefit of changing the trees into moveable decorations, which could be arrayed practically anywhere. Growing citrus trees in pots was not without its drawbacks, however, and trees grown outdoors tended to require less care and to grow fuller and produce more fruit and flowers than their potted kin. To protect those trees from cold temperatures, gardeners built temporary wooden shelters around them during the winter months (Woods and Warren 1988:4-11; Hix 2005:10-11). These shelters, called "orangeries" because they often enclosed orange trees, sometimes incorporated braziers, stoves or furnaces for heat, especially in England, the Netherlands, and places further north (Woods and Warren 1988:12-15; Hix 2005:10-11).

Early orangeries were often poorly ventilated, unlit, and rudimentary. They did their job, but their seasonal construction and deconstruction was labor intensive, and there was clearly room for improvement (Britz 1974:133; Woods and Warren 1988:10-13). At the dawn of the 17th century, a French gardener named Olivier de Serres published a horticultural manual entitled *Le Théâtre d'Agriculture*, and in it described a more permanent plant-house. De Serres' building was an airtight structure with a sturdy back wall and slanted, skylit roof, which encased a variety of plants. To keep the cold out, the building was heated by a charcoal brazier, and had glass or canvas windows to let light in. In the summer, the side walls could be entirely removed to allow more sunlight and fresh air to reach the plants. De Serres' structure was a natural evolution of the orangery, but he can take credit for reintroducing the greenhouse to Europe. The impact of *Le Théâtre d'Agriculture* was immense, to the point that by the mid-1600s "*serre*" had become a French word for "greenhouse" (Woods and Warren 1988:17, 31; Hix 2005:15).

De Serres' text helped start a long era of experimentation with greenhouses across Europe. In late 17th-century England, gardeners tested a variety of methods of heating greenhouses, including using pans of burning charcoal, raised or sunken hearths, open fireplaces, and iron stoves. These heat sources were normally placed adjacent to plants. That close proximity was less than ideal, as extreme, direct heat could damage or kill delicate plants, and soot and smoke could block sunlight, retarding plant growth (Britz 1974:141). The Dutch, who were relentlessly innovative when it came to greenhouse design, were the first to install a sub-floor stove-and-flue heating system, which allowed for more moderated and even heating of plants and easier shunting of smoke and soot outside a greenhouse. That design was imported to England in 1684 by gardener John Watts, who used it in the new greenhouse at the Chelsea Physic Garden in London (Britz 1974:141-142; Hix 2005:20-21; Laird 2006:157-158).

Although an improvement, Watts' design could still leave plants "sick, langourous [sic] and tainted," according to his contemporary John Evelyn (Woods and Warren 1988:31). Evelyn, also a gardener, introduced his own greenhouse design in the 1699 *Kalendarium Hortense*. His proposed heating system consisted of an external furnace connected to a series of earthenware pipes. The pipes ran through the firebox and floor of Evelyn's greenhouse, and connected with a vent at one end. Besides heating the structure, Evelyn intended his furnace, pipe and vent system to bring fresh air into the building while simultaneously expelling stale air (Britz 1974:142-143; Woods and Warren 1988:31; Laird 2006:158-162). Despite Evelyn's modifications, some gardeners were distrustful of stove-and-flue systems, arguing that they were difficult to manage and

could harm plants if run improperly (Pogue 2003:2). Interestingly, Evelyn recommended that heat in the greenhouse be monitored by thermometer, still a very new invention in the late 17th century (Britz 1974:143).

Besides his new heating system, Evelyn recommended a greenhouse be about 12 feet deep and 11 feet tall, and have an enclosed porch or antechamber, in order to prevent the flow of cold air into the building from outside (Britz 1974:144). He suggested that the walls be lined with cork, an improvement on the mattresses, hay, wood shutters, and reed mats apparently utilized as insulation in English greenhouses of the time (Koppelkamm 1981:11-12; Woods and Warren 1988:31). Evelyn's writings also indicate that he was aware of the importance of "large and ample" windows in greenhouses (Woods and Warren 1988:31; Laird 2006:164).

Large windows were used in greenhouses for two reasons in the 17th century: first, they allowed the buildings to be partially heated by the sun. Louis XIV's greenhouse at Versailles, built in 1685, was heated entirely via sunlight, let into the building through expansive, south-facing windows (Hix 2005:15-16). Having the windows face south allowed the most light to enter the greenhouse; due to the relative locations of the sun and Earth, the south sides of buildings tend to receive more sunlight than anywhere else.

The second reason for large greenhouse windows is, of course, that plants need sunlight to grow. Although that fact is painfully obvious to the modern gardener, it was not a universally known truth in the 16th, 17th, or 18th centuries (Woods and Warren 1988:17; Yenstch 1994:118-120). In fact, many early greenhouses were built in heavily

shaded locations, and received little to no sunlight at certain times of year (Woods and Warren 1988:36). Even so, some gardeners like John Evelyn recognized the connection between plant growth and sunlight, and argued for the use of larger windows in greenhouses and better placement of those buildings (Britz 1974:144; Hix 2005:16-17; Laird 2006:164). Regardless of their size, windows were expensive to install, as glass itself was a costly commodity (Koppelkamm 1981:11; Renaud 1990:91). Further, at least in England and its colonies, the manufacture and sale of glass was highly regulated and taxed (Woods and Warren 1988:36, 61; Renaud 1990:91; Scharfenberger 2004:60-62). Despite these financial obstacles, the size of greenhouse windows gradually increased from the late 17th century onward, eventually culminating in magnificent mid-19th-century buildings made almost entirely of glass (Britz 1974:144; Koppelkamm 1981:11; Hix 2005:16-17; Laird 2006:164).

Greenhouse Designs and Terminology in the 18th and Early 19th Centuries

Typical late 17th- and early 18th-century greenhouses were rectangular masonry buildings with substantial rear and side walls, and a less robust front wall with large windows set throughout. To take best advantage of available sunlight, greenhouses were almost always oriented facing south. The windows in the south façade were normally set vertically, as they would be in a dwelling or other structure. However, as early as 1700 some gardeners and physicists noticed that having the front wall and windows sloping down and away from the roof actually allowed more sunlight into the building. This is because even though glass is translucent, sunlight can still ricochet off its surface if it

strikes the material at a suboptimal angle. To keep the deflection of light rays to a minimum, it is best that they strike a glass surface at a perpendicular angle.

Awareness of this phenomenon had two major effects. First, it kicked off a century of experimentation and debate over the optimal angle for greenhouse windows, beginning with botanist and physicist Herman Boerhaave, who directed the Leyden, Holland botanical garden from 1709 to 1730 (Loudon 1817:4-11; Koppelkamm 1981:12). Second, it helped split greenhouses into two broad stylistic categories, referred to in this text as the 'Traditional' and 'Lean-to' styles.

The Traditional greenhouse maintained the architectural patterns of its forebears, with a series of large, vertical front windows on its south side, separated and supported by wood or masonry piers (Figure 5). In contrast, the Lean-to style greenhouse had a sloped front wall comprised almost entirely of glass, sometimes resting on a very short knee wall or foundation (Figure 6) (Pogue 2003, 2009; Beranek et al. 2011:34-35). Due to the greater amount of windows, this type of greenhouse tended to be better lit, and was superior to the Traditional greenhouse when it came to actually cultivating plants. As a result, Lean-to greenhouses were viewed as more practical structures. Though their utility was recognized early, Lean-to greenhouses were less common than their Traditional cousins in England until the 1790s (Woods and Warren 1988:90-91; Hix 2005:22-23). This appears to have been the case in the United States as well (Pogue 2003).

Traditional-style buildings had more space for architectural embellishment, since their windows took up less room, and they were often treated as ornamental buildings (Hix 2005:16-17). Those intended as decorative structure were not always built with an

eye toward actually raising plants, and one author lamented that "many green-houses, as they are commonly built, serve more for ornament than use… it is rare to find one that will keep plants in good health during the winter" (M'Mahon 1806:81).

It is important to note that the 'Traditional' moniker was not a historic designation. 'Lean-to' was used in at least one 19th-century publication (Chorlton 1856:19) and may have been used earlier, but does not appear to have been common. Instead, historic authors tended to describe greenhouses based on what was grown in them, specifying if a building was a "pinery", or "vinery" for example (primarily growing pineapples or grapes, respectively), or if it was a "stove" or "hot-house"; in other words, a heated structure (Kennedy 1776:210; Abercrombie 1789; M'Mahon 1806; McIntosh 1838; Pogue 2003:3).

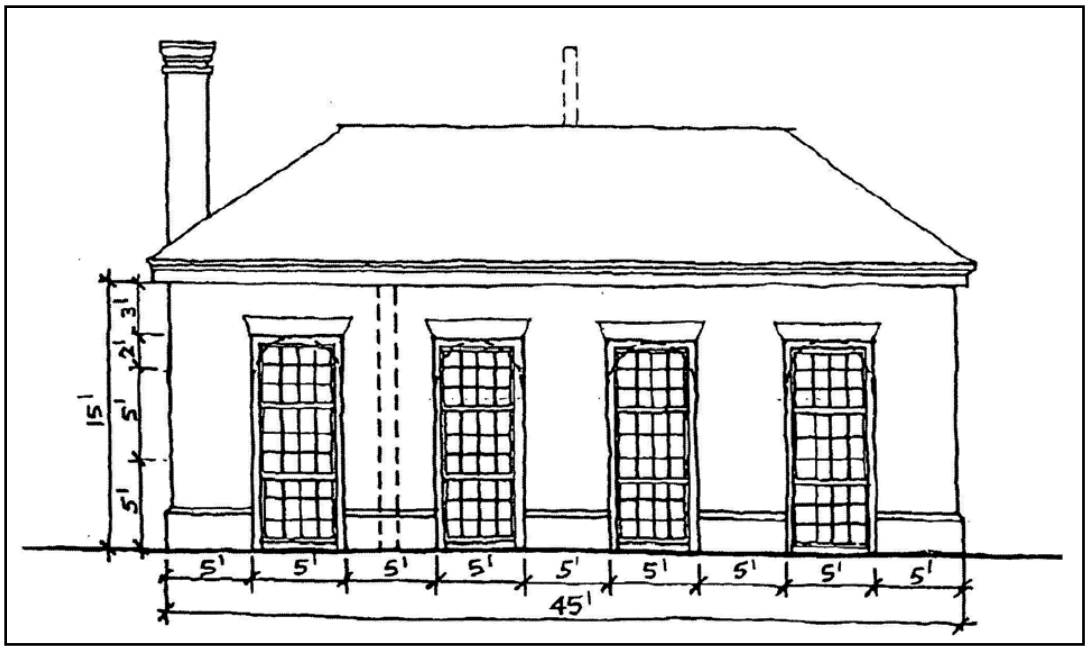

Figure 5. Conjectural sketch of the ca. 1740 "Traditional" style greenhouse at Green Spring Plantation in Virginia (Brinkley 2004:144).

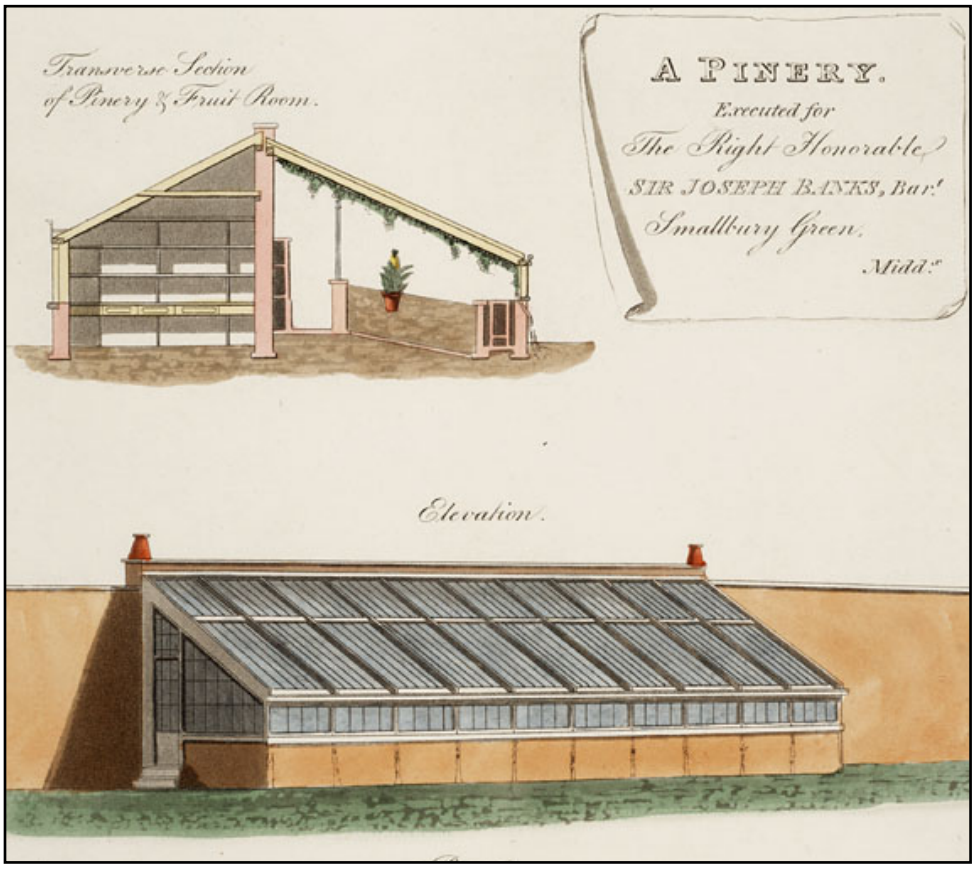

Figure 6. An early 19th-century "Lean-to" style greenhouse in England (Tod 1823:Plate XI).

In many instances "hot-houses" and "stoves" were home to delicate exotic or tropical plants, which could not survive outdoors in non-native climates. Other plants, such as grapes, were sometimes grown alongside the more exotic items in hot-houses as well. Although in modern parlance the word "greenhouse" is used for any building dedicated to growing plants indoors, historically the term often referred to unheated or

lightly heated buildings that housed sturdy plants only through the winter and fall. In spring and summer, the plants, which were grown in pots, were moved outdoors. A "conservatory" was normally a year-round home for a variety of plants, which were generally grown in built-in beds (Abercrombie 1789:81-83; Steele 1793:115; Gardiner and Hepburn 1804:187-188, 196, 203; M'Mahon 1806:37, 78-83; Speechly 1821; Hibbert and Buist 1832; McIntosh 1838; Edmonson and Smith 1999:244; Pogue 2003:2; DeForest 2010:16-17).

These definitions of "greenhouses" and "hot-houses" were in common use in the United States at the end of the 18th century, and would likely have been used by the Gores, Lymans, and Greenes, and their gardeners. In addition, North American "greenhouses" of that time tended to be built in the Traditional style, while "hot-houses" were often constructed in the Lean-to style (Gardiner and Hepburn 1804:187-188, 196; M'Mahon 1806:78-99; Pogue 2003:2-3). This dichotomy is most clearly shown in plates from William Pain's *The Practical House Carpenter*, an English construction handbook reprinted in Boston in 1796 (Figures 7 and 8) (Pain 1792:102-104; Lewis and Floyd 1999:5). "Forcing-house", "plant-house", and "glasshouse" tended to be generic terms for buildings within which plants were grown (Kennedy 1776:210; Kyle 1783; Speechly 1821; Hibbert and Buist 1832). Of course, the exact definitions of these terms varied over time and from author to author (Britz 1974:140; Woods and Warren 1988:31, 92-94; Renaud 1990:91; Pogue 2003:3).

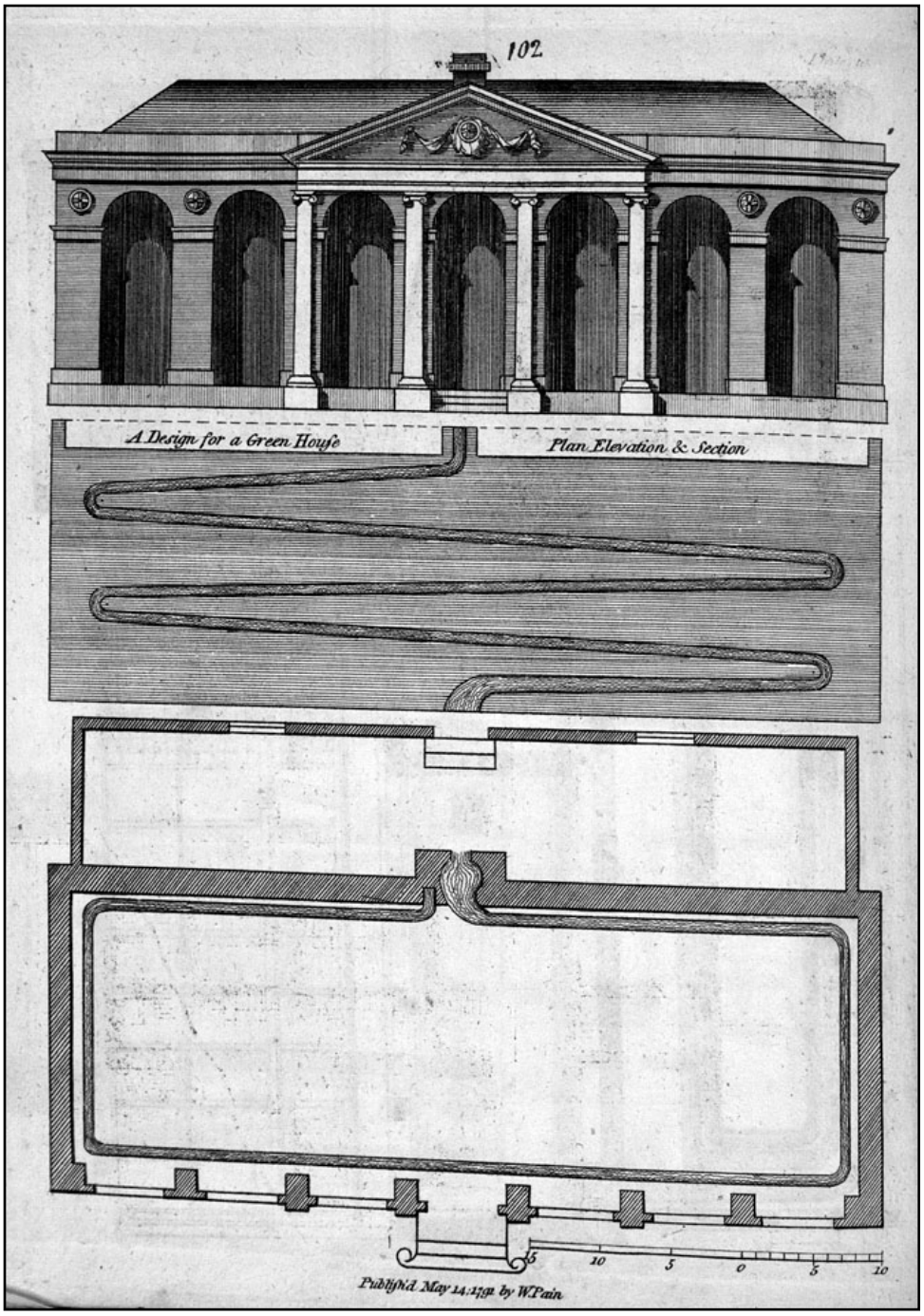

Figure 7. Drawing of a plan for a late 18th-century greenhouse (Pain 1792:102).

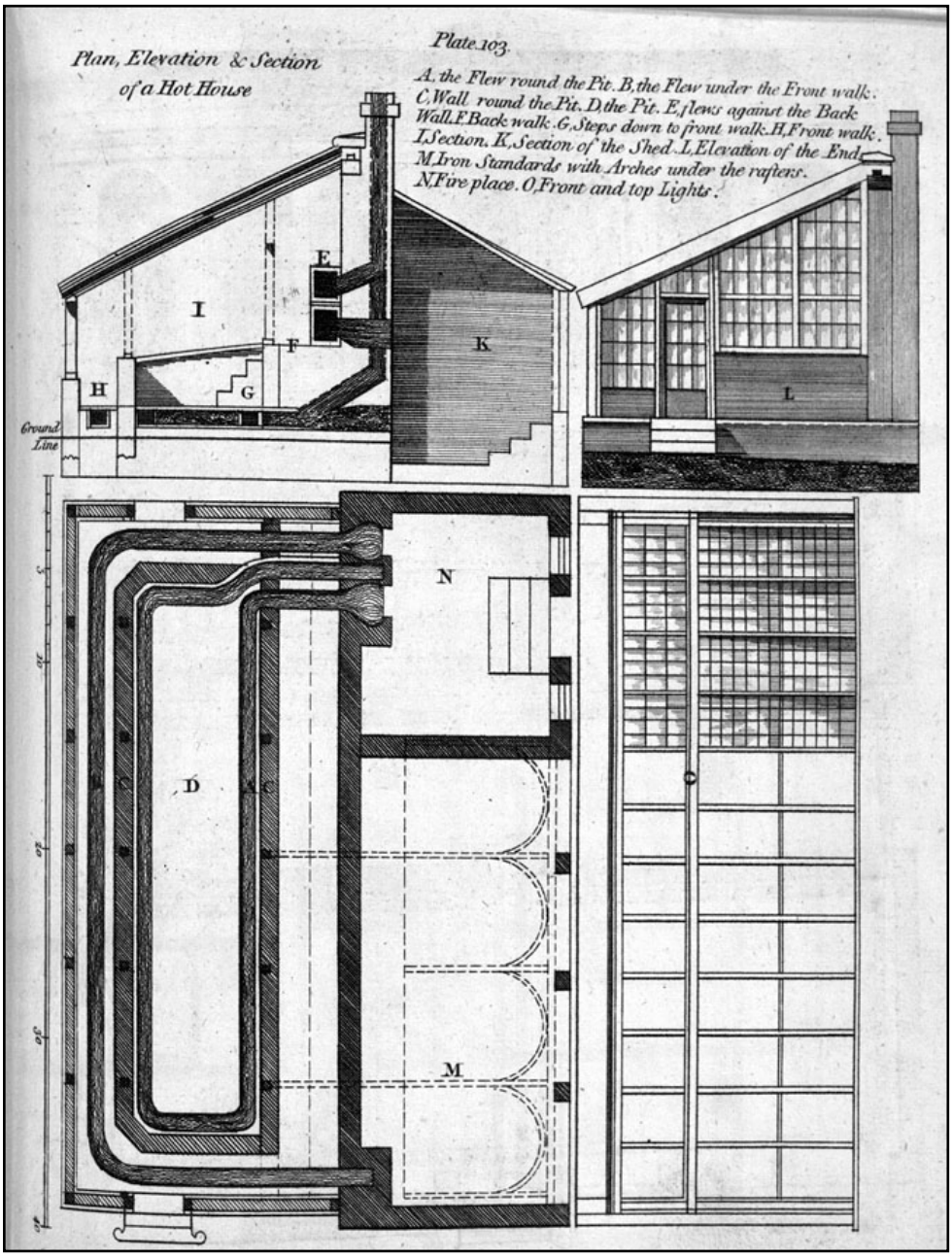

Figure 8. Drawing of a plan for a late 18th-century hot-house (Pain 1792:103).

A likely source for the variation in greenhouse terminology was the rapid growth of interest in botany that occurred throughout the 17th, 18th, and 19th centuries. As Europeans explored the world, they developed a fascination with the exotic, and a worldwide trade in foreign plants quickly sprung up. This trade was driven by several factors, not the least of which was curiosity (Belden 1965:107; Britz 1974:133; Woods and Warren 1988:31; Edmonson and Smith 1999:245-247; Sikkens-De Zwaan 2002:206; Hix 2005:11-27). In addition, Europe's aristocracy rapidly developed a taste for gardening, or at least for aesthetically pleasing rare plants, competing among themselves to produce the best gardens and to hire the most skilled gardeners (Sikkens-De Zwaan 2002; Hix 2005:14). Author Richard Steele noted in 1793 that a greenhouse was "what every gentleman of rank and fortune would wish to possess," (113) and that gardening was an excellent pastime for "men of sense" (127). His contemporary Walter Nicol similarly stated that greenhouse gardening was "a most rational amusement, profit and pleasure being in some measure blended together," and pointing out that "the wealthy eat a melon… with as much propriety as [they] drink a bottle of port" (1798:3-4). Nicol's last comment speaks to the value and prestige afforded greenhouse-grown plants.

Wealthy traders and industrial pioneers, grown rich from colonial trade and the burgeoning Industrial Revolution, followed the aristocracy into their horticultural endeavors. Physicians and apothecaries also clamored for exotic plants, experimenting with them to find new cures for diseases such as malaria. Naturalists, medical professionals, and amateurs studied at botanical gardens, which were often sponsored by universities, governments, or aristocrats (Belden 1965; Woods and Warren 1988:31-32;

Edmonson and Smith 1999; Pogue 2003:4; Hix 2005:16-18). Dutch and Italian universities boasted botanical gardens as early as 1533, and the University of Leiden in the Netherlands is known to have built an early greenhouse in 1599 (Hix 2005:10). British botanical gardens first appeared in the early 1600s, and by the beginning of the 18th century, greenhouses could be found throughout England (Hix 2005:17). London was a hotbed of horticultural activity: its greenhouses were known to have contained exotic plants such as "hibiscuses and passion flowers, mimosas, canna lilies, plumbago, geraniums… pelargoniaum… jasmine, asplenium, solanum and daturas" (Woods and Warren 1988:31). Philip Miller's *The Gardeners Dictionary*, which was first published in 1731 and contained explanations of botanical terminology and detailed advice on growing various plants, proved so popular that it went through ten editions, including two published after the author's death in 1771 (Miller 1768; Woods and Warren 1988:64-67). Even Russia boasted an official Imperial Botanic Garden, complete with heated greenhouse, built in St. Petersburg during the first quarter of the 19th century (Hix 2005:46-47).

North America was not exempt from the growing interest in horticulture, though garden fashions and greenhouse technology tended to lag behind that of Europe (Hix 2005:25). One of the earliest known American greenhouses was located in Annapolis, Maryland. This building was constructed around 1730 by the politically powerful Calvert family, and was heated not by flues, but by a hypocaust (Yentsch 1994:114-116). Another early greenhouse was constructed in 1747 at the Drayton Hall plantation in South Carolina. This structure was built in the Traditional style (Wheaton 1989:2; Pogue

2003:4). Tradition ascribes the first greenhouse in Massachusetts to Andrew Faneuil, who is thought to have built one on Boston between 1710 and 1738, though this has not been confirmed (Pogue 2009:40). Gardiner Greene, also of Boston, is known to have owned a greenhouse on his property beginning sometime in the late 1730s (Woods and Warren 1988:84). By the 1780s, many wealthy Americans boasted private greenhouses, especially in the Chesapeake and Philadelphia areas, though they were still rare enough to be considered "unusual" (Pogue 2009).

Greenhouse Technology

With this new interest in botany came a host of books and pamphlets discussing every facet of the subject. By the late 18th and 19th centuries, there was an abundance of English-language gardening manuals, many of which provided detailed instructions of the management of greenhouses (e.g., Kennedy 1776; Kyle 1783; Abercrombie 1789; Steele 1793; Nicol 1798; Gardiner and Hepburn 1804; Loudon 1805, 1817, 1824; M'Mahon 1806; Cushing 1814; Speechly 1821; Prince 1828; Hibbert and Buist 1832; McIntosh 1838; Chorlton 1865). Architectural books could also discuss greenhouses (e.g., Pain 1792; Lightoler 1809; Tod 1823). These texts are an invaluable source of knowledge about greenhouse management in the 18th and 19th centuries, and they highlight not only the common practices of the time, but also how greenhouse technology evolved. For example, Philip Miller included descriptions and diagrams of an example greenhouse in both the first and sixth editions of *The Gardeners Dictionary*. In both diagrams, the greenhouse is comprised of a central, unheated room and flanked by two

heated wings. The primary difference between the two editions is that in the earlier, 1731 version, the entire structure is built in the Traditional style. In the later, circa 1751 edition, the wings have glass roofs. This mimics the layout of the Chelsea Physic Garden greenhouse, which by 1752 was a Traditional-style building flanked by two Lean-to-style wings (Woods and Warren 1988:64-67; Hix 2005:22-23) The Elgin Botanic Garden greenhouse, built in New York in 1801, was arranged in the same way (Hix 2005:25).

According to 18th- and 19th-century manuals, greenhouses were often constructed with raised planting beds, around which wove flues that typically contained hot air or smoke. These flues might run along the bottom or the top of the planting beds, under the floor, and/or through the rear wall of a greenhouse (Kyle 1783:9-10, 101-102; Abercrombie 1789:20-26; Steele 1793:115-127; Nicol 1798:71; Gardiner and Hepburn 1804:188; Loudon 1805:14, 31-32; Pogue 2003:2-3). The walls of the flues were usually brick, which would hold and radiate out heat from the hot smoke (Hix 2005:48). Most flues seem to have been simple rectangular chambers, but there were more innovative designs. For example, John Claudius (J.C.) Loudon, a famous 19th-century horticulturalist, refitted a greenhouse with chambered flues, which were intended to slow the movement of smoke across the building and help wring every bit of heat from it. He also added an "air flue" atop the "smoke flue," which served two purposes: to move heated air from the furnace room around the building and to absorb some of the excess heat from the smoke flue, thus preventing overheating nearby plants (Loudon 1805:37-42). Though this particular flue system does not appear to have been widely adopted, it

does highlight the amount of effort greenhouse designers put into every aspect of their buildings.

An alternative to a furnace and smoke flue system was one that employed a boiler to produce steam. The earliest English patent for a steam heating system dates to 1791, though the technology may have been employed as early as 1788 (Hix 2005:49). Steam was already often produced in greenhouses by pouring water on heated flues, in order to help fruit ripen and tropical plants to grow and to prevent the spread of insects (Nicol 1798:57-58, 89-89; Loudon 1805:158-161). Some early steam heating systems appear to have pumped steam directly into greenhouses, or sent it up through beds of bark or stone (Hix 2005:49). Gardeners warned against excessive steaming, as it could cause rot in structural materials and plants, and lead to dangerous temperature swings as moisture in the air cooled and condensed. For these reasons, as well as their expense, J.C. Loudon considered the construction of a boiler system that pumped steam directly into a greenhouse to be "the most absurd thing imaginable (1805:159).

A more practical approach to steam heating was to replicate the traditional flue system, replacing the furnace with a boiler and the flues with steam pipes. These types of steam systems were embraced by Loudon and others for their cleanliness and efficiency, though they were not without problems. Steam pipes worked well for transmitting heat, but cooled more rapidly than brick flues, which would radiate heat more slowly and consistently. As a result, steam boilers had to be fired constantly. The boilers were also expensive and could explode if they became over-pressurized. Gardeners refined boiler and pipe systems into the 1830s, but there was no wholesale migration to steam heat.

Flue systems continued to be used in the early 1800s, even though a few were converted into steam systems (Woods and Warren 1988:121; Hix 2005:49-52).

Bark beds, which were often raised, could also be built within greenhouses to provide heat, often in conjunction with flue systems. Bark beds would be filled with bark, manure, or compost, which release heat as they decay. Potted plants would typically be placed in the bark bed itself (Abercrombie 1789:20; Gardiner and Hepburn 1804:188; M'Mahon 1806:90; Woods and Warren 1988:3; Renaud 1990:95-97). Hot beds were similar, and were essentially outdoor bark beds that were covered over with a sloped glazed frame, forming a mini greenhouse. These hot beds were usually 5 feet wide and about 9-12 feet long (Beranek et al. 2011:37).

Notwithstanding the 1831 suggestion to heat greenhouses with "the breath of cattle" (Woods and Warren 1988:121), the next innovation in greenhouse temperature control came with the invention of hot-water heating (McIntosh 1838:12-47; Woods and Warren 1988:121; Pogue 2003:2). The first hot-water heating system for a greenhouse was developed in 1816 by the Marquis de Chabannes, and was depicted in a pamphlet he published two years later. That system used a water-jacketed boiler to feed hot water to a series of pipes running beneath planting beds. The pamphlet also depicted a household hot-water system. In 1822, William Atkinson developed a similar system, which fed hot water from a boiler into cast-iron pipes wrapped around a greenhouse. Smoke from the fire that maintained the boiler also flowed through flues around the greenhouse (Woods and Warren 1988:121; Hix 2005:52-53).

Hot-water systems quickly surpassed flue and steam heat in popularity in England, as they produced a more even and controllable heat. They also required less fuel and attention than steam heating systems, in addition to being much safer (Woods and Warren 1988:121). The later 1820s saw the invention of the thermosiphon, which allowed hot water to be pumped from a first-floor boiler throughout a multi-story building. By the mid-19th century, hot-water heat was the preferred heating system for English greenhouses, as well as many homes (Hix 2005:54). These systems were not common in the United States until the mid-19th century, though some wealthy Americans were able use them in their homes and greenhouses (Renaud 1990:92; Hix 2005:54).

The vast majority of 18th- and early 19th-century greenhouses were rectangular, though Loudon makes mention of houses with "a number of sides" or "circular" plans, indicating that builders were experimenting with different layouts (1805:70). These experiments, along with advances in metalworking and the abolition of the English glass tax, would eventually give rise to elegant greenhouses made almost entirely of glass, which allowed for any number of different footprints (Loudon 1817; McIntosh 1838; Koppelkamm 1981:18-24; Woods and Warren 1988:112-127; Beale 2002:74-75).

Although the advent of these buildings was not far off, rectangular greenhouses were still the norm in the decades around 1800. The smaller versions of these buildings were generally between 40 and 60 feet long, 10 to 20 feet tall, and 10 to 20 feet wide, and heated by a single furnace. This furnace, which would have been built over an ash pit and probably had a cast iron door or hatch, was typically placed behind a greenhouse. The furnace location was not standardized and occasionally furnace/storerooms would be

built on ends of a greenhouse (Tod 1823:12, Plate V). While frowned upon, furnaces could sometimes be located on the front elevation as well. Larger buildings, which could be quite expansive, would have multiple furnaces to better distribute heat (Kyle 1783:9-15, 66-68; Nicol 1798:vii; Loudon 1805:12-15; M'Mahon 1806:79, 84; McIntosh 1838:199-200; Renaud 1990:92). Furnaces and furnace-rooms were viewed as less "agreeable to the eye" than the actual core of a greenhouse, and the less they could be seen, the better (Kyle 1783:15). Plaster, though found by some to be quite ugly, was frequently added to walls and flues (Kyle 1783:12-14; Loudon 1805:37-38; M'Mahon 1806:81). This whitewashing was intended to maximize the amount of sunlight that reached greenhouse plants, by reflecting rays off the walls of the building (Renaud 1990:91).

Greenhouses could have several entrances. Typically, these were located at the east and west ends of the building, though some authors suggested placing an additional door in the center of the front elevation. Lean-to greenhouses would not have front entrances, due to their architecture. However, some Traditional greenhouses are known to have had entrances on their front elevations. Attached furnace rooms or sheds acted as antechambers for some greenhouses, which helped prevent cold air from entering the main body of the plant-house during chilly weather (Kennedy 1776:259-261; Abercrombie 1789:22; Gardiner and Hepburn 1804:187-188; M'Mahon 1806:79; Loudon 1824:19-20; Renaud 1990:101-103; Weber 1996; Chesney 2009). Air flow into the house was facilitated by opening sash windows or installing air holes in the north wall

(Kennedy 1776:259-261; Kyle 1783:15-16; Nicol 1798:54-56; M'Mahon 1806:82; Loudon 1817:73).

Glass made in the late 18th and early 19th centuries was generally green, light green, or aqua in color, due to iron impurities present in the material (Renaud 1990:102; Lockhart 2006:45). One interesting side-effect from this tint is that it reflected some of the sun's rays, protecting greenhouse plants from the "fiercest heat of the sun". This protection disappeared when colorless glass became more widely used in greenhouses in the 1830s (Woods and Warren 1988:89; Lockhart 2006:47). Sash windows in greenhouses could measure up to 6 feet wide, with a variety of pane sizes (Abercrombie 1789:25; Nicol 1798:143-144; M'Mahon 1806:79-80). Smaller window panes tended to be cheaper to purchase, and some gardeners recycled panes from other buildings (Nicol 1798:143-144; Loudon 1805:13). At least one publication specified that window panes for hot-houses measure no "larger than 8 by 6 inches" (Speechly 1821:299). When used as part of a roof or in lean-to structures, panes of glass were typically laid like shingles, with a slight overlap, and sealed with lead, putty or another material to prevent leaks (Abercrombie 1789:25; M'Mahon 1806:80, 89; Renaud 1990:102). The entire roof of lean-to greenhouses was not always glass; in some cases, the rear portion was formed of wood or stone shingles (Gardiner and Hepburn 1804:187).

Many 18th- and early 19th-century English greenhouses appear to have had unpaved floors, despite the fact that greenhouse authors consistently recommended the installation of some sort of solid floor, made of large paving bricks or flagstones. The goal of this pavement was to prevent excess water from accumulating in a greenhouse, or

at least to allow for what water did collect to be easily sopped up (Kyle 1783:12-14; Nicol 1798:42, 124-125; M'Mahon 1806:81; Loudon 1817:73). Some authors also recommended installing drains in or around a plant-house for the same purpose (Nicol 1798:41; Speechly 1821:33-34).

Greenhouse manual authors typically agreed on the need for a thick, solid north wall, especially in a lean-to type structure. This wall would support much of the weight of the roof, contain flues, and help insulate the greenhouse. The side and front walls were less robust, and would either contain several windows or be almost entirely glazed (Kyle 1783:9-10, 66-68; Abercrombie 1789:22; Gardiner and Hepburn 1804:188; Beranek et al. 2011:34-38). Authors writing for the early 19th-century American market specified that "greenhouses" be built with upright masonry walls supporting vertical windows, matching the Traditional style, and stated that "hot-houses" have sloped front elevations, matching the Lean-to style (Gardiner and Hepburn 1804:188, 196; M'Mahon 1806:78-80, 84; Pogue 2003:3).

In addition to its role as the primary windowed elevation, the front wall of a greenhouse was sometimes built as a partially open feature. The above-ground portion of the wall would be solid, while the below-ground portion would either be comprised of a series of open arches or have regular small openings. These arches or openings would link interior planting beds with soil outside the greenhouse, allowing the roots of plants to extend into the exterior environment (Kennedy 1776:259-261; Abercrombie 1789:82; Nicol 1798:40-41; Loudon 1824:27; Cooperman 1993:75-76; Beranek et al. 2011:39-40). Greenhouse and architectural manuals indicate, but do not explicitly state, that this type

of construction was most commonly used for vineries. Occasionally, greenhouses growing fruit trees, such as peaches, figs, or cherries, would also have below-ground arches on their front or rear walls (Nicol 1802:222-228, Plate II, Plate III; Lightoler 1809:15; Speechly 1821:113-114; Tod 1823). Figures 9 and 10 show examples of greenhouses, used to grow grapes and/or fruit trees with had below-ground arches.

A plant-house could have any combination of planting beds, sometimes called "borders" if they were flush with the ground, and potted plants on tiered shelves or "stages" (Kennedy 1776; Kyle 1783; Nicol 1798; M'Mahon 1806; McIntosh 1838:199-200; Renaud 1990:95-97; Laird 1996). Potted plants would also be placed in bark beds (Gardiner and Hepburn 1804:188). The same types of plants could be grown in a building in both beds and pots: for example, grapes could be started in pots and transferred to beds in the same greenhouse after they had grown (Speechly 1821:80-85). However, there appears to have been a general tradition of growing plants in pots in "greenhouses" and plants in borders or beds in "conservatories" (M'Mahon 1806:82). How plants were arrayed in a greenhouse was often of great concern to gardeners, who strove to identify the most productive and aesthetically pleasing arrangements, and debated the relative merits of various types of shelves and displays. Even so, the arrangement of planting beds and shelves within greenhouses seems to have been relatively flexible (Kennedy 1776:260; Abercrombie 1789:22; M'Mahon 1806:82; Laird 1996).

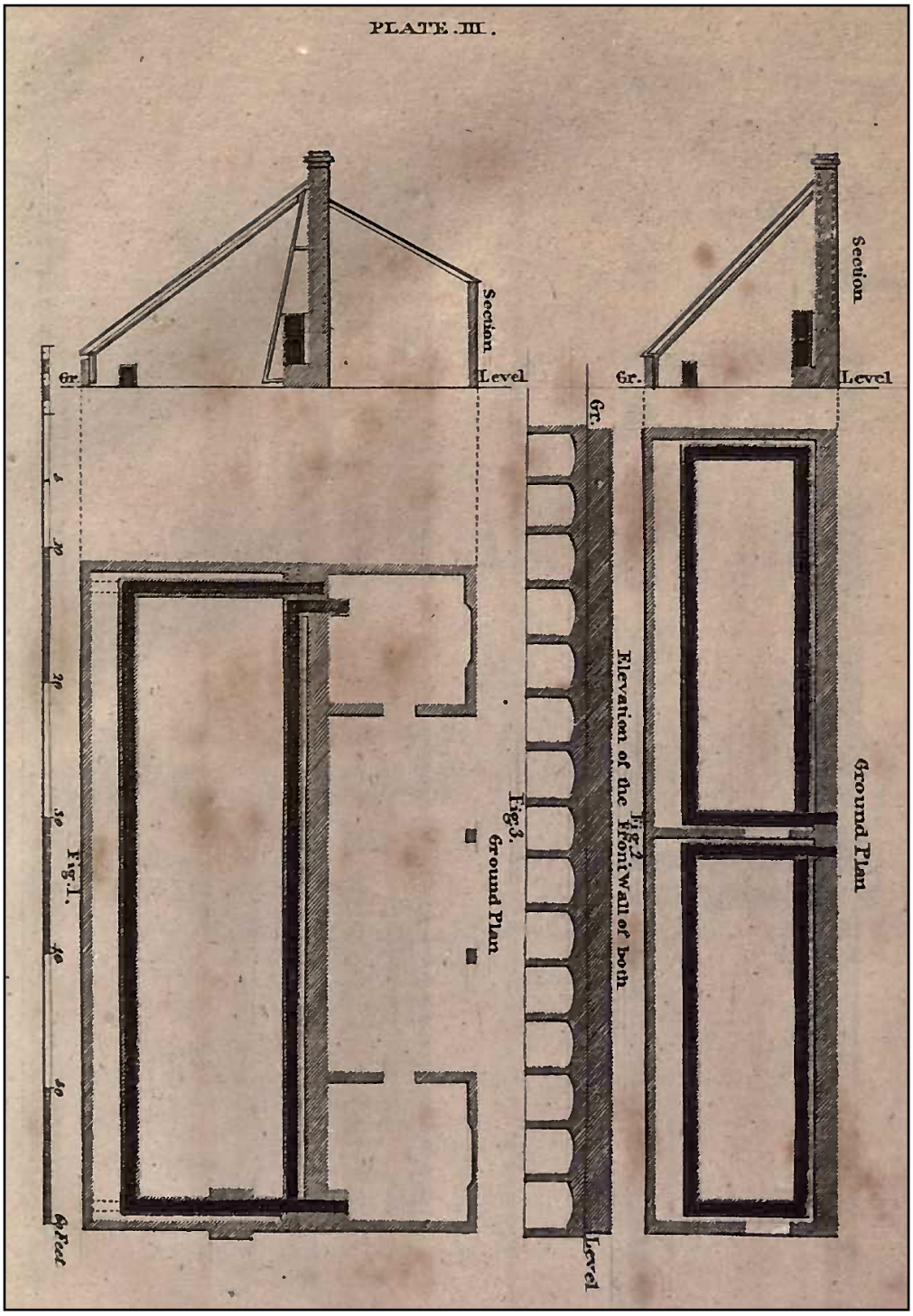

Figure 9. Drawing of a plan for early 19th-century graperies with partially-open front walls (Nicol 1802:Plate III).

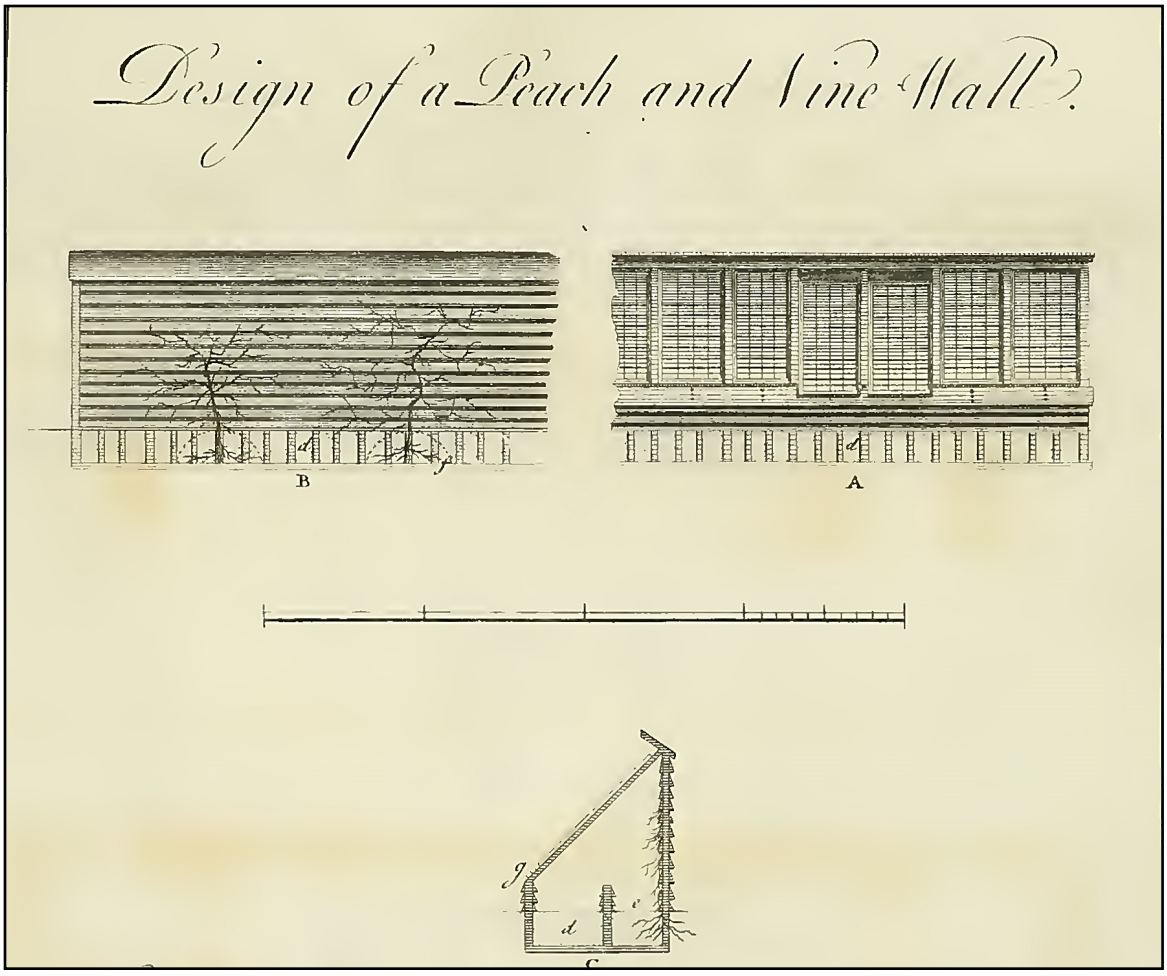

Figure 10. Drawing of a plan for a greenhouse built to grow grapes and peaches. The front and rear walls are both built atop piers, with the trees grown along the rear, and the grapes along the front (Lightoler 1809:15).

CHAPTER 4:

GROWTH AND PROSPERITY: WHY BUILD GREENHOUSES?

The Expense of Greenhouse Ownership

The design and layout of greenhouses might have varied in the 17th, 18th and 19th centuries, but one thing did not change: their cost. Prior to the mid-1800s, when prefabricated greenhouses hit the European market, these buildings were "a luxury… confined only to the wealthy" (Hix 2005:119). The materials used in greenhouse construction, particularly the glass, were expensive, and each structure was custom built (Koppelkamm 1981:11; Woods and Warren 1988:36, 61; Renaud 1990:91; Scharfenberger 2004:60-62; Hix 2005:116). In fact, when the Cambridge Botanical Garden in Massachusetts set out to build their own greenhouse in 1810, the organization was unable to find anyone who would quote them an exact price for the construction. The organization was also unable to decide on what they considered a fair price to build the greenhouse, highlighting the relative uniqueness of the structures (Beranek et al. 2011:36).

Some historical pricing data for greenhouses do exist, however. Philip Miller, famed gardener at the Chelsea Physic Garden and author of the 1731 *Gardener's and Botanist's Dictionary*, is known to have had a greenhouse with two stoves built at the

garden in 1732, for a cost of £1,675. It is not clear if that greenhouse was built in the Lean-to or the Traditional style, though examples of the former were present at the Chelsea Physic Garden by 1751 (Woods and Warren 1988:64-66). Regardless, the greenhouse was expensive and would have cost over $200,000 in modern American dollars. A large, 327-foot long Traditional-style greenhouse, built at the Margam estate in South Wales in 1790, was similarly expensive and built for around £1,600 (Woods and Warren 1988:80). Another late 18th-century Traditional greenhouse built at Warwick Castle cost at least £4138, or $590,000 in modern dollars (Woods and Warren 1988:101).

An unheated 50-foot long by 20 feet wide and 14 feet tall greenhouse, built in 1856 in an advanced style consisting mostly of glass, was estimated to cost $934. That price, which would be around $26,900 in modern dollars, included the cost of materials, labor, and plants (Chorlton 1856:21-25). The 1806 Gore Place greenhouse was similarly sized (see Chapter 5), and this price provides probably the closest estimate for what that building would have cost to build and stock.

Of course, the expenses did not stop with construction. Maintaining and running greenhouses also required a significant investment of time, money, and labor. Day-to-day operations included watering, pruning and repotting plants, opening and closing windows, stoking fires, and removing insects and other pests. If a full-time gardener or other laborers were employed for these tasks, the overhead for a greenhouse could add up quickly. Records from the Cambridge Botanical Garden also show that greenhouses needed frequent repairs: a glazier visited several times a year to replace broken window panes, and every 7-8 years the building required repairs to its masonry and fireplaces.

Tools used in that building were also constantly being sharpened, repaired, or replaced (Beranek et al. 2011:38).

The combined costs for building and maintaining a greenhouse could be staggering. For example, the Duke of Devonshire built and refurbished several greenhouses at the Chatsworth estate in Derbyshire, England. Between 1830 and 1840, the Duke spent between £467 and £1,769 per year on construction and maintenance costs, £245 to around £600 on coal to heat the buildings, and £70 to £276 on a salary for his head gardener, Joseph Paxton (Woods and Warren 1988:122-123). Taken together, the Duke spent between £782 and £2645 per year on the greenhouses at Chatsworth, or between $90,000 and $290,000 in modern dollars. Considering that these expenses do not include the prices of greenhouse plans or the global plant-collecting expeditions that the Duke financed, the actual costs of managing the estates' greenhouses were undoubtedly much higher (Woods and Warren 1988:123-124).

An 1881 account puts the cost of maintaining Colonel Thomas Handasyd Perkins' greenhouses in Brookline, Massachusetts, at $10,000 per year from 1800 to 1850, or around $200,000 in modern dollars (Wilder 1881:39). Perkins appears to have brought over foreign gardeners to tend to his greenhouses, which were "considered the most advanced in horticultural science of any in New England," at least according to later sources (Wilder 1881:39).

Not all greenhouses built from 1600-1900 were quite as expensive as those at Colonel Perkins' estate, but these were not cheap buildings accessible to everyone. Universities and governments could afford to build greenhouses, but only the wealthiest

private citizens could do the same. So why bother with the expense at all? For institutions and governments, the answer was relatively simple: greenhouses were extensions of existing botanical gardens and provided controlled environments in which to study plants, both exotic and local. Botanists and naturalists used the botanical gardens' greenhouses to aid in cataloging and classifying plants, while doctors and pharmacists analyzed plants for potential medical uses (Koppelkamm 1981:11; Hix 2005:26-27, 46-47; Rieppel 2016:6-8). For the wealthy elite who built private greenhouses, the motivating factors were much more complex and were tied up with issues of identity formation and expressions of power and prestige, in addition to scientific curiosity.

Landscape, Meaning, and Identity

Archaeologists have long recognized that objects, buildings, and landscapes can hold a diverse number of symbolic meanings and encode information about ideology and identity. People define and express their cultural affiliations and identities in part through the items they purchase, the foods they eat, the way they build, organize and decorate their homes, and how they interact with and modify the landscape (Carson et al. 1981; Johnson 1992; Little 1992; Monks 1992; Yentsch 1994; Cook et al. 1996; Deetz 1996; Leone et al. 2005; Cochran and Beaudry 2006; De Cunzo and Ernstein 2006; Lightfoot et al. 2010; Silliman and Witt 2010; Mullins 2011). These material expressions of identity can be discrete or public, and conspicuous consumption—the "acquisition and display of possessions" (Ordabayeva and Chandon 2011:27)—is a key part of social signaling,

interpersonal competition, and the accumulation of social status or prestige (Williamson 1999; Mullins 2011).

Artifacts are often the focus of studies of conspicuous consumption, but people, institutions, and governments could also express their beliefs and identities through landscape and architecture. A classic study of this is Mark Leone's (1984) analysis of William Paca's 18th-century garden in Annapolis, Maryland. Paca, a wealthy planter and politician, built his 1763 garden using perspective tricks to make it appear larger than it was and on a then-outdated rectilinear plan. Leone has argued that the outmoded garden pattern was chosen specifically to contrast with the "wilderness that the colonists faced" in North America at the time. By arranging the local flora into a precise, ordered garden, Paca metaphorically declared his control over nature. Coupled with the illusion of an expansive garden, Leone suggested that William Paca was attempting to encode his belief in a hierarchical, rigid system onto the landscape and to demonstrate to his neighbors, servants, and slaves that he was at the pinnacle of this system, able to dominate nature itself, and by extension, their own lives (Leone 1984, 1988:31; Chesney 2009:6-12; Leone et al. 2005:139).

At Poplar Forest, Thomas Jefferson laid out an intensely personal landscape after his retirement from the presidency. "At the retreat's ornamental core, Jefferson combined elements of landscape design encountered over a lifetime of studying, visiting, and creating gardens" (Gary and Proebsting 2016:62). A "naturalistic aesthetic" dominated part of the property, while ordered, geometric patterns appeared on others. An octagonal brick house had an east wing of service rooms, while on the west side trees "stood in for

architectural features… creating an arboreal wing" (Gary and Proebsting 2016:63). The brick house was also a unique mix of styles, drawing on Italian Renaissance architecture, "the villas of ancient Rome," and Jefferson's love "of contemporary French townhouses" (Gary and Proebsting 2016:62). Jefferson's ability to create this landscape was ultimately based on power—without his enslaved labor force, it never would have come to fruition (Gary and Proebsting 2016:75-76)—but it does not seem to have been about power dynamics. Rather, the landscape at Poplar Forest was a culmination of Jefferson's experiences and interests.

Even without actually owning or building a landscape, people can encode meaning onto it. For example, in the 17th and 18th centuries, slaves were able to sell a variety of goods at Charleston's markets. The city government consistently tried to curtail the slaves' presence at the markets by passing increasingly restrictive laws, to no avail (Joseph 2016:101-104). "Despite accusations of theft and a litany of legislation and regulation [enslaved African Americans] dominated Charleston markets," including one in the heart of the city. This central market was eventually moved to a less obvious location, where African American vendors could be effectively hidden from view. "Charleston needed its African citizens to survive, but sought to minimize their appearance on the landscape so there could be no question about who controlled the city" (Joseph 2016:104). Despite this, enslaved vendors continued to sell goods in the heart of the city, maintaining a claim on Charleston's landscape and thwarting government attempts to erase their presence (Joseph 2016:108-109).

The Purposes of Greenhouses: Power, Prestige, and Science

Like Paca's garden, greenhouses have often been associated with expressions human dominance over nature and served as physical symbols of their owner's social and political power (Yentsch 1994; Laird 2006). King Louis XIV, for example, constructed a greenhouse over 1000 feet long at Versailles. This building was stocked with orange trees and was a key stop on the ritual path the King laid out for visitors (Hix 2005:15-16). This massive structure, and its delicate contents, was part of an overarching landscape dedicated to demonstrating Louis XIV's power and dominance over everything and everyone in France (Turner 1986:76). In her examination of the 18th-century Calvert Orangery in Annapolis, Anne Yentsch noted that "gardeners built orangeries to grow tropical plants or to keep others alive and blooming out of season, something ordinary farmers could not do. Owning an orangery gave a family symbolic control over the plant kingdom" (1994:113).

For the Calverts, their ownership of a greenhouse was also part of a bid to prove, and increase, their prestige. Yentsch wrote that "Englishmen achieved social status, in part, by ostentation; conspicuous display was *de rigueur* among the gentry" (1994:104-105). Beginning in the 16th century, novel, exotic, and above all, fashionable items took on great importance as prestige items among the English aristocracy, to the point that one contemporary observer complained that "noblemen now adopt products and services that 'smell of beyond the seas'" (McCracken 1988:11-20). Exotic plants, first oranges, then pineapples and other tropical and foreign flora, were one of a number of items collected by the nobility, who needed to have the most novel, interesting accouterments possible in

order to maximize their social standing (McCracken 1988:11-14; Woods and Warren 1988; Hix 2005). This type of social competition was not limited to England and wealthy Americans vied for standing in the same way. Greenhouses were necessary to keep many exotic plants alive and became important parts of social competition among the elite:

> Gardens and greenhouses provided important spaces for socializing: to walk, admire the view of a well laid-out estate, and to see (and sometimes taste) exotic and unusual plants. The views from someone's gardens, the abundance of their fruit trees, and the taste and skills of their gardener were measures on which people were compared among the social elite (Beranek et al. 2009:94).

Because of their importance in the battle for prestige, greenhouses were sometimes used to hold dinner parties and banquets and could be decorated or feature ornate, aesthetically pleasing architecture (Woods and Warren 1988:39, 46, 101-103). Decorated or ornate greenhouses were often of the Traditional style (Hix 2005:16-17). In some cases, an estate would contain two greenhouses: one primarily functional, dedicated to growing plants, and one ornamental, for displaying plants and showing to visitors. In those cases, the more functional greenhouse would be situated at a distance from an estate's mansion, while the ornamental structure would be close to or adjacent to the mansion (Beale 2002:74). Like the plants they contained, the aesthetics of a greenhouse were rubrics on which the elite could be judged.

Prestige and power were not the only reasons to build greenhouses. For example, Kirk Boott, a wealthy trader and resident of Boston, had a well-known passion for gardening. When he built a new townhouse for his family around 1805, he made sure to include an attached Lean-to style greenhouse. The yard around his home was almost entirely dedicated to his garden, and he once remarked that "our chief pleasure is in our family, and among our flowering plants" (Emmet 1987:26-27). Boott's father, brother, and four of his five sons were also passionate gardeners; two of his sons were early members of the MHS (Emmet 1987). It is important to remember, however, that Boott was afforded the opportunity to indulge in his horticultural passions because of his wealth, and though he may not have intended it, the presence of a greenhouse on his property was a clear signal of his financial eminence. This wealth would later help his son, Kirk Boott Jr., to finance the Boott Cotton Mills in Lowell, Massachusetts, the first planned industrial city in the United States (Emmet 1987:30; Beaudry 1989:20).

Bushrod Washington, nephew of George Washington and inheritor of his Mount Vernon estate, built a greenhouse on his property between 1812 and 1815. Washington's greenhouse was built to support his interest in scientific agriculture and was one of a few experimental agricultural buildings at Mount Vernon. The greenhouse was not only housed experiments, but it was itself an experiment: it was built out of pisé, a type of rammed earth similar to adobe that Washington was testing out as an economical building material (Hallock 2004:42-44).

The motivations people had for building greenhouses—expressing power, gaining prestige, and growing or studying plants—were also wrapped up in issues of identity

formation. Although he was a wealthy merchant, Kirk Boott also considered himself a gardener. For him, building a greenhouse was a necessary part of being a good gardener, writing in 1783 that "amongst professional gardeners no place is esteemed a good one without Hot House and Green House" (Emmet 1987:28). Christopher Gore was known to have viewed himself as a member of the New England aristocracy, and his actions and purchases often spoke to this self-characterization. When he was Governor of Massachusetts, for example, he rode around in an extravagant, ostentatious carriage. He was widely mocked for this choice, which was derided as far more appropriate for a British lord than an American politician. Nevertheless, the opulent carriage fit in with Gore's idea of his own "station and pretensions." The same can be said for his "extensive gentleman's library," and his maintenance of a country estate (Pinkney 1969:118; Thornton 1989:32). Greenhouses were typical accouterments for the wealthy, once described as "an appendage to every villa" and as marks "of elegant and refined enjoyment" (Loudon 1824:v). Given Gore's aristocratic self-image, it makes sense that he would want to have a greenhouse on his property.

Gore likely had other considerations as well. Scientific agriculture was in vogue during his lifetime, and was seen by wealthy Americans as a patriotic and aristocratic duty and as a way to associate themselves with farmers – then viewed as the Republican ideal – and to distance themselves from the distrusted commercial activities through which most had earned their fortunes (Thornton 1989:1-25). As greenhouses were necessary spaces for maintaining exotic plants and useful in agricultural experiments, due to their meticulously controlled climates, they were often incorporated into the broader

schemes of scientific agriculture on country estates (Belden 1965:109; Cooperman 1993). Not all of those who professed to be "gentlemen farmers" actually enjoyed agriculture, but Christopher and Rebecca Gore both seem to have had genuine interests in farming and gardening (Hammond 1982; Thornton 1989; Brockway 2001; Beranek et al. 2011). Christopher, in particular, appears to have truly considered himself a gentleman farmer, as evidenced by his constant experimentation with crop varieties, farming techniques, and new agricultural technologies, not to mention his participation in the MSPA and frequent examination of his fields. As such, a greenhouse would be a natural addition to his estate.

Contemporary New England Greenhouses

The greenhouse at Gore Place was built at the same time as the mansion, in 1806. A greenhouse manual from 1804, written by John Gardiner and David Hepburn, provides one example of a contemporary American hot-house design:

> The front, and the front half of the ends, should be formed of brick, to the height of two feet, upon which sashes five feet hight [sic] should be erected; the back wall and the back part of the ends should be of brick, and much thicker at the bottom than top, with flues in the walls to form shelves, for pots to stand upon. The front half of the roof should be sashes, to slide at pleasure, and the back part of shingles. There should be a shed out side of the back wall to keep off the cold, and shelter the fire place. The level of the ground under the shed should be three or four feet lower than the floor of the hot house. Under the shed a furnace must

> be erected, the flue of which must wind underneath the floor of the hot house, and communicate with the flues in the back wall, through which smoke will escape. A bark pit must be erected in the middle of the hot house, by building a wall three feet high, having an alley round the pit, for the convenience of attending plants in it and on the shelves. The flues may either run under the alleys or adjoining them; the object of the fires being to warm the air in the house; in the latter case, they will form a bench or step, on which pots may be placed. The bark in the pit naturally ferments, and is warm, therefore the flues are not to be under the pit or joining it. The front of the house should be fronting the south, and the door on the east end, adjoining the back wall. A thermometer should be kept in the house, by which to regulate the heat (Gardiner and Hepburn 1804:187-188).

Whether or not the Gores read Gardiner and Hepburn's manual or any other can only be speculated on. However, they likely drew inspiration for their 1806 greenhouse from contemporary examples owned by their neighbors or others they saw or heard about in their travels.

Greenhouse design varied greatly, and how the Gores chose to build theirs should provide insight into their thought processes, identities, and goals. Take for example Kirk Boott's 1804 greenhouse. An engraving done between 1840 and 1847 depicts the greenhouse in good repair and indicates it stood until at least that time. Boott's greenhouse was abutted by several hot beds and was surrounded by a large garden. Placed against his Boston townhouse, the greenhouse was constructed in a Lean-to style,

with glazed sides and a partially glazed roof. No decorative embellishments were visible on or near the greenhouse (Figure 11).

"Heat was supplied by a wood fire, the smoke of which was conducted through a horizontal brick flue past the growing benches, to a chimney," which appears to have been located at the west end of the building (Emmet 1987:28). The greenhouse measured around 18 feet long by 7 feet wide and 9 feet tall.[1] No door is present in the center of the structure; instead, the building was entered from its east or west ends.

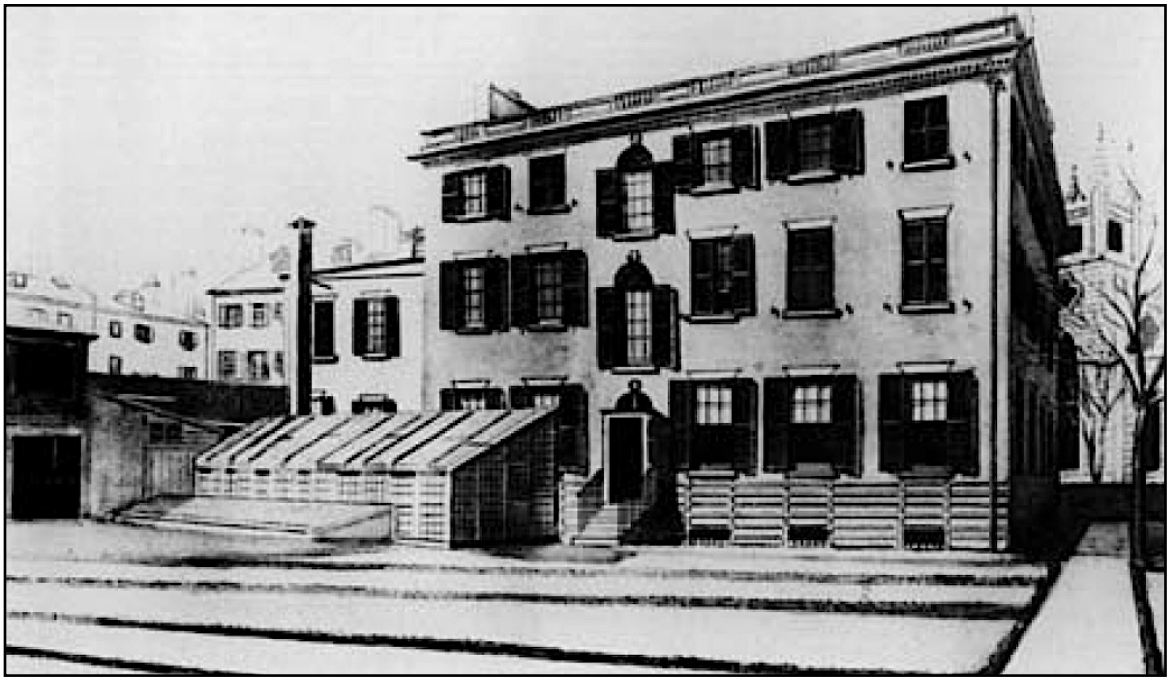

Figure 11. Engraving of Kirk Boott's Boston home and greenhouse, done between 1840 and 1847 (Emmet 1987:26).

[1] These measurements are estimated from the engraving.

Boott grew a variety of flowers in his greenhouse, such as roses, jasmines, coxcombs, balsams, and xeranthemums, as well as lettuce and cucumbers. Most of his greenhouse plants were native to the United States or England, though he also grew at least one tropical plant, the castor-bean tree (*Ricinus communis*) (Emmet 1987:27-28). The presence of that plant, as well as contemporary accounts of the building, suggest that it was heated year-round, and would have been considered a "hot-house."

The Boott family, and Kirk in particular, were noted as having strong passions for horticulture (Emmet 1987). This seems to have been reflected in his greenhouse. The structure's placement up against the house, partially blocking the mansion's windows suggests Boott saw it as important. Its small size made it poorly suited for tours or dining, but it would have been fine for pure horticulture. The Lean-to design was also the most efficient for growing plants. It was stocked with low-prestige plants; in fact, Kirk himself once wrote that "a common observer would think there was hardly anything worth looking at" in the building. One of his sons also reflected that Kirk was most proud of his "salads and cucumbers" (Emmet 1987:27-28).

Boott's unadorned but efficient greenhouse growing unremarkable plants amid a large garden paints a picture of a man who cared more about his own enjoyment of gardening than showing off to the neighbors or gaining political capital with a "glassy penthouse of ignoble form" stocked with exotic or experimental flora (Pogue 2003:1). We can infer, then, that Boott's greenhouse was built primarily as an extension of his identity as a gardener and interest in horticulture. However, as an elite structure, the Boott greenhouse would still have signaled Kirk's elite position in the social hierarchy.

The Lyman family, the Gores' neighbors in Waltham, also owned a large country estate with greenhouses. The Vale, as the estate was known, was purchased by Theodore Lyman Sr. in 1793. The Bootts and the Lymans were close friends, and other leading New England families, including the Gores, Adamses, Hamiltons, Otises, and Hancocks, were known to have visited the Vale on multiple occasions (Emmet 1987; Parson 2009:102). The earliest Vale greenhouse was built in 1798. That building contained brick walls and a glazed, slightly sloped roof. Two raised, brick-lined planting beds run the length of the building, one against the south wall and the other against the north wall, separated by a narrow path. A stove is built into the west end of the north bed, and flues run inside the walls of the bed. The building overall is relatively small with a low ceiling. The small size, cramped interior, and presence of glazing only on the roof make the 1798 greenhouse similar to "nursery" or "succession" greenhouses described in Bernard M'Mahon's *The American Gardener's Calendar* (1806:93-95). These buildings were typically used to start pineapples, which the Lymans were known to have grown (Parson 2009:102).

The 1798 greenhouse was built relatively far away from the Lyman mansion, in the kitchen garden. The garden, greenhouse, and other nearby utility buildings are hidden behind a 425' long peach wall, which separates the pleasure grounds adjacent to the mansion from the estate's more practical spaces. That the 1798 greenhouse is hidden from view is not surprising, as its undecorated walls, practical form, and small interior space make it unsuitable for public display. Further, utilitarian greenhouses, often those built in the Lean-to form, were sometimes considered unappealing structures unbefitting

refined, tasteful pleasure grounds (Woods and Warren 1988:61). At the Vale, the peach wall was built in part to prevent people from seeing "useful and unpleasing objects" (Emmet 1996:9).

The brick peach wall was examined archaeologically and was found to sit atop a stone foundation. The top of this foundation contained mortared slate tiles to "shed surface water away" and to prevent moisture from seeping into and damaging the overlying bricks. Interestingly, in the late 19th century, a temporary building—known as the "peach wall house"—was constructed seasonally against the wall to protect the trees growing against it. It is not clear, but this practice may have started far earlier (Pinello 1999:9-10).

The Lymans built three additional greenhouses against the peach wall, facing the pleasure grounds. The earliest of these was built in 1804, and was constructed in a Lean-to style. This building was intended to grow fruits such as pineapples, figs, lemons, limes, and bananas—exotic, high status plants. In the 1870s, these plants were replaced with grape vines (Historic New England 2017). The greenhouse was divided into two rooms along its long axis: the south room was the growing space, where plants were kept, while the north room was a workspace and storeroom that also contained furnaces. Smoke flues were run through the wall separating the two rooms. The sides and sloped roof of the south room were entirely glazed, while the north room had brick walls and an opaque roof.

The original interior configuration of the south room of the 1804 greenhouse is not known (Beranek et al. 2011:41). However, the building itself is almost identical to the

"Hot House" depicted in *The Practical House Carpenter*, a construction manual available in Boston beginning in 1796 (see Figure 8) (Pain 1792:102-104; Lewis and Floyd 1999:5). As a result, it is likely that the original interior of the south room contained two narrow walkways, one along the south wall at floor level and one raised along the north wall, separated by a planting bed. From the south walkway, this bed would appear raised, while it would be level with the rear walk. The manual shows smoke flues running under the floor and in the north wall; the 1804 greenhouse definitely has flues in the north wall, but it is not clear if any subfloor flues are present.

An additional two greenhouses were added to the peach wall in 1820 and 1840. Both of these are nearly identical to the 1804 greenhouse. The 1820 structure is known today as the Camellia house, but was originally built to house peach trees (Historic New England 2017). Camellias are a type of flowering plant that originated in eastern Asia. Those kept at the Vale were among the earliest camellias in the United States, and were imported from England. The 1840 greenhouse was constructed to grow flowers for show in the Lyman mansion (Parson 2009:104). Archaeological excavation on the north side of the greenhouses shows that they sat adjacent to a thorough drainage system. Planting pots and window glass were also found near the buildings (Pinello and White 2000:11-12). The 1804-1840 greenhouses are partially plastered today; this covering likely extended across the entire interior of the buildings historically.

Theodore Lyman Sr. was a cofounder of the MSPA, wealthy merchant, Federalist, and gentleman farmer. As scientific agriculturalist and country estate owner, it is not surprising that he built greenhouses, nor that they held "a handsome collection of exotics"

(Kendall 1809:10). By all accounts, Lyman enjoyed farming, but there may have been more to his decision to build greenhouses than meets the eye (Emmet 1987:25). His grandson, Arthur Lyman, wrote that Theodore "raised pineapples, but gave them up, as he did many other things, when other people had them also" (Parson 2009:102). This fact suggests that Theodore Lyman Sr.'s main focus in building the 1804-1840 greenhouses was prestige: he wanted to have the best collection of exotic flora around, and to show it all off. The 1804-1840 greenhouses, which would have held these exotic plants, were part of his display of status, hence their presence on the pleasure grounds. The 1798 greenhouse, which was fairly rudimentary and likely augmented his kitchen garden, would have made a poor display piece, and was banished to the work yard behind the peach wall.

Essex County merchants John Tracy and Elias Haskett Derby also owned greenhouses in the Boston area. Tracy built his in 1782, while Derby's was constructed around 1790 in Salem. The Derby greenhouse was unusual, in that its primary windowed elevation, which typically faced south, was oriented facing west (Figure 12). The greenhouse was also not quite rectangular in plan, measuring 61 feet long by 18 feet wide on the north wall and 16 feet wide on the south wall. Constructed in the Traditional style, the building was split into four rooms: a large central "Stove," in this case a heated room for delicate plants flanked by a furnace room on the north side and two presumably unheated rooms, a "Green House" and a "Necessarie," or privy, on the south side. Windows are present on the west and south elevations. Those on the west are extremely small for a greenhouse; so small, in fact, that they would not have let in enough light to

keep plants alive year-round. The windows on the south elevation are far larger, and are more typical of what would be expected in a greenhouse (Woods and Warren 1988:84-85). The "Stove" room also contained a staircase, presumably connecting to an upper floor.

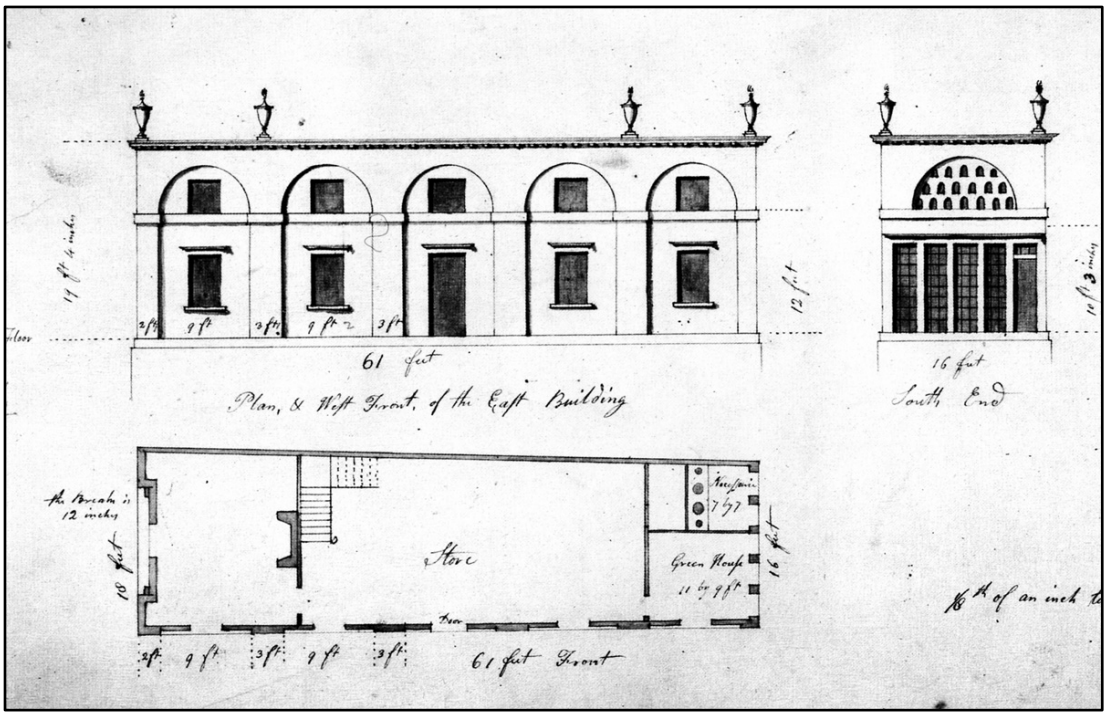

Figure 12. Samuel McIntire's drawing of the late 18th-century Derby greenhouse in Salem, Massachusetts (Woods and Warren 1988:85).

Given the poor situation of the greenhouse, it is likely that the building was used more as a prestige structure and decorative addition to Derby's gardens than as part of scientific agricultural efforts. The building would have been aesthetically pleasing, with decorative urns, trim, and an arcaded west wall, but would have been terrible for growing

plants, due to its irregular orientation and tiny windows. Somehow, Derby was able to grow aloe plants and prickly pears (Beranek et al. 2011:33), both prestigious exotics at the time, but his collection was likely very small, considering the difficulties with light the "Stove" would have had. The "Green House" room would have been much better for horticulture, but was very small, measuring only 11 feet by 9 feet. Derby may have used the "Stove" to overwinter plants normally grown outdoors, or to hold small gatherings surrounded by a few plants, but it would have been fairly useless as a horticultural laboratory. As a result, it is unlikely that he built the greenhouse as part of an interest in scientific agriculture or botany, and it is far more likely that it was meant as a pleasant-looking embellishment to his garden and for use as an occasional banquet hall.

Christopher and Rebecca Gore almost certainly saw the greenhouses at the Vale, at least those built in 1798 and 1804. Given the proximity, they probably also saw Kirk Boott's greenhouse in Boston and may have seen Elias Haskett Derby's in Salem. Greenhouses were located up and down the east coast and in England, and the Gores undoubtedly saw a few others during their travels. As such, the Gores could have drawn inspiration from any number of greenhouses across the world. The buildings described here simply serve to illustrate contemporary New English examples and to provide a comparative baseline.

CHAPTER 5:

EXPOSING THE ROOTS: ARCHAEOLOGICAL TESTING

The Fiske Center for Archaeological Research has undertaken several excavations at Gore Place, three of which were partly or entirely focused on the 1806 greenhouse (Smith and Dubell 2006; Smith 2007; Smith et al. 2010; Beranek et al. 2011; Romo et al. 2014). The earliest of these, in 2004, was a shovel test survey (Smith and Dubell 2006). A subsequent data recovery project took place in 2008, opening 52 square meters (560 square feet) of area around the western end of the greenhouse (Beranek et al. 2011). An additional 94 square meters (1012 square feet) was excavated in and around the greenhouse in 2012. The author participated in the 2012 project and helped write and organize the report on its results (Romo et al. 2014). Much of the research present in this thesis was originally conducted during the writing of the 2012 report.

The entirety of the 1806 greenhouse has not been exposed; however, all of these projects, and the subsequent studies and theses they inspired, uncovered a great deal about the history of Gore Place and about the layout, organization, and use of the greenhouse and its environs. This information is crucial to determining the answers to the research questions explored in this thesis: namely, what were the Gores' motivation for building the greenhouse, how did it fit into the overall estate plan, what did it look like,

how long was it used, and what was grown there? To get at these answers, this chapter presents an overview of the important archaeological discoveries at the 1806 greenhouse site and around the estate.

The 2008 excavations were conducted as a single block of 13 two-meter square test units (Trench 2008), while in 2012 eight trenches (Trenches 1-4, 7-10) were opened at the greenhouse site. Between them, these eight trenches contained 23 two-meter square test units, and a single one- by two-meter unit (Figure 13). Ground penetrating radar (GPR), magnetometry, and electromagnetic conductivity surveys were conducted ahead of the 2012 project in order to provide additional guidance for the excavations (Romo et al. 2014:31). Soil layers within test units were assigned unique context numbers during both projects. To facilitate analysis, similar contexts spread across multiple test units were grouped together as "lots." For comparative purposes with the 2012 project report, features discussed in this chapter are listed with their lot designations (Table 1).

Although *terminus post quem* (TPQ) and mean ceramic dates (MCD) were calculated for all of the lots from 2012, they proved unhelpful in dating features. This is because the diagnostic artifact assemblage across all lots was largely the same; even modern topsoil (Lots A and V), which contained plastic and other recent items, yielded mostly historic artifacts of the same general types seen across the site. As a result, relative dating proved most useful in defining the greenhouse site timeline (Table 2).

This artifact pattern, while precluding concrete dating of features, does indicate that the area around the 1806 greenhouse has seen relatively little modern disturbance. A decorative garden (Lot B) atop the building's remains seems to have caused some

damage, but no large-scale earthmoving has taken place. In fact, the MCD for Lot B was 1789, well within the limited range of MCDs observed at the greenhouse site. Overall, the greenhouse site has remained fairly intact since the building's 19th-century demise.

Table 1. Relevant lot designations for features and soil levels discussed in Chapter 5.

Lot	Description	Trench
A, V, B, BF, CL	Modern topsoil and features.	1-4, 7-10, 2008
C, K, P, AB, CD, CG, CH, CI	Soil over and around greenhouse rubble deposits and cobble surface.	1, 2, 4, 2008
D, G, M, AK, BC, BZ	Rubble deposits atop/inside greenhouse.	1, 2, 4, 2008
S, BD	Greenhouse wall and floor deposits.	1, 2008
E, I, J, BE, CJ, CK	Redeposited subsoil outside north wall of greenhouse.	1, 4, 2008
F	Large manure/compost pit or garden feature outside north wall of greenhouse.	1, 4
H, N, AD, BA, BB	Historic surface levels outside greenhouse.	1, 2, 4, 10, 2008
L, O, Q	Subsoil and transition to subsoil.	1, 2, 10
R	Semicircular wall and its builder's trench.	2, 10, 2008
U	Cobble surface and underlying fill.	2
Y	Soil under and adjacent to gravel paths.	3
W, X, Z, CC	Gravel pathways and associated soils.	3, 7, 10, 2008
AA, AG, AI, AJ, CE	Planting features and possible planting features.	3, 7, 8, 9, 2008
AH	Possible post hole cut into redeposited subsoil.	4
AF, BW	French drains.	10, 2008
BU	Historic planting bed adjacent to greenhouse.	2008
BG-BP	Historic post holes.	2008
BQ	Cartway/road between greenhouse and carriage house.	2008
CA, BX	Stone drain and its builder's trench.	2008

Table 2. Lots excavated in 2012, broken down by relative date.

Time Period	Lots	Description	TPQ	MCD
Pre-Greenhouse	H, N	Historic surfaces south of the greenhouse.	1820	1792
	AD	Historic surface north of the greenhouse.	1795	1792
Greenhouse-Era	AA	Historic planting holes.	1820	1803
	D, G, M, S, AK	Greenhouse deposits.	1795	1789
	E, I, J	Redeposited subsoil.	1795	1796
	F	Manure/compost pit feature.	1795	1789
	L, O, Q	Subsoil layers.	1780	1805
	R	Semicircular wall.	1790	1792
	U	Cobble surface and underlying fill.	1790	1778
	X	Circular gravel path.	1790	1792
	Z	Enclosure gravel path.	1790	1792
	W, Y	Probable historic surface southeast of greenhouse.	1820	1792
Post-Greenhouse	A, V	Modern surface/topsoil.	2001	1792
	B	Modern garden.	2000	1789
	C, K, P, AB	Layers sealing greenhouse-era deposits.	1966	1794
	AF	Eastern French drain.	1780	1792
	AH	Possible post hole.	N/A	N/A

The 1806 Greenhouse

Historical maps indicated that the 1806 greenhouse was located on the north side of the entrance drive, just east of the 1793 carriage house. Excavations in that area exposed portions of the greenhouse building, which was divided into two rooms: the main body of the greenhouse (herein called the "main room"), and an attached storeroom/furnace room (the "addition") on the west end. The addition was almost entirely exposed in Trench 2008. Trenches 1, 2 and 4 all contained portions of the main room.

Deposits associated with the main room were comprised of dense layers of mortar, plaster, brick, and stone rubble situated atop limited floor and wall deposits (Lots D, G, M, S, AK, BC, BD, and BZ).

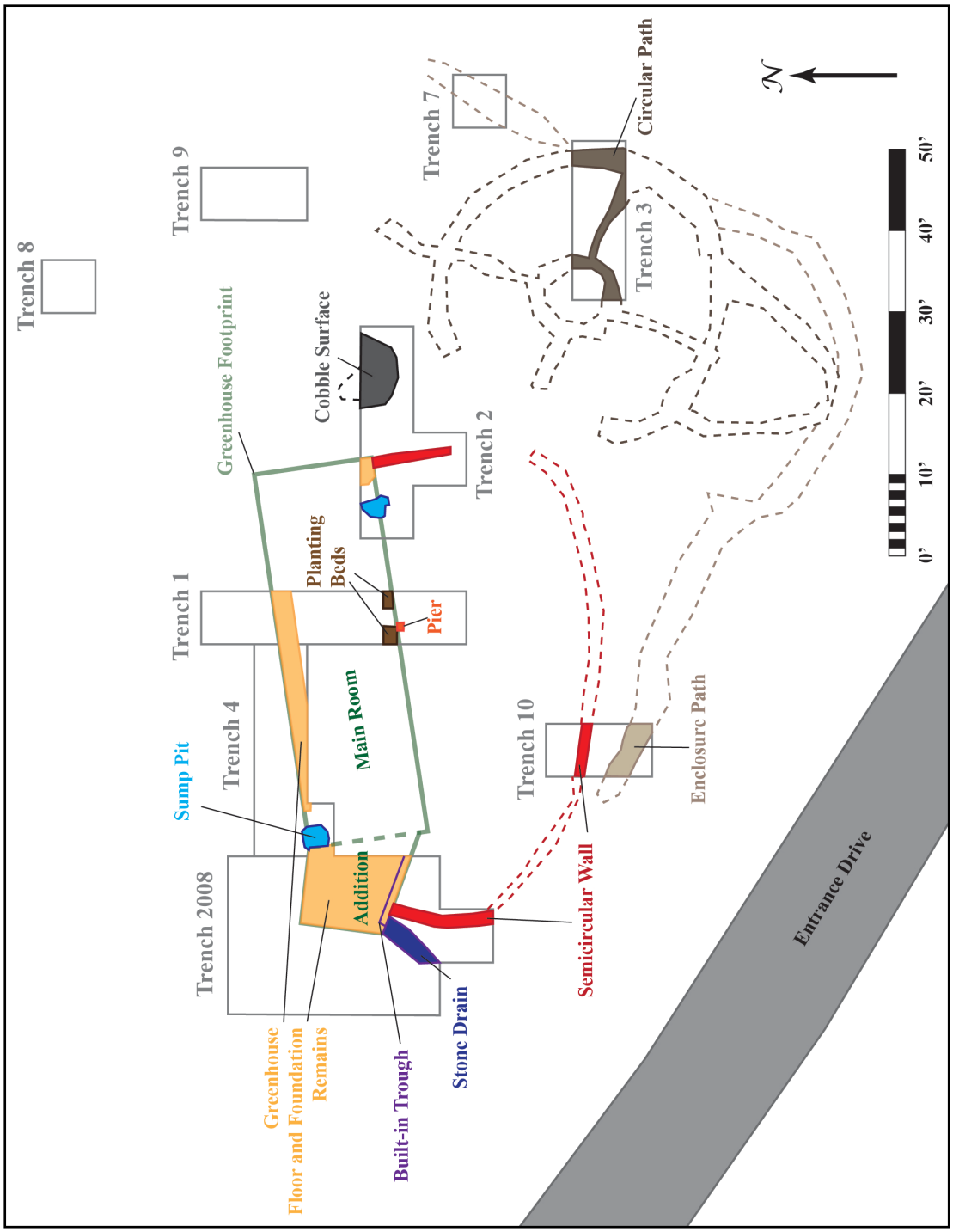

Figure 13. Plan map of the 2008 and 2012 excavations at the greenhouse site, showing the major features. Dashed lines represent continuations of features seen in the GPR survey. Adapted from Romo et al. 2014:32.

The rubble was filled with highly fragmented material and was almost entirely architectural in nature. Interestingly, the rubble layers had clear horizontal boundaries, two of which corresponded with the locations of the north and east foundations (Romo et al. 2014:43). The sheer volume of brick indicates that it was a key component of the greenhouse's walls.

The north and east foundations of the main room were highly degraded with only the lowermost portions remaining intact. The orientation of these foundations matches that shown on the historic estate plans, which depict the main room of the greenhouse running almost east-west, angled slightly east-northeast. This layout was not in line with the rest of the buildings at Gore Place, but would have been the optimal orientation to ensure the southern face of the building—where the windows would have been located—received the maximum amount of sunlight every day. This clearly shows that the Gores built the greenhouse with an eye toward functionality, which not everyone did. For example, the front primary windowed elevation of Elias Haskett Derby's 1790 greenhouse faced west and had tiny windows, both of which would have prevented the plants stored inside from receiving enough light to survive year-round (Woods and Warren 1988:84-85). This lack of regard for plant growth seems to have been common for purely decorative greenhouses (M'Mahon 1806:81).

The foundations were made of large, dry-laid fieldstones and appear to have been built directly atop subsoil (Lots L, O, and Q) or redeposited subsoil (Lots E, I, and J). The overlying rubble deposits contained mortared stone and large amounts of fragmented brick, suggesting that the greenhouse walls were comprised of stone foundations

mortared to and supporting brick walls. This building technique was used elsewhere on the historic Gore Place property at the 1837 Robert Murray farmhouse (Smith 2007). Thin pieces of slate, covered in mortar, were also found in the rubble. The slate was probably used to help keep moisture from seeping up into the main room, and would have been set between the foundation and the overlying brick walls of the building. This construction technique was used at the Vale to protect their peach wall from "rising damp" (Pinelo 1999:9).

Several other slate fragments, without mortar but containing nail holes, were also found in the rubble. Based on their appearance, they were likely roofing shingles. Depending on how the greenhouse was built, these shingles could have covered a portion of the roof of the main room or been confined only to the addition. Plaster with lathe impressions indicates that either the walls, ceiling, or both were constructed with lathe, plastered, and then whitewashed. However, lathe-impressed plaster was a relatively minor component of the destruction debris, which may indicate that only small parts of the building were plastered wood. Plaster was recommended for greenhouses of all types in order to reflect light onto plants (Kyle 1783:12-14; Loudon 1805:37-38; M'Mahon 1806:81; Renaud 1990:91).

Based on the correspondence of the north and east boundaries of the rubble deposits with the north and east foundations of the main room, the south edge of the rubble probably marks where the south wall of the building had been (Figures 14 and 15) (Romo et al. 2014:43-44). This indicates that the main room of the greenhouse had exterior dimensions of 47 feet (east-west) by 14 feet (north-south). These dimensions

make it very likely that the main room was 14 feet tall as well (Abercrombie 1789:22; M'Mahon 1806:79, 84). The addition is 10 feet by 10 feet, bringing the overall size of the greenhouse to 57 feet long by 14 feet wide.

Figure 14. Photo showing the south edge of the rubble deposit within the greenhouse footprint. The edge of the rubble and the visible pier mark where the south wall would have been. Photo courtesy of the Fiske Center.

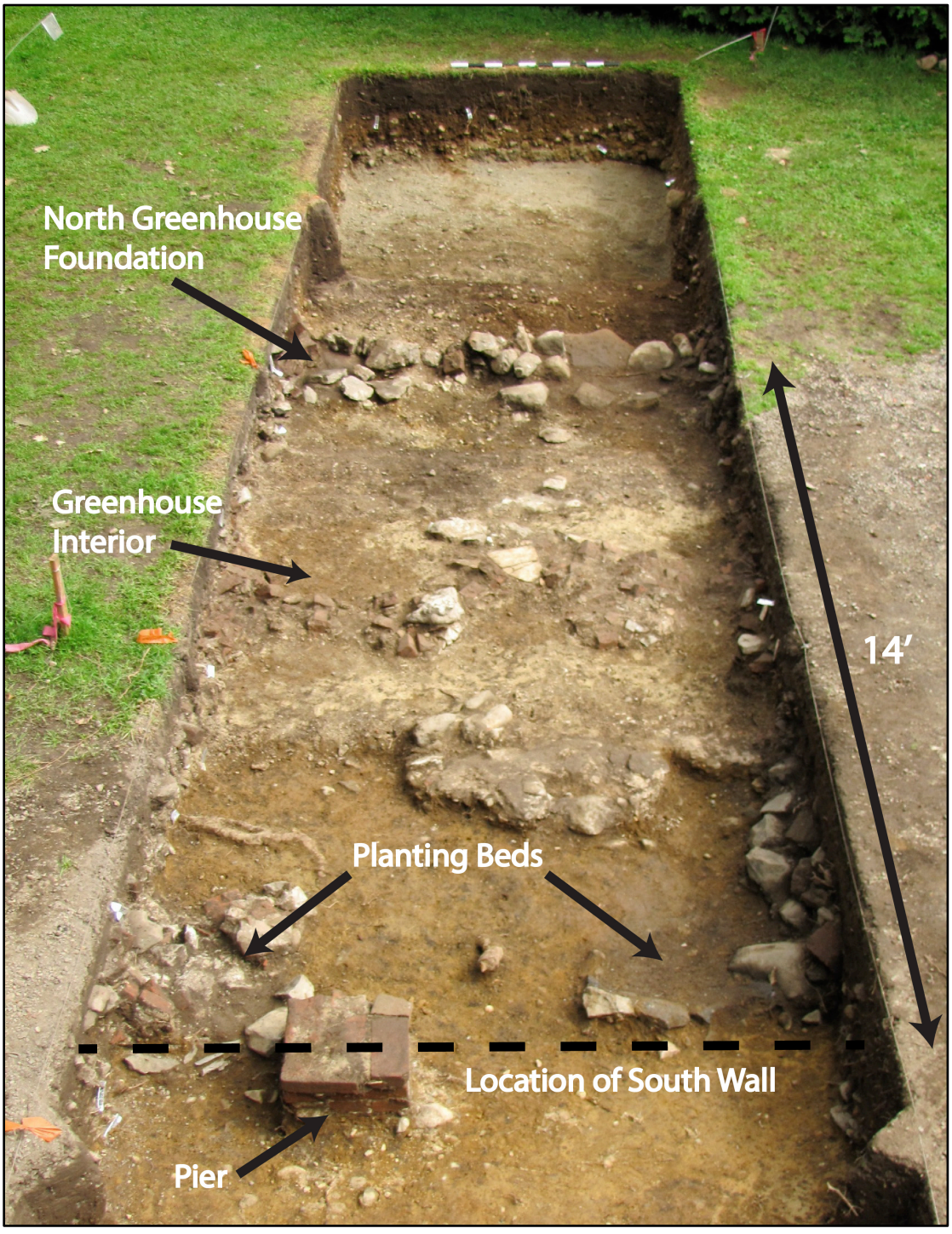

Figure 15. Photo of Trench 1, showing the locations of the greenhouse foundations, planting beds, and pier. Photo courtesy of the Fiske Center.

Surprisingly, no intact south foundation was discovered beneath the rubble deposits. Instead, three features were found in its place. One of these was a deep pit that cut through clayey subsoil into the underlying glacial sand (Lot M). The pit was ringed with large stones in a regular pattern, suggesting an effort to reinforce the hole. A second, almost identical pit was found abutting the north foundation of the greenhouse, where the main room and the addition meet (Lot G). These features appear to have been sump drains (Romo et al. 2014:46-47).

The other two features were shallow depressions that cut into thin fill deposits and came down on glacial sand (Lot S). The near ends of the depressions were approximately 2 feet apart, while the centers of their exposed portions were about 5 feet apart. The depressions contained rubble and could represent the remains of a robber's or builder's trench for the south foundation. However, there is another plausible explanation. Some greenhouses were built with a wall, typically the front one, that that sat atop piers or arches. The space between these piers was filled with planting soil, and plants would be grown in adjacent planting beds. This allowed plants grown inside the greenhouse to extend roots outside. A few 18th- and 19th-century greenhouse manuals describe this type of wall (Kennedy 1776:259-261; Nicol 1798:40-41; Lightoler 1809:15; Cooperman 1993:75-76).

This construction technique was put into practice at Nicholas Biddle's Andalusia plantation greenhouses, located outside Philadelphia. Those buildings were constructed around 1835, and were used to grow grapes. The greenhouses' front walls sat on piers, and grapevines were planted in beds along that wall, allowing the plants' roots to spread

outside the building (Kratzer 1995). This type of construction was most commonly used for vineries but could also be used for greenhouses growing fruit trees. In the latter case, the front or rear wall could be atop piers; how they were constructed depended on where the fruit trees were planted. For example, if the trees were located at the rear of the structure, then the rear wall would have below-ground arches or piers, and vice versa (see Figures 9 and 10) (Nicol 1802:222-228, Plate II, Plate III; Lightoler 1809; Speechly 1821:113-114; Loudon 1824:27; Tod 1823). Greenhouses that did not use this construction technique typically had solid foundations under the entire structure.

The total width of the beds is not known, as both extend outside of Trench 1. However, the centers of the exposed parts of the beds are about 5 feet apart. Guides for growing grapes in greenhouses note that grapevines are often planted 3 to 4 feet apart, though 6 to 12 feet of space, depending on the type of grape grown, was preferable (Speechly 1821:112). As such, a 5-foot spacing would be within the range for beds for greenhouse-grown grapevines.

A single large block of bricks, still mortared together, was found just south of the rubble layer in the main room. Although only one was found, the block's size, shape, and location match what would be expected for a pier. Taken together, the lack of a foundation, presence of a pier-like feature and locations of planting beds strongly suggest that the Gores built their 1806 greenhouse with a front wall that sat on arches or piers. None of the bioturbation often associated with tree roots was noted in the planting beds found in the 1806 greenhouse. As a result, the interrupted front wall was probably installed to facilitate the cultivation of grapes in that building.

Not all of the plants from the 1806 greenhouse would have been grown in planting beds. In fact, many plants were grown in pots, as evidence by the numerous planting pot fragments recovered from around the greenhouse. A study undertaken by Rita DeForest of the planting pots recovered from the 2008 excavations around the addition indicated that at least "150 distinct vessels" were recovered from that area (2010:40). These pots ranged in size from tiny "thumb pots" 2 cm (0.66 feet) in diameter, which would have been used "by propagators to start seeds and cutting," to far larger vessels 30 cm (0.98 feet) wide that would have held large plants, though most pots fell between these extremes (DeForest 2010:53, 94). Interestingly, thumb pots were not used by casual gardeners; as a result, their presence at Gore Place indicates "that the greenhouse was used for serious horticultural endeavors" (DeForest 2010:95).

The thumb pots may have been used to start grapes. In the 18th and 19th centuries, a major horticultural challenge was adapting European grapes to the North American climate. Almost all local grape varieties were unsuitable for eating or making wine; as a result, horticulturalists had to adapt foreign grapes or hybridize new ones (Pauly 2007:13, 73-79). If the Gores were attempting this, they had to grow grapes from seed, which was "undoubtedly… the only way to obtain new kinds of grapes" (Speechly 1821:50). Grapes started in pots could be transferred to beds after a short time (Speechly 1821:80-85).

Very few of the pots were decorated, and those that were generally had incised banding or wavy lines. Two of the undecorated vessels showed evidence of scratched-in letters and numbers (DeForest 2010:65-76). Plants grown in pots could have been arrayed

on shelves, seated in raised bark beds, or placed directly on the ground (Kennedy 1776; Kyle 1783; Nicol 1798; Gardiner and Hepburn 1804:188; M'Mahon 1806; McIntosh 1838:199-200; Renaud 1990:95-97; Laird 1996; Weber 1996:36).

Fragments of glass bell jars were also recovered from the vicinity of the greenhouse. Bell jars are dome-shaped glass vessels that are placed over plants, to essentially serve as mini-greenhouses. By the end of the 18th century, several sizes of bell jar were available, used for different sized plants. Several of the planting pots recovered from the greenhouse seem to have been built to hold bell jars. Literary references to specific plants grown under bell jars, such as newly grafted camellias, and hyacinths and other bulbs, offer the possibility that these plants were grown at Gore Place (DeForest 2010:95-98).

Other tools and architectural items were also found. Keys, latches, and lock parts attest to the presence of locked doors or containers in the building, and these suggest that the Gores or other owners placed a high degree of value on the items and plants kept in the greenhouse. Four partial knife blades were also recovered from the site, which may have been used as pruning knives. Small pieces of copper alloy or ferrous wire may have been used to tie plant stems to wooden supports; similar artifacts from other greenhouses were used for the same purpose. Various items in the building were labeled: the planting pots with scratched-in letters and numbers, and rectangular lead tags with impressed numbers attest to this. Bottles and vials may have held chemicals or pesticides for use in the building (DeForest 2010:76; Beranek et al. 2011:88-91).

Window glass was surprisingly scarce around the greenhouse, but was found in three different colors: colorless, aqua, and solarized. These colors result from different impurities in the glass. For example, aqua glass gets its light blue-green tint from iron inclusions. Solarized glass is formed when manganese dioxide, added to glass during manufacturing as a decolorant, begins to break down due to exposure to the sun's ultraviolet radiation. Eventually, the originally colorless glass takes on a pink or purple tint, becoming "solarized" (Lockhart 2006). Although it became common in the late 19th and early 20th centuries, manganese was apparently used in glass as early as 1800, and early 19th-century American glassmakers were aware of its use as a decolorant (Jessen and Palmer 2005:145-146; Lockhart 2006:49-50). The windows in the greenhouse were almost certainly aqua to begin with, but the Gores or subsequent owners probably replaced some or all of the windows with solarized glass later in the building's life. Architectural hardware recovered from the site indicates that at least some of the glass originated from sash windows.

Table 3 shows the surface area of glass recovered during the 2012 and 2008 projects. The surface area of the 2012 assemblage was calculated by measuring the volume of glass via water displacement, and then dividing the volume by the average thickness of the window glass shards. An average surface area per shard was then calculated, allowing the surface area of the 2008 glass assemblage to be estimated.

The window glass found in or near the building was only a minute fraction of what would have been needed to glaze any type of greenhouse, regardless of how the windows were arranged (Table 4). As a result, it is likely that the glass was recycled

whenever the 1806 greenhouse was demolished. This would have been financially prudent, as glass was often one of the major expenses in greenhouse construction (Koppelkamm 1981:11; Woods and Warren 1988:36, 61; Renaud 1990:91). It is very likely that the glass was reused when the later greenhouses at the fruit wall were built (Romo et al. 2014:78).

Table 3. The surface area of the different colors of window glass recovered during the 2012 project, along with the estimated surface area for the glass from the 2008 project.

	2012 Project		*2008 Project (Estimated Amounts)*		*Combined Totals*	
Color	**Surface Area (ft^2)**	**Percent of Assemblage**	**Surface Area (ft^2)**	**Percent of Assemblage**	**Surface Area (ft^2)**	**Percent of Assemblage**
Aqua	6.08	80.21	4.04	75.94	10.12	78.45
Colorless	0.48	6.33	0.85	15.98	1.33	10.31
Solarized	1.02	13.46	0.43	8.08	1.45	11.24
Total (year)	7.58		5.32		12.9	

Table 4. Estimated surface area of glass needed to glaze a Lean-to or Traditional greenhouse of comparable size to the 1806 Gore Place Greenhouse.

Recovered Glass (ft^2)	**Amount Needed for a Traditional Greenhouse (ft^2)**	**Percent Recovered**	**Amount Needed for a Lean-to Greenhouse (ft^2)**	**Percent Recovered**
12.9	240	5.38	836.8	1.54

Although no intact floor remained in the main room, fragments of marble tiles were recovered in and near the greenhouse. The tiles seem to have been mortared together atop a layer of sand. These tiles are very similar to those used in the main hall of the Gore Place mansion. Greenhouse manuals of the 18th and 19th centuries consistently recommended that greenhouses include some sort of solid floor to help with drainage (Kyle 1783:12-14; Nicol 1798:42, 124-125; M'Mahon 1806:81; Loudon 1817:73). Given the amount of tile fragments present at the greenhouse, the Gores were clearly following this advice, though other types of flooring may also have been used. Typically, these manuals recommended brick or stone, but marble seems an unusual choice. The presence of marble tiles would be unusual for a simple, practical building, but not for one that was expected to be viewed by discerning visitors, and thus needed to be impressive. As such, the marble flooring suggests that the main room of the greenhouse was meant to be seen.

The addition did not have a marble floor. Rather, it had a brick floor, most of which was still intact (Lot BD) (Figure 16). That room was also built on a different orientation as the main room, one that squared with the walkways, gardens, and buildings present across Gore Place. This suggests that the Gores were attempting to lessen, however slightly, the visual discontinuity between the greenhouse as a whole and the surrounding landscape. The difference in orientation suggests that the room was not used to house plants, and the lower-status floor indicates that it was unlikely to have been a public space. Instead, the addition was probably a storeroom. Most greenhouse manuals recommended the construction of such a storeroom as part of a greenhouse where tools could be kept. Often, these rooms would also contain a furnace or stove (M'Mahon

1806:85; Loudon 124:151-152; Renard 1990:94-103; Lewis and Floyd 1999:5-6). The 1806 greenhouse was no different: dense coal deposits were found in the addition, strongly implying a furnace was located nearby (Beranek et al. 2011:63, 73). Coal furnaces could be smaller than those used for burning wood; considering the small size of the addition, a coal furnace might have been a space-saving choice (M'Mahon 1806:86).

Figure 16. The addition. The semicircular wall and stone drain can be seen in the upper left corner of the photo, adjoining the southwest corner of the greenhouse. Photo courtesy of the Fiske Center.

Further evidence for a stove or furnace in the greenhouse comes from the presence of soot-blackened bricks, which could have come from a chimney or smoke

flues. At the time the greenhouse was built, furnaces or stoves would have been attached to brick flues conducting smoke or hot air. These flues would almost certainly have been located in the north wall of the main room, but could also have been incorporated into the walls of raised planting beds. Flues could also run beneath the floor (Kyle 1783:9-10, 101-102; Abercrombie 1789:20-26; Steele 1793:115-127; Nicol 1798:71; Gardiner and Hepburn 1804:188; Loudon 1805:14, 31-32; Pogue 2003:2-3; Hix 2005:48). However, no evidence for subfloor flues was observed during excavation at the 1806 greenhouse.

The addition's location, at the west end of the greenhouse, is a bit unusual, as most manuals recommended that storerooms and/or furnace rooms be located behind the main room of a greenhouse, but it is not without precedent (Figure 17) (M'Mahon 1806:85; Loudon 124:151-152; Renard 1990:94-103; Lewis and Floyd 1999:5-6). The addition at Gore Place may have been built at the west end of the greenhouse for visual reasons, or so that it was slightly closer to the 1793 carriage house, the adjacent cartway, or a nearby well, all of which sat a short distance to the west. Whatever the reason for the addition's location, it almost certainly contained an entrance to the greenhouse. Greenhouses could have several entrances, typically located at the east and especially west ends of the buildings (Kennedy 1776:259-261; Abercrombie 1789:22; Gardiner and Hepburn 1804:187-188; M'Mahon 1806:79; Loudon 1824:19-20; Renaud 1990:101-103). The 1834 plan of Gore Place shows what appears to be a path connecting to the southwest corner of the addition, which was very likely the location of a door. The 1841 map of the estate shows a different path connecting to the east end of the main room. The east door would have been the main visitor entrance.

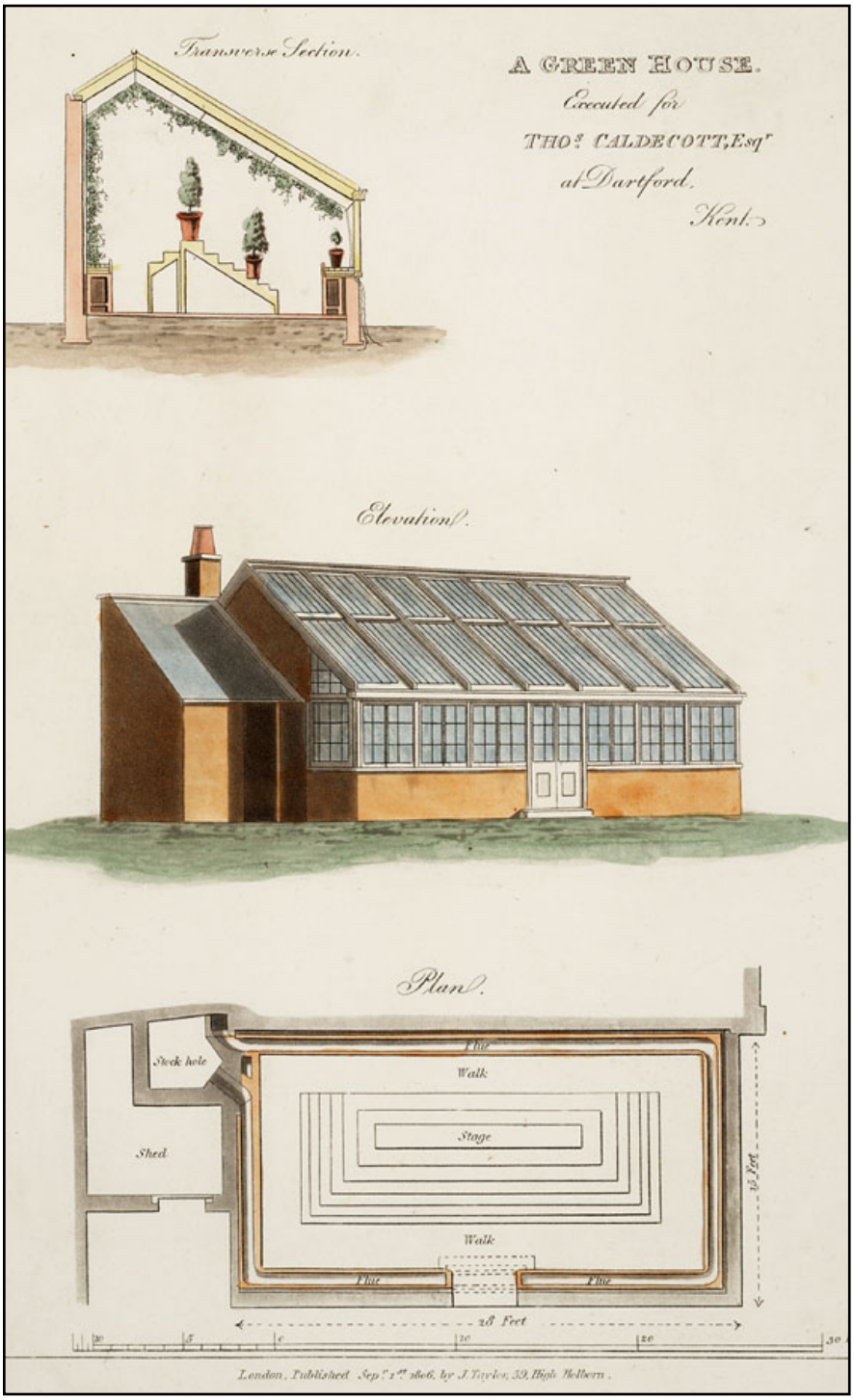

Figure 17. An early 19th-century greenhouse in England with a storeroom/furnace room attached to the west end (Tod 1823:Plate V).

The Greenhouse Yard

The east door would have been located near two gravel paths (Lots W, X, and Z) discovered during GPR surveys of the area. One of these was a rectangular path that encloses the greenhouse yard (Lot Z), and appears on the 1834 map of Gore Place. The path was not squared with the greenhouse—it was oriented on the same axis as the rest of the estate—but its location makes it clear that it was associated with the building. This enclosure path probably helped to set the greenhouse yard apart from the surrounding area, creating a more formal, refined space distinct from the neighboring carriage house and vegetable garden. A large cobble surface (Lot U) was also found just outside the east end of the greenhouse (Figure 18). The enclosure path appeared in Trenches 3, 7, and 10, while the cobble surface was present in Trench 2.

Figure 18. The cobble surface east of the greenhouse. Photo courtesy of the Fiske Center.

The cobble surface would have been just south of a path leading to the east entrance of the 1806 greenhouse, and it was probably used as an external workspace and a platform for displaying greenhouse-grown plants. In *The Green-House Companion*, J.C. Loudon recommends moving potted plants out of a greenhouse during the summer, and placing them where they can enjoy abundant sunlight and fresh air (1824:173-174). He also makes a point of specifying that wherever the plants are staged should be "impervious to earth-worms," and suggests constructing a platform of "gravelly matter," paved flagstones, or "a flooring of broken bricks and Roman cement" (1824:150-151).

The cobble surface would have fallen in line with Loudon's recommendations, and its location near the east greenhouse entrance would have made it both accessible for workers and easily seen by visitors. Further, Loudon noted that places on the "north or east side of walls or hedges" were good places to situate greenhouse plants even if no platform was erected (1824:174). Thus, the cobble surface's location made it doubly appropriate to stage plants. The enclosure path, made of "gravelly matter," probably functioned in the same way, and Loudon noted that "lining the sides of broad gravel walks with pots of the hardier sorts has a fine effect, and [the plants] will pass their summer there very well" (1824:174-175). Moving potted plants outside of the greenhouse during the summer would have been done for both practical and aesthetic reasons. It was recommended to help with plant growth, but would also have created a temporary garden space around the greenhouse and shown off the plants to any visitors entering the estate along the nearby entrance drive or the greenhouse through its east entrance (Loudon 1824:173-174).

A second gravel path was located in the southeast corner of the greenhouse yard, adjacent to the enclosure path. This path consisted of two concentric circles with four radiating spokes running at 90º angles to each other (Lot X). The east end of the larger circle and east spoke linked with the enclosure path. Connecting to the south end of the larger circle was a V-shaped path, oriented to its bifurcated end linked to the circle, and its united end linked to the enclosure path.

The western spoke of the decorative paths leads toward a large, semicircular wall (Lot R) that once connected to the southeast and southwest corners of the of the 1806 greenhouse. This wall was brick, and was supported by an irregular foundation made of dry-laid fieldstones and brick, just like the greenhouse's foundation. Portions of this wall were exposed via excavation in Trenches 2, 10, and 2008, while the rest of it was mapped using GPR. Interestingly, the west spoke of the decorative path aims directly for what appears to be a gap in the wall identified by GPR (Figure 19).

Neither the 1834 nor the 1841 map depict the decorative paths or the semicircular wall. However, the maps are also missing historically documented features such as the rectilinear garden paths through the vegetable and flower gardens. As such, it is possible that the cartographers simply left the wall and paths off their maps. So when were these features constructed? The fact that the enclosure path is depicted on the 1834 plan strongly indicates it was built by the Gores. The rectangular nature of the path supports this idea, as it is in line with the rectilinear patterns the Gores used for the vegetable and flower gardens. It may have been constructed along with the greenhouse in 1806, but this is not clear.

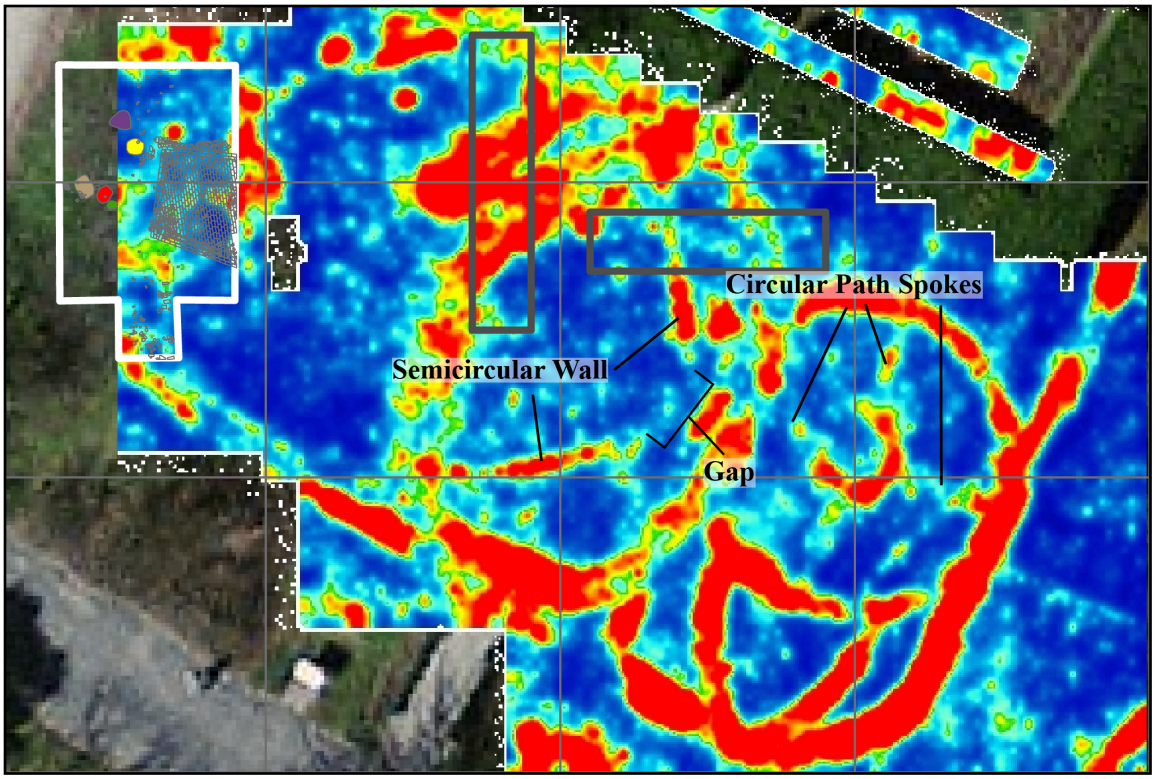

Figure 19. Gap in the semicircular wall seen near the circular path. Labels were added to a base GPR slice produced by John Steinberg and Brian Damiata for the Fiske Center.

The decorative paths and the semicircular wall were probably built by Theodore Lyman Jr. The Vale, purchased by Theodore's father in 1793, had grounds laid out in a fashionable style popular in England at the time. Wide serpentine paths, "broad expanses of grass and water, and unobstructed views of deer, cattle," and randomly planted forest trees all contributed to a landscape meant to depict a cleaner, tamed version of nature but also to break away from the older rectilinear patterns that had gone out of style (Emmet 1996:9; Parson 2009:104-105). Lyman Jr. was known to have hired gardener Robert Murray to redesign the flower garden at Gore Place after he purchased the estate. Murray

changed the Gores' rectilinear garden into a newer, more fashionable one that favored circular, curvilinear designs. The new flower garden was completed in 1835 (Brockway 2001:31).

Theodore Lyman Jr. was clearly exposed to, and favored, curvilinear paths and non-traditional garden patterns, unlike the Gores, who seem to have preferred the old rectilinear style. The Gores were definitely responsible for the enclosure path, but it is very likely that Theodore Lyman Jr. built the decorative paths at the 1806 greenhouse. Lyman Jr. probably also constructed the adjacent semicircular wall. This inference is based on the fact that the only gap in that wall lines up precisely with the new garden paths, but there is no evidence that the earlier enclosure path reached to that gap. Further, the curved nature of the wall would have visually matched the decorative garden.

In addition, the Gores and Lymans seem to have viewed their properties differently. At the original Lyman seat of the Vale, "useful and unpleasing objects," such as the kitchen garden and farmyard were hidden from view of the main house by an 11 feet tall peach wall (Emmet 1996:9). In contrast, the Gores seem to have intentionally blended their work and pleasure spaces. For example, the Straight Walk led directly from the 1806 mansion to the agricultural fields and was laid out for Christopher to observe his farm directly. The entrance drive offered unobstructed views of the 1793 carriage house to the north and the old vegetable garden to the south—both "useful" features—in addition to the high-status 1806 greenhouse. This is understandable for people like the Gores, who were thoroughly enmeshed in their scientific agricultural and horticultural pursuits. Theodor Lyman Jr., coming from the Vale with its focus on aesthetics and

prestige, may have been attempting to concretely define the boundaries between the work and pleasure spaces at Gore Place and bring the greenhouse more fully into the pleasure grounds by constructing the semicircular wall and circular garden, reorganizing the landscape in a way that the Gores would not have.

A line of post holes was found just west of the greenhouse, running north-northeast (Lots BG-BP). This line would have supported a substantial fence adjacent to a path running between the carriage house and greenhouse (Lot BQ). This fenceline, like the semicircular wall, may have been a Lyman-era addition to the greenhouse yard, but this is not clear.

The circular path seems to have replaced earlier features: in Trench 3, several rows of small planting holes (Lot AA) were found beneath the path. These holes may have held decorative garden plants or been part of a nursery, starting plants which would eventually be replanted elsewhere on the estate (Romo et al. 2014:55). In the latter case, there is no reason that the young plants could not also have been decorative; certainly their prominent location near the enclosure path and entrance drive suggests some aesthetic value. A hybrid use of the yard—as both decorative landscape and practical workspace—would seem to be in line with both the Gores' approach to their estate, but also with the idea of greenhouses in general.

A definitively practical feature, a stone drain (Lot CA), was located at the southwest corner of the greenhouse, just outside the semicircular wall (Figure 16). This drain linked to a small trough running along the inside of the south wall of the greenhouse addition. Its location fits exactly with a recommendation in William

Speechly's *Treatise on the Culture of the Vine* that states "There should be a drain in front of the stove, to carry off the water… and this drain should be as low as the foundation of the building, and close adjoining to its front wall" (1821:33). Some of the marble tiles recovered from the greenhouse showed evidence of moisture damage; these tiles, and the two sump drains found in the building, suggest that water management was an important concern. The stone drain appears to have been part of an overall effort to shunt excess water out of the building.

Another feature directly associated with the greenhouse was a large pit just north of the building (Lot F). This pit was found just beneath topsoil in Trenches 1 and 4, and cut through what appeared to be a historical surface layer (Lot AD), two layers of redeposited subsoil (Lots E and I), and into sterile glacial subsoil (Lot O). The pit's soil was dark and organic, with charcoal flecking throughout. Based on its location, the pit was contemporary with the greenhouse, and its organic-rich fill suggests that it was associated with manure/compost production (Romo et al. 2014:49). The Gores were known to have used the nearby carriage house for that purpose, and this work may have extended into the greenhouse area (Beranek et al. 2011:11).

The redeposited subsoil north of the greenhouse appears to have been part of landscaping that took place around the time the 1806 greenhouse was built. This is evidenced by the fact that Lots E and I were piled up against the building's foundations in some places, indicating that the foundations were exposed when the soil was laid down. Additional landscaping deposits (Lot BE) were noted around the addition in Trench 2008.

The fact that landscaping took place around the greenhouse at the time it was built indicates that the structure was not merely added to the estate wherever was convenient. Instead, the Gores selected and specifically prepared the space around the building, no doubt increasing the expense of an already costly structure. Further evidence that the Gores put a great deal of thought and effort into the greenhouse yard comes from the presences of the enclosure path, cobble surface, stone drain, and planting holes. These features would have worked in concert with the 1806 greenhouse, facilitating its functioning (the stone drain and cobble surface), providing places to show off its plants (the cobble surface and enclosure path) and refining the space around the prestigious building (the enclosure path and planting holes). The yard was not simply an afterthought; it was the exterior space of the greenhouse, as much a component of the building as the addition or main room. This level of commitment shows that the Gores were serious about their greenhouse.

The greenhouse was deconstructed sometime between 1841 and 1900; probably in the early part of that period. Its architectural materials were repurposed for other features: the window glass was probably reclaimed and used elsewhere, while some bricks, foundation stones, tools, planting pots, and other items were collected and used as fill for French drains (Lots AF and BW) installed in the greenhouse yard. One of these drains (Lot AF) cuts through the enclosure path in Trench 10, indicating that the path fell out of use at the same time the greenhouse was demolished. The semicircular wall and circular path were probably also eliminated at that time, while the cobble surface may have remained in use as a workspace (Romo et al. 2014:86).

CHAPTER 6

REAPING THE HARVEST: DISCUSSION AND CONCLUSION

In 1806, a short time after returning from an extended stay in England, wealthy Federalist politician Christopher Gore and his wife Rebecca built a handsome, fashionable mansion on their country estate, Gore Place, in Waltham, Massachusetts. They also built a new greenhouse, replacing one that had burned down in 1799 and destroyed their original mansion. Greenhouses were prohibitively expensive structures in the 19th century, and building a new one would not have been a trivial task for the Gores. In fact, the Gores would only have been able to afford a greenhouse due to their great wealth.

So why bother with the expense? English and American elites built greenhouses for several reasons. One motive was power: greenhouses allowed people to create self-contained environments, blocking out the weather and allowing gardeners to produce crops of vegetables and flowers out of season. Because of this, "owning an orangery gave a family symbolic control over the plant kingdom," and by extension, the world at large (Yentsch 1994:113). The fact that an owner could afford to build a greenhouse in the first place also sent a message: that they were part of the wealthy elite. No yeoman farmer

could pay for a private greenhouse; only the upper class had the means, and owning one was a clear declaration of aristocratic status.

All greenhouses were elite buildings, but they were not identical structures. At the time that the Gores built their greenhouse in 1806, there were two broad styles of greenhouse: an older "Traditional" style and a newer "Lean-to" style. The former was a masonry structure with large south-facing windows set into a vertical wall, while the latter had a sloped south façade comprised almost entirely of glass. This binary choice gives the illusion that greenhouses were relatively standardized, but the devil is in the details. Nineteenth-century greenhouse builders had a host of different greenhouse layouts and interior arrangements to choose from, many presented in the plethora of greenhouse construction and management manuals available at the time. As a result, the reasons someone had for building a greenhouse, beyond aristocratic pretense, could have a strong impact on the attributes of the structure.

The elite men and women of early 19th-century New England had several reasons to build greenhouses. Social competition was one motivation. At the time, social status among the elite was increased through conspicuous consumption, and exotic plants were fashionable prestige items. These plants, which often could not survive the harsh New England winters without the protection of a greenhouse, would be prominently displayed as part of the elites' posturing for status. Greenhouses themselves could be decorated, inside and out, as part of the same vying for prestige.

Some individuals also built greenhouses because of a real or feigned interest in horticulture and agriculture. In 18th- and 19th-century America, commerce was looked

down upon as an unscrupulous activity. Unfortunately for the wealthy men of New England, most had made their fortunes in the disreputable fields of banking or trading. To gain political capitol, some elites attempted to associate themselves with a far more respected profession: farming. To do this, they purchased country estates and farmland outside Boston, rebranding themselves as patriotic "gentlemen farmers." Gentlemen farmers practiced "scientific agriculture," which focused on experimenting with new farming technologies and techniques to improve agriculture in the United States. Greenhouses, with their controlled environments, provided excellent spaces to cultivate new species of plants or to test new horticultural methods. Of course, an interest in botany and horticulture was reason enough to build a greenhouse for some—no ulterior political motives necessary.

So what motivated the Gores? Christopher and Rebecca are both known to have had interests in agriculture and horticulture. Christopher was a cofounder of the Massachusetts Society for Promoting Agriculture (MSPA), a scientific agricultural society. He was known to deeply value his country estate, and ran it as a farm for the entire time he owned it. He also consistently experimented with new tools, crop varieties, farming practices, and livestock breeds; unlike those only interested in scientific agriculture for the political capitol, Christopher Gore walked the walk. Rebecca seems to have had a similar interest and was elected as an honorary member of the Massachusetts Horticultural Society three years after her husband died.

Some of the artifacts recovered from the greenhouse bear this out. Tiny planting pots, called thumb pots, were found associated with the building. These types of pots

were only used by those serious about horticulture (DeForest 2010:95). The greenhouse itself was also positioned to take full advantage of the southern sun, despite the fact that to do this the structure had to be built on a different orientation than the rest of Gore Place, disrupting the aesthetics of the estate. The Gores also devoted an entire yard to the structure, landscaping a space just north of the entrance drive for the estate, and adding several support features around the greenhouse. The landscaping and additional features, which included a gravel pathway, cobble surface, stone drain, and planting holes, would have been additional expenses incurred merely to support the greenhouse. Taken together, the yard, artifacts, and physical attributes of the greenhouse itself all indicate that the Gores were serious about growing plants in the greenhouse.

A commitment to scientific agriculture was not the only motivator for building the greenhouse. Christopher Gore was also known as both a man acutely aware of "what important people thought of him" and one who considered himself a member of the American aristocracy (Pinkney 1969:55). Greenhouses were considered almost necessary accouterments for country estates and aristocrats, and were described as "an appendage to every villa," and a mark of "elegant and refined enjoyment" (Loudon 1824:v). A man like Christopher Gore, who took up scientific farming and purchased a country estate in part because they fit with his idea of his own "station and pretensions," would of course want a greenhouse (Thornton 1989:32).

The Gore's awareness of how their peers might view them is highlighted in subtle ways in the greenhouse. First, the building was placed just north of the entrance drive for Gore Place, where every visitor would see it. While the main room of the greenhouse was

facing south, the addition, a storeroom/furnace room located at the west end of the structure, was built on the same orientation as the rest of the estate. This would have helped mitigate the greenhouse's discontinuity with the estate's other buildings. The structure also appears to have had marble tile floors identical to those seen in the main hall of the Gore Place mansion. While historic greenhouse manuals recommended stone or brick floors, the use of the marble, especially the same marble used in the main house, indicates that high-class visitors were intended to tour the building. A straightforward, utilitarian structure that only workers would see the interior of would not have had a marble floor. The 1806 greenhouse was definitely meant to be seen and toured by the Gore's upper crust visitors.

Overall, it seems that the Gores had two motivations for building their 1806 greenhouse: an actual interest in horticulture and scientific agriculture, and aristocratic airs. These motivations speak clearly to the identities that the Gores, especially Christopher, cultivated. In his letters to close friend Rufus King, Christopher often bragged about his farm. He carefully recorded crop yields and kept abreast of new innovations from overseas. A path, the Straight Walk, was specifically laid out so that the Gores could inspect their farm fields. Christopher did not simply dabble in scientific agriculture, he seems to have truly considered himself a gentleman farmer. Whatever his other motivations, building a greenhouse would have been an excellent way for Christopher to show that he was committed to scientific agriculture.

This commitment was partly a product of his wealth and social status. Gentleman farming was a major part of aristocratic behavior in England and the United States in the

18th and 19th centuries. Gore was a rich political climber and self-identified American aristocrat. His purchase of a country estate, Gore Place, with its mansion and farmland, was an attempt to replicate the patterns of British nobility and to fit in with his American peers. Well-traveled, Gore would have known that scientific farming was a part of the aristocratic act, as was owning a greenhouse, which "every gentleman of rank and fortune would wish to possess" (Steele 1793:113). As such, it is almost inconceivable that Christopher would not have built a greenhouse as part of a continual enactment of his aristocratic identity.

So where does Rebecca fit in with the greenhouse? None of her letters or writings are known to have survived, and biographers tended to focus on Christopher Gore, but not Rebecca. However, we do know that Rebecca had a keen interest in horticulture. She also seems to have grown oranges, variegated orange trees, lime trees, roses, and geraniums at Gore Place after Christopher had died. Rebecca was also an amateur architect who helped design the Gore Place mansion and had an interest in landscape design, having advised her cousin Catherine Codman on how to update both their estate's mansion and grounds to match contemporary English fashions. As an intelligent, capable woman with an interest in architecture, landscape design, and horticulture, Rebecca very well could have managed the 1806 greenhouse. Women were known to have managed greenhouses elsewhere in the United States; Margaret Carroll, for example, was a late 18th-century woman who managed her own greenhouse and advised George Washington on how to construct his (DeForest 2010). Whether or not the 1806 greenhouse was

exclusively Rebecca's space is difficult to prove. However, it is extremely unlikely that she did not at least help manage it, given her interest in horticulture.

While Theodore Lyman Sr.'s greenhouses at the nearby Vale estate were praised for their "handsome collection of exotics," no such praise was forthcoming for Gore Place (Kendall 1809:10). Visitors seem to have remarked on the estate's field crops, but made no mention of unusual or impressive plant specimens (Brockway 2001:24). As such, it seems unlikely that the 1806 Gore Place greenhouse grew particularly unusual or interesting plants. However, the greenhouse does seem to have grown grapes.

Gore Place is known to have grown cherry, peach, and pear trees, in addition to grapevines. In 1824, all of these were damaged or destroyed by a spring frost (Viens 2010:47), indicating they were planted outside, probably at the fruit wall. That feature had been labeled "Fruit Wall & Grapery" on an 1834 plan of Gore Place, adding some corroboration for this inference. At first glance, this would seem to preclude growing any of these plants in the 1806 greenhouse. After all, why use a greenhouse when you have a dedicated fruit wall and grapery? Certainly, peach, pear, and cherry trees were probably only grown at the fruit wall. For grapes, things may have been different.

Firstly, grapes were notoriously difficult to grow. Beginning in the 17th century, Americans consistently tried and failed to grow grapes—specifically European wine grapes (Pauly 2007:23-32). Local grape varieties were unsuitable for winemaking or eating, and European wine grapes were viewed as "the indicator species for culture" (Pauly 2007:29). Unfortunately, frost, bacteria, and fungi thwarted almost every effort by

Americans to cultivate wine grapes (Pauly 2007:20-23). One way to protect against these threats would have been to grow grapes in a protected environment such as a greenhouse.

Another method would be to create new grape species. This would have been accomplished by hybridizing local and foreign grape varieties, and necessitated growing plants from seeds (Speechly 1821:50; Pauly 2007:13, 73-79). Tiny planting pots called thumb pots were used by serious horticulturalists explicitly for growing plants from pots (DeForest 2010:94-95). Grapes started in pots were usually moved to beds once they had grown somewhat (Speechly 1821:80-85).

Thumb pots have been recovered from the 1806 Gore Place greenhouse, which also had planting beds arrayed along its front (south) wall. This wall was almost certainly built on a foundation of evenly spaced piers. Between the piers would have been soil, to allow plants growing in the adjacent beds to spread their roots outside the greenhouse. This type of construction was recommended by 18th- and 19th-century gardeners only for greenhouses growing grapes and/or a few types of fruit trees, such as peaches, figs, or cherries (Kennedy 1776:259-261; Nicol 1798:40-41, 1802:222-228, Plate II, Plate III; Lightoler 1809; Speechly 1821:113-114; Tod 1823; Cooperman 1993:75-76). The spacing of the beds, on 5 foot centers, matches with planting patterns in contemporary graperies (Speechly 1821:112; Prince 1828:59). Furthermore, no evidence for large, root-related bioturbation of the soil in the planting beds—the type that would be expected from fruit trees—was observed, adding additional circumstantial evidence for grape-growing in the 1806 greenhouse. One other piece of evidence comes from the work journal of Jacob Farwell, the farm manager at Gore Place. In 1822, he wrote that he was

"helping Heathcoat [sic] about the hothouse" (Beranek et al. 2011:32-33). By all accounts, grapes were commonly planted in hot-houses—buildings heated year-round to keep tropical plants alive—where they thrived alongside more exotic fare, such as pineapples (Abercrombie 1789:81, 131; Speechly 1821:7-10, 57, 80-85). That the 1806 building was specifically a hot-house is supported by Theodore Lyman Jr.'s 1834 request for his brother to send him some pineapples (Brockway 2001:32), which could only have lived in such a building. Fruit trees could be grown in hot-houses as well, but unless carefully managed the heat could be "too considerable for peaches, nectarines, cherries, and other kinds" (Abercombie 1789:81). When grapes were planted in hot-houses that contained other plants, they were typically planted in beds along the front wall, with a partially open foundation (Abercrombie 1789:81-82; Speechly 1821:80-85)—exactly what was uncovered at the 1806 Gore Place greenhouse. Grapevines, in particular, also needed to be kept dry (Speechly 1821:33-34); several drainage features, including a stone drain connected to a built-in trough, as well as two sump pits, were found at the 1806 greenhouse, indicating water management was a priority for the Gores.

Given all of this information, it is likely that grapes were grown in the 1806 greenhouse. It is probable that the Gores used the greenhouse as a protected, controlled environment to grow new, hybrid grapes from seeds—grapes that would hopefully thrive when planted outdoors at the fruit wall. Having multiple areas dedicated to grape-growing was not unusual; some estates had two grapery greenhouses that would be harvested in alternating seasons (Chorlton 1856:83). Testing new grape varieties before committing to a full-scale planting was recommended by historic gardeners, since the

fruit from a new type of grapevine could very well turn out to be inedible (Speechly 1821:59-60).

Maintaining grapevines in the greenhouse had other benefits, as well. For example, growing grapes outside at a fruit wall without glass coverings to help retain heat could produce uneven ripening and bad harvests; something that would not be an issue in a greenhouse (Speechly 1821:138). Further, seed-grown grapevines do not produce fruit right away, and even then, it takes some time to produce large crops (Speechly 1821:50; Chorlton 1856:21-24). Growing some stock grapevines in a greenhouse would have been a good idea for the Gores, so that they did not have to start over entirely when fungus, bacteria, or frost claimed the outdoor vines.

In the summer of 1816, Christopher Gore wrote that his grapery had yielded 1600 bunches of grapes (Brockway 2001:26, 57; Beranek et al. 2011:31). Using figures provided in an 1856 greenhouse manual, an unheated greenhouse dedicated solely to grapevines and measuring 50 feet long, 20 feet wide, and 14 feet high could be expected to produce about 750 bunches of grapes per harvest after four years in operation (Chorlton 1856:21-25). Multiple harvests could be reaped from heated greenhouses, the first in the winter/spring and the second in the summer (Chorlton 1856:84-87). Theoretically, the Gores could have harvested their 1600 grapes from the 1806 greenhouse alone. This, however, is unlikely since the 1806 greenhouse was not dedicated solely to grapes. This is supported by the already-discussed planting pattern—which matches hot-houses growing grapes alongside other plants—as well as the "hothouse" reference by Jacob Farwell and the 1834 map notation of "greenhouse," both

of which indicate a lack of specialization for the building. In addition, the cobble surface and enclosure walkway associated with the greenhouse were likely used for holding greenhouse-grown potted plants during the warmer months. Although mature grapevines could be kept in pots, they were more commonly grown in beds (Speechly 1821; Chorlton 1856). As such, it is almost certain that other plants were grown alongside the grapevines in the 1806 greenhouse.

So what did the building look like? Archaeological excavation tells us that the building was split into two rooms: a "main room" where plants were grown that measured 47 feet long by 14 feet wide and an "addition" that acted as a storeroom and housed a furnace and measured 10 feet by 10 feet. The structure would probably have been 14 feet tall. The main room had a marble floor with plastered walls and a flue heating system. Mature grapevines would have been grown in beds against the south wall, while younger vines and other plants would have been grown in pots on shelves and sometimes under bell jars. The front wall sat atop arches, allowing the grapevines' roots to extend outside. The addition had a coal-fired furnace and a brick floor. Two sumps and a stone drain, connected to a built-in trough, would have shunted excess water out of the building. Keys and lock parts attest to the presence of high-value items in the building. At least some of the building's windows were sash windows. Aqua-colored glass would have been used originally for the windows; this would have been replaced later with solarized glass. The main room was angled to best catch the sun, while the addition was oriented in line with the other buildings and features at Gore Place, helping to lessen the

visual discontinuity of the greenhouse overall. Doors were located at the east and west ends. Finally, the structure would have been built in a Lean-to style.

This inference is based on two facts. First, the Gores took their horticulture seriously, and the most advanced and productive style of greenhouse available in 1806 was the Lean-to variety. For people committed to scientific agriculture, who made sure to angle their greenhouse so it caught the most sun despite disrupting the aesthetics of the estate, it is nearly inconceivable that the Gores did not built the most efficient structure they could. Second, hot-houses growing grapes alongside other plants were specifically built in the Lean-to style, and the grapevines planted along the front wall would be trained up the rafters of the sloped façade of the building (Figure 20) (Abercrombie 1789:81-82, 128-129; Speechly 1821:80-85). As late as 1856, Lean-to style buildings were still in common use as vineries (Chorlton 1856:30-35).

Depending on what greenhouse manuals they read or other greenhouses the Gores visited, the internal arrangement of the 1806 greenhouse could have varied. However, it is probable that the trough drain seen in the addition continued along or near the south wall of the main room (Speechly 1821:33). A 60 foot long, 14.5 foot wide, and 15 feet tall greenhouse depicted in Walter Nicol's 1802 version of *The Scotch Forcing and Kitchen Gardener* is similar in size to the Gore Place greenhouse, and also grew grapes (see Figure 9). The heating system in the 1806 Gore Place greenhouse likely resembles Nicol's and would have consisted of a flue running out from the addition, along the west wall, and then turning to run just behind (to the north) of the grape beds before turning to parallel the east wall and then turning again to run along the rear wall back to the addition

at the west end of the building, forming a loop (Nicol 1802:226-228, Plate III). Another example is depicted in George Tod's 1823 greenhouse architecture book (see Figure 17) (Plate V). This layout was common for Lean-to greenhouses (Abercrombie 1789:129; Pain 1798:103; Nicol 1802:226-228, Plate III; Tod 1823; Chorlton 1856:34-35).

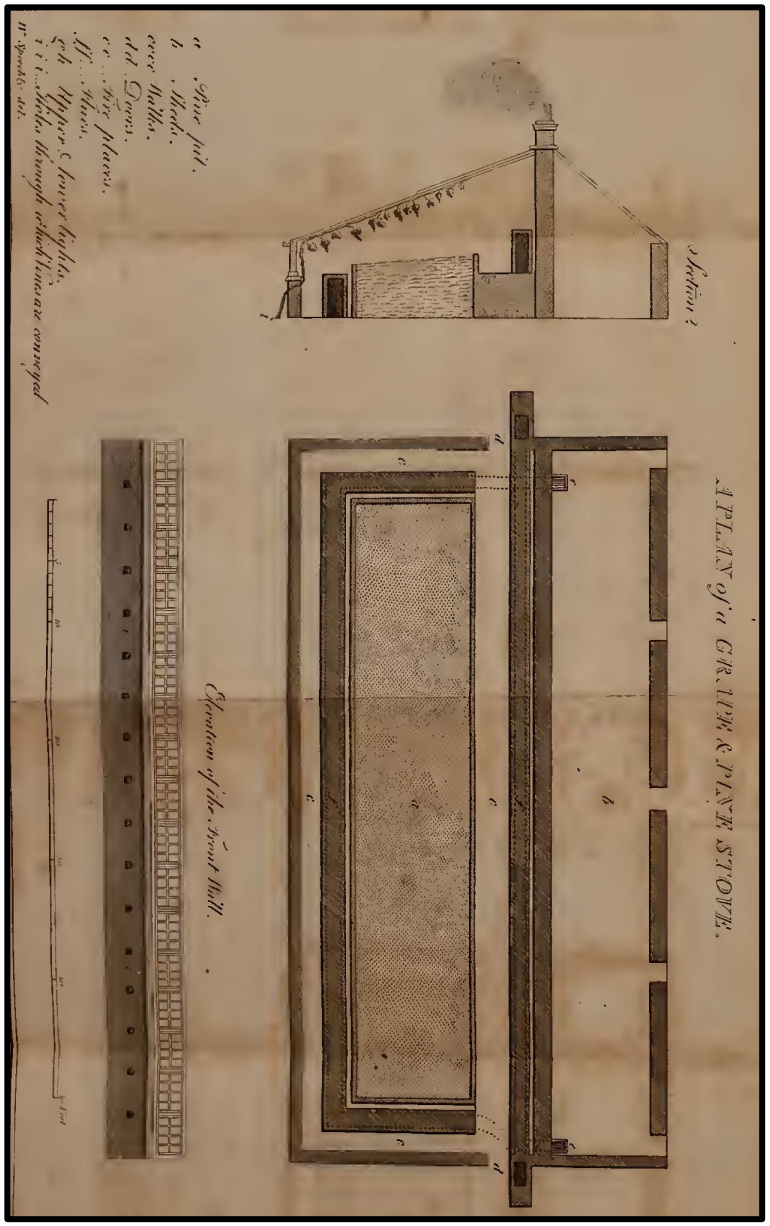

Figure 20. Plan drawing for a late 18th- to early 19th-century hot-house built to grow grapes and pineapples. The grapevines are trained along the rafters of the sloped roof. This also shows a variation on the construction of the front wall, where the vine is actually planted outside and then grown through a small gap in the greenhouse wall (Speechly 1821:Plate VI).

Beyond this, the interior arrangement is unclear. A bark bed could have been present in the structure, or may have been omitted. Potted plants could have been arrayed on this bed, on shelves in the center or rear, or situated directly atop the rear flue. There may or may not have been a door connecting the addition and main room (Abercrombie 1789:129; Pain 1798:103; Nicol 1802:226-228, Plate III; Gardiner and Hepburn 1804:187-188; Tod 1823; Chorlton 1856:34-35). As the Gores had undoubtedly seen greenhouses both in the United States and abroad, and would have had access to a variety of gardening manuals, they would have had lots of design choices to select from.

The goals of this thesis were to determine why Christopher and Rebecca Gore built their new greenhouse in 1806 and to ascertain what the building looked like. The evidence suggests that the greenhouse was built in a Lean-to style to grow grapes and other plants. The Christopher Gore's identity as an American aristocrat and scientific farmer, and presumably Rebecca's similar interest in horticulture, spurred the construction of the building, which functioned as a symbol of the family's wealth and status in addition to allowing them to tackle one of the more significant agricultural challenges of the era: growing grapes.

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