HYBRID TERRITORY: THE SHAPING OF PUBLIC DISPLAY AT RUTGERS GARDENS

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ABSTRACT OF THE THESIS

Hybrid Territory: The Shaping of Public Display at Rutgers Gardens

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An important but often overlooked aspect to Rutgers Gardens is the work of plant scientists in shaping visitor experience. Research on plant hybrid science offers a lens to define Rutgers Gardens' sense of place. This is most apparent in the ways plant scientists have shaped the physical form of the Rutgers University landscape, as well as the how their work at Rutgers Gardens is distributed beyond the botanical garden. In this thesis, I organize my investigation of Rutgers Gardens as a display and botanical garden chronologically around three major periods of plant hybridization research: the foundational era, the ornamental dogwood era and the contemporary hazelnut hybrid research era. A mixed methods approach of archival research, interviews, and mapping and diagramming is used to construct a historical narrative of plant hybridization within the realm of Rutgers Gardens. This research indicates that initially, plant hybrid scientists played a critical, if not the sole, role in shaping the public botanic display at Rutgers Gardens. Over time, though, plant hybrid scientists' role diminished. Furthermore, plant hybridization is an ideal lens through which to study the history of Rutgers Gardens, as well as the history of the New Jersey Agricultural Experiment Station and the College of Agriculture, now Rutgers University's Cook Campus and the School of Environmental and Biological Sciences. Trends of plant hybridization research parallel trends of

agricultural diversification, suburbanization and edible and sustainable agricultural practices in New Jersey. Lastly, a tension between public access and private research and economic botany exists at Rutgers Gardens. This tension should be maintained in order to sustain Rutgers Gardens' sense of place as a hybrid territory of scientific research, economic botany, display and design.

DEDICATION AND ACKNOWLEDGEMENT

Dedicated to my father, Richard Patrick Hanrahan (1935-2010), and brother, Thomas William Hanrahan (1964-2010).

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Purpose

On September 7, 2012 a review committee selected WXY Architecture + Urban Design from a pool of eight firms responding to a Request for Proposal (RFP) at Rutgers University to study the feasibility of incorporating a visitor center at Rutgers Gardens in North Brunswick, New Jersey. In part, the feasibility study intends to evaluate the future role of buildings at Rutgers Gardens, the university botanical garden. More specifically, the architects were tasked with examining how buildings may enhance Rutgers Gardens' image within the University and the regional community. The study is to review the potential for siting buildings within the physical context of existing hydrology, visibility from nearby roadways, and access to parking. It is also to examine how future buildings will relate to the mission[1] of the Gardens and enhance visitor experience within the Gardens.[2] An important but often overlooked aspect of Rutgers Gardens is the work of plant scientists in shaping both plant collections and visitor experience at the public garden.

In this thesis, I organize the investigation of Rutgers Gardens as a display and botanical garden chronologically around three major periods of plant hybridization research: the foundational era, the ornamental dogwood era and the hazelnut hybrid era. This thesis explores the history of plant hybridization and the potential for revealing it as an element of visitor experience, an important but often overlooked aspect of a botanical garden. In doing so, four key elements become apparent. First, the work of plant

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[1] According to the website, the mission of Rutgers Gardens is "to promote and provide accurate information about the art of horticulture with an emphasis upon the relationship between plants, human health and nutrition in the designed, as well as in the natural landscape." "Our Mission," Rutgers Gardens, accessed February 9, 2013, http://rutgersgardens.rutgers.edu/about.html.

[2] Bruce Crawford, e-mail message to author, February 9, 2013.

scientists has shaped the form and structure of Rutgers University and Rutgers Gardens with the advancement and investigation of plant hybrids since the founding of the Rutgers Scientific School (now part of Rutgers University) in the late 1800's and with the initial purchase of the land that now contains the Gardens. Since the establishment of what became known as Horticulture Farm No. 1, plant scientists have been intimately involved with the development and collection of plants (Woodward 1932), and, to this day, continue to build and preserve a rich germplasm of agricultural and ornamental plant hybrids (Molnar and Capik 2012). Many of these plants exist at Rutgers Gardens while others reside on nearby university properties. Second, plant breeders have shaped, both directly and indirectly, the visitor's experience at Rutgers Gardens with the spatial form of plant material accessions and hybrid crosses as well as the research fields, laboratories and barriers necessary for experimentation. Third, the scientific research agenda of plant hybrids, informed by cultural, economic, historical and political values, contextualizes the relevance of plant hybrid research and its influence on public botanic display. Lastly, this study reveals how the scientific research originating at the Garden's extends beyond the institutional walls of Rutgers University. Plant hybrids manifest as a physical product—thus, promoting and distributing the ideas that created them. Each of the four key aspects of this thesis defines Rutgers Gardens as a hybrid territory, a productive landscape and a landscape of display and experience, as seen through the lens of scientific plant hybridization research.

This research will first present the historical narrative of plant hybridization research at Rutgers Gardens and illustrate that it is not immediately apparent to the visitor. One sees reference to the historical foundations of the garden's collections on the

Rutgers Gardens website. Yet, no overriding historical narrative of scientific research, such as systematic arrangement or signage, is expressed in the design of its collections. The individual plants shown in Figure 1, for example, the original seedling trees from which all other Stellar Pink® and Ruth Ellen® cultivars were derived, sit within the garden collection, unadorned and unmarked. Additionally, while the incorporation of a Rutgers Gardens visitor center has the potential to expose these imprints in the landscape, there is a threat, depending upon its ultimate placement and design, that these elements could be obscured, damaged, or inadvertently removed.

Figure 1. Original Seedling Trees of Stellar Pink® and Ruth Ellen®

Another objective is to illustrate the need for public outreach and education in a hybrid botanical garden. The tension between plant hybridization as a business, both in the sense of controlled hybrid research and in the production of economic botany, and public access in a botanical garden complicates reveling of the historical narrative and contemporary operation of plant hybridization. In a botanical garden, there is a potential conflict between public use and access and the agenda of the scientist researching and producing plant hybrids have high demand in the marketplace. In a public setting, the viable market-bound product of hybridization—a living progeny of plant hybrids—may easily be stolen and subjected to contraband reproduction. While plant patents and

trademarks do offer protection against such acts, the tension between the business of research and the desire for public display remain. Furthermore, access restriction to protect the hybrid research, challenges the very definition of a botanical garden, as a place founded on the principles of scientific exploration, systematic display and aesthetic arrangement of plants for public enjoyment and education. This tension suggests the need for spatially separating public areas of display from private areas of research and economic botany.

Figure 2. Stellar® Dogwood Series. Photo collage rendering highlighting the tension between hybridization research and ornamental display.

In early discussions regarding the methods used to investigate plant hybridization at Rutgers Gardens and its surroundings, the proposal to reveal specific locations of original plant hybrid seedlings and progeny was, in several instances, vetoed by the

research scientists. Mapping or diagramming, for example, has the potential to expose the location of a viable, unreleased product, opening it to theft by any opportunistic horticulturalist or competitor. Moreover, the production of a map spatially locating a living plant as intellectual property in a public garden, much like location maps for endangered species, becomes an invitation for exploration that may damage or destroy years of painstaking work, regardless of whether or not the experience with the plant is through direct encounter or experienced through a physical abstraction of its location. While the physical location of germplasm used in creating the living organisms as intellectual property may be intentionally obscured by the hybridizer, the map exposes the hybrid crosses to the potential for illicit reproduction, and use, of the genetic progeny that represents decades of investment by researchers. The influences of market demand may ultimately determine the level of abstraction required to spatially represent plant hybrids. When comparing the contemporary plant hybrid research at Rutgers Gardens, for example, locations of progeny related to hazelnut hybrids may have less significance than the locations of progeny of dogwood hybrids, solely due to the potential value of the plants in the marketplace. In other words, the question of public knowledge or visitor experience of intellectual property within a botanical garden varies by species. Not all hybrids are created as equals.

Finally, the notion of boundary is critical. Facilities that host plant hybrid research adjacent to public display, often separate the research area with fences, locked buildings, signage, and even disperse research activities to different Horticulture Farms.[3] In doing so, the physical arrangement of research activities within the territory of Rutgers Gardens

[3] Rutgers Gardens was formerly known as Horticulture Farm No. 1. Plant Hybridization research also occurs at neighboring facilities such as Horticulture Farm Nos. 2 and 3, in addition to multiple facilities throughout the state of New Jersey.

both enhances and detracts from the visitor experience. As such, the question arises as to how much of the research program's dispersed activities may be realistically experienced by a visitor. In addition to the physical dispersal of plant hybrid work, the distribution and reach of scientific ideas, physical product for the production of nursery stock and the financial and contractual minutia related to the plants themselves spreads to a much larger landscape, far beyond the territory of Rutgers Gardens. Dispersed activities occur in physical locations ranging from laboratories, classrooms, researcher offices, research test plots and fields, research nurseries, university licensing offices, lawyer's offices, the United States Patent and Trademark Office (USPTO), commercial growers' fields, commercial nurseries, farmer trials and countless landscapes from public parks, to private gardens, and farmers' fields. The physical geography of these locations is determined in cooperation between the researchers, legal administration and the plant hybrid's own environmental requirements and limitations, which are sometimes the traits manipulated through hybridization. This involves a complex interaction with time, climate, disease and market demand that expand the reach of both the plant breeding program and Rutgers Gardens. Through the work of plant scientists and the plant hybrids originating from these locations, the territory of Rutgers Gardens, display and visitor experience extends far beyond the existing boundary of Horticulture Farm No. 1.

Research Methods

A mixed methods approach of archival research, interviews, and mapping and diagramming is used to construct a historical narrative of plant hybridization within the realm of Rutgers Gardens.

According to Deming and Swaffield (2011), leaders of research methodologies in Landscape Architecture, archival research, sometimes-called historiography, is the "interpretation of the historical record of human actions and events, and this record's representation as a recognizable narrative" (164). The features that distinguish this type of research in relation to the study of Rutgers Gardens and the actions of plant scientists on the formation of the Gardens are historical evidence of studies practiced over time, historical documentation of experiments and Rutgers University records related to the assemblage of property and its use through time. Archival research traces sociocultural and socioeconomic processes related to agriculture and suburbanization. Laboratory notes indicate the scientific methods used to gain systematic knowledge of hybridized plants, as well as the spatial arrangement in the botanical garden in support of breeding research and public display.

A series of interviews develops an understanding of the spatial configuration of Rutgers Gardens through periods of plant hybrid development, especially since the 1930's. An interpretive/constructionist approach is used for the unstructured interviews. According to Rubin and Rubin (2012), leaders in the role of research based on interviews, the goal of interpretive/constructionist interviewing "…is to describe particular events, processes, or culture from the perspective of the participants, usually using qualitative techniques… [The method is] interested in contending and overlapping versions of reality

[where] many truths [are] possible" (2012, 23). According to Deming and Swaffield (2011), documentary analysis using the examination of external documents is often used to supplement unstructured interviews.

Mapping and diagramming visually represent data collected from archival and interview research to build a richer narrative related to plant breeding at Rutgers Gardens. Depending on the data, collection, inventory, and catalogue methods will be used for data gathered from different sources. Ultimately, the data or knowledge gathered was used to reveal the relationships between the social and cultural history of Rutgers Gardens and the activities of the plant breeding. As James Corner (1999) states, "For [a generation of young landscape architects, architects and urban planners] mapping refers to more than inventory and geometrical measure… the map is first employed as a means of 'finding' and then 'founding' new projects, effectively re-working what already exists… [and thus,] are valued for both their revelatory and productive potential" (224) and as a tool for "searching, disclosing and engendering new sets of possibility" (225).

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A Short History and Definition of Hybridization

Noel Kingsbury (2009), author of *Hybrid: The History and Science of Plant Breeding*, chronicles the work of plant breeders to millenniums of agricultural cultivation, wild plant selection, foraging and the collection of seed. Genetic resources have been incrementally modified as seeds from high performing plants were selected based on their desired characteristics in one harvest and planted the next season, thereby modifying the gene pool over time. This traditional knowledge of intuitively breeding by selection eventually gave way to the development of a more direct and systematic experimentation with plant breeding and controlled genetic manipulation of plant hybridization within the last century. Kingsbury claims that plant-breeding activities allowed the cultivation of a consistent food source composed of high performing crops, which, in turn, gave humans greater chances of survival. After securing consistent food sources, people turned to the enhancement of the landscape surrounding them through similar selection and modification of the genetic resources of ornamental plants. Ultimately, this gave way to an interest in ornamentals and fostered the nursery trade. The power of a plant hybrid lies in the plants novelty, including its ability to attract the attention of consumers, and, as Kingsbury summarizes, this marketplace demand has emerged from "an endless search for novelty." He goes on to state that:

> …Whenever people have had the leisure time and income to stop worrying about spending all their working hours producing edible crops, they have turned to growing a few plants for decoration, often picking out natural oddities… Once gardening became a popular hobby and the nursery trade an industry, this search for novelty became a business (2009, 334).

Given the combination of the agricultural and ornamental interests in plant hybridization, how might one define the role of the plant breeder? In Kingsbury's opinion, plant

breeding means "improving upon nature" (2009, 7). Likewise, he compares the study of the history of plant breeding to revealing an evolving narrative of how humankind understands of nature and culture.

Kingsbury further states that the foundations of systematic plant breeding evolved in the seventeenth and eighteenth centuries, when the political, social and economic forces in various countries throughout the world individually conspired with the need for agricultural diversification. He continues that through the eighteenth and nineteenth centuries those practices became even more deliberate through processes of "trial and error" experimentation in order to create a superior line of crops. While many countries hesitantly entered the world of Mendelian principles[4] to improve crops, the United States became one of the first nations to invest in such genetic research in order to steadily develop a system of agriculture that could function in its diverse and unknown landscapes. Scientific methods of plant breeding prospered and expanded, and, it was not until the pursuit of first-generation (F_1) corn hybrids[5] in the last century that plant hybridization began to embrace the technological advances in the field. As I discuss later, Dr. Elwin Orton not only completed his graduate work in the expanding field of genetics based on corn hybrids, but also studied under some of the leaders in the field at the time.

While the long history of naming and classifying plant selections have met varied purposes ranging from the honorific to the imperial or intellectual claim inherent in branding a plant, it was not until the early twentieth century that plant scientists gained protection from intellectual property theft. The United States House of Representatives

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[4] Gregor Mendel (1822-1884) demonstrated that genes determined traits passed from one generation to the next generation in peas. Traits were passed through the crossing of parents from pure lines where dominant and recessive alleles unite to create a genetic pair, thus controlling the inheritance of the trait.

[5] One "pure" or distinct selection is crossed with another distinct plant selection in order to create a predictable hybrid, known as an F_1 hybrid

and the United States Senate passed the Plant Patent Act of 1930, offering inventors and scientists intellectual property protection over plants. It was the first law of its kind worldwide to extend such rights to a growing organism (Smith 2009). At that time, though, the Act only provided intellectual property protections for fruit trees and some ornamental plants (Kingsbury 2009). Despite this, the legal stage for the art and science of plant hybridization fell under legal protection. Those protections would soon be extended to a variety of plants and institutions involved in plant hybrid research.[6]

At Rutgers University, plant patents date back to the 1930's. Dr. Maurice Blake received a 17-year patent (Plant Patent No. 31) in 1932 for his improvement of peaches. Dr. Elwin Orton acquired 15 patents for his work in dogwood breeding. He also trademarked and registered several other plants. According to Phil Normandy, a woody plant curator at Brookside Gardens in Wheaton Maryland,

> "Orton's other genius is that he insisted on the dogwoods being patented and trademarked, because that way the money goes to Rutgers [to continue to fund the research program]. That's not the way most state-university-run plant breeding programs work, and it was considered radical at the time, but in hindsight it turned out to be a good thing." [7]

The business of plant hybridization at Rutgers University is currently handled by the Office of the Executive Dean of Agriculture and Natural Resources, Licensing and Technology: Agricultural Products. Researchers interested in trademarking, patenting or licensing plant hybrids contact this office. The process generally takes three or more years, including two years of compiling legal paperwork with an additional year or more

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[6] The patent and copyright clause of the U.S. Constitution is the basis for intellectual property rights in the United States. "The Congress shall have Power To…promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries…" (U.S. Cons. art. I, § 4, cl. 8). The Plant Patent Act of 1930 and Plant Variety Protection Act in 1970 extended intellectual property rights to biological products, including plant hybrids. The 1980 Bayh-Dole Act established rights to university research benefiting from federal funds, and was expanded by Public Law 98-620 in 1984.

[7] Bob Hill, "A Breeder Apart: Elwin Orton," *The American Gardener* October 2012, 39-40.

under review at the USPTO. Once a patent is achieved, its lifespan is twenty years. The minimum cost to establish a patent is approximately $20,000 (Maredia et. al. 1999). Trademarks may be applied for and continually renewed. The office negotiates licensed agreements with propagators to produce nursery stock of Rutgers' plant hybrids. In total, there are eighteen licensed growers within the United States in addition to one in Germany and another in Australia.

Botanical Gardens

To fully understand hybridization at Rutgers Gardens, it is first necessary to relate it to the historical development of botanical gardens. The idea of botanical gardens, since their precursor gardens of the Medieval Era and through their proliferation during the Renaissance, evolved to provide a higher scientific purpose through a systematic display of plants, opportunities for enlightenment for both researchers and caretakers in daily contact with plants, and to offer opportunities for education, aesthetic pleasure and entertainment for their public patrons. Eventually historic botanic gardens became intimately tied to the agenda of Universities as institutions that supported scientific advancement and exploration across a number of disciplines (Johnson 2011). But even these institutional research and display gardens emerged from a much deeper cultural movement in garden history.

The function of a botanical garden is determined, as Nicolas Robin (2008), a notable scholar on the influence of scientific theories within the design of botanical gardens states, "through the structure and arrangement of its content" (383). In other words, "botanical gardens are places displaying scientific knowledge, where the public should admire the beauties of nature and find a systematic presentation of plants" (384). The balance between the development of scientific knowledge and public access characterizes the role of a botanical garden. That role evolved first with functions of developing and disseminating the scientific knowledge of botany, and secondly, with the opening to a curious public and their visitation.

The garden historian, Elizabeth Barlow Rodgers (2001), aligns the development of the botanical garden with the individual expression of autonomous knowledge over the

production and modification of nature as a method of seeking closer harmony with the Divine.[8] This emerging idea of small experimental garden took the form of a secret garden,[9] which according to Rodgers, ultimately gave way to physic gardens, and eventually botanical gardens. From the historical formation of a garden as a place of individual pleasure grounded in the pursuit of spiritual stimulation along with the quest for knowledge provided by the systematic display and experimental arrangement of native and exotic plants, a framework evolved that allowed increased scientific exploration with plants coupled with public access.

Nuala C. Johnson (2011), author of *Nature Displaced, Nature Displayed*, states that physic gardens developed in order to support research into the medicinal properties of plants at medical universities. The first of these gardens developed as an educational resource within a university and was founded at Padua University in 1545. The idea of an experimental garden continued to expand through Central Europe. Then, in the Age of Exploration, a more contemporary version of the botanical garden emerged, in parallel with other Renaissance gardens. Yet, unlike the private gardens of the time with their prominent architectural displays, botanical gardens placed plants as the centerpiece of their display of power. According to Johnson, the early botanic garden was a symbol of authority, scientific prowess, global reach through expeditions and trade, and colonial reach through exotic diversity.

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[8] Barlow credits Petrarch (Francesco Petrarca, 1304-1374) with the development of humanism, an intellectual movement where human will, severed from the limiting traditions of the Middle Ages and inspired by the writings and knowledge developed in Antiquity, was able to manipulate nature in order to achieve a closer relationship and understanding of the Divine. Petrarch himself established a personal research garden with a collection of rare plants upon which he experimented at his home Fontaine-de-Vaucluse.

[9] According to Rodgers (2001), the secret garden is a small space within the larger Renaissance Gardens that allowed intimate contact with plants.

> "…Scientific classification was hailed both as both a symbol and agent of a larger intellectual triumph, one that would ultimately reverse the traditional relationship between humans and the natural world. This mastery over the intellectual domain of natural history was matched by a European hegemony over the geographical terrain of the globe through the acquisition (formally and informally) of overseas territories. Disputes over nomenclature and the identification of species were a regular feature of nineteenth-century naming practices and…were as much about the assertion of personal and institutional power as scientific knowledge. The authority to name was in large part an expression of the geopolitical positioning of particular national cultures. American naturalists, for instance, resisted outsiders' efforts to denominate and describe, and so lay academic claim to species indigenous to North America" (Johnson 2011, 7-8).[10]

The pursuit of scientific knowledge and botanical education merged with notions of a public leisure, where the institution could systematically display its living scientific symbols in an artful designed experience. Johnson summarizes the shape, structure and the popularity of the displays within botanical gardens as being "informed by the disciplining practice of taxonomic regulation, …questions of aesthetic appeal, the fragility of maintaining scientific order and the desire to entertain as well as educate. …The design of the space itself is the lens through which the science of botany is projected" (10-1). As Johnson noted, botanic gardens served as a canvas for the combination of science and art.

[10] Dr. Connors of the Department of Ornamental Horticulture was the first plant scientist at Rutgers to lay claim to a hybrid with the use of the name Rutgers. He developed a hybrid scarlet carnation developed in 1925 (Woodward 1932, 307). Dr. Orton later used the Rutgers name in his series of Rutgers hybrid dogwoods.

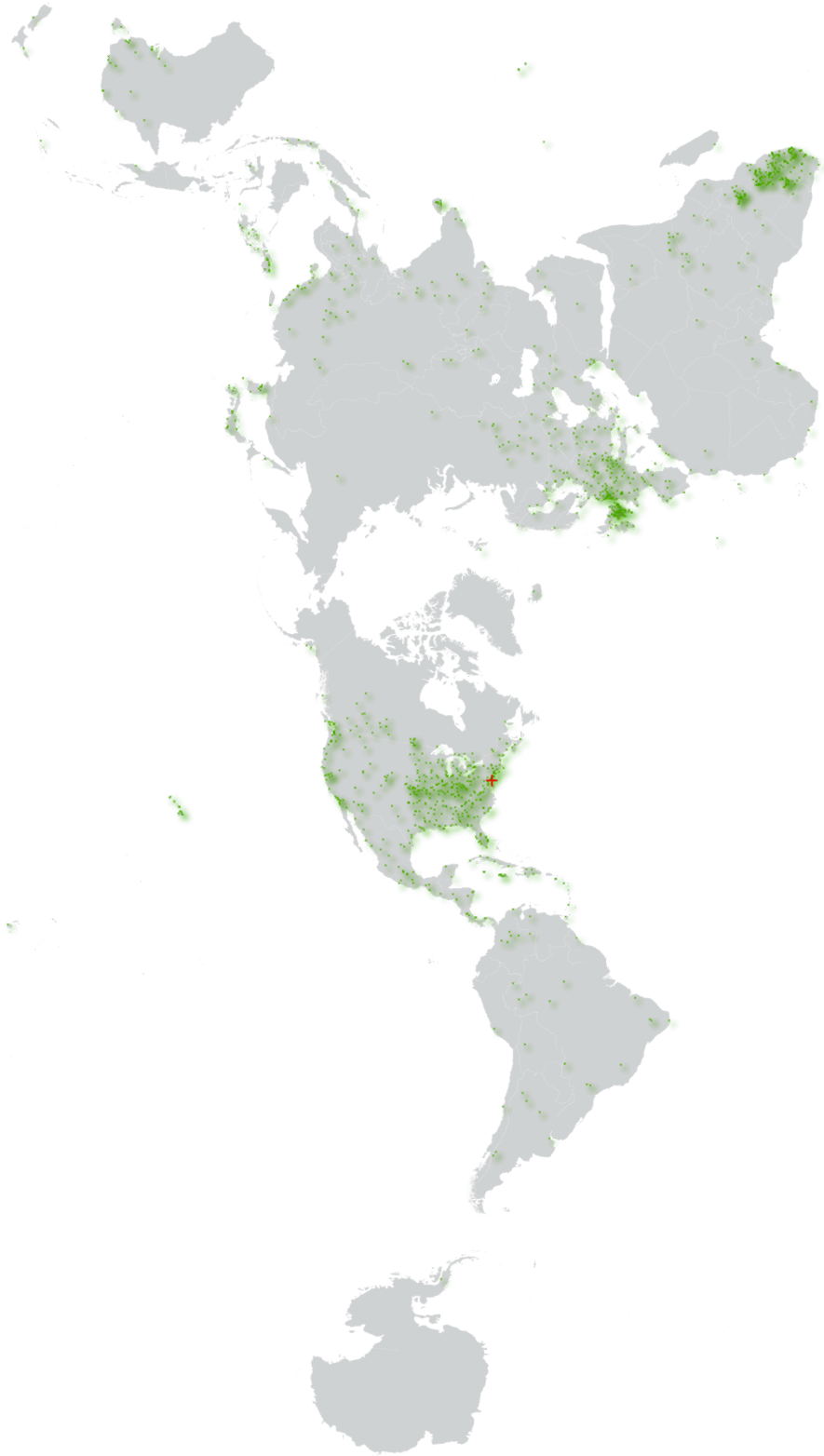

Figure 3. Botanical Gardens of the World[11]

[11] According to the Botanical Garden Conservation Institute, an international organization working with the worldwide conservation of threatened plants, Rutgers Gardens is one of nearly 1,500 botanical gardens

This historical analysis situates Rutgers Gardens as a contemporary botanical garden that developed as an idea from a long lineage of places of scientific exploration, educational botany (integrated with university functions) and public display. While future research would be required to compare Rutgers Gardens and botanical gardens in the world of similar size, composition[12] or founded by similar institutional mechanisms, such as the land grant university system, or through similar research agenda related to plant hybridization, suffice it to say that Rutgers Gardens fits within the historical lineage of the idea of botanical gardens. Similar to the idea of the secret garden as a physical expression of the scientific study of plants, Rutgers Gardens emerged from the roots of scientific exploration tied to its local and regional context. It is now a place associated with an academic institution focusing on the scientific study of plants and educational botany, as well as a place designed for public enjoyment.

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worldwide, and one of over 600 botanical gardens in the United States. Figure 2, Botanical Gardens of the World, shows the locations of many of the major botanical gardens of the world, with a large concentration of gardens in Central Europe and a large number of gardens dispersed throughout the United States. "Garden Search," Botanical Garden Conservation Institute, accessed March 1, 2013, http://www.bgci.org/. Furthermore, "over 200 million people visit botanic gardens each year, about one in 33 of all people in the world" (Chang 2008, 233).

[12] Botanical gardens in the United States initiated with a form that was intimately tied to agriculture. John Bartram, a farmer and botanist, established the first major botanical gardens on the his six-acre farm near Philadelphia (Wott 1982) along the Schuylkill river in 1728 which eventually contained over 2,000 plant species arranged in a sophisticated layout according to natural plant associations, according to James Chapelle, the author of an unpublished textbook on Landscape History at the University of California Berkeley Extension, in "1.4 Earliest Surviving Botanic Garden in the New World." *The Magic of Landscape: Notes for the Class 'Gardens, Parks and Urban Open Spaces,"* Spring Semester:18-2.

II. Hybrid Territory: The Shaping of Public Display at Rutgers Gardens

Land Development and Ownership

The development of Rutgers Gardens as a botanical garden is tied to the formation of Rutgers University's Cook Campus (formerly known as the College of Agriculture and the Rutgers Scientific School) beginning in 1864 and the development of the New Jersey Agricultural Experiment Station beginning in 1880. As a Land Grant College, the initial purchase of over 530 acres of land for the entire College Farm and Campus occurred between 1864 and 1926. The territory of Rutgers Gardens is but one component of that initial purchase. Figure 4 shows the initial extent of what was then known as the College Farm campus in light green along with the parcels that now comprise Rutgers Gardens, or Horticulture Farm No. 1, in the darkest green. In addition, other parcels that have also been used as territories of plant hybridization research and are part of the "horticulture farm" expansion noted with a medium green tone. Additional parcels near the horticulture farms were purchased later—namely, Helyar Woods and Horticulture Farm No. 3. These properties are shown in a darker red indicating that they were purchased as part of a later expansion and are now part of the Cook/Douglass Campus of Rutgers University, shown in light red. Limiting this study to the contemporary understanding of the boundaries of Rutgers Gardens is artificial. It is, therefore, necessary to expand the study of plant hybridization at Rutgers Gardens to include Horticulture Farm No. 2, the Equine Science Center and Horticulture Farm No. 3. This expanded view has implications for the notion of visitor experience. These locations are not part of Rutgers Gardens, and as such, it is likely that they do not provide

opportunities for visitors to experience the plant hybridization research accomplished within.

Figure 4. College of Agriculture (1927) and Rutgers' Cook Campus (2013) Parcel Map

A summary of the development of the parcels and their relationship to Rutgers Gardens, plant hybridization and public access is summarized in the Table 1.

Date Acq.	Tract No.[13]	Acres	Name / Owner Prior to Purchase	Rutgers Historical Name / Use	Current Use / Name	Plant Hybrid Research[14]	Public Access
1912	13, 13B	95.4	George H. Cook	Beef Cattle Operation	Equine Science Center (13) & Rutgers Gardens (13B)	Fruit Trees, Dogwoods, Hazelnuts	Partially Open to Pubic (13B)
1916	16A-G	35.7	Wolpert Farm	Horticulture Farm No. 1	Rutgers Gardens	Fruit Trees, Ornamental, Dogwoods	Open to Public
1923	15A-G	22.7	Welchman Farm	Horticulture Farm No. 1	Rutgers Gardens	Fruit Trees, Dogwoods, Hazelnuts	Partially Open to Public
1926	14	87	Gebhardt Farm	Horticulture Farm No. 2	Center for Turfgrass Science	Fruit Trees	
1937[15]	n.d.	50.8	Rutgers Trustees	Helyar Woods	Helyar Woods	Dogwoods (Accession)	Open to Public
1940	n.d.	80	State of New Jersey	Horticulture Farm No. 3	Horticulture Farm No. 3	Dogwoods, Hazelnuts	

Table 1. Parcel Acquisition and Use.

Rutgers Gardens began as Horticulture Farm No. 1, as it was referred to in 1916 and 1923 when tracts 16A-G and 15A-G were purchased.[16] Immediately the idea of the garden centered on the issues of scientific study of agriculture and food production, primarily driven by Pomology research within the Department of Horticulture. While

[13] Refer to Appendix for Tract Numbers.
[14] Only documented plant hybrid research within the realm of this thesis study is considered (Ornamentals, Fruit Trees, Dogwoods and Hazelnuts) in this table.
[15] Date according to: Joint Meeting with Building and Grounds Committee, Master Plan Study, Cook Douglass Campuses, 1974 September 27, Rutgers University, Board of Governors Educational Planning and Policy Committee 1951-1986, Records, Special Collections and University Archives, Rutgers University Libraries.
[16] It should be noted that the territory of Rutgers Gardens and inhabitants that have cared for the prior to the date that the land was purchased by the Rutgers Trustees are not included in this study, but have shaped the land. Further study into the role of the Lenape Indians, for example, and how they used both science and art to shape the landscape (similar to the studies of M. Kat Anderson in *Tending the Wild*) as well as the colonial and post-colonial landowners and their impact on the landscape is a subject for future research. For a complete listing of colonial and post-colonial land ownership, refer to the appendices.

maintaining some focus on commercial production of agricultural food products, research at Horticulture Farm No. 1 evolved to include ornamental plants in the early-to-mid 1920's, in response to the needs of a suburbanizing public and the industries that provided to them. As the Division of Horticulture implemented research of ornamentals, the landscape of the research farm also shifted. Traces of these early research activities still exist to this day, and the remnants that now shape the botanical collection and its contemporary use as pleasure garden can be traced back from the gradual shift from agricultural to ornamental research. Over the next eight to nine decades, the collections and form of the farm increasingly reflected a focus on ornamental display through the incorporation of public programs such as vegetable and flower garden shows, public display gardens and gardening courses. Scientific research with plant hybrids continues to play a role for visitor experience and display within the gardens, albeit a diminishing one, in which recent crosses of plant hybrids call the outskirts of Rutgers Gardens their home.

Pre-Rutgers Gardens (1864-1916)

Horticultural experiments on College of Agriculture land predate the establishment of Rutgers Gardens. According to Woodward (1932), experiments were first proposed in 1895 to help the fruit and vegetable growers in New Jersey solve problems, "which they lacked the knowledge to solve" (270).[17] Although profitable at the time, the agricultural practices were rapidly shifting with mechanization and demanded higher yields and streamlined practices to remain competitive. The College of Agriculture, along with its outreach arm, the New Jersey Agricultural Experiment Station, filled this need with their explorations into farming practices and high performing plant hybrids. Maurice A. Blake was hired in 1906 and expanded the Department of Horticulture's vision to focus on Pomology, Vegeculture and Ornamental Horticulture research, "an evolution paralleling the trend of horticultural interest of New Jersey toward specialization" (Woodward 1932, 273). Prior to the purchase of the Horticulture Farms, though, the Department of Horticulture established a fruit tree orchard and vegetable farm along Nichol Avenue in New Brunswick near the current site of Blake Hall. In 1908, a greenhouse, parts of which remain to this day, was built to expand the research activities and house the Department of Horticulture. The form of this research farm can be seen in Figure 5.

[17] Alva T. Jordan, an Assistant in Horticulture for the New Jersey Experiment Station, was appointed in 1895 and surveyed 3,058 growers in New Jersey. The survey revealed the need for methodical research that would assist the producers (Woodward 1932).

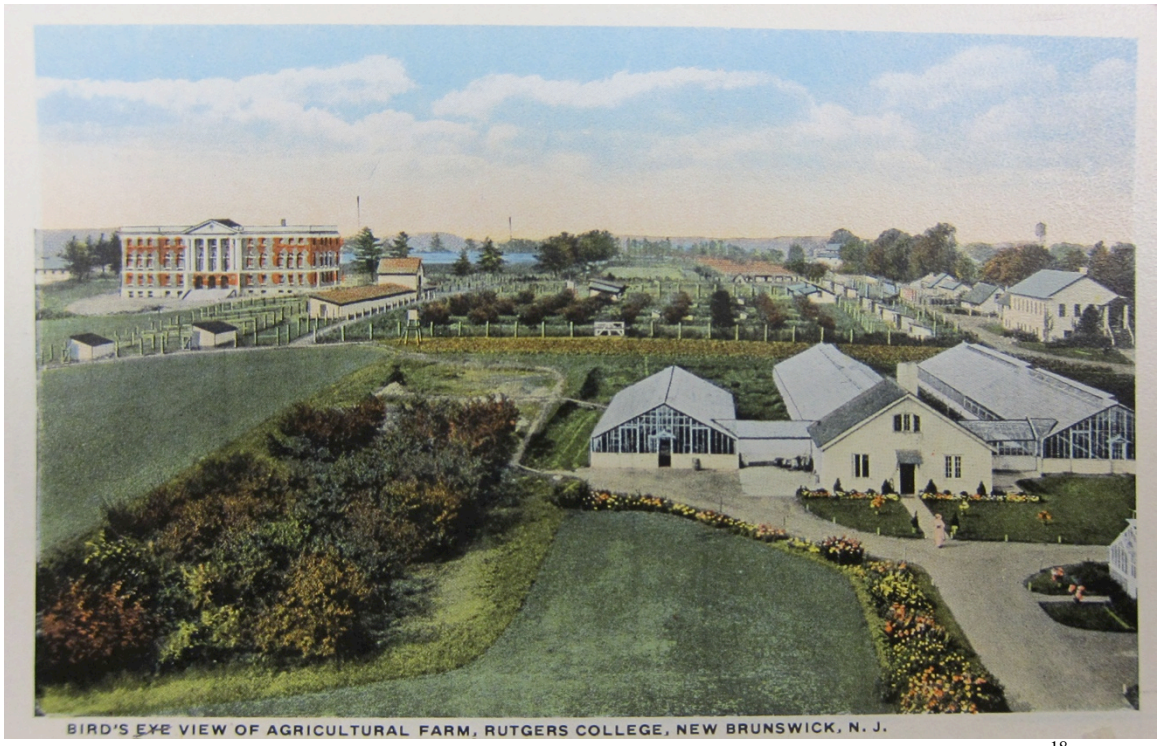

Figure 5. Realm of the Department of Horticulture before the Horticulture Farms.[18]

The expanded focus of agricultural and ornamental research was likely inspired by the charge of Dr. Jacob B. Lipman, the head of the New Jersey Agriculture Experiment Station. According to Woodward, he responded to the requests from an increasing non-agricultural population of New Jersey residents to develop an institution, which, because of its reliance on public funds, needed to provide services to both commercial agriculture and non-agricultural interests. This resulted in an expansion into the scientific aspects of ornamental horticulture (Woodward 1932, 110). The demand for increased floriculture knowledge was driven by the needs of the State Florists' Association and other rising interests in floriculture around the State. The Department of Horticulture met those demands with an expansion of the campus greenhouse in 1911.

[18] Bird's Eye View of Agricultural Farm, Rutgers College, New Brunswick, N.J., pre-1918-1930, Buildings and Grounds: Cook College—Greenhouses, Buildings & Grounds: College of Agriculture Experiment Station—Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.

Soon, the Department of Horticulture outgrew their greenhouse offices, and agricultural interests lobbied for a separate building for the Department of Horticulture. It would be situated between Nichol Avenue and Lipman Drive with a central structure facing Lipman Drive and two side wings flanking the central structure. World War I, though, impacted the construction of the new building. Construction costs rose with the uncertainty of the war and the original $75,000 appropriated was not enough to implement the full vision of the building. It was ultimately value-engineered to the single central structure, without the proposed side wings, now known as "old Blake Hall." The war also impacted the plant research priorities of the department. According to Woodward, the focus of the country shifted from luxuries, such as flowers and ornamentals, toward necessary food production. The greenhouse became almost entirely devoted to food production. Despite this, the Horticulture Department managed to sustain its floriculture investigations on a much smaller scale. Throughout the war, interest in the services of the College and the Extension Service remained high, and, according to Dr. Lipman, the participation of the United States in World War I served to stimulate the growth of the Extension Service as "the pressure for advice, technical information, and demonstrations [grew] greater from week to week."[19] With the end of the First World War, increases in suburban and urban development brought significant change to the landscape of New Jersey and the College of Agriculture campus.

[19] Memorandum by Jacob B. Lipman, 1932-1933, Appropriations and Cut Backs in the Baker-Lipman Controversy, Agriculture Experiment Station, Minutes and Reports 1894-1955, Special Collections and University Archives, Rutgers University Libraries.

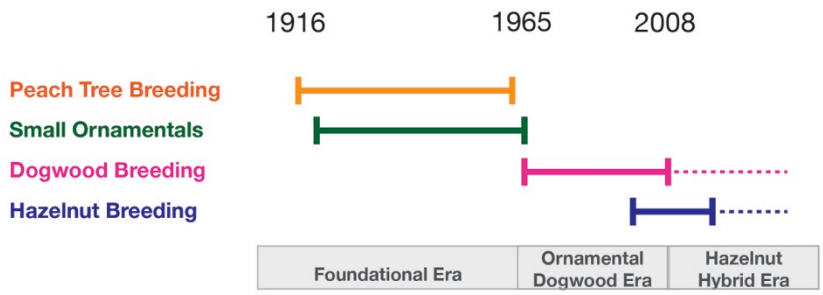

Figure 6. Eras of Hybridization at Rutgers Gardens.

Era of Hybridization: Foundational Era – Peaches (1916-1964)

Peaches have a long history in New Jersey dating back to the 1600's. According to Ernest Christ, Rutgers Cooperative Extension Professor Emeritus, peaches were the first fruit crop that New Jersey growers focused on with commercial vigor. New Jersey orchards were large suppliers for the New York market. By 1890, the high point the State's peach production, four million peach trees were growing in the state.[20] Then, the San José scale, a fruit tree pest, ravaged the State's industry at the turn of the century.

In 1907, Dr. Charles H. Connors initiated the peach-breeding program at the New Jersey Agricultural Experiment Station in Vineland, New Jersey before Dr. Maurice A. Blake took control of the program in 1914. Shortly after a change in the lease of the land at Vineland, Dr. Blake moved the peach program to newly purchased land in New Brunswick.[21] Between 1912 and 1926, over 100 acres of land, Horticultural Farm No. 1 and Horticultural Farm No. 2, expanded the realm of the Horticulture Department. Initially, the purchase provided the opportune area for the Experiment Station's peach-

[20] "A History of the New Jersey Peach," New Jersey Agricultural Experiment Station, accessed March 1, 2013, http://njaes.rutgers.edu/peach/statistics/nj-peach-history.pdf.
[21] A four-year 1914 agreement between the director of the New Jersey Agricultural Experiment Station and the Training School at Vineland, New Jersey leased nearly seven acres for an experimental orchard, Agreements with the Federal Government, 1914-1918, Special Collections and University Archives, Rutgers University Libraries.

breeding program, where the lands became part of the largest experimental orchard in the world, testing varieties from all over the United States and the World.[22]

By the time the peach-breeding program moved to the Horticulture Farms at the College, the number of peach trees growing in New Jersey had dropped to approximately 2.5 million. In comparison to the 1910 Census of Agriculture, while the number of farms producing peaches (-11%) and the acreage of peach tree production (-25%) declined in New Jersey, there was a 434% increase in bushels harvested—nearly one bushel per tree in 1925 (USDA 1925; USDA 1910). The work of Dr. Blake and his hybrid research may have contributed to these increases in productivity through the development of named and selected hybrids designed to overcome the impacts of disease. The New Jersey State Board of Agriculture and the American Pomological Society have honored Dr. Blake for his efforts in reviving the Peach industry in the New Jersey and his impact on the economics of the State.[23]

After four years of research into peach hybrids at the Horticulture Farms, 650 initial seedlings of crosses yielded 66 worthy candidates for additional testing. Forty-three peach trees were selected from 1,700 seedlings that fruited in 1921. And ultimately, "289 one-year-old peach trees of three promising seedlings were distributed among 50 fruit growers" (Woodward 1932, 285) in New Jersey. Demand for new peach tree varieties remained high and investment in the program continued. By 1926, Dr. Blake had managed the collection of 334 different species of peach and nectarine trees at the Horticulture Farms, in addition to 5,000 trees that were the direct result of breeding crosses. By 1927, peach tree varieties were being distributed across state borders, as well

[22] "Maurice. A Blake," *Horticultural News*, January 1948.
[23] Ibid.

as internationally, and even to a botanical garden in Vienna. Between 1921 and 1928, over 30,000 trees were distributed in New Jersey. Restrictive limits of five-to-ten trees per person were implemented to ensure that trees could be distributed evenly to the public. It is likely that much of this distribution initially occurred at the horticulture farms and became part of the experience at the Gardens.

The popularity of the 'Golden Jubilee' Peach, an open-pollinated seedling resulting from a cross between 'Elberta' and 'Greensboro' in 1925 illustrates the incremental increases in the commercial production of peach trees at the horticulture farms. Between 1927 and 1928, 12,000 trees and 33,000 buds were distributed to nurserymen, growers and 192 New Jersey residents. The trees were also distributed internationally and domestically in the United States. The demand for the variety far outweighed the Department's ability to effectively distribute it. As a result, a network of New Jersey propagators were contracted to make the hybrid available to consumers in greater quantities. It was a distribution system similar to the current network of licensed growers at Rutgers University. In addition, "each person who made a request for trees was asked to sign an application form which contained an agreement that the trees were to be planted in New Jersey and that no propagation of the variety was to be permitted" (1932, 288). This was an early control mechanism for the new distributed network of licensed growers and their consumers prior to plant patent protections.

While the Department of Horticulture continued to pursue interests in peach breeding, it began to restructure research priorities in response to a surplus in fruit production throughout the United States and low consumer prices. In a letter to the President of Rutgers University, Dr. Blake warned of a pending production season

without profit for most fruit growers throughout the nation. He also noted, however, that New Jersey growers would not be as negatively impacted as others, due to their proximity to larger consumer markets and lower overhead expenses, primarily due to freight costs involved in the distribution to nearby larger markets.[24] Despite the surplus, the peach-breeding program continued. In fact, the collection of peach trees was expanded in 1928 when Professor Blake procured six leading European varieties that were the most popular in Europe when the colonies in America were settled. Twelve trees, two of each variety, would supplement the Rutgers collection and would be used to trace the parentage of peach tree hybrids developed by the Horticulture Department. European varieties were also used in displays to showcase the advanced yield of the peach hybrids developed by the Department.[25]

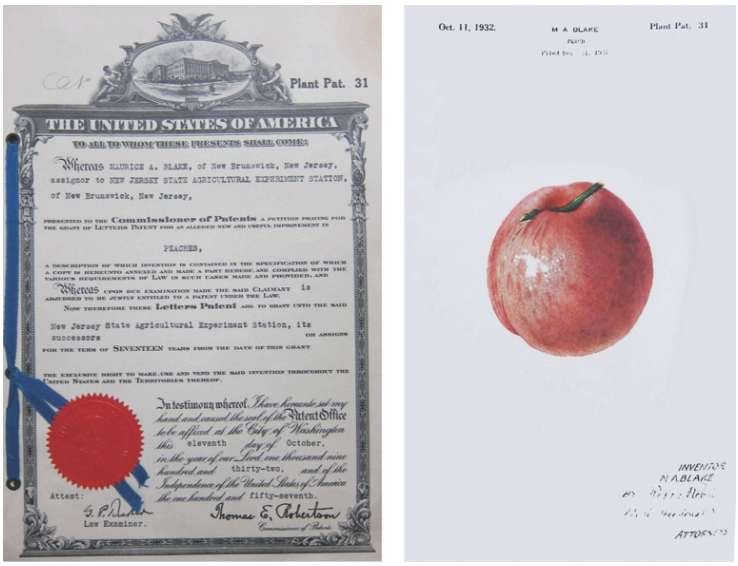

Figure 7. Original Peach Tree Patents, Inventor M. A. Blake, 1932.[26]

[24] Maurice A. Blake to President John M. Thomas, 3 November 1926. Experiment Station, 1923 and 1926-28, Office of the President (John Martin Thomas), Series I, Subject Files, 1911-1932, Special Collections and University Archives, Rutgers University Libraries.
[25] Maurice A. Blake to President John M. Thomas, 18 April 1928. Agriculture, College of, Blake M. A., Office of the President (John Martin Thomas), Series I, Subject Files, 1911-1932, Special Collections and University Archives, Rutgers University Libraries.
[26] Peach Patent, 1932, Series 2 Patents, Cook College: Agricultural Experiment Station, Special Collections and University Archives, Rutgers University Libraries.

Era of Hybridization: Foundational Era – Ornamental Horticulture (1922-1965)

In 1926, Dr. Blake, while serving as the chief of the Horticulture Department, recommended to university President, John Thomas, that Dr. Charles H. Connors lead a new Division of Ornamental Horticulture, specializing in floriculture and landscape gardening.[27] Blake noted that Connors had been successfully breeding carnations and researching hydrangea coloration since 1913. Blake also cited Connor's success in establishing a test garden at Horticulture Farm No. 1 in conjunction with the State Dahlia Society, as well as his public outreach with garden clubs in New Jersey. In the letter, Blake hints at the need for diversification in the focus of the Horticulture Department with the inclusion of an ornamental horticulture focus and the gradual transition from its primary focus on peach tree breeding. "The most important project was originally our peach breeding work, in which we made great progress. Demands from the floricultural interest became so heavy that we were obliged to give considerable attention to that, even though our funds were very limited."[28] According to Woodward,

> …remarkable interest in ornamental plantings and landscaping and a corresponding expansion of commercial floriculture… Advancement in cultural interests and esthetic task in beautifying both private and public grounds became evident on all sides. In 1921, the resumption of floricultural investigations was made possible through private donations of funds and plants. Direct state appropriations for the purpose were not renewed. Many subsequent donations of ornamentals by florists and nurserymen contributed substantially to the development of the work. The demand for various types of advice and assistance with reference to flowers, shade trees, and ornamentals rapidly increased. The way was opened for larger service when a separate Department of Ornamental Horticulture was created in 1926, headed by Dr. Connors. Recognition of the place of leadership the Station and College have assumed in this field has been

[27] In 1927, Dr. Connors would go on to teach the college's first landscape design course, a precursor to the work of the Department of Landscape Architecture[27] that would emerge as a University offering in 1964 (Steiner 1986).

[28] Maurice A. Blake to President John M. Thomas, 6 June 1926, Agriculture, College of, Office of the President (John Martin Thomas), Series I, Subject Files, 1911-1932, Special Collections and University Archives, Rutgers University Libraries.

> reflected in the great volume of inquiries for information, the demand for lectures before garden clubs and similar organizations and for services as judge at flower shows, the request for the Station publications on floriculture, and the large enrollment in unit courses [public short courses] in flower gardening, offered each spring since 1925. (306)

According to Woodward, "by 1930 [the experimental farms] were completely utilized for experimental plantings in fruits, vegetables and ornamentals" (277). And, between 1925 and 1926, according to a list of twenty-five New Jersey Agricultural Experiment Station projects implemented by the Department, nine were related to fruit trees and included peach breeding, pruning, growth rates and fruit food studies. Eight projects related to vegetables and small fruits. And, seven projects related to ornamental plants, particularly carnations, roses, and hydrangea.[29]

The transition from a sole focus on agricultural to the inclusion of ornamental hybridization can be partly attributed to the influx of urban dwellers from rural lands between 1860 and 1920. According to Christopher Grampp (2008), a Landscape Architect and author of *From Yard to Garden*, in 1860, only 20% of the United States population lived in sub/urban areas. By 1920, 50% of the country lived in cities or suburbia. By 1925, almost half of the population of the United States owned their own home. The new suburbanites looked for ways to turn the utilitarian spaces surrounding their homes into front yards of ornament and backyard garden rooms for outdoor living.

Concurrent alterations in the nursery trade reflect this massive suburban migration. According to Grampp (2008), ornamentals in the nursery trade originally made up only 10% sales. By 1900, that number jumped to 50%. And, by 1925, just a year before Dr. Blake recommended Dr. Connors to head the Department of Ornamental

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[29] Memoranda of Jacob B. Lipman, Agricultural Experiment Station, Minutes and Reports 1894-1955, Special Collections and University Archives, Rutgers University Libraries.

Horticulture, and three years after the first ornamental display garden was installed at Horticulture Farm No. 1, 75% of the nursery trade was devoted to ornamental plant material. The ratio of edible plants to ornamental plants sold in the United States completely reversed (114).

In a 1934 memorandum to Governor-Elect, Harold B. Hoffman, Dr. Jacob Lipman, gave nearly equal weight to Extension Service activities related to commercial agricultural programs for farmers and those related to ornamental horticulture focused on lawns, shade trees, shrubs and flowers in order to promote the Extension program to the newly elected Governor.[30] The influx of ornamental varieties also continued through the research and display resulting in more than 600 tested varieties of dahlia and iris, 75 varieties of peonies, and 76 varieties of evergreen and deciduous shrubs. Dr. Connors had already registered and named 65 dahlia seedlings that, according to Woodward (1932), became "leading varieties" (308).[31]

In Figure 8, a 1936 birds-eye photograph of Horticulture Farm No. 1, the diversity of experimental research and display created by the Department of Horticulture is shown. The picture was likely taken from the top of a structure that no longer exists near the intersection of Highway 1 and Ryders Lane and looks out across the experimental farm and display gardens. A central axis runs between the Holly House and various display and research plots into the distance toward the heavily wooded area of Helyar Woods. In the foreground, the image shows a mixture of plantings, which appear almost entirely

[30] Memorandum by Jacob Lipman to Governor-Elect Harold G. Hoffman, 17 December 1934, Agriculture, College of, Office of the President (Robert C. Clothier), Special Collections and University Archives, Rutgers University Libraries.

[31] Connors also developed a scarlet colored carnation. In 1925, he named the variety, "Rutgers," according to Woodward (1932).

devoted to vegetable and small fruit production.[32] On the opposite side of Fruit Tree Road (now an extension of Log Cabin Road), a display of shrubs extends parallel to the road and terminates at the central axis. According to the Rutgers Gardens website, the shrub display is the oldest collection, originally planted in 1927 and supplemented by Ben Blackburn beginning in the 1930's.[33] Opposite the shrub collection and the central axis, is a vine orchard. Beyond the shrub garden and vines, a series of nine display gardens,[34] are divided by a low linear series of hedges running parallel to the shrub display. Two taller filial hedges that break the shorter linear hedge system mark entrances and the internal circulation system of each display garden. This series of garden beds was the initial location of ornamental displays, such as the Iris Display garden, already established in 1922, which became popular attractions for visitors to the farm during public display events. Adjacent to the last display garden and closest to the old Welchman residence, is a gridded planting of what appears to be young trees. Beyond the series of display gardens, is what appears to be a small, but well-established orchard, likely peach or apple trees. Adjacent to it, a younger orchard exists. Beyond the orchard, the Log Cabin roof can be seen under construction, given the visibility of the roof framing. On the left side of the picture, there appears to be a chicken coop in the foreground, followed by a series of large shade trees separating two parallel roads. The

[32] According to Woodward (1932), the vegetable investigation consisted of test plots for beets (1916), cabbage (1921), tomatoes (1921) and cantaloupe (1923).
[33] "Shrub Collection," Rutgers Gardens, accessed February 27, 2013, http://rutgersgardens.rutgers.edu/shrub.html.
[34] Connors (1953) wrote an article aimed at home gardeners. It is likely that the display gardens also included tests based on his writing, including: dahlia, bearded iris, rhododendron, broadleaved evergreens-boxtree, Japanese hollies, vines such as silver fleeceflower (*Polygonumg auberti*) and *Clematis paniculata*, climbing roses, pansies, tufted pansy, canterbury bell, forget-me-not, foxglove, columbine, hybrid delphiniums, *lilium candidum*, chrysanthemums, strawberries, pansies, annual larkspurs, poppies, coreopsis, petunias, phlox, calendulas, cornflowers, snapdragrons, flowering dogwood, sugar maple, roses (hybrid tea and polyanthus), california privet hedges, and peonies.

silhouette of three signs, one marking the shrub garden, another marking a display between the two roads and a third marking the first display garden beyond the shrubs are visible in this picture.

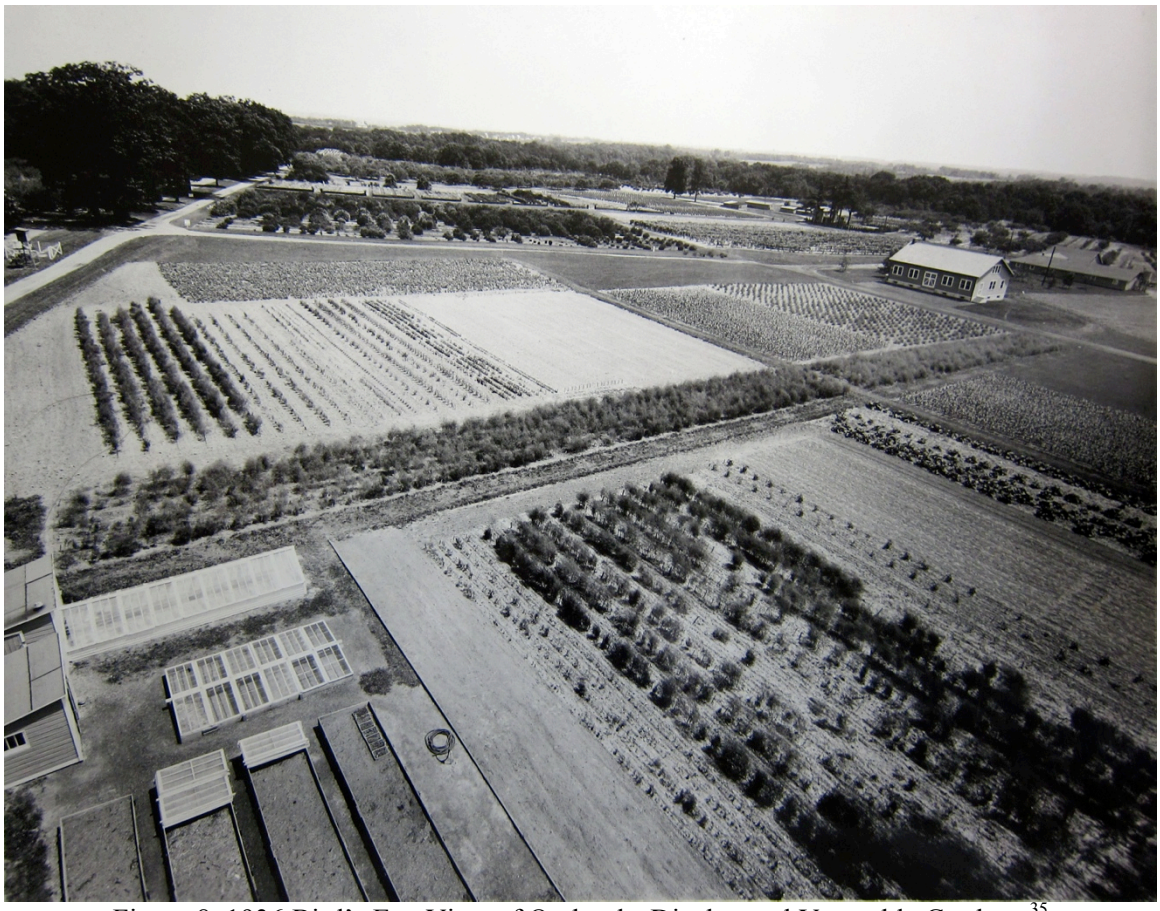

Figure 8. 1936 Bird's Eye View of Orchards, Display and Vegetable Gardens.[35]

According to Woodward, ornamental displays were first established during the same year that the nursery was built on the farm in 1922. In 1930, the farm boasted of more than 600 tested varieties of dahlias and iris, including displays in test gardens developed in coordination with the Dahlia Society of New Jersey and the American Iris

[35] Horticulture Farm No. 1, 1936, Buildings & Grounds: Cook College – Farm Views (Horticulture), Buildings and Grounds: College of Agriculture Experiment Station—Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.

Society.[36] "The Station's test grounds have become a center of interest to dahlia lovers" (Woodward 1932, 308). The displays were opportunities to showcase the selected and developed varieties in cooperation with partner community organizations. Dr. Connors also established trials of gladiolus in cooperation with the New Jersey Gladiolus Society. It is also likely that the farm contained a display of peonies at some point, as Connors developed over 75 varieties. Furthermore, Connors likely initially established a shrub display garden containing over 89 genera, 208 species and 76 varieties of hardy evergreen and deciduous shrubs at Horticulture Farm No. 1.[37] In addition, according to Woodward, research was being conducted into exotic or invasive species as part of a joint program with the Office of Foreign Seed and Plant Introduction of the U.S. Department of Agriculture, although the exact location at the farm is unknown.

[36] The Bearded Iris display was most likely the precursor to the Donald B. Lacey Display Garden, which was constructed in 1964.

[37] The Rutgers Gardens website lists this as one of the oldest collections surviving sections of the existing collection. Ben Blackburn, a Rutgers Professor, expanded this section between 1930 and 1950.

The Origins of Display and Public Access

Figure 9. 1929 Field Day Event at Horticulture Farm No. 1.[38]

It is clear through archival research of both letters from Department leaders to university Presidents and photographs of display events that public access to the territory of Rutgers Gardens had been promoted and applauded. It is unclear, though, exactly how public access was managed and monitored within the display gardens. There is no evidence of a restrictive gate or fence from neither the entrance near Highway 1 nor the entrance near Ryders Lane between the early 1900's nor the mid-1960's. Even after the construction of a cloverleaf at the intersection of Ryders Lane and Highway 1 in the mid-1960's, which ate into the landscape of the Gardens and reconfigured the entry/exit sequence to its current location off of Ryders Lane, there is no evidence of physical control of the main entry.

[38] Field Day Event, 1929, Field Day 1929 Program Photo Event, Cook College of Agriculture: Event—Display Gardens, Field Days, Special Collections and University Archives, Rutgers University Libraries.

Figure 10. 1939 Chrysanthemum Field Day.[39]

Figure 11. Iris Display Garden, the first ornamental display garden, during Iris Field Day held in Late May in 1939.[40]

[39] Chrysanthemum Field Day, 1939, Event: Chrysanthemum Field Day, October 22, 1939, Cook College of Agriculture: Events—Display Gardens, Field Days, Special Collections and University Archives, Rutgers University Libraries.

Figure 12. "A Photograph of a Photographer," Iris Display Garden.[41]

Figure 13. Iris Display Garden in 1939.[42]

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[40] Iris Field Day, 1939, Event: Field Day—Iris, Cook College of Agriculture: Display Gardens and Field Days. Special Collections and University Archives, Rutgers University Libraries.
[41] "A Photograph of a Photographer", Ibid.
[42] Iris Display Garden in 1939, Ibid.

Display and public access appear to have been encouraged as part of the promotion of select plant hybridization during the Department of Horticulture's era of research. It could be that public access was simply controlled through advertised event-based mechanisms. Yet, an examination of campus master plans show that public access emerged organically as campus plans speak to the popularity of the display gardens throughout the spring and summer months, both during and outside of display events. Over time, public visits to the Gardens became less associated with special events and visitors flocked to the Gardens at various times throughout the year.

Figure 14. 1967 Vegetable and Flower Garden Open House.[43]

The first documented restriction of access within the gardens applies, not to the display gardens or research, but to the construction of the Log Cabin,[44] likely opened in

[43] Open House, 1967, Event: Open House—Vegetable and Flower, August 5, 1967, Cook College of Agriculture: Events—Open House, Science Field Day, Shows, Special Collections and University Archives, Rutgers University Libraries.

1937 near the edges of the Gardens. The potential public use of its interior convened a special governing committee. The committee recommended that the public could enjoy the use of the new facility, but only under the sponsorship of a College employee.[45] The goal was to ensure that sufficient control of the use of the structure and that it would be protected from vagrant misuses and trespassing. It is not clear whether the committee governance was a response to an existing problem with trespassing in the display gardens, or if it was a preemptive strategy to avoid such situations.

Figure 15. 1972 Vegetable and Flower Open House.[46]

In addition to documented evidence situating the first ornamental display garden to 1922, official display events are documented in archival pictures between 1929 and 1988. Archives indicated that Iris Field Days, Chrysanthemum Field Days, Annual

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[44] Professors Blake and Connors were credited with creating an attractive landscape design for the new Log Cabin.

[45] William H. Martin to President Robert C. Clothier, 11 May 1937. Committee: Log Cabin 1936-1942, Office of the President (Robert C. Clothier), Special Collections and University Archives, Rutgers University Libraries.

[46] Open House, 1972, Event: Display Gardens—1972 Vegetable and Flower Open House 1972, Cook College of Agriculture: Events—Display Gardens, Field Days, Special Collections and University Archives, Rutgers University Libraries.

Flower Display Events, and Vegetable-Flower Open Houses were part of the display event circuit at the Gardens. The signage and historical documents also reveal that these events were initially aligned with the plant hybrid research of the Horticulture Department at the time. Earlier pictures of the events indicate less concern with an artful planting design of plant hybrids. Display gardens benefited from a more agricultural sensibility. Numerous rows of plant varieties enabled circulation between individual beds, much like rows of agricultural crops or orchards simplify harvest. Initially separate events were aligned with specific plants, such Iris Field Day and Chrysanthemum Field Day. In the 1960's, the event structure shifted to a more comprehensive display of vegetable and garden plants with the establishment of open house events. The arrangement of planting beds and circulation appears to be less concerned with highlighting specific plants in agricultural-like rows of plants.

The pictures show that these events were well attended with large groups of people gathering around beds of ornamental plants. They also indicate a kind of romantic relationship and interaction with the plants on display as staged pictures highlight women and children interacting with ornamentals in full bloom. Attendance records were not discovered, but at least one archival picture notes that nearly 4,000 gardeners received guided tours during a Vegetable-Flower Open house in 1967.[47] Later pictures also illustrate that events were highlighted by the participation of lecturers, most likely communicating the findings of their scientific research with ornamentals to visitors.

[47] 12068, Event: Open House—Vegetable-Flower August 5, 1967, Cook College of Agriculture: Events—Open House, Science Field Day, Shows, Special Collections and University Archives, Rutgers University Libraries.

Figure 16. 1974 Flower Garden Show.[48]

Figure 17. 1987 Display Garden Event.[49]

[48] Flower Garden Show, 1974, Event: Open House—Vegetable and Flower and Lawn, July 27, 1974, Cook College of Agriculture: Events—Open House, Science Field Days, Shows, Special Collections and University Archives, Rutgers University Libraries.

[49] Display Garden Event, 1987, Event: Display Gardens, Cook College of Agriculture: Events—Display Gardens, Field Days, Special Collections and University Archives, Rutgers University Libraries.

Campus Maps and Planning

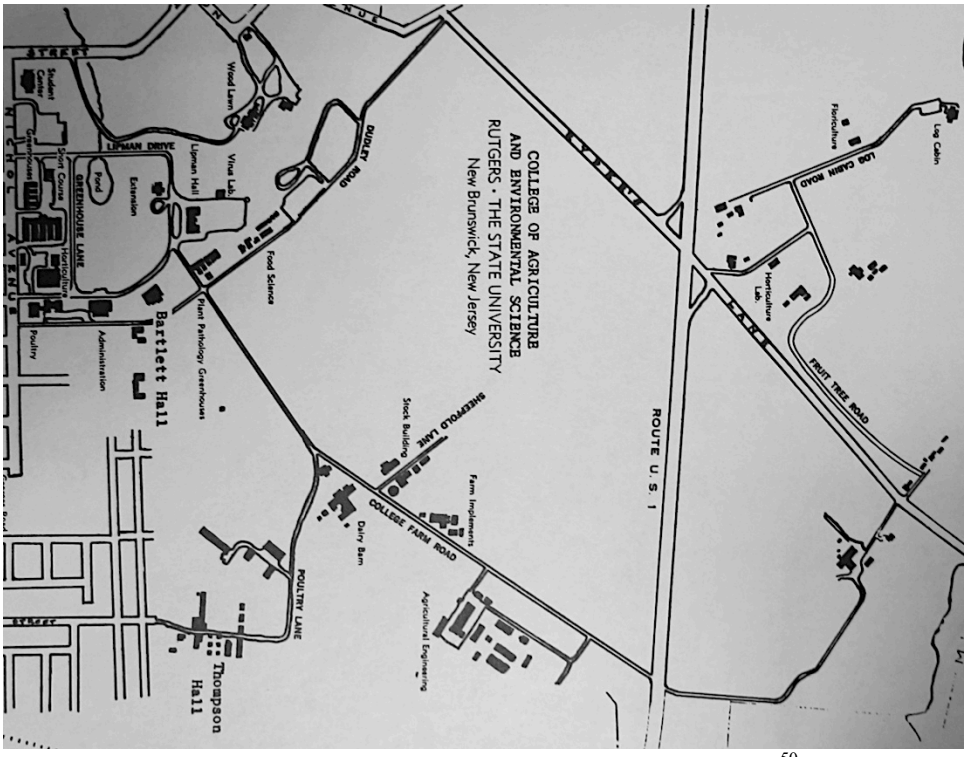

Figure 18. College of Agriculture Map (circa 1960)[50]

When the territory of Rutgers Gardens is investigated from the perspective of campus maps and planning, the emergence of Rutgers Gardens as an official "Display Garden" can be seen along with a glimpse into the emerging popularity of the site for public visitors. The earliest campus map found, most likely dating to the late 1950's or early 1960's (Figure 18), situates two Floriculture buildings along Log Cabin Road within Rutgers Gardens along with a series of unmarked buildings and a Horticulture Lab between the main internal circulation road, Fruit Tree Road, and what was then the primary entrance to gardens off of Ryders Lane.[51] After the Highway 1 and Ryders Lane

[50] College of Agriculture Map, circa 1960, Buildings and Grounds: Cook College—Campus Map (undated), Buildings & Grounds: College of Agriculture Experiment Station—Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.
[51] Map of College of Agriculture and Environmental Science, n.d. Buildings and Grounds: Cook College—Campus Map (Undated), Buildings & Grounds: College of Agriculture Experiment Station – Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.

intersection was reconfigured, both the 1969 and 1973 (Figure 19) campus maps demarcated Ornamental Display to the north of Log Cabin Road and the Gardens of Horticulture Farm No. 1 to the south.[52] The 1977 and 1979 campus maps showed only a small portion of the Gardens, but still mark it as the Display Gardens.[53] The most recent campus map,[54] contains the name, Rutgers Gardens, but gives no indication if the facility is publically accessible open space or a restricted access botanical garden.

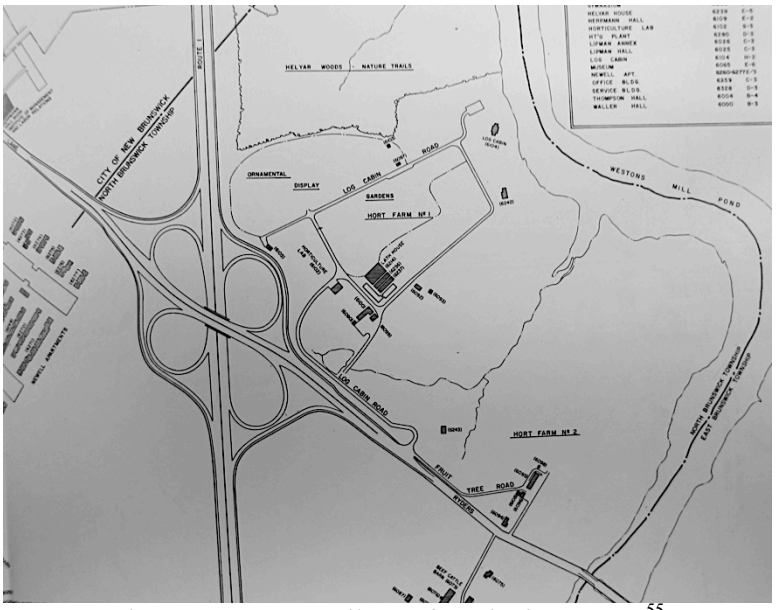

Figure 19. 1973 College of Agriculture Map.[55]

Between the 1940's and 1960's there was a significant restructuring of Rutgers Gardens. At some point, vegetable research was moved out of Horticulture Farm No. 1. It

[52] College of Agriculture and Environmental Science, 1969 & 1973, Buildings and Grounds: Cook College—Campus Map (Undated), Buildings & Grounds: College of Agriculture Experiment Station – Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.
[53] Cook College Campus, 1977, Buildings and Grounds: Cook College—Campus Map 1977. Buildings & Grounds: College of Agriculture Experiment Station – Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.
[54] New Brunswick/Piscataway Campus Map, Department of Transportation Services, accessed March 15, 2013, http://parktran.rutgers.edu.
[55] College of Agriculture Map, circa 1960, Buildings and Grounds: Cook College—Campus Map (undated), Buildings & Grounds: College of Agriculture Experiment Station—Cook: 100th Birthday, Special Collections and University Archives, Rutgers University Libraries.

is likely that this occurred with the purchase of Horticulture Farm No. 3 in 1940. In its place, a collection of hollies was established. A research program with American Holly was initiated and financed by Clarence R. Wolf, a founder of the Holly Society of America, Inc. and managed by a graduate student at the college. The 1950's accession of American Hollies[56] ultimately replaced the vegetable and small fruit plots shown in Figure 20.

Figure 20. Vegetable and Fruit Research Near the Current Site of the Holly Collection at Rutgers Gardens.[57]

The exact dates of the removal of the fruit orchards at Horticulture Farm Nos. 1 and 2 are unknown. But, in 1960, a committee[58] on the future land use for the

[56] By the time Dr. Elwin Orton arrived at Rutgers University in 1960, the gardens collection held over 200 species and cultivars of hollies. Bob Hill, "A Breeder Apart: Elwin Orton," *The American Gardener* October 2012, 38.

[57] Experimental Planting, n.d., Horticulture, Cook College of Agriculture, Special Collections and University Archives, Rutgers University Libraries.

[58] The role of a 1959 and 1960 Self Study of the role of the College of Agriculture and the relationship with the New Jersey Agriculture Experiment Station recommended eliminating the autonomous status of the New Jersey Agricultural Experiment Station and the Cooperative Extension Service and integrating them

Agricultural Experiment Station demarcated tracts of land that were available for immediate sale, as well as lands that were available for sale or lease after the present uses came to a close. While it is unclear if the committee response was a reaction to the university's explorations into potential revenue generation divesting in their land holdings or a self-directed exploration into the investment of additional land to meet growing requirements for future research. The committee outlined their need for 650 additional acres of land for research activities and a 300% increase in operating budget. The timing of the report did coincide with plans to relocate the peach-breeding program, and outlined the requirement for a ten-year period in which to reestablish fruit tree crops on the newly purchased land. Ultimately, a 250-acre farm, the Ornamental Research and Extension Center, located in the Cream Ridge section of Upper Freehold was purchased in the early 1960's and the peach tree-breeding program was gradually transferred from New Brunswick and the territory of Rutgers Gardens between 1964 and the late 1970's.[59] After the transition period, according to the committee, approximately 100 acres of land in New Brunswick, containing the contemporary site of Rutgers Gardens, would be available for transfer, as shown in Figure 21. The committee does note that, of the 100 acres, half of the land could be used to expand the small fruits and ornamental horticulture research. The committee also recommended expanding the vegetable

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into the College of Agriculture. "Those engaged in the field of agricultural production must be provided with superior research and education in Food Science, with all of its many ramifications, in Ornamental Horticulture, with its highly important aesthetic values, and in the fundamental field of Family Living." (Rutgers College of Agriculture, 1960. Rutgers University, Dean of Administration, John L. Swink Records, 1958-1961. Special Collections and University Archives, Rutgers University Libraries.)

[59] Joe Goffreda, e-mail message to author, January 10, 2013.

research on Horticulture Farm No. 3, by moving other departmental research situated there to different locations.[60]

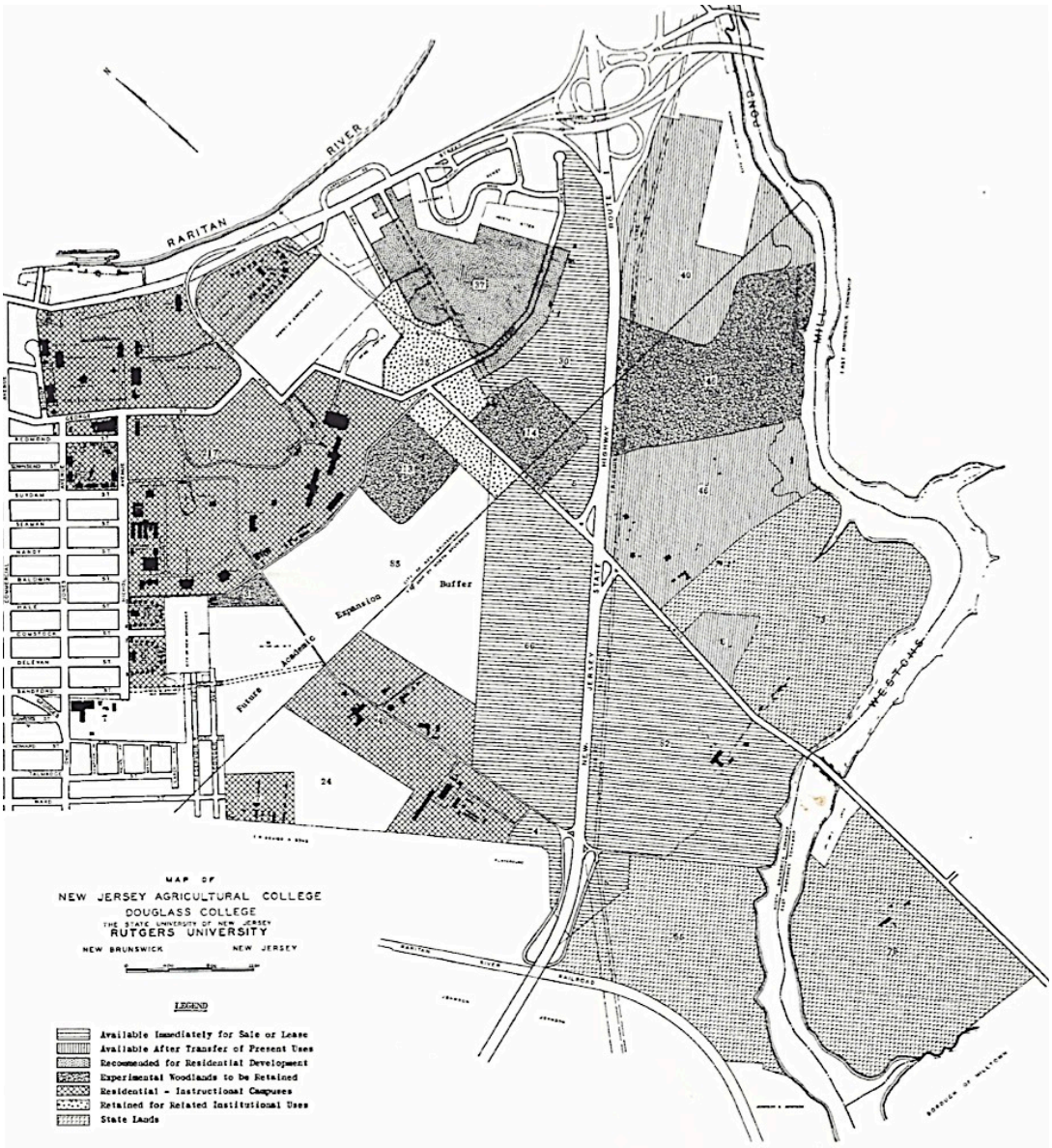

Figure 21. Map of Future Land Use/Sale Recommendations.[61] It notes that Horticulture Farm No. 1, marked #46 on the map above is "available for sale or lease after present uses terminate," likely referring to the transfer of the peach tree breeding program to Cream Ridge.

[60] To Dean John L. Swink, 28 November 1960, Agriculture, College of (1960), Rutgers University, Dean of Administration, John L. Swink Records, 1958-1961, Special Collections and University Archives, Rutgers University Libraries.

[61] To Dean John L. Swink, 28 November 1960, Agriculture, College of (1960), Rutgers University, Dean of Administration, John L. Swink Records, 1958-1961, Special Collections and University Archives, Rutgers University Libraries.

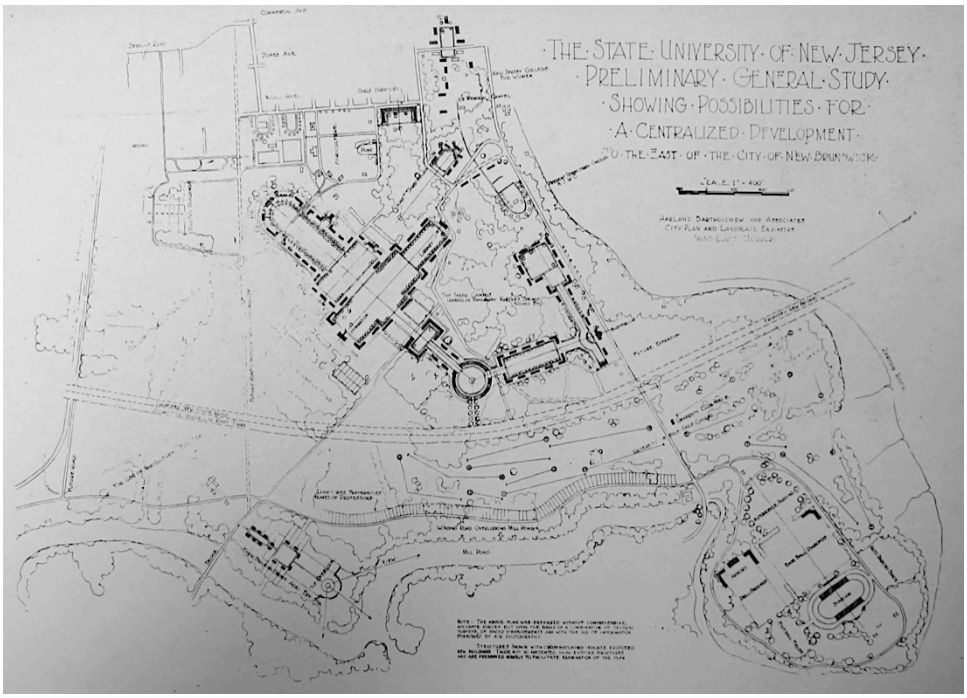

Figure 22. 1927 Bartholomew plan recommends resident housing at Rutgers Gardens.[62]

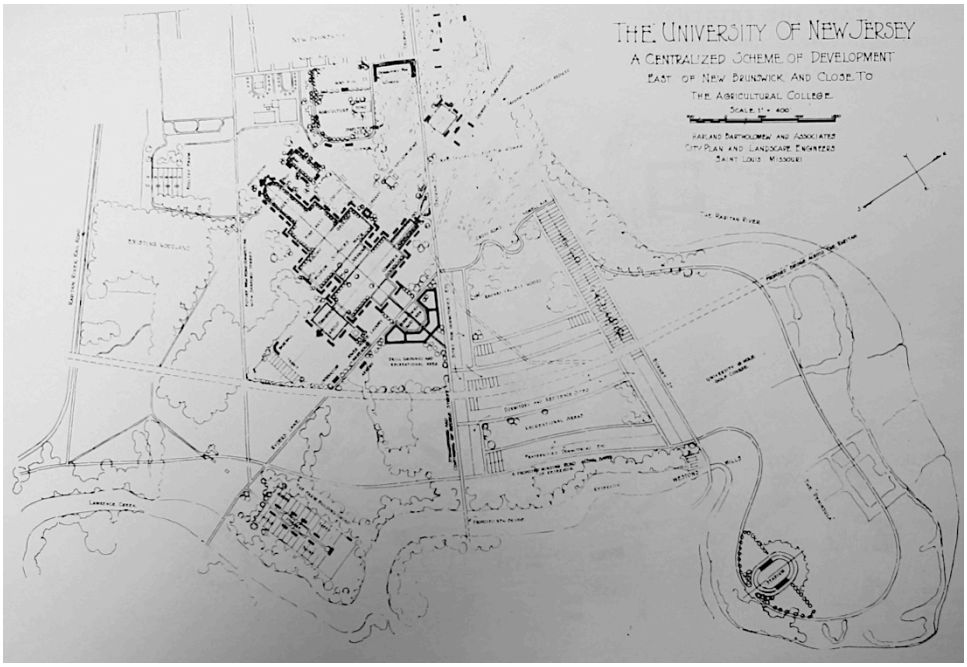

Figure 23. 1960 Bartholomew Plan does not designate a use for Rutgers Gardens but surrounds it with recreational land uses.[63]

[62] Bartholomew Plan, Master Plan, Douglass College & College of Agriculture and Environmental Science, November 1969, Cook College Master Plans, Special Collections and University Archives, Rutgers University Libraries.
[63] Ibid.

The Bartholomew[64] Plan of 1927 recommended replacing Rutgers Gardens with college housing and a golf course and the 1960 update to the plan left Rutgers Gardens untouched but surrounded it with recreational land uses. The 1969 Douglass College & College of Agriculture and Environmental Science Campus Master Plan grappled with the issues of public display and research at Rutgers Gardens. First, it notes that the holly, display and horticulture gardens in combination with its orchards and Helyar Woods are "one of the best known and beautiful features" of the campus which "during the spring and summer have attracted thousands of visitors to admire and study the new discoveries in ornamental horticulture" (26). The campus plan suggests the creation of a County or State park using State-owned lands, used by the university for research at the time, along the Lawrence Brook and Weston's Mill Pond, adjacent to Rutgers Gardens.[65] It would convert portions of the land from their existing research activities to natural areas for public access. The result of this conversion to a publically accessible park would benefit from its proximity to, what the plan claims as, a well-established garden. The plan states that the park in proximity to the Gardens would "provide access for nature study to wooded areas and to enjoy the aesthetic stimuli of an arboretum or "living laboratory"" (27). The plan also noted that the, "public has always been welcome to view the trees and flowers in bloom and to visit the natural setting of Helyar's woods. With the increasing population growth in the central Jersey area, such unique features will be increasingly important as educational facilities for school children and a growing attraction for the

[64] Harland Bartholomew, founding principal of Harland Bartholomew & Associates, was the first individual to be hired as a full-time city planner in the United States when he started working for the city of Newark, New Jersey in 1914. "Harland Bartholomew, 100, Dean of City Planners," December 7, 1989, *New York Times*, accessed April 5, 2013, http://www.nytimes.com/1989/12/07/obituaries/harland-bartholomew-100-dean-of-city-planners.html.

[65] The master plan called for the sale of portions of the Equine Science Center and Horticulture Farm No. 2 which would be used as a public park.

general public and the nature lovers of the State" (27). This statement indicates that public access within the territory of Rutgers Gardens had always existed. The proposed plan for the public park in relation to the "Living Laboratory" of Rutgers Gardens is shown in Figure 24.

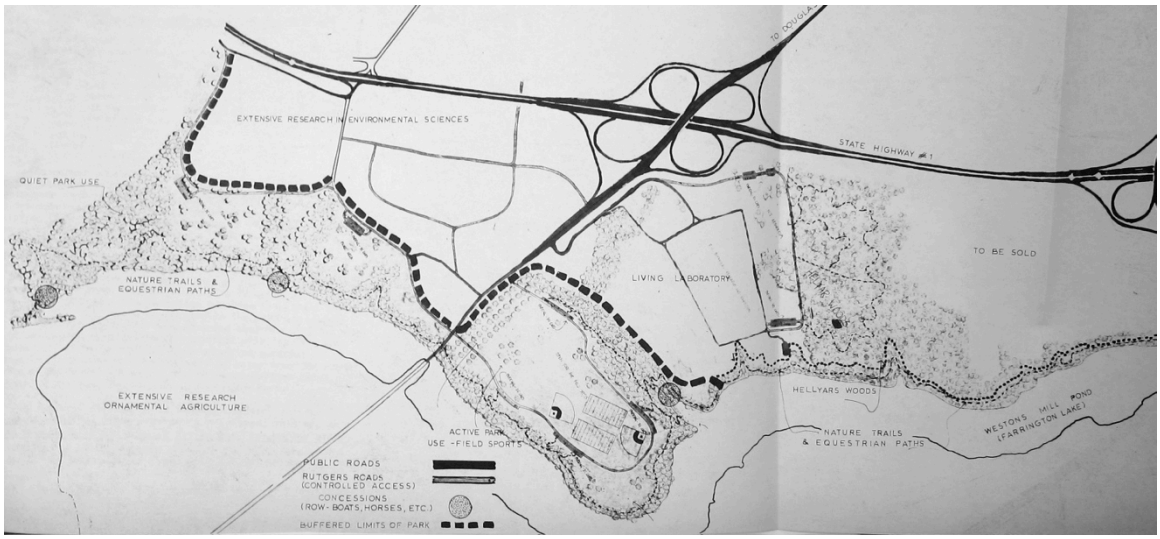

Figure 24. Proposed Public Park adjacent to Rutgers Gardens. Rutgers Gardens proposed as a Living Laboratory in a 1969 Campus Master Plan by the Director of Campus Planning, Dr. E. B. Wilkens.[66]

The proposal addressed issues related to public access and maintaining the purity of private research activities, as the public park would likely increase visitation to the area. The proposal recommended that a buffered edge between the public park and the research areas of the university would "prevent intrusion by the public upon the research activities" (27). By this time, though, according to an interpretation of the master plan, the purity of private research did not include the current boundaries of Rutgers Gardens. The area that is now Rutgers Gardens was labeled as a "Living Laboratory" and it was recommended that it become "a 'semi-public area' where existing research areas in

[66] Dr. E. B. Wilkens, A.I.P, Director, Campus Panning, Master Plan, Douglass College & College of Agriculture and Environmental Science, November 1969, Cook College Master Plans, Special Collections and University Archives, Rutgers University Libraries.

ornamental horticulture, the Helyar Woods, and even perhaps under appropriate controls, the use of the Log Cabin on a limited basis for the public to take advantage of the natural conditions in the Helyar Woods, the beauty of the horticultural studies, the Holly gardens, etc." (27).[67] While the discourse that followed this campus proposal is unknown, it appears to be the foundation of the situation that currently exists within Rutgers Gardens. Although no public park was established adjacent to the Gardens, the plan is one of the first documented discussions of a more formalized expression of landscape-based control of public access between the boundaries of public land and private research on public land. It also hints at the notion of Rutgers Gardens as already becoming a known as a hybrid territory, somewhere between private research and public display, as if the history of the display of scientific research and hybridization through public events had enabled citizens to claim this territory as their own through collective and progressive use and enjoyment during public events.

[67] Dr. E. B. Wilkens, A.I.P, Director, Campus Panning, Master Plan, Douglass College & College of Agriculture and Environmental Science, November 1969, Cook College Master Plans, Special Collections and University Archives, Rutgers University Libraries.

Era of Hybridization: Ornamental Dogwood Era (1965-2008)

Dr. Elwin Orton received his bachelor degree in horticulture, specializing in Pomology, from Penn State in 1952. Shortly after he pursued a master's degree in Horticulture at Ohio State in 1954 where he worked with a well-known geneticist D.F. Jones, the first individual granted a patent for a genetic technique—one that genetically restores fertility in corn hybrids (Kingsbury 209, 242). After Dr. Orton received his doctorate in Plant Genetics from the University of Wisconsin, studying under another well-known hybridizer of corn, Royal Alexander Brink, he decided to break away from basic plant genetics and pursue opportunities in plant breeding. Orton is quoted as saying that "I realized then … that people who work in basic genetics are too intelligent for me. I decided I'm going to stick with what I know and look for work in plant breeding."[68] He joined Rutgers as an Associate Research Professor in Ornamental Horticulture in 1960, funded jointly by the New Jersey Agricultural Experiment Station and the Holly Society of America. He was tasked with developing hybrid crosses of American holly (*Ilex opaca)* and English holly (*Ilex aquifolium)*. The ultimate goal was to introduce new plant material that could be used for holiday decorations and might invigorate the niche cut holly industry in Southern New Jersey. Although Orton was successful in establishing crosses with these plants, he did not achieve satisfactory ornamental results, namely due to the sterility of the crosses, which lacked the desired ornamental fruit.[69]

Because of this, Dr. Orton turned his attention to dogwoods, known as the "penultimate four-season plants in the landscape: spring flowers, summer fruit and

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[68] Qtd. in Bob Hill, "A Breeder Apart: Elwin Orton," *The American Gardener* October 2012, 38-9.
[69] While Dr. Orton's research into plant hybrids included hollies, dogwoods, firethorn, and sumac, I will focus on how Dr. Orton shaped the gardens with his interspecific crosses of the flowering dogwood (*Cornus florida*) and the Asian kousa dogwood (*Cornus kousa*).

foliage, autumn fruit and leaf color, and winter bark and form" (Cappiello and Shadow 2005, 23). From Dr. Orton's own eye, he evaluates the plant as,

> At the time *C. florida* was regarded as the most popular of all small, flowering trees in the US. It is attractive in all seasons of the year: the floral display of white, pink or red bracts make it a colorful harbinger of spring; the bright red fruit is attractive among the leaves in late summer; the strong hues of red, yellow, orange and green provide a fabulous autumn foliage display; and the bare horizontal branches provide winter interest, particularly when covered with snow…*Cornus kousa* was introduced to the US in about 1904 but did not become widely used for about 50 years, probably because the plants flower too late to be a harbinger of spring and are mostly vase-shaped as young trees. However the plants were found to be more drought tolerant than plants of *C. florida* and highly resistant to the common dogwood borer that can quickly destroy landscape plantings of *C. florida*. Thus, the thought that one might be able to develop vigorous F_1 interspecific hybrids of *C. kousa* and *C. florida* was exciting, as was the thought that one might be able to develop red-bracted hybrids of *C. kousa*.[70]

The native flowering dogwood has been a popular discovery since colonial settlement in America (and likely even before). According to Cappiello and Shadow (2005), flowering dogwood seeds appeared in catalogs in England almost immediately after European settlement in the New World. There are documented attempts of selected varieties sold at nurseries in the eastern states back to the 1880's through the mid twentieth century, "but large-scale nursery production of selected clones remained a non-issue until about the 1950's" (29). Over time, dogwoods have become a popular landscape tree, the third most popular selling deciduous flowering tree in the United States.[71]

Dr. Orton started his work at Rutgers Gardens well after the first wave of a post-World War II housing boom. But, it was still a time characterized by rapid divestment in central cities and capital investment in suburban areas surrounding central cities

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[70] Elwin Orton, "From Hollies to Dogwoods." *Plantsman*, March 2008, 60.

[71] According to the USDA's Census of Horticulture Specialties (2009), the Dogwood was the third most popular deciduous flowering tree sold in the United States. Nearly two million trees were sold in 2009. It was a market valued at $46,536,000. Tennessee is the largest producer and seller of dogwood trees (USDA 2009).

(Beurargard 2006). Between 1950 and 1980, 83% of growth in the United States occurred in suburban lands, characterized by single-family homes with front and backyard gardens (Grampp 2008). By 1970, buyers at nurseries preferred ornamentals to edibles at a rate of ten-to-one. Furthermore, according to a 1973 survey of customers at nurseries, "beautification of the home" was the main reason people bought plants (115). By 1960, the nursery trade in New Jersey was booming. In 1959, Nurseries in the state were selling nearly $9.5 million of nursery products (USDA 1959) and by 1974, sales in New Jersey nearly doubled to almost $19 million in sales and acreage used by nurseries increased 54%.

In 1965, Dr. Orton began identifying and collecting dogwoods for his research into the ornamental qualities and disease resistance.[72] Based on his accession records and his own hand drawn map of Rutgers Gardens, he divided the Gardens and small portions of the Equine Science Research Farm (at the time, the Beef Cattle farm) into 53 different research fields. His field arrangement covered almost the entire territory of Rutgers Gardens. Figure 25 illustrates how and when he distributed the flowering and kousa dogwood plant material that he received from a variety of nurseries and other locations within the Gardens.

[72] According to accession records, someone had already recorded the receipt of at least two flowering dogwoods from Princeton Nurseries in 1940 and 1949 that were planted in the shrub gardens.

Figure 25. The Collection of flowering and Asian kousa dogwood varieties.

The map illustrates that the majority of the collection of dogwoods occurred between 1965 and 1980. He identified approximately ten flowering dogwoods that already existed within the Gardens prior to his arrival. Those dogwoods were located in the shrub garden, near the log cabin, in Helyar Woods and in the Ericaceous garden (likely the current Rhododendron Garden). His records also indicate that he propagated

some of the existing trees and planted them in his research fields. Dr. Orton did not supplement the original display garden collections with his accessions.

Of the hundreds of trees received from nurseries in New Jersey, New York, Pennsylvania, Ohio, Maryland, Tennessee and Alabama, he amassed an almost equal proportion of white-bracted and pink/red-bracted flowering dogwood varieties. He collected fewer Asian Kousa dogwoods, almost mainly white-bracted varieties. He also collected a few specimens from nearby residences, noting striking traits such as bloom time and the coverage or size of bracts. His notes often indicate descriptions of physical traits that were atypical of other plants of the same variety. For example, one record states, "This plant is said to have 25% more flowers than the typical kousa and flowers last from mid-June to late August."[73] The majority of specimens were acquired and potted in the nursery at the Gardens before being transplanted in research fields. Two fields emerged as the primary destinations: field #33, the field farthest from the display gardens and currently not publically accessible, and field #30, adjacent to the horticulture lab and greenhouse. Furthermore, there appears to have been a strong connection with Dr. Blackburn at Willowwood Arboretum[74] in New Jersey. After transplanting and evaluating accessions, he sent many varieties there, most likely for field trials. While over seventy of the plants collected died through the period of evaluation,[75] the current status

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[73] *Cornus* Accessions, n.d., Horticulture Lab, Rutgers Gardens, Rutgers University, New Brunswick, New Jersey. Note that it is uncertain if these accession records are complete.

[74] Willowwood Arboretum, originally known as "Paradise Farm," was purchased as a country home in 1908 by Robert and Henry Tubbs, two wealthy businessmen, and avid gardeners and plant collectors, from New York. Dr. Benjamin Blackburn of the Department of Horticulture at College of Agriculture became acquainted with the Tubbs and eventually moved to Willowwood Farm, as the brothers renamed the property. Dr. Blackburn became the proprietor of the estate in 1958 after the death of Henry Tubbs. Dr. Blackburn remained in control of the Arboretum until 1980 when the Morris County Parks Commission assumed control. "About Willowwood," The Willowwood Arboretum, accessed April 5, 2012, http://www.willowwoodarboretum.org/about-ww.

[75] Trees that died were marked simply, "Dead" followed by the date.

of the other dogwood accessions is unknown. Genetic mapping of the dogwood collection at Rutgers Gardens is currently in progress.

After years of collection and evaluation, Dr. Orton attempted interspecific crosses among the native flowering dogwood[76] (*Cornus florida)* and the Asian kousa dogwood (*Cornus kousa)*. Dr. Orton is credited with being the first plant breeder to pursue controlled breeding between dogwood species (Cappiello and Shadow 2005). Bob Hill, a horticulture journalist, summarizes Dr. Orton's experimentation as follows:

> In the late 1960s he collected flowering dogwood pollen and froze it. A month later, when the kousa dogwood came into bloom, he hand-pollinated the flowers using a flat toothpick with a rounded end… The hybrid seeds took a year to germinate. Once the young plants were large enough, Orton planted them in an outdoor plot, then waited eight to nine years until most of them flowered… To ensure the plants were truly disease resistant, Orton gave them a tough love.[77]

The investment of eight-to-nine years in order to evaluate the success of flowering and other characteristics is considerable, especially when replicated across thousands of experiments between various hybrid crosses. According to Orton, "controlled crosses with *C. florida* revealed that the pink and red pigmentation of the floral bracts was conditioned by a single recessive gene in the homozygous state and that the intensity of the anthocyanin pigmentation of the floral bracts of each seedling could be reliably predicted by the intensity of the anthocyanin pigmentation visible on the underside of the cotyledons".[78] Reviewing Dr. Orton's lab books offers a glimpse into the methodical process experimentation and the gradual accumulation of experience and knowledge of the crosses between dogwood species, once thought not to be possible (Molnar and Capik

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[76] Dogwoods gained popularity in America long before the period of suburbanization. American colonists used them among many other species as a source for dyes (Rutkow 2012).
[77] Bob Hill, "A Breeder Apart: Elwin Orton," *The American Gardener* October 2012, 38-9.
[78] Elwin Orton, "From Hollies to Dogwoods," *Plantsman*, March 2008, 61.

2012). Figure 26 represents the controlled crosses with plants over 28 years. It is but three of hundreds of similar crosses made by Dr. Orton which ultimately developed the Stellar® series of hybrid dogwoods.

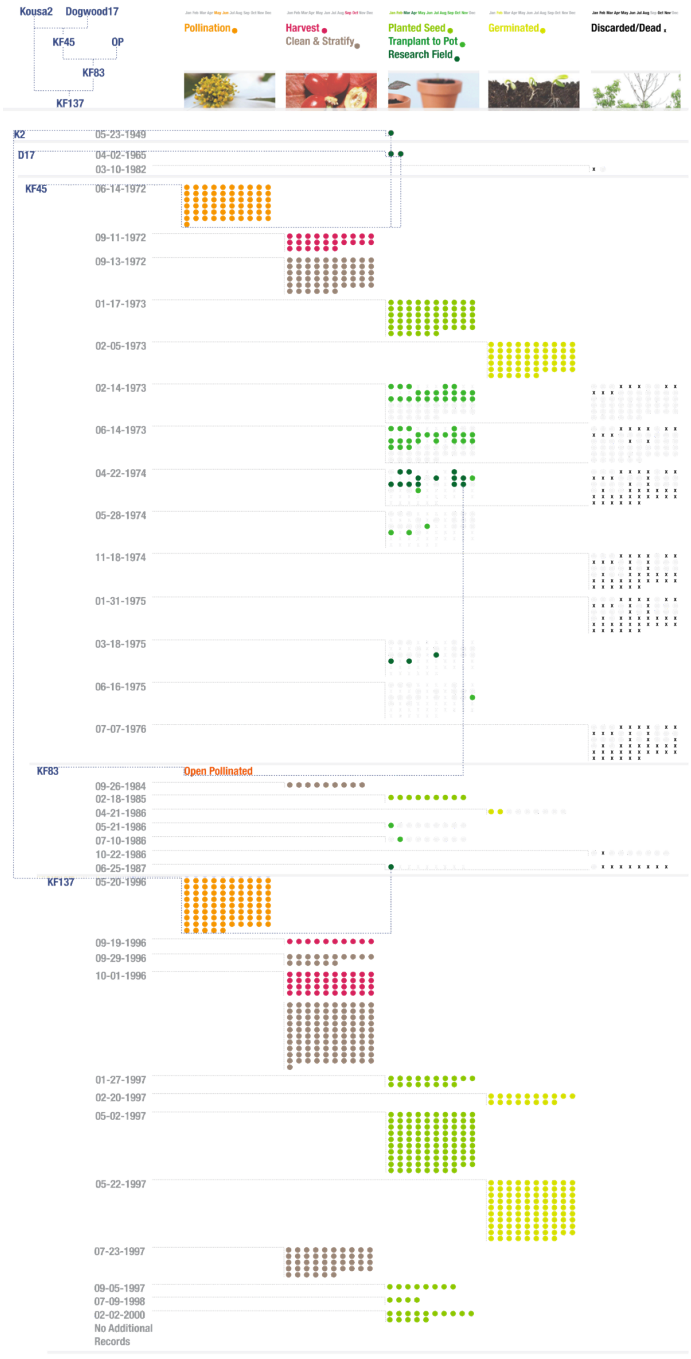

Figure 26. Controlled Dogwood Crosses – The Process of Experimentation.

The timing of the release of six Rutgers hybrids in the Stellar® dogwood series in 1990 was fortuitous due to its coincidence with dogwood anthracnose (*discula destructiva*), a disease wreaking havoc on the native flowering dogwood market. According to Orton, the disease, "by 1990, threatened the very existence of plants of *C. florida* throughout its native range."[79] When Orton started his research with dogwoods approximately twenty-five years earlier, disease from a variety of sources was just beginning to impact the flowering dogwoods. Ultimately, through testing and evaluation, he released six disease resistant hybrids. They were patented and trademarked crosses branded as *C.* x *rutgersensis*, the Rutgers' dogwood hybrids: Stellar Pink® ('Rutgan'), Aurora® ('Rutban'), Celestial® ('Rutdan'), Stardust® ('Rutfan'), Ruth Ellen® ('Rutlan'), and Constellation® ('Rutcan'). According to "The University estimates that the retail value of his creations is greater than $200 million and the royalty proceeds to Rutgers exceed $1.9 million."[80] Bob Hill calls one of the parents of Constellation® at Rutgers Gardens, "a living artifact of one of the most significant woody plant breeding advances in horticultural history."[81]

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[79] Elwin Orton, "From Hollies to Dogwoods," *Plantsman*, March 2008, 61.
[80] "Rutgers Plant Breeder Elwin Orton Inducted into NJ Inventors Hall of Fame," 28 November 2012, Newsroom, Rutgers University Office of Communications, accessed February 20, 2013, http://sebsnjaesnews.rutgers.edu/2012/11/rutgers-plant-breeder-elwin-orton-inducted-into-the-nj-inventors-hall-of-fame/. Note that these figures include all patented and trademarked plants invented by Orton.
[81] Bob Hill, "A Breeder Apart: Elwin Orton," *The American Gardener* October 2012, 36.

Era of Hybridization: Hazelnut Hybrid Era (1995-current)

The current plant hybrid research programs in and around Rutgers Gardens comprise a continuation of the ornamental dogwood research in combination with ornamental and agricultural hazelnut plant hybrid research. The research activities within Rutgers Gardens are mainly located outside of the publically accessible portions of the collections and dispersed across multiple horticulture farms and research fields. The primary long-term mission of the program is the development of a commercially and sustainably viable perennial agricultural product for the farmers in the Northeastern United States. The introduction to a Sustainable Agriculture Research & Education (SARE) grant states, "Diversification is vital to the success and longevity of many small farms in the northeastern U.S."[82] This dialogue is reminiscent of the dialogue between plant scientists at the College of Agriculture during the foundational years when research on ornamental and agricultural breeding was seen as an important method for diversifying agriculture in New Jersey from the late 1800's to mid-1900. Now, though, there is an increased focus on sustainability through the notion of low-input perennial agriculture. In addition to this, there is an added focus on an interaction between the rural and the urban, where the public may often visit farms and learn about innovative farming practices. [83] A secondary mission of the hazelnut-breeding program intends to promote the use of disease-resistant hazelnuts as viable ornamental and edible landscape plants by developing disease resistant strains (Molnar and Capik 2012). The ornamental hazelnut

[82] "Hazelnuts: A New Sustainable Crop for the Northeastern United States," 2011, Sustainable Agriculture Research & Education, accessed February 6, 2013, http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewRept&pn=ONE09-106&y=2011&t=1.
[83] "Hazelnuts: A New Sustainable Crop for the Northeastern United States," 2011, Sustainable Agriculture Research & Education, accessed February 6, 2013, http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewRept&pn=ONE09-106&y=2011&t=1.

qualities that are currently under evaluation are weeping habits, dissected leaves, golden leaves, brilliant pink and orange autumn foliage and tree forms (Capik and Molnar 2011).

Figure 27. Hazelnut Research Field at Horticulture Farm No. 3.

Dr. Thomas Molnar has been working at Rutgers University with a Hazelnut breeding program for over 17 years, expanding on his original research inspired by professor C. Reed Funk, an award-winning breeder in the Rutgers University turfgrass-breeding program. Dr. Molnar worked with Dr. Funk[84] for approximately two years in the turfgrass program before his mentor turned to explorations of nut trees as perennial and sustainable food, feed and oil crops. After several years of collecting and evaluating different species (walnuts, chestnuts, hazelnuts, etc.) from around the country, they

[84] According to the In Memoriam, C. Reed Funk's "dream was to eradicate the world hunger." He founded a non-profit organization, Improving Perennial Plants for Food and Bioenergy (IPPFBE), to promote the investigation of plant species not commonly used to produced food, timber and energy. IPPFBE, accessed March 16, 2013, http://ippfbe.org.

determined that hazelnuts held the most promise for northeastern farmers. Dr. Molnar continued his work with his graduate Ph.D. dissertation on hazelnuts. Later, he was hired to continue the work of Dr. Orton in the Woody Ornamental Breeding Program at Rutgers University in addition to a continuation of investigations of ornamental and agricultural hazelnuts. The hazelnut genetic improvement program began in 1996 with a primary objective of developing disease resistant crosses of European hazelnuts (*Corylus avellana*) with the American hazelnut (*C. Americana*). A Hybrid Hazelnut Consortium including Rutgers University, Oregon State University, University of Nebraska—Lincoln and the Arbor Day Farm have joined to engage in the scientific research and breeding of hybrid hazelnuts.[85]

According to Rosengarten (1984), an expert of edible nuts, the hazelnut, or filbert as it is also called, may be one of the oldest agricultural plants in Europe, especially in Turkey, Italy, Spain, France, Germany and England. The earliest records of European hazelnut cultivation in the northeastern United States date to 1629. Largely, though, early attempts failed because of the inability of the trees to thrive in colder winters and the presence of eastern filbert blight (EFB)[86], fungus that impact European hazelnuts. While the American hazelnut is impacted by EFB, it has developed disease resistance, but is limited as a commercially viable agricultural product as it produces thick-shelled nuts that are much smaller compared to EFB-susceptible European hazelnut. EFB materializes through cankers and branch dieback leading to the ultimate death of the plant.

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[85] "Continuing Research Advanced Hazelnuts," Arbor Day Foundation, accessed March 17, 2013, http://www.arborday.org/programs/hazelnuts/consortium/research.cfm.

[86] *Anisogramma anomala* (Peck) E. Müller, or eastern filbert blight (EFB) causes severe cankering, branch dieback, and the death of most European hazelnuts. American hazelnuts, though, are a tolerant host of the fungus.

The current source for most of the hazelnuts within commercial trade is the European hazelnut, which, when grown in the United States, have historically come from orchards in Washington and Oregon. The two states represent less than five percent of the world's filbert production,[87] but according to Molnar and Capik (2011), 99% of the hazelnuts produced in the United States come from the Willamette Valley in Oregon. The regions also tend to produce much larger nuts, which, according to Rosengarten (1984), inspired a growth in demand over smaller commercial nuts produced in other regions of the world. Unfortunately, eastern filbert blight (EFB), now currently exists in this growing region, which was not the case in the past. Breeding efforts of the partners involved in the hybrid hazelnut consortium are working to combat this.

Figure 28. Hybrid hazelnut research at Rutgers Gardens.

Approximately 8,000 three-year old hazelnut trees along with a collection of other nut bearing trees are closely planted in rows among research fields directly adjacent to

[87] Turkey is the largest producer of filberts, followed by the coastal regions of Italy and Spain.

the main Rutgers Gardens collection, separated by a fence with signage noting "No Trespassing," as shown in Figure 28. Furthermore, the majority of the research related to ornamental and agricultural hazelnuts within the vicinity of Rutgers Gardens occurs on Horticulture Farm No. 3 and the Equine Science Center. Approximately 5,000 trees are planted on Horticulture Farm No. 3 and 8,000 trees are planted adjacent to the Equine Science Research Center. In addition, 7,000 hazelnut trees are planted at the Cream Ridge Research Center in Freehold, New Jersey, alongside the peach-tree breeding program that was expanded under Dr. Blake's realm in the early 1900's.

The arrangement of fields within Horticulture Farm No. 3 and the fields adjacent to the Equine Science Center represent the pursuit of the breeding objectives of the current hazelnut-breeding program. The field rotation and planting represents approximately fifteen years of progress. The field adjacent to the Equine Center serves as an area where seeds collected from Poland in 2006, were planted and inoculated with the EFB fungus. Plant scientists use this field of 8,000 plants to gather and analyze data on the effects of the EFB fungus, as 95% of the trees in this area show signs of EFB infection. On Horticulture Farm No. 3, trees from a collection originating in Russia and the Ukraine are planted in a small field near the greenhouse and represent advanced generations of varieties that are disease resistant. These trees have been used to advance the disease resistant traits of controlled crosses. Seeds from plants are collected and after germinating in a greenhouse through the winter, are placed outdoors to acclimatize before they are planted in research fields for testing and evaluation. Fields on the farm contain first-year seedlings, second-year seedlings, and third-year seedlings identified by a code that indicates its location by a numbered sequence detailing farm location, row number

and plant number. For example, HF3AR03P67 notes the 67th plant on Horticulture Farm No. 3 in row 03 of field A. Over 30,000 hazelnut trees are identified through this system, and each progeny, containing between 50 to 100 trees, is planted in a separate row. First-year seedlings are exposed to EFB in the spring, using inoculation sticks tied to the trees. By the second year, the progression of the disease is expected. Evaluations begin in the winter, and continue for years. Third-year seedlings continue to be evaluated for disease resistance as it continues to progress through the plant and are evaluated for two more years before investing time into nut evaluations. Severely impacted trees are thinned to make more room for the growth of more promising trees. This process spans several years before nuts for each tree may be analyzed. This analysis of nutshells occurs in years 4-7 and is based on the appearance of the nuts within the shell (a desired trait for nuts potentially sold as a whole hazelnut) and the nut kernel characteristics (desired traits for nuts sold to confectionary food processers).

The best selections are clonally propagated and planted in replicated trials consisting of four trees for each clone. There are currently eight replicated trials in North America. As described in the SARE project report,[88] developing viable hazelnut hybrids eventually means that plant scientists pursue field trials throughout the northeastern farms to systematically evaluate the potential of the hybrids in commercial production. Field trials require a farmer commitment of at least seven years after the first planting of the hybrid hazelnut and will include 80 trees—five of each 14 Rutgers hybrids and two Oregon selections used as controls. Yield is a major factor in the analysis of trees in

[88] "Hazelnuts: A New Sustainable Crop for the Northeastern United States," 2011, Sustainable Agriculture Research & Education, accessed February 6, 2013, http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewRept&pn=ONE09-106&y=2011&t=1.

different locations along with disease resistance, flowering time, and the impacts from pests and cold hardiness within each trial.

The quest for the development of disease-resistant hazelnut crosses that exhibit hardiness in the colder winter and spring months of the Eastern climate has spanned over seventeen years. According to Dr. Molnar, approximately 25 out of every one thousand-hazelnut trees planted may be selected for advanced study and controlled crosses. Only one out of every 4,000 may be selected as cultivars with desirable traits. Ultimately, if the program averages one or two hybrid releases to farmers each year (averaged over decades) the achievements of the breeding program may be considered a success. While survival of crosses in the face of EFB and climate is one obstacle, the traits of these plants in their ability to produce high-quality nuts determined by yield, shape, shell thickness and a ratio of kernel to shell weight is another critical factor. For the breeding program, this means that incremental increases in yield traits must be achieved by hybrid releases year over year. In other words, a hybrid selected for release in 2015 would not likely be chosen for release twenty years later because of expected yield increases. This differs greatly from the measurability of releases from the dogwood-breeding program. While yield is quantifiable, the ornamental traits of dogwood hybrids are extremely subjective. The eye of the plant breeder evaluates the beauty of form, flower color, and seasonal characteristics. In many ways, the science of plant breeding is an art that includes not only an evaluation of the traits of an individual organism, but also an intuitive understanding of the potential consumer of each market-based product.

III. Key Findings

Summary of Key Findings

The history of Rutgers Gardens is intimately tied to the history of the College of Agriculture (now known as Cook Campus and the Rutgers School of Environmental and Biological Science (SEBS)) and the New Jersey Agricultural Experiment Station (NJAES). The historical narrative of plant hybridization reveals a continued quest to balance agricultural and ornamental horticulture research with the notion of public display and visitor experience. Because of this, plant hybridization is an ideal lens through which to study the history of Rutgers Gardens and the history of SEBS and NJAES. The Department of Horticulture transformed Horticulture Farm No. 1 into a productive landscape to serve the State of New Jersey as it competed to become a major provider of commercial agricultural and nursery products for the expanding city centers of Philadelphia and New York. Over time, the landscape of the Gardens developed as a result of direct research efforts and underlying values and context, as well as the public's shifting ideas of both a display and a home garden.

With the initial purchase of the land in the early 1900's through the federal land grant process, the farm became a center for agricultural production and research, a place where New Jersey farmers could experience and learn about the development and diversification of food crops based on scientific exploration. It started during a time when a focus on commercial agriculture in New Jersey responded to a need for increased agricultural literacy rooted deeply in science. Furthermore, it aimed to help agricultural producers remain competitive suppliers of perishable foodstuffs, which were often characterized by high distribution costs. Given their strategic position in the

industrializing Northeast, the Department of Horticulture met the specialized agricultural needs by developing a landscape of research and display of agricultural plant hybrids. Initially, plant hybrid scientists played a critical, if not the sole role, in the shaping of this public botanic display.

Horticulture Farm No. 1 continued to evolve during rapid urbanization and suburbanization characterized by significant population growth in the Northeast. Agricultural suppliers diversified into the realm of ornamental horticulture to meet the demands of an expanding nursery trade and the non-agricultural interests of a public with increased wealth and leisure time. The Department of Horticulture gradually adjusted Rutgers Gardens as landscape of research and display of ornamental plant hybrids. Initially display gardens and events were organized around plant hybrid research of specific plant types, such as the Iris Field Day and the Chrysanthemum Field Day. Over time, though, events became less specialized and structured with a garden open house format.

Most recently, as research of ornamental hybrids continues, agricultural diversification has resurfaced with the promotion of sustainable perennial food crops and edible landscaping. Plant hybrid scientists have expanded the research agenda to sustainable agricultural plant hybrids. Over time, plant hybrid scientists' role in shaping public display within the Gardens has diminished. The role of plant hybrid research now represents a lessened, or potentially, a concealed role, in the current form and structure of the Gardens. While remnants of plant material and display gardens remain to this day, the scientific foundations and importance of this research are not highlighted within the structure of visitor experience. Research plots and remnants of hybrid crosses are not

organized within a systematic public display. Such organization could highlight the role of this critical research for the improvement of economic agriculture and botany in New Jersey, ornamental aesthetics through periods of urbanization and suburbanization, and an emerging resurgence of the values of sustainable agriculture and edible landscapes.

The clear separation between research and display amplifies the distinction between public botanic display and private research areas within the botanic garden. While the requirement for private research areas to protect the economic potential of certain plant hybrids and controlled research exist, the opportunity to integrate portions of these areas and research on hybridization into the narrative of public display within the botanical garden is essential. The legacy of Rutgers Gardens as a place of research and the development of plant hybrids enrich the potential to express this story within the landscape. The tension between public display and private research should be maintained in order to sustain elements of this hybrid territory of science, economic botany, display and design. If the landscape of Rutgers Gardens becomes completely focused on display, the historical narrative of scientific research and economic botany might inadvertently be eliminated from the landscape. Likewise, if the sole focus of Rutgers Gardens becomes a landscape of scientific research and production, the focus of Rutgers Gardens as a place of public engagement with science and leisure might also be eliminated.

Discussion of Findings & Conclusion

Opportunities to increase the legibility of the historical narrative of plant breeding and research in the landscape or within a new visitor center abound. In addition to integrating the narrative of the foundational, ornamental dogwood and hybrid hazelnut eras of plant breeding, Rutgers Gardens could be an ideal site to showcase the diversity of plant-breeding research implemented throughout New Jersey by Rutgers University and the NJAES. By doing so, a broader array of research and its importance within the State could become part of the systematic botanic display and visitor experience. Many botanical gardens, for example, arrange collections based on themes related to plants such as habitat, taxonomy, popular use, and many more (Chang et. al. 2008). Simple arrangement and interpretation could be used to develop a series of collections that highlight plant hybridization research while expressing a narrative of the university's plant-based research achievements. A New Jersey plant community collection based on unique habitats such as bogs, fens, or forests, or a perennial edible landscape collection (peaches, asparagus, hazelnuts, all subjects of plant breeding research at Rutgers), could be established to illustrate both themes related to the plants and the achievements of plant hybrid research at the university.

An opportunity to highlight and memorialize patented plants, or the progeny that produced them, exists at Rutgers Gardens. For instance, patented peach trees that once had an impact on agricultural production in the early twentieth century could be reintroduced in the Gardens. Dogwood varieties and hybrid dogwoods that salvaged a potentially doomed flowering dogwood trade could be highlighted and interpreted through signage. Hazelnut hybrids that pursue the introduction of new forms of

sustainable agriculture as well as disease resistant ornamentals could also be integrated into the collections. Eric Rutcow (2012), author of *American Canopy*, states that:

> Our trees are living history. Each has a story to share, though it is well guarded, locked away in eternal silence. Uncovering these hidden tales requires a degree of tenacity. One must develop a feel for the many factors that determine why any given tree arrived at a particular spot and subsequently survived. Rarely in our nation does a tree's life involve no intervention, direct or indirect, from mankind. (345).

In a similar way, the trees as objects of research, including the hybrids and named varieties, may serve as examples of this living and evolving history of Rutgers Gardens. With the help of traditional botanical garden devices such as signage, classification and arrangement, hybrids and varieties within the existing public realm could easily be memorialized. Yet, it should be noted that living plants are temporary memorials in the landscape. While they may live several decades, eventually, the monuments to these historical acts will cease to exist as part of the public display.

Another possible expression of the landscape of hybridization could be integrated with smaller research plots, understood as "sacrificial plots."[89] Such plots could be made publically accessible at the interface between existing display gardens and private research areas, while public access within larger portions of field research remains restricted. Opening small portions of once private research areas offers opportunities to experience the scale and operation of the research. It could offer visitors a perspective of the industrial, agricultural and productive nature of a controlled research process,

[89] Dr. Laura Lawson, an academician and a leader of research on community gardens, speaks of the notion of "sacrificial tomatoes" in the arrangement of community garden plots where public access and private garden production have the potential to create conflict. Select high-value tomato plants, for example, are placed in the front of garden plots, closest to areas most publically accessible. The majority of other high-value tomato plants, however, are placed in the most inaccessible areas of the plot where they are more difficult for the public to access. The understanding is that the most visible plants in the front may be pilfered easily, without damaging plants that are more difficult to access. The "real" plot of tomatoes in the background remains protected by their less accessible location and the lure of the plants at the front of the plot. (Laura Lawson, pers. comm.)

including encounters with diseased trees, the thinning of trees and the rotation of research plots. It might also offer increased student or adult educational and "citizen science" opportunities with plant hybridization.

The danger of the publically accessible research areas, though, still lies between potentially sacrificing the purity of scientific research within those areas and the notion of an authentic visitor experience. If the public, for example, interferes with the objects of the research by harvesting flowers or nuts, it ultimately interferes with the researcher's ability to maintain the plants as a significant part of the research population. If the ability to maintain a portion of the population as valid research objects is compromised, one must question whether maintenance of these "sacrificial research plots" would and should be maintained by scientists focused on meeting their research objectives. In addition, if the "sacrificial plots" become a pseudo-research area arranged specifically for visitor experience and not for the value of the scientific study, would they simply become a make-believe creation, an abstraction, of the real plant-based research and hybridization, creating an inauthentic visitor experience? Given these unresolved issues, future research into the ability of revealing an abstraction of plant hybrid research, either through an exhibition or the visitor center, is required.

There are other challenges to integrating the experience of plant hybrid research into the visitor experience at Rutgers Gardens. As successful plant hybrids have the potential of becoming market-based products, restrictive public access to the progeny is critical for maintaining the ability to release hybrids into the marketplace. The potential of illegally replicating unreleased selections, even if they are inferior to the hybrids chosen for market release, increases the risks of damaging the future profitability of the

university's plant hybridization program. While this danger appears to be dependent upon the economic success and popularity of the plant hybrid in the marketplace, the necessity for "sacred" and inaccessible research areas exists within a public garden.

Furthermore, the layout of current plant hybrid research at Rutgers Gardens introduces additional issues. The research is spread among multiple neighboring farms and the major roads separating the spaces exacerbate the fragmentation of research activities. Ultimately, the volume and scale of the research operation cannot be fully realized by visitors to Rutgers Gardens. The dispersed nature (and necessity of experimentation with plant hybrids in different settings) may actually serve as a benefit to some of the aforementioned issues related to the tension between public access and private plant hybrid research. A dispersed territory of plant hybrid research, with infrastructural barriers such as roads, may ultimately serve to protect the "purity" of the research activities by clearly segregating private areas from the realm of public display.

The benefits of combining the narrative of the science and history of plant hybridization into landscape-based story telling mechanisms at Rutgers Gardens outweigh these challenges. According to Chang (2008), a botanical garden that does not engage interpretive devices is simply an enjoyable public park. Likewise, in a university setting, the interpretive narrative has the potential to satisfy both public outreach and education with the delivery of scientific knowledge and an understanding of history. Rennie and Stocklmayer (2003) offer four examples of how individuals learn science and technology outside of classroom settings, such as botanical gardens. These range from visiting exhibitions in order to seek specific knowledge or as a result of curiosity, pursuing personal interests and hobbies, searching for information in order to make a

decision on how to handle a personal situation, and receiving community-based education delivered by an institution to a group that is thought to need the information. Historically, scientists within the territory of Rutgers Gardens have offered these interpretive devices through educational programs, tours and display gardens.

With the feasibility study of a visitor center, the continued work of the Director of the Gardens, and the personal interests of plant scientists in engaging the community with the landscape and the scientific research, the "living laboratory" concept of engaged action and experience at the botanical garden holds great potential. The existing interface between the private research area and public display (currently separated by a "private road" and a deteriorating fence) is one of the most promising areas in the Gardens to engage the community of visitors within the landscape. A caged wall, its volume increasing over time, filled with discarded seedling trees from the hazelnut research fields could serve as an interpretive reference and a barrier to research fields. In sections, periodic openings, similar to the openings in the original ornamental display gardens, could allow visitors to pass through the wall into small gathering areas, "sacrificial research plots," art installation areas, or viewing rooms. Interactive displays programmed to simulate the collection and controlled crosses of plants might enable the "virtual scientist" to follow and interact with the process of hybridization. A research allée of plant hybrid trees could protrude from the "private road" into the research area, between research fields toward the tributary of the Lawrence Brook. It would allow visitors to walk the promenade, observing row after row of the agricultural planting of hybrid seeding trees, without giving them full access to the research fields themselves. A gathering area or outdoor instructional kitchen for demonstration, food preparation,

preservation or even roasting, might serve as the destination on the promenade. While the need for further research and testing of strategies to integrate the historical and scientific narratives in the landscape remains, interpretive devices such as interactive computer-based exhibitions, visual installations, signage, and outdoor educational areas would enhance the landscape narrative of Rutgers Gardens as a hybrid territory of economic botany, scientific research and display.

Appendices and Bibliography

I. History of Land Ownership

Figure 29. Overlay Map of College of Agriculture Parcels.[90]

Tract # 13-B (Horticulture Farm No. 1/Rutgers Gardens) [91]

	-	1676	Thomas Lawrence
1676	-		Cornelius Longfield
	-	1742	Henry Longfield
1742	-		Gilbert Van Sickelon and Hojn Ryder
	-	1785	John Ryder
1785	-	1837	Barnardus and William Ryder
1837	-	1862	William Ryder and Stephen Ryder
1862	-	1877	William Ryder
1877	-	1912	George H. Cook
1912	-		The Trustees of Rutgers College of New Jersey

[90] Parcel Map (Woodward 1932, 554-5) with Google Maps underlay (Google, Inc.)
[91] College Farm: Superintendent's Reports (1902-1912). College Farm A.C. (need label). Special Collections and University Archives, Rutgers University Libraries.

Tract # 15A (Horticulture Farm #1/Rutgers Gardens) [92]

	-	1676	Thomas Lawrence
1676	-		Cornelius Longfield
	-		Henry Longfield
	-	1767	Richard Gibb
1787	-		Hannah Harris
	-	1792	Mary, Richard Gibb, Thomas and Robert Harris
1792	-	1796	Richard Gibb, Thomas & Robert Harris
1796	-	1799	Thomas and Robert Harris
1799	-	1800	Edward Matthews
1800	-	1800	Thomas and Robert Harris
1800	-	1811	Charles Gilmore
1811	-	1813	Abraham Potts
1813	-	1819	Robert Watt
1819	-	1819	Hutchings
1819	-	1820	James Murphy
1820	-	1823	James Richmond
1823	-	1836	Frederick Richmond
1836	-	1838	David D. Stelle & Edward T. Stelle
1838	-	1852	Edward T. Stelle
1852	-	1862	Robert Carson
1862	-	1865	Robert Carson Jr. & William F. Carson
1865	-	1888	Ten Ryck Sutphen
1888	-	1891	Bernard Morris
1891	-	1904	Estate of Bernard Norris
1904	-	1905	Alfred Morrell
1905	-	1908	William W. Heath
1908	-	1910	Alfred W. Morrell
1910	-	1919	Nicholas R. Norisse
1919	-	1923	Philip Welchman
1923	-		The State of New Jersey

Tract #15B (Horticulture Farm No. 1/Rutgers Gardens) [93]

	-	1811	Same as Tract #15A
1811	-	1812	Abraham Potts
1812	-	1813	Charles Gilmore
1813	-	1817	John Keyworth
1817	-	1823	James Richmond
1823	-		Same as Tract #15A

[92] Ibid. 91.
[93] Ibid. 91.

Tract #15C (Horticulture Farm No. 1/Rutgers Gardens) [94]

	-	1811	Same as Tract #15A
1811	-	1813	Abraham Potts
1813	-	1837	Moses Willcooks
1837	-	1839	Edward Elkins
1839	-	1853	Vincent Runyon
1853	-	1862	Robert Carson
1862	-		Same as Tract #15A

Tract #15D (Horticulture Farm No. 1/Rutgers Gardens) [95]

	-	1811	Same as Tract #15A
1811	-		Abraham Potts
	-	1816	Richard Burdsall
1816	-	1817	Abraham Potts
1817	-	1822	Margaret White
1822	-	1862	Elisa M. Evans
1862	-	1869	Elizabeth M. & Isabella J. Evans
1869	-	1891	Bernard Morris
1891	-		Same as Tract #15A

Tract #15E (Horticulture Farm No. 1/Rutgers Gardens) [96]

	-	1811	Same as Tract #15A to 1811
1811	-	1815	Abraham Potts
1815	-	1823	Margaret White
1822	-	1862	Elian M. Evans
1862	-	1869	Elizabeth H. & Isabella Evans
1869	-	1891	Bernard Morris
1891	-		Same as Tract #15-A

Tract #15F (Horticulture Farm No. 1/Rutgers Gardens) [97]

	-	1811	Same as Tract #15-A to 1811
1811	-	1826	Abraham Potts
1826	-	1809	Richard Hanley
1859	-	1862	Robert Carson
1862	-	1865	Robert Carson Jr. & William F. Carson
1865	-	1867	Ten Ryck Sutphen
1887	-	1891	Bernard Morris
1891	-		Same as Tract #15-A

[94] Ibid. 91.
[95] Ibid. 91.
[96] Ibid. 91.
[97] Ibid. 91.

Tract #15G (Horticulture Farm No. 1/Rutgers Gardens) [98]

		1862	Same as Tract #13
1862	-	1869	William Ryder
1869	-	1887	Ten Ryck Sutphen
1887	-	1891	Bernard Morris
1891	-		Same as Track #15-A

Tract # 16A (Horticulture Farm #1/Rutgers Gardens) [99]

	-	1676	Thomas Lawrence
1676	-		Cornelius Longfield
	-		Henry Longfield
	-	1767	Richard Gibb
1787	-		Hannah Harris
	-	1792	Mary, Richard Gibb, Thomas and Robert Harris
1792	-	1796	Richard Gibb, Thomas & Robert Harris
1796	-	1799	Thomas and Robert Harris
1799	-	1800	Edward Matthews
1800	-	1800	Thomas and Robert Harris
1800	-	1811	Charles Gilmore
1811	-	1812	Abraham Potts
1812	-	1816	Margaret White
1816	-	1823	James Richmond
1823	-	1836	Frederick Richmond
1836	-	1838	David D. Stelle & Edward T. Stelle
1838	-	1856	David D. Stelle
1856	-	1857	Heirs of David D. Stelle
1857	-	1862	Robert Carson
1862	-	1865	Robert Carson Jr. & William F. Carson
1865	-	1888	Ten Ryck Sutphen
1888	-	1889	Peter O'Rourke
1892	-	1892	Patrick O'Rourke
1892	-	1905	Joseph E. Smith
1905	-	1916	Frank Wolpert
1916	-	1916	Jacob Lipman
1916	-		Trustees of Rutgers College in New Jersey

[98] Ibid. 91.
[99] Ibid. 91.

Tract #16B (Horticulture Farm No. 1/Rutgers Gardens) [100]

		1811	Same as Tract #16A
1811	-	1812	Abraham Potts
1812	-	1813	Charles Gilmore
1813	-	1817	John Keyworth
1817	-	1823	James Richmond
1823	-		Same as Tract #16A

Tract #16C (Horticulture Farm No. 1/Rutgers Gardens) [101]

	-	1823	Same as #16B
1823	-	1836	Frederick Richmond
1836	-	1836	David D. Stelle & Edward T. Stelle
1836	-	1852	Edward T. Stelle
1852	-	1862	Robert Carson
1862	-		Same as Tract #16A

Tract #16D (Horticulture Farm No. 1/Rutgers Gardens) [102]

	-	1792	Same as Tract # 16A
1792	-	1794	Richard G., Thomas, and Robert Harris
1794	-	1823	James Richmond
1823	-	1841	Walter M. Richmond
1841	-	1846	William Flagg
1845	-	1856	William Parsons & George Eldridge
1856	-	1858	George Eldridge
1858	-	1862	Robert Carson
1862	-		Same as Tract #16A

Tract #16E (Horticulture Farm No. 1/Rutgers Gardens) [103]

	-	1792	Same as Tract #16A
1792	-	1794	Richard G., Thomas, and Robert Harris
1794	-		John Harris Jr.
	-	1823	James Richmond
1823	-	1868	William Richmond
1868	-	1869	Mary E. Adrain
1869	-	1888	Ten Ryck Sutphen
1888	-		Same as Tract #16A

[100] Ibid. 91.
[101] Ibid. 91.
[102] Ibid. 91.
[103] Ibid. 91.

Tract #16F (Horticulture Farm No. 1/Rutgers Gardens) [104]

	-	1792	Same as Tract #16A
1792	-	1794	Richard G., Thomas, and Robert Harris
1794	-		John Dennis Jr.
	-	1814	Thomas Harston
1814	-	1823	James Richmond
1823	-	1830	Henry and James Richmond
1830	-	1830	Edward Elkin
1830	-	1839	Vincent Runyon
1839	-	1859	Richard Wanley
1859	-	1862	Robert Carson
1862	-		Same as Tract #16A

Tract #16G (Horticulture Farm No. 1/Rutgers Gardens) [105]

	-	1862	Same as Tract #13
1862	-	1869	William Ryder
1869	-	1888	Ten Ryck Sutphen
1888	-		Same as Tract #16A

[104] Ibid. 91.
[105] Ibid. 91.

II. Rutgers Gardens Map

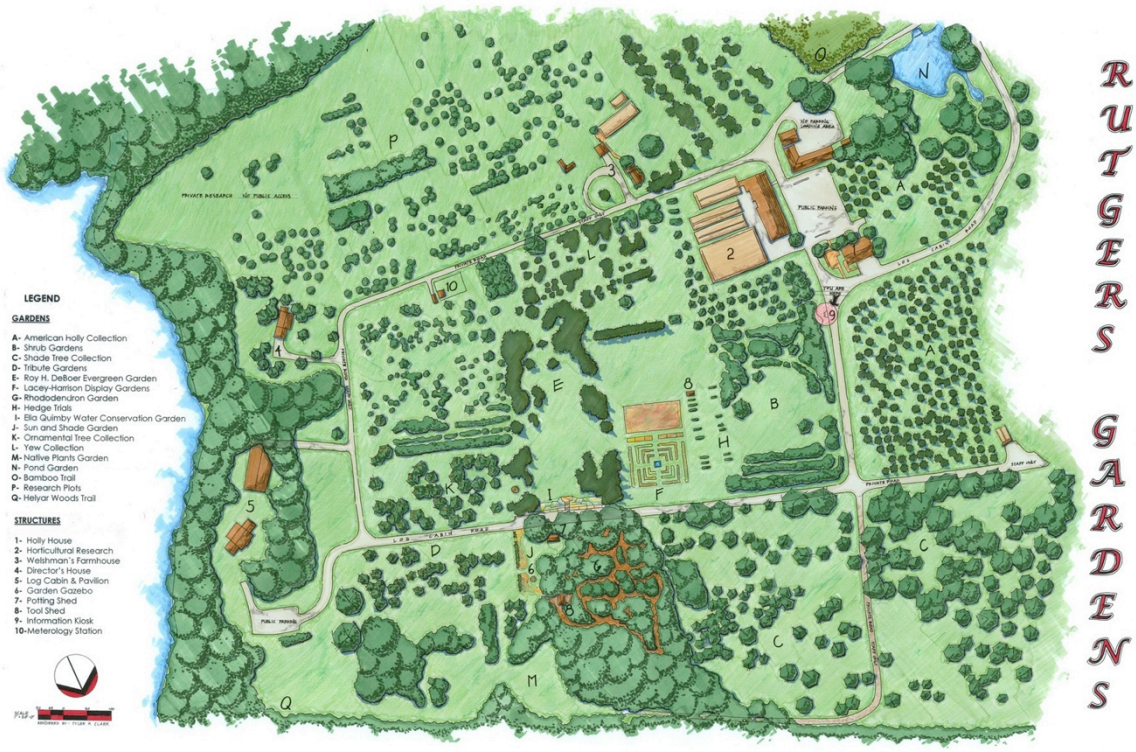

Figure 30. Current Map of Rutgers Gardens[106]

[106] "Garden Map," Rutgers Gardens, accessed March 24, 2012, http://rutgersgardens.rutgers.edu/map.html.

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