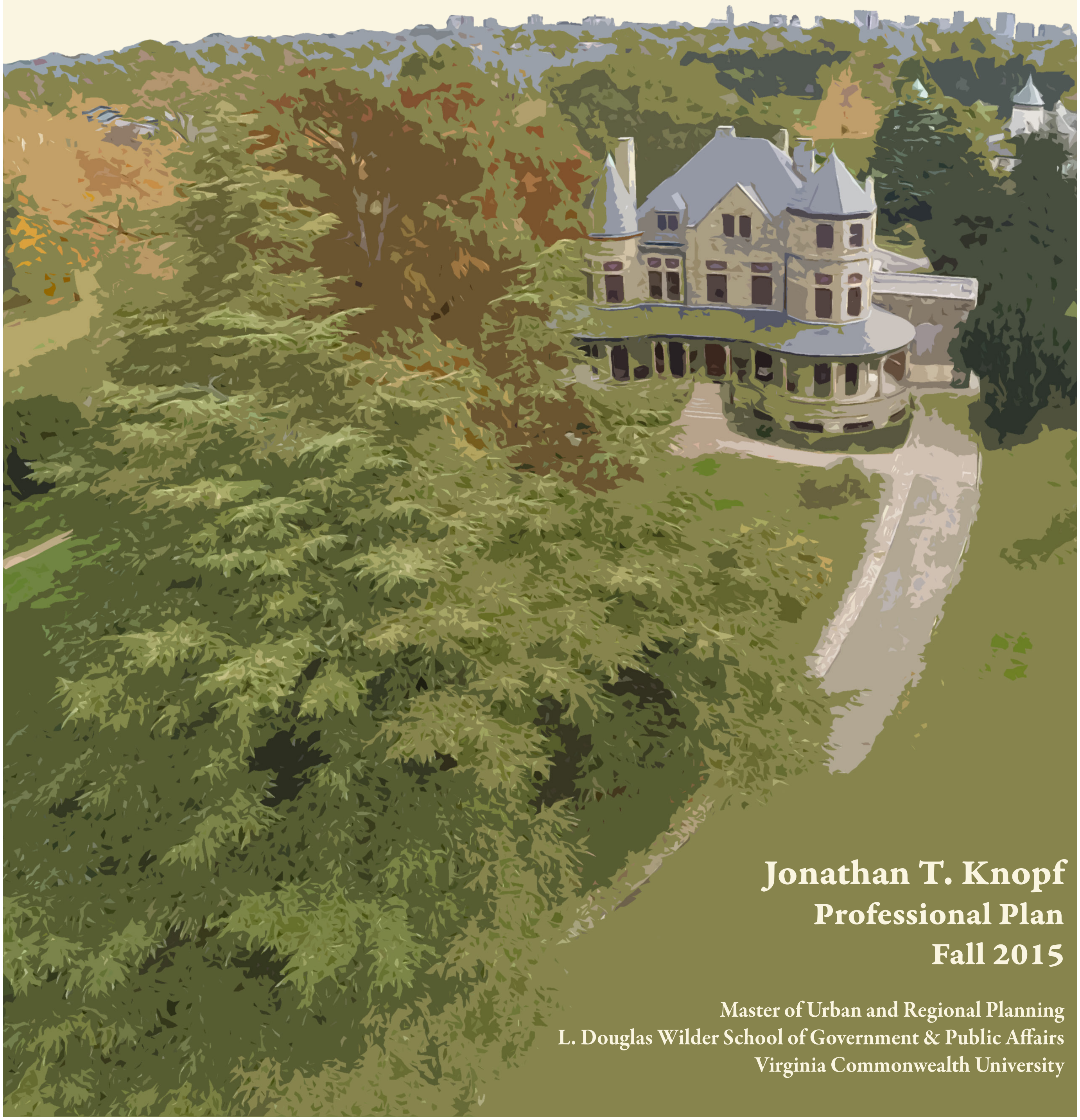
MAPPING THE MAYMONT EXPERIENCE

CULTIVATING ENVIRONMENTAL STEWARDSHIP AND EDUCATION THROUGH GIS



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Professional Plan

Fall 2015

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Mapping the Maymont Experience

Cultivating Environmental Stewardship and Education through GIS

Prepared for:

MAYMONT
An American Estate

Prepared by:

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Table of Contents

List of Figures and Tables

Executive Summary

The Maymont Estate is one of the most important natural and historical assets in the City of Richmond. Along with a restored Gilded Age mansion, a wildlife center, a family farm area, and many other amenities, Maymont is home to a magnificent Arboretum. The Arboretum, which contains many one-of-a-kind and champion trees, is *passively* appreciated every day when visitors enjoy the scenery, shade, and fresh air it provides. However, most guests are not *actively* aware of the Arboretum's historical and ecological significance.

This plan proposes a geographic information system (GIS) based Arboretum map that allows the public to digitally explore and learn about the Arboretum. Furthermore, this map will act as a foundation to catalogue and display Maymont's many other historical and natural assets, which are collectively referred to as the "Maymont Experience."

An analysis of existing conditions revealed Maymont as a prime candidate to implement such a map, primarily due to an impressive living collections policy responsible for digitally cataloging nearly all of the Estate's existing trees. GPS coordinates for many trees were also logged during prior attempts to map the Arboretum.

However, the current system was found to be incapable of supporting the upgrades necessary to establish a GIS-based solution. Therefore, this plan analyzed new software options, case studies of similar mapping projects, and suggestions from local experts to offer an alternative future in which Maymont utilizes a suite of new technologies to promote and preserve its unrivaled assets.

This vision is anchored by four goals: migrating all current data into a system that supports mapping capabilities, developing an interactive web map for users to explore the Arboretum, establishing the map as a resource for public education and engagement, and incorporating other valuable assets beyond the Arboretum into the map.

For these goals to be accomplished, Maymont will continue to rely on its dedicated staff and expert volunteers, along with collaboration from community organizations and institutions. Although the successful completion of this plan requires significant effort and coordination, Maymont can reach this desired future with little to no added costs.

Plan Outline

***Mapping the Maymont Experience* is divided into the following five sections:**

1. Introduction

This first section describes the client organization, provides project background, and states the plan's purpose. It also reviews the plan's guiding principles and theories, as well as its context within the goals of both Maymont and the region.

2. Existing Conditions

The second section provides a comprehensive overview of Maymont's living collections policy, existing woody plants database, and its technical capacity to build an integrative GIS platform.

3. Investigation

The third section researches potential GIS and software options, public garden case studies, and analyzes feedback from an Advisory Committee of experts.

4. Vision

The fourth section outlines the goals, objectives, and strategies for fulfilling Maymont's internal needs, engaging the public using interactive GIS, and building capacity needed sustain the project.

5. Implementation

The final section provides a detailed timeline of the necessary actions to develop a new database and Arboretum map, along with the subsequent steps required to expand the system into a fully integrative Maymont Experience.

1. Introduction

1.1 The Client

The client for this plan is the Maymont Foundation, which is responsible for maintaining and operating the Maymont Estate in Richmond, Virginia. Situated on 100 acres on the north bank of the James River, the Estate was the original home of Major James H. Dooley and his wife, Sallie May Dooley. The property was transferred to the City of Richmond, in accordance with the couple's wishes, upon Mrs. Dooley's death in 1925. In 1926, Maymont's gates were opened to the public.

The private, nonprofit Maymont Foundation was founded in 1975 to ensure that the Dooley's gift remained in brilliant condition for all visitors. Maymont is visited by half a million guests annually, all of whom enjoy free admission to the estate's mansion house, wildlife exhibits, nature center, and expansive gardens. The Estate is on the National Register of Historic Places, and has been designated a Virginia Historical Landmark.

The Foundation's mission to "preserve and celebrate Maymont for the pleasure and education of everyone" is anchored by their vision for the estate to become "a premier, admission free destination that offers enriching integrated experiences" in both nature and history (Maymont 2011). The integration of these two elements produces an unrivaled "Maymont Experience" for visitors. The following plan proposes a customized geographic information system (GIS) to track and display these assets, which will nurture public engagement and promote resource preservation.

Figure 1.1 Location of Maymont within the City of Richmond.
Sources: ESRI, City of Richmond

Figure 1.2 The Maymont Estate in the 1930s.
Source: Maymont, via historyreplaystoday.org

1.2 Background

One of Maymont's most impressive natural features is its vast collection of trees and shrubs, collectively referred to as the Arboretum. Although the Estate originally featured a small number of natural trees, the land was mostly meadow. After settling on the property, the Dooleys slowly transformed the Estate into an example of Gilded Age splendor in the natural environment. Today, the Arboretum includes many stunning examples of trees native to Eastern North America, along with hundreds of exotic species imported from across the globe, primarily by the Dooleys themselves.

Gordon Tarbox, the Director of Brookgreen Gardens in South Carolina, once declared that "[Maymont's] magnificent tree collection could not be duplicated in one hundred years," thanks to the original landscape architects who meticulously planted these trees with ample room to grow and thrive. By planning for future generations, the Dooleys ensured that visitors today enjoy an urban forest unlike any other.

However, maintaining and tracking the Arboretum is not a simple task. As of 2015, Maymont's woody plants are cataloged in a homemade electronic database that stores information about the species, size, and condition of individual plantings. Each tree or shrub is cataloged, and plotted by hand onto paper maps used by the horticulture department for landscape design and maintenance. Although this system earns marks for its simplicity, it falls short of significantly advancing Maymont's mission to serve as an educational resource by sequestering the majority of Arboretum data out of the public's hands.

Integrating GIS into Maymont's Arboretum should be the first step toward mapping the Maymont Experience. In fact, the Foundation has been slowly attempting to georeference its woody plants for nearly a decade after it received a grant for a handheld global positioning system (GPS) device. Although volunteers succeeded in digitally logging the location of hundreds of trees over many months, the data has remained unused, and many trees have been planted since then. No formal plan was ever drafted to integrate the georeferenced plants into the existing database, nor have there been significant efforts to publish the data for public consumption.

1.3 Purpose of Plan

For Maymont's unparalleled tree collection to be truly enjoyed by all, it must be available for every on- and off-site visitor to explore. Therefore, the *initial* purpose of this plan is to design and implement a new Arboretum database to power an online map displaying basic information for all of the Estate's trees. This map will be published on Maymont's website and allow anyone with internet access to digitally browse the Arboretum.

The *primary* outcome of the plan, however, will be to use an Arboretum map as the means to a greater end by providing the necessary foundation to ensure the entire suite of Maymont's assets – both natural and historical – is strategically maintained to provide educational and recreational opportunities for generations to come.

The end result will be a transformation of the public's *passive appreciation* of Maymont's natural and historical assets into *active appreciation* using technology to promote engagement, education, and stewardship.

1.4 Guiding Principles and Theory

Mapping the Maymont Experience is framed by three guiding principles: Strategic Collection Management, Engagement and Education via GIS, and Capacity Building. These concepts are each informed by relevant theories in public garden management, participatory GIS, and sustainable community development.

1. Strategic Collections Management

This plan must meet the internal needs of the Foundation to easily and accurately manage its extensive collection of living plants and natural assets.

One of the major roles of a public garden is to serve as a library for plants. Just as traditional libraries have collection policies for books, periodicals, and other pieces of literature, public gardens have "living collection policies" that outline the procedures for documenting repositories of plant specimens (Blackwell 2013). Sound and vetted collection policies provide public gardens with an accurate assessment of their resources, expedite maintenance activity, and help guarantee collections are preserved for the future.

However, it is crucial that the data collection process reflects the central mission and distinguishing characteristics of a particular garden. In Maymont's case, examples of unique data fields might include whether a specimen is an original Dooley tree, native or exotic status, and names of persons or organizations for whom certain memorial trees are named. These variables directly relate to the Foundation's core mission. The gathering and dissemination of Arboretum data will act as a pilot program for the potential digitization of Maymont's other assets, including wildlife habitats, walking trails, and water features.

2. Engagement and Education via GIS

An interactive GIS web map should be designed to expand the Maymont Experience into the digital realm.

GIS and associated digital mapping tools have become prolific among government agencies, planning departments, and similar groups over the past several decades, and are recently finding a niche among public gardens. Such organizations have discovered that GIS allows them to efficiently gather, analyze, and disseminate information to advance their respective missions. The ability to link geographic layers with the queries and information stored in a database makes GIS a powerful tool for public gardens to reach a larger audience, secure greater funding, and accomplish their unique goals. When guided by the principle of *participatory GIS*, which generally refers to the use of local knowledge and "bottom-up" involvement of citizens to create maps and geographic data, gardens further establish themselves as vital community partners (Brown and Weber 2011).

Alliance for
Public Gardens GIS

Figure 1.3 Alliance for Public Gardens GIS Logo.
Source: APGG

To this end, the **Alliance for Public Gardens GIS** has developed a framework for institutions like Maymont to incorporate GIS into their plant management systems. The Alliance, spearheaded by the University of California-Davis, is a consortium of botanists and cartographers dedicated to expanding GIS software beyond its traditional applications by providing a GIS toolkit for public gardens (Alliance for Public Gardens GIS 2012). This assistance includes grants, data models, and professional consulting, but relies heavily on proprietary ArcGIS software produced by Esri, which has the largest market share of digital mapping products. Although this model may not fully satisfy Maymont's needs, the Alliance's approach provides a strong theoretical background on which to base this plan.

A core component of the Alliance's mission, as explained in its *Guide to GIS for Public Gardens* handbook, is to recognize the important but often unrecognized role that public gardens play in the lives of many different communities (Alliance for Public Gardens GIS 2013). These institutions are living museums, curated and managed for the benefit of the citizens that support it. Public gardens not only provide recreation space for their visitors, but staff also engage in research and education as part of their missions. These unique places hold vast amounts of geospatial data that often go unnoticed by the public because they are not accessible. GIS unlocks this information to anyone with computer access, and opens new opportunities for the institutions themselves. By creating a digital inventory of geographic features such as trees, water features, and habitats, a public garden can increase its capacity for landscape management, asset curation, education, and fundraising.

3. Capacity Building

Lasting relationships with community partners must be forged to ensure project sustainability.

Keeping a database full of thousands of plants up-to-date is not a simple task, nor should it be the sole responsibility of Maymont's small but dedicated horticulture staff. Therefore, this plan will explore relationships with local stakeholders to build the capacity necessary to sustain the project for years to come.

Building partnerships between public and private institutions, especially public gardens, spurs local community development by building citizen trust and encouraging participation in their local environment (Gough and Accordino 2011). Maymont is in a unique position to capture this potential, due to its existing status as "a model of public-private park management" according to the American Planning Association (2011). Maymont actively promotes and encourages community partnerships, and educates the public beyond its permanent exhibits by providing tours, children's discovery camps, and other events. Planning for a new mapping system and database should be no exception.

Recent research indicates that building "capacity through interdependence" requires each partner to recognize that the benefits of a potential alliance will be greater than the benefits achieved by working alone (Gough and Accordino 2011, 855). This principle will guide the development of the database by viewing community partners as beneficiaries of the project, as opposed to treating them as merely consultants or laborers.

Potential educational partners include Virginia Commonwealth University Life Sciences and Department of Biology, the Virginia State University Department of Agriculture, the J. Sargeant Reynolds Community College Horticulture Program, along with public and private grade schools throughout the Richmond region. Organizations such as the Richmond Tree Stewards, Richmond Master Gardeners, the Garden Club of Virginia, and BeautifulRVA might serve as project sustainers. Bringing community stakeholders into the planning process early and often will increase Maymont's value as an educating institution, and encourage partners to contribute to the plan's overall implementation.


Source: Harrison Williams

1.5 Plan Context

Mapping the Maymont Experience is firmly rooted not only in Maymont's mission and vision, but also in the Foundation's six Shared Values: ***Stewardship***, ***Education***, ***Preservation***, ***Excellence***, ***Inclusion***, and ***Enjoyment*** (Maymont n.d.). An Arboretum map will help Maymont care for and maintain its precious resources, fulfilling its commitment to be a responsible steward for the Dooley's gift. In addition, such a map will expose a wealth of knowledge to the public, encouraging them to explore the Estate's natural treasures.


Source: Harrison Williams

Strategic Plan

Maymont's 2008-2013 Strategic Plan provides further justification for the project, as evidenced by the following relevant strategies:

Goal I. Programs, Events, Interpretation and Visitor Services. Strategy E:
"Evaluate and apply new technologies for enhanced interpretation and educational programming."

A new GIS-driven database and online map will utilize state of the art technology to deliver an integrative learning experience to a worldwide audience.

Goal III. Marketing and Public Relations. Strategy C:
"Educate the community about the value of the Maymont Experience to further cultivate a sense of ownership, responsibility, and support."

Showcasing the Arboretum and other assets through an easily accessible format will allow the public to further appreciate the important role that Maymont plays in the community.

Goal III. Marketing and Public Relations. Strategy E:
"Reposition and promote Maymont as a national destination."

There is no other public garden in the country like Maymont, due largely to its magnificent Arboretum. Publishing an online map of the Maymont Experience will encourage potential visitors from around the globe to explore the Estate in person.

Goal III. Marketing and Public Relations. Strategy H:
"Strengthen collaboration between Maymont Foundation and local, regional and state partners."

Using participatory GIS and capacity building techniques to develop this map will reinforce existing collaborations and create new partnerships with important organizations.

Goal IV. Collections and Exhibits. Strategy A:
"Provide proper care and management of collections conforming to best practices."

Upgrading Maymont's collections policy to include GIS will help streamline horticultural operations by making the identification and tracking of plants much more robust and user-friendly.

Interpretive Master Plan

In 2011, Maymont adopted an Interpretive Master Plan (IMP) that called for increased collaboration between its separate departments to develop a cohesive educational program for guests. New teaching initiatives should be easily accessible and draw visitors into a deeper relationship with the natural and historic features of the Estate. Most importantly, they should reinforce Maymont as an "aggressive advocate for conservation and historic preservation."

The main goal of the IMP combined three objectives:

1. Create engaging and enjoyable experiences for guests to appreciate Maymont's natural and historical resources.
2. Help guests recognize Maymont as not just a "city park," but a magnificent expression of human design in the natural environment.
3. Incorporate modern day issues to highlight Maymont's efforts in conservation and historical preservation.

A map that showcases the Maymont Experience will allow the public to become more engaged by providing them with unique information about the Arboretum, which is perhaps the most accessible resource on the Estate, but also the one that visitors know the least about. Allowing guests to comprehensively explore the trees will help them appreciate the skill and forethought required to produce an Arboretum of such quality. Finally, the map will become a platform for guests to learn about the Arboretum's many environmental and social benefits.

Beyond the Gates

A new Arboretum map and database is needed now more than ever for Maymont to become a forerunner in the conservation and preservation of large-scale public gardens. The Foundation's current Spirit of Generosity fundraising campaign charges Maymont with "demonstrating leadership" in this capacity, so that all visitors – whether online or in person – may interpret and appreciate the estate's incredible amenities (Maymont 2015).

The proposed interactive portion of the database would expand Maymont's prowess among the professional horticultural and dendrological communities, both domestic and abroad. Scientists and gardeners researching specific ecosystems or tree species will be able to study Maymont's Arboretum in high detail. Furthermore, the plan will advance Richmond's goal to have citizens engaged in issues regarding sustainability and green space, as noted in its *RVAgreen* plan (City of Richmond 2012). Simply put, the purpose of this plan is to showcase one of Richmond's most underrated assets and to ensure it remains prosperous for generations to come.

Source: Harrison Williams

1.6 Approach and Methods

This document will address a series of important questions that require exploration before creating a comprehensive map of the Maymont Experience. These include, but are not limited to:

To what extent can the proposed map and database utilize Maymont's existing inventory and collections policy?

It would be advantageous to build directly off of Maymont's current Arboretum database. Since the vast majority of trees on the Estate have already been geographically tagged, significant time and resources would be needed to start the collection over from the beginning. The plan will determine how the existing woody plants database might act as the foundation for the initial Arboretum map.

How have other public gardens integrated GIS into their mission?

Maymont will not be the first public garden to use GIS. Many institutions across the country have incorporated digital mapping into their collections policy, as well as their public outreach efforts. Analyzing comparable case studies will be necessary to help develop a set of best practices for designing a map of the Maymont Experience.

What strengths and traits unique to Maymont need to be expressed in the map?

While drawing experience from previous plans is a necessary element for this process, Maymont is a natural treasure with exceptional history and character. To satisfy the Foundation's vision of Maymont as a premier destination, numerous components should be accounted for in a map that reflects the Estate's unique assets.

How will professional communities and the public as a whole use the map?

An effective map, whether a single sheet of paper or a fully interactive online application, is designed with its audience in mind. The Maymont Experience encompasses many different concepts – recreation, environmental education, historical interpretation, among others – that deserve special attention. This plan will engage the community to influence the design and interactivity of the map.

What kinds of software and technology are needed to create and implement the map?

> "GIS" incorporates a wide variety of programs that assist in the collection, organization, analysis, and publishing of geographic data. There are many possible routes available for creating an online map of the Maymont Experience, each with its own advantages and disadvantages. It is imperative that the proposed database and linked map products are powered by a system that is affordable, simple to use, and easy to maintain.

These questions will be answered using a wide variety of data sources and collection methods. To understand the existing systems in place at Maymont, a full institutional analysis will be accomplished by reviewing the Foundation's current plant inventory, collections policy, and database structure. Several case studies will be evaluated to determine the strengths and weaknesses of previous efforts to publish online maps of public gardens, with special attention paid to the system and database architectures used in each instance. A series of recommendations and best practices will follow that analysis.

To foster community input, an Advisory Committee will be established to guide the initial design phase of the map and database. The Committee will be comprised of stakeholders from Maymont, local academics, certified arborists, and other public representatives. Committee members will be asked to provide their comments and suggestions, including how the project's success might be measured. Initial comments from the members will then be compiled and distributed among the entire Committee for secondary feedback. Once organized and analyzed, the information will be presented in tables, diagrams, and maps to assist in the visualization of data flow.

2. Existing Conditions

2.1 Maymont Living Collections Policy

Maymont horticulture staff currently keep track of their woody plants (both trees and shrubs) using a combination of hand-drawn paper maps and a custom-built Microsoft Access database. Plants are assigned a species code, a specific type code to indicate a possible subspecies, and an individual specimen number. For example, the second Blue Atlas Cedar on record would be classified as follows:

005	Species code for *Cedrus atlantica*, an Atlas Cedar
A	Specific type code for *Cedrus atlantica Glauca*, a Blue Atlas Cedar
2	Tree number to indicate it is the second Blue Atlas Cedar in the database

These three fields are the primary means of tree identification at Maymont. The database contains many other data fields, which are discussed in the next sections, along with the physical mapping system used in conjunction with the digital collections.

Tree List by Number

Species Code	Botanical Name	Common Name	Family
002 SP	Abies nordmanniana	Nordmann Fir	PINACEAE
003 SP	Abies pinsapo	Spanish Fir	PINACEAE
003 A	Abies pinsapo Glauca	White Spanish Fir	PINACEAE
004 SP	Larix decidua	European Larch	PINACEAE
005 SP	Cedrus atlantica	Atlas Cedar	PINACEAE
005 A	Cedrus atlantica Glauca	Blue Atlas Cedar	PINACEAE
005 B	Cedrus atlantica Glauca Pendula	Weeping Blue Atlas C	PINACEAE
006 SP	Cedrus deodara	Deodar Cedar	PINACEAE
007 SP	Cedrus libani	Cedar of Lebanon	PINACEAE
008 SP	Cephalataxus harringtonia	Plum Yew	CEPHALOTAXACEA
008 A	Cephalataxus harringtonia Fastigiata	Fastigiate Plum Yew	CEPHALOTAXACEA
009 SP	Chameacyparis species	Unknown Falsecypres	CUPRESSACEAE
010 SP	Chamaecyparis obtusa	Hinoki False Cypress	CUPRESSACEAE
010 B	Chamaecyparis obtusa Aurea	Aurea Hinoki Falsecy	CUPRESSACEAE
010 A	Chamaecyparis obtusa Fernspray	Fernspray Hinoki Fals	CUPRESSACEAE
010 D	Chamaecyparis obtusa Gracilis	False Cypress	CUPRESSACEAE
010 F	Chamaecyparis obtusa Kosteri	Kosteri Hinoki Cypres	CUPRESSACEAE
010 C	Chamaecyparis obtusa Nana Gracilis	Nana Gracilis False C	CUPRESSACEAE
010 E	Chamaecyparis obtusa Tetragona Aurea	Gold Hinoki Falsecypr	CEPHALOTAXACEA
011 SP	Chamaecyparis lawsoniana	Lawson Cypress	CUPRESSACEAE
011 A	Chamaecyparis lawsoniana Oregon Blue	Oregon Blue Lawson	CUPRESSACEAE
012 SP	Wisteria species	Unknown Wisteria	FABACEAE
013 SP	Chamaecyparis pisifera	Hinoki Falsecypress	CUPRESSACEAE
013 C	Chamaecyparis pisifera Aurea	Yellow Falsecypress	CUPRESSACEAE
013 D	Chamaecyparis pisifera Filifera	Thread Sawara Cypre	CUPRESSACEAE
013 A	Chamaecyparis pisifera Filifera Aurea	Gold Thread Falsecyp	CUPRESSACEAE
013 E	Chamaecyparis pisifera Squarrosa	Sawara False Cypres	CUPRESSACEAE
013 F	Chamaecyparis pisifera Tetragona Aurea	Golden Hinoki Falsec	CUPRESSACEAE
013 B	Chamaecyparis pisifera Tilifera Aurea	Gold Spangle Falsecy	CUPRESSACEAE
014 SP	Cryptomeria japonica	Japonica Cryptomeria	TAXODIACEAE
014 A	Cryptomeria japonica Yoshino	Yoshino Japanese Ce	Taxodiaceae
015 SP	Cunninghamia lanceolata	Common China Fir	TAXODIACEAE
015 A	Cunninghamia lanceolata Glauca	Blue China Fir	TAXODIACEAE
016 SP	Ilex aquifolium	English Holly	AQUIFOLIACEAE
016 A	Ilex aquifolium Marginata		
017 SP	Ilex opaca	American Holly	AQUIFOLIACEAE

Wednesday, May 27, 2015 *Page 1 of 13*

Figure 2.1 First page of the list of species and types found in Maymont's Arboretum.
Source: Maymont

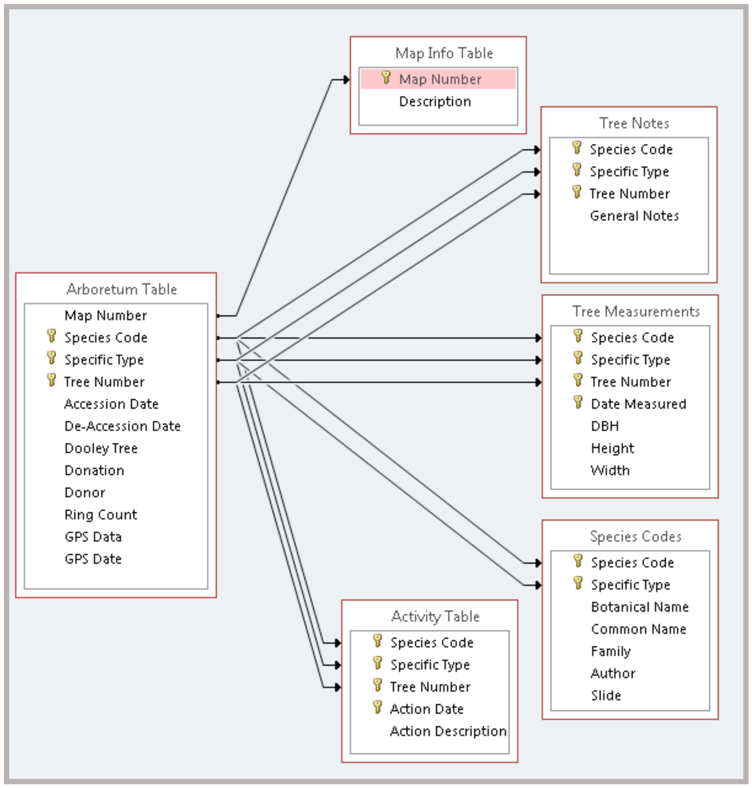


Figure 2.2 Table relationships in the woody plants database.
Source: Maymont

2.2 Maymont Tree Database

Microsoft Access is a database management system (DBMS) that links separate tables of information together using "key" fields. One table may contain columns A, B, and C while another contains columns D and E. If columns A and D contain the same types of values (e.g., numerical species codes), they can be designated as keys to create a relationship between the two tables. Using a DBMS is a convenient way to link together different types of data without building a single bulky and complex table.

In the early 2000s, Maymont created a woody plants database in Access to log its trees and shrubs in a digital format. As of the summer of 2015, there are more than 4,700 individual tree and shrub records, although many of these entries represent specimens that no longer exist in the Arboretum. The database contains three important tables: the *Arboretum Table*, *Species Codes Table*, and *Map Info Table*.

Table 2.1: Arboretum Table

The main table storing all unique information about plant specimens is the *Arboretum Table*:

Field Name	**Data Type**	**Description**
Map Number	Short text	Label for map tile on which plant is located.
Species Code	Number	Unique three-digit identifier for plant species. (002 through 318)
Specific Type	Short text	Alphabetic label for each unique plant forma, cultivar, or variety of a species (A, B, etc.). If the specimen is a primary species and not a specific type, 'sp' is used.
Tree Number	Number	Number of tree for a specific type.
Accession Date	Date (MM/DD/YYYY)	Date specimen was planted.
De-Accession Date	Date (MM/DD/YYYY)	Date specimen was removed, or died, if applicable.
Dooley Tree	Yes/No	Indicates whether tree is original to the Dooley Estate.
Donation	Yes/No	Indicates whether tree was donated or given as memorial.
Donor	Short text	Name of donor or individual/group memorialized.
Ring Count	Number	Number of growth rings counted for trees that have been removed.
GPS Data	Yes/No	Check box for whether geographic coordinates for plant are logged. (Currently unused.)
GPS Date	Date (MM/DD/YYYY)	Date of most recent GPS data collection. (Currently unused.)

Table 2.2: Species Code Table

The *Species Codes Table* lists all of the species and subspecies of plants at Maymont:

Field Name	Data Type	Description
Species Code	Number	Unique three-digit identifier for plant species. (002 through 318)
Specific Type	Short text	Alphabetic label for each unique plant forma, cultivar, or variety of a species (A, B, etc.). If the specimen is a primary species and not a specific type, 'sp' is used.
Botanical Name	Short text	Latin name of plant containing genus, species, and type (if applicable).
Common Name	Short text	Name associated with plant in everyday use.
Family	Short text	Taxonomic family for plant.
Author	Short text	Person or group responsible for publishing botanical name, if known.

Source: Harrison Williams

Table 2.3: Map Info Table

Because Maymont does not use any mapping software to track its Arboretum, the horticulture staff rely on a series of hand-drawn 11 by 17 inch paper maps to plot tree and shrub locations around the Estate. The *Map Info Table* lists the identifiers for the specific maps used, so that each plant may be found on a particular map. Plants are represented by dots with the species and type code next to the point. The *Map Info Table* has two fields:

Field Name	Data Type	Description
Map Number	Short Text	Denotes the number or text code for each map. Maps 01 through 12 are "tiled" across the estate to create a gridded mosaic (**Figure 2.5**). Maps with two-character codes correspond to areas for which more detailed maps have been created.
Description	Short text	Provides full names for each of the following two-character map codes: 'AV' = Aviary 'DC' = Dwarf Conifer 'ER' = Eagle Raptor 'IG' = Italian Garden 'JG' = Japanese Garden 'NC' = Nature Center 'NU' = Nursery 'SL' = Shrub Labyrinth

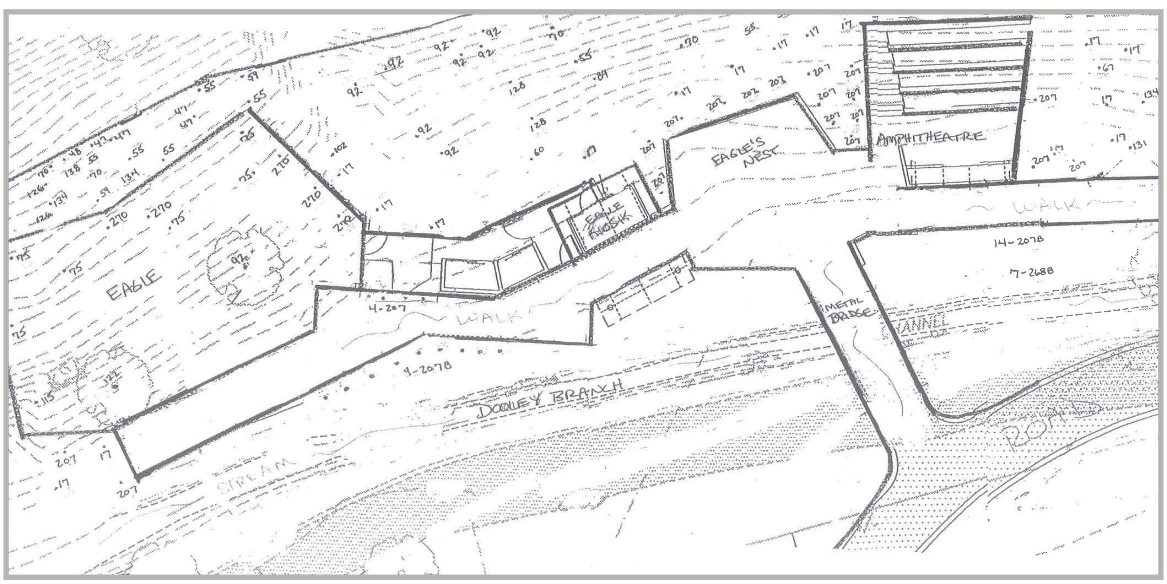


Figure 2.3 'ER' map for trees surrounding the Eagle and Raptor exhibits.
Source: Maymont

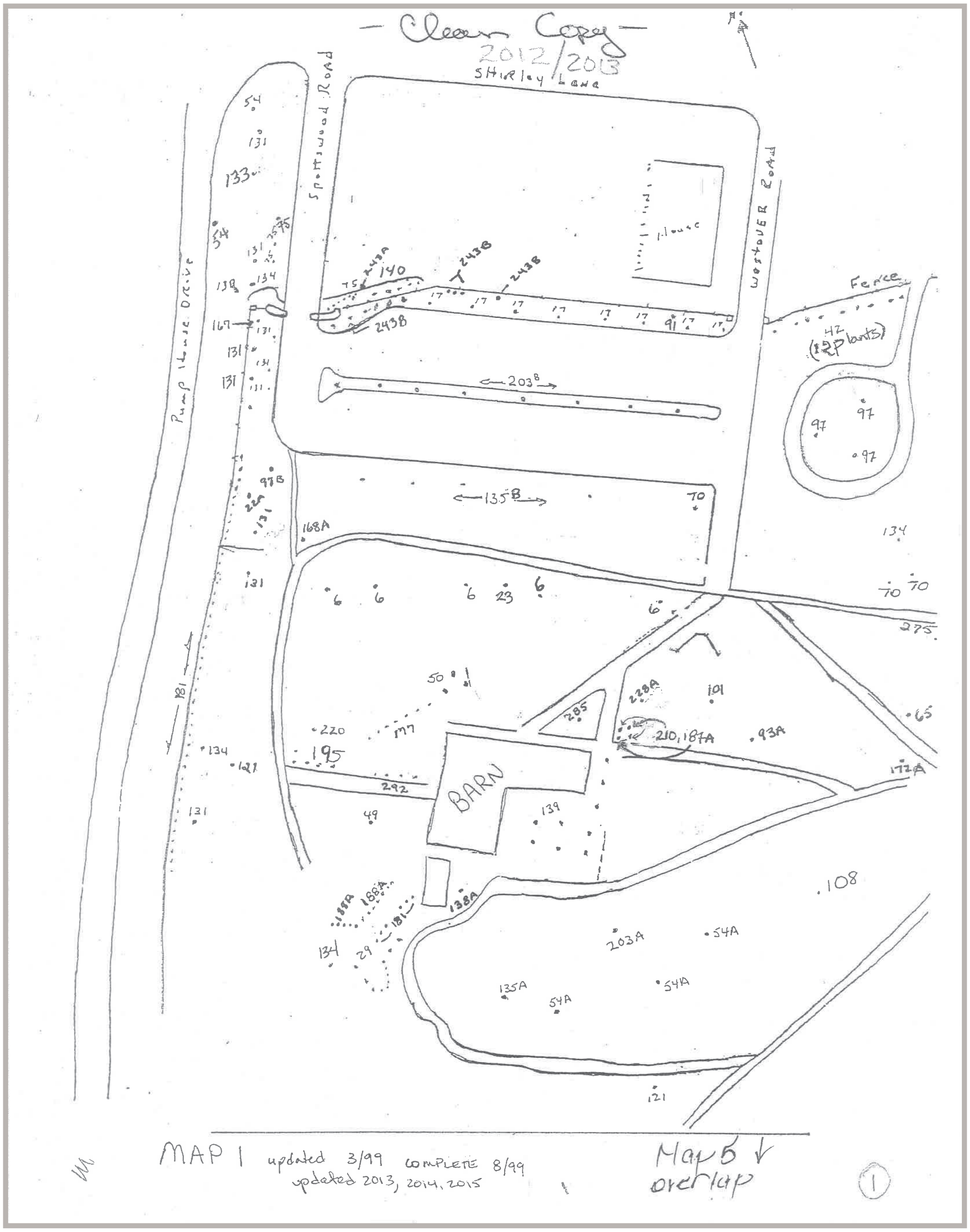


Figure 2.4 Map 01 for trees at the northwest corner of the Estate.
Source: Maymont

2.3 Prior Efforts to Map the Arboretum

From December 2008 to July 2009, several Maymont volunteers used a handheld Trimble TerraSync field computer to log the GPS coordinates for many of the trees around the estate. The volunteers followed a specific series of instructions to ensure that the data collected for each day were consistent with other days. By the end of the project, 37 days were spent in the field and 1,590 trees were geotagged.

For every day that tree data were collected, the volunteers created a new log file in the Trimble to avoid total data loss in the event of a user error or software glitch. Each file was named for the date using a MMDDYYYY format, so that data logged on December 20th, 2008 was stored in a file named *12202008*.

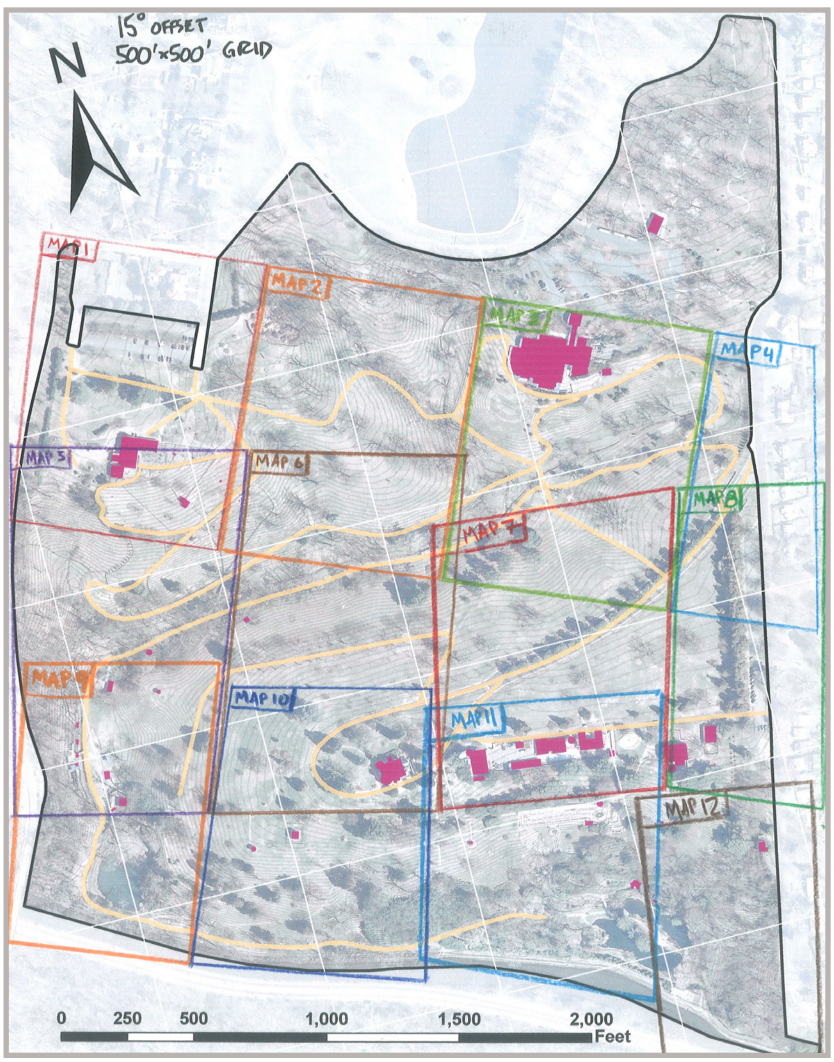


Figure 2.5

Hand-drawn mosaic showing locations of the 12 map tiles currently used to locate Maymont's trees.

Sources: Maymont, Author

Table 2.4: Trimble TerraSync Input Table

Each data file on the Trimble device contained tree records with the following fields:

Field Name	Date Type	Description
Species_Code	Text	Corresponds to original three-digit species code.
Specific_Type	Text	Corresponds to original type code.
Tree_Number	Text	Corresponds to tree's number for specific type.
General_Notes	Text	Comments about the tree.
Accession_Date	Date	Date tree was planted, if known.
De_Accession_Date	Date	Date tree was removed from Arboretum, if applicable.
Ring_Count	Text	Number of growth rings counted for trees that have been removed.
DBH	Text	Diameter of tree trunk at breast height, in inches.
Date_Measured	Date	Date of measurement, in MM/DD/YYYY format. (User-added)
General_Condition	Text	Short description of tree's condition.
Date_of_entry	Date	Date of measurement, in MM/DD/YYYY format. (Automatically logged)

Following the field data collection, a few efforts were made to plot the tree points into desktop mapping software. Volunteers were able to transfer each day's collection onto a computer as a shapefile. A *shapefile* is a standard file format (*.shp*) used by digital mapping applications to store the geographic coordinates of points, lines, and polygons on the earth's surface. These features may then be projected onto existing maps for analysis or publication.

QGIS, a free desktop mapping program that will be discussed more in later sections, was installed with the intention of using the tree shapefiles to assist in horticultural maintenance activities. Volunteers began to create instructions for how to make tree queries in QGIS, but these instructions were never completed.

Unfortunately, the absence of Maymont staff or volunteers with significant experience using GIS data prevented the project from advancing. Other priorities, along with the already high demands of day-to-day maintenance of the Estate, took precedence. Although the Access database continued to be updated annually, the shapefiles sat unused for more than five years.

2.4 Analysis of Existing Conditions

Maymont is in a very strong position to have its Arboretum integrated into a digital map. A vast majority of its trees have already been geotagged and made into shapefiles that can be used in mapping software. In the process of collecting these geographic points, many important tree attributes were also recorded, including species, type, size (DBH), and condition. Therefore, there is no need for staff and volunteers to spend hundreds of hours in the field collecting points to form the foundation for this project.

Figure 2.6 shows these original tree locations projected onto an aerial map of Maymont. These points begin to provide significant insight into the Arboretum's richness and diversity. However, a number of technical barriers preclude an easy migration of existing data to a new map-based system:

- Although data input for the shapefiles was based on tables from the existing database, there is no current relationship between the database and the shapefiles. GPS data is not included in any part of the database.

- While volunteers succeeded in logging over a thousand trees across the Estate in 2008 and 2009, over a hundred have been planted since then, and many trees have been removed or have died. For any new map to be accurate, the shapefiles need to be cross-referenced with the current database to determine which trees need to be geographically tagged and added to the shapefiles.

- In many places, the data lack consistency and uniformity. For example, some date fields include entries with only a year and no day or month. Fields meant for numerals occasionally contain entries with text. Fields with mixed data types are difficult for database and mapping programs to track and analyze.

- A large number of entries are blank or null. Only a portion of the trees have a measured DBH. Many of the original Dooley trees do not have accession dates (because staff do not know when they were originally planted), and even more do not have a recorded condition. However, every tree does have a corresponding species and type, and staff actively update de-accession dates.

- There is no field that distinguishes each plant between a tree and shrub. Although this classification may be determined by the plant's species, it would be far easier to have an additional field that designates each plant as a tree or shrub. This field will be necessary if users want to only view trees.

- Each plant does not have a unique identification number. Instead, an individual specimen is determined by combination of three fields: species code, specific type, and tree number. Combining these fields into a single identifier would help track and plot each tree.

For the proposed Arboretum map to be simple, reliable, and easy to use, these issues need to be addressed and remedied. Still, the data provide a solid foundation for creating the map. There is no benefit from ignoring the database and shapefiles and starting from a blank slate. Instead, this plan will provide the strategies necessary for evolving Maymont's current collections system into a map-based solution for maintenance and public engagement.

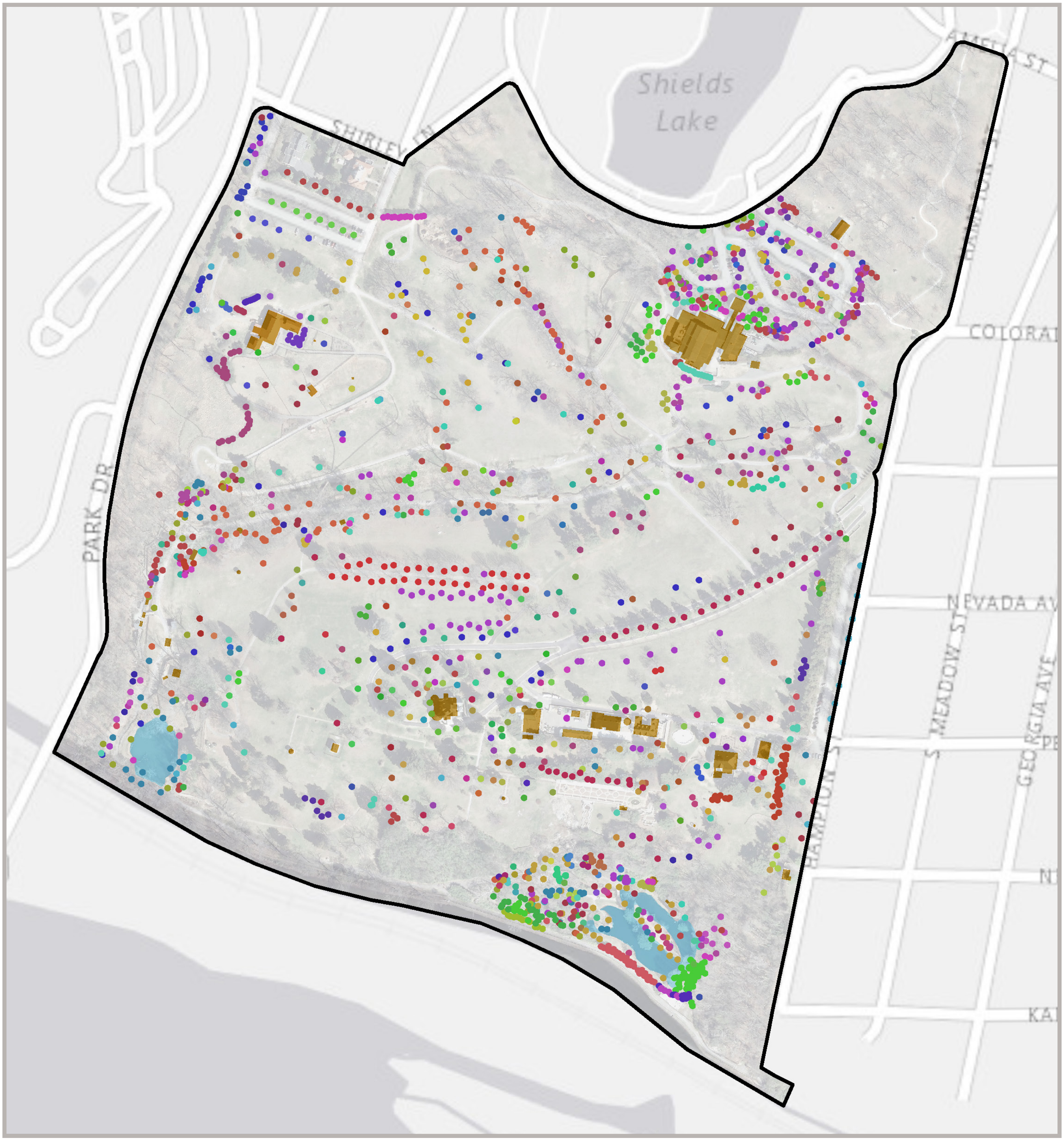


Figure 2.6 Locations of all trees logged by volunteers in 2008 and 2009. Different colors represent different species.
Sources: Maymont, ESRI, City of Richmond GIS

3. Investigation

3.1 GIS and Related Software

A large portion of this plan will be based on the integration of different technologies to create a cohesive mapping system for Maymont's diverse assets. Because there are many options to choose from, this section is dedicated to assessing the types of software available to help determine which ones are best suited for Maymont's needs.

ArcGIS vs. QGIS

GIS does not refer to a specific program, but rather a suite of tools used to collect, store, manipulate, analyze, and publish spatial data (Demers 2009). There are numerous collections of GIS software available, but **ArcGIS** and **QGIS** are the two most prevalent. ArcGIS, the industry standard, is a proprietary group of programs produced by the American company Esri. The ArcGIS suite integrates desktop programs, field data collection software, and web map publishing. It is also very expensive; ESRI commands annual licensing fees for thousands of dollars depending on the range of ArcGIS programs an organization uses.

The most common alternative to ArcGIS is QGIS. First released in 2002, QGIS is a single software program that is free and open-source. The developers have not attached any license fees, so it is free for anyone to download on any computer. As an open-source program, QGIS's code is also freely available for developers to improve upon it, and create diverse and powerful plugins to accomplish a multitude of different tasks.

Maymont needs the new map and database to be sustainable and reliable for the foreseeable future. Although ArcGIS is far more commonly used than QGIS, its high cost presents a significant obstacle for the non-profit Foundation. Therefore, QGIS will be used as the platform on which to base the Arboretum map.

Database Management Systems

As previously explained, Maymont's current woody plants database is housed in Microsoft Access. However, Access lacks the ability to store geographically-referenced spatial data such as shapefiles. Therefore, the database will need to migrate into another DBMS that not only houses spatial data easily, but can also act in a server capacity to allow the data to be accessed by many users at once.

Another free, open-source solution is **PostgreSQL**. Unlike Access, which is a relational DBMS, PostgreSQL is an object-relational database management system (ORDBMS) that allows users to store unconventional objects like photos and videos (Obe and Hsu 2011). In this case, an ORDBMS is necessary so that Maymont can use spatial data as a new "object" in the database and connect the shapefiles with existing tables in the database. Although PostgreSQL cannot handle spatial data on its own, **PostGIS** is available as an open-source extension for PostgreSQL that allows it to store geographic data. Both PostgreSQL and PostGIS are highly compatible with QGIS.

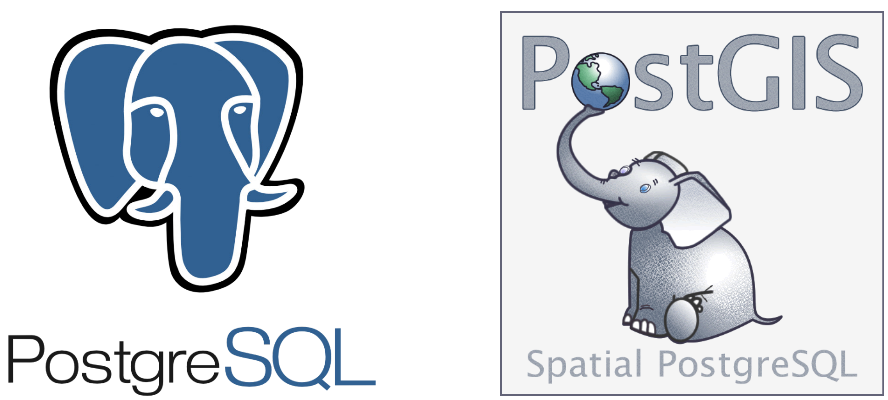


Figure 3.1 PostgreSQL and PostGIS logos.
Sources: postgresql.org, postgis.net

Building Web Map Applications

The combination of QGIS, PostgreSQL, and PostGIS will provide the basic system architecture of a new Arboretum map for internal use by Maymont staff. It will also allow new types of data, beyond woody plants, to eventually be integrated into the map. However, further tools are needed to build and publish an interactive map for the public on Maymont's website.

The recommendations in this section are based on the outline for developing a GIS web application in *PostGIS Essentials* (Marquez 2015). First, **Apache** web server (which is also free and open-source) is installed to house the map application and allow internet users at access it. Next, Microsoft's **PHP** server-side scripting language is installed to provide the programming language needed for client users (the public) to query and access the database on the server. Finally, the web application is designed using tools found in **Leaflet**, a free JavaScript library of interactive mapping features. A plugin for QGIS (*qgis2leaf*) is available to easily customize and export the map's layers into a web application.

The JavaScript code produced by Leaflet will be integrated into the PHP code hosted on the server, which will pull information from the PostgreSQL database. The full script may then be incorporated into a new or existing page on Maymont's website for the public to access the map.

Figure 3.2 Leaflet logo.
Source: leafletjs.com

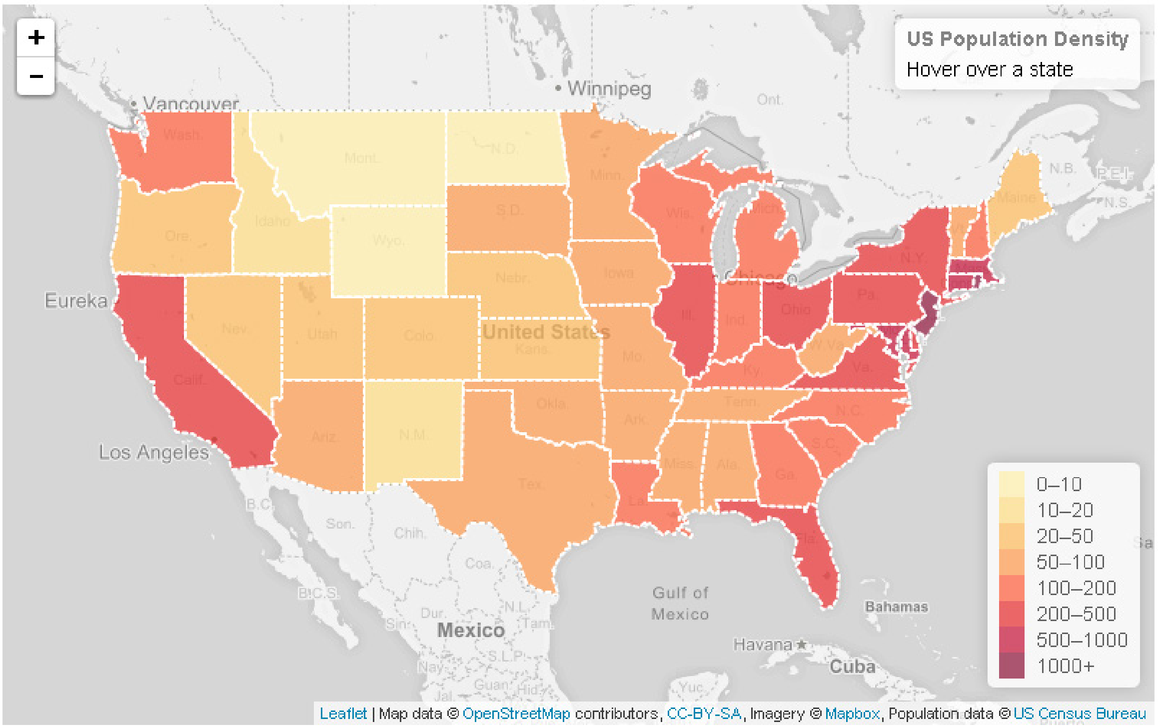


Figure 3.3 An interactive map made using Leaflet.
Source: leafletjs.com

3.2 Case Studies

Although Maymont's needs are as unique as the Estate itself, this plan will draw heavily from two existing attempts to map and inventory similar public spaces. The first demonstrates the benefits of participatory GIS, while the second establishes best practices for a living collections policy specifically developed for a mapping application.

Case Study 1: University of Wisconsin-Madison Arboretum Map

Perhaps the best example of a community-driven public garden map is the one developed by the University of Wisconsin-Madison Arboretum. The project's primary goal was to engage the public by creating a suite of interactive online maps showcasing the arboretum and its various assets (Wallace 2010). Map builders noted that community input was crucial to the map's initial design, and remains vital to its success. For example, the initial stakeholder meeting invited not only professional botanical and cartographic experts, but also members of the general public who would be the map's end users. Input from both groups proved crucial to the map's final design, which offers three unique experiences depending on the user's needs: participating in research and education, planning a visit, or adding their own data.

Following public suggestions, map architects created a space for users to submit their own data, which enhance the entire map experience. For example, visitors can easily pinpoint their favorite spots to view fall foliage or budding flowers, providing staff with valuable phenological information. This user-generated content helps build trust in the system by allowing local knowledge to be incorporated into the digital manifestation of a public institution. However, the designers also noted that general users should not have free reign to edit a large portion of the map's base layers. While the democratization of data was an important goal, guaranteeing the map's integrity took precedence over total public access.

The UW-Madison Arboretum map was purpose-built from the ground up using ArcGIS, XML, Adobe Flash, Photoshop, and Illustrator. Along with ArcGIS, the Adobe products carry expensive license fees. Therefore, while this map database and its coding structure may not be the best for Maymont to reproduce, it shows that a customized system guided by cooperative design is very possible.

Figure 3.4 Screenshot of UW-Madison Arboretum Map.
Source: UW-Madison Arboretum

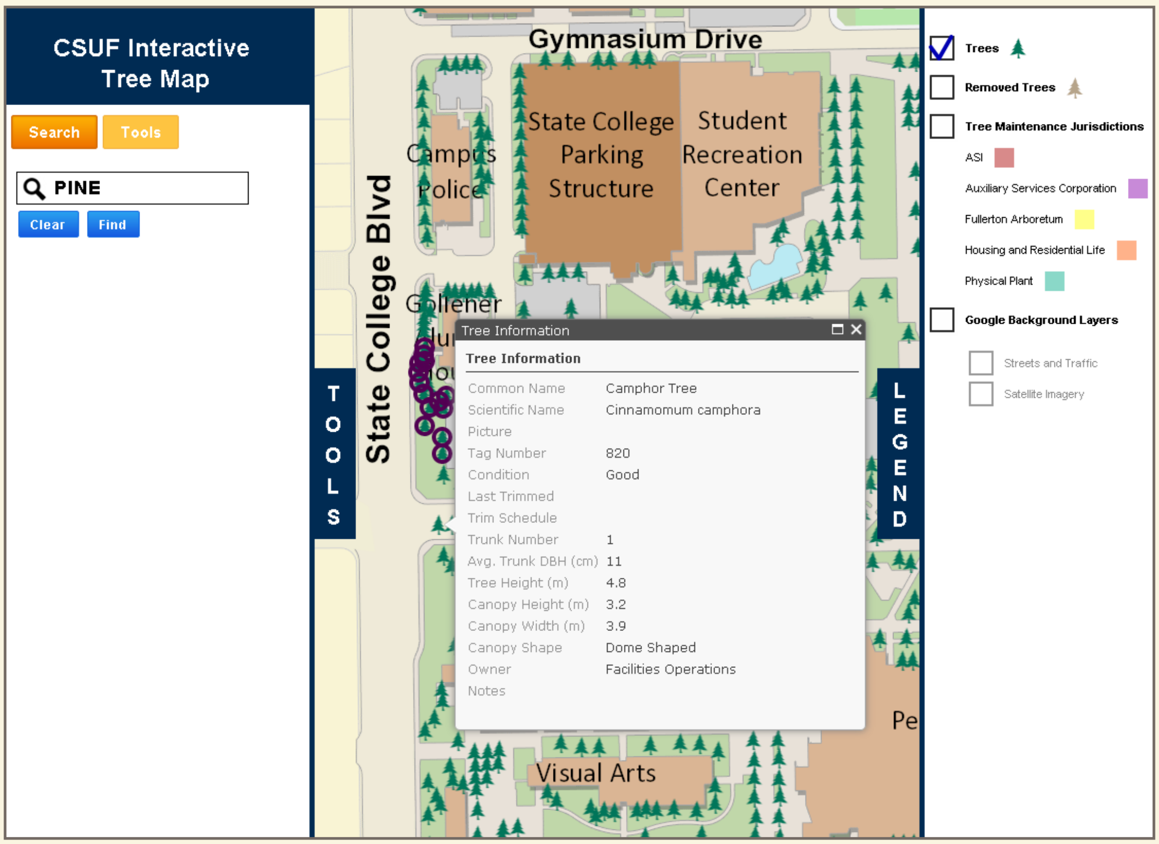


Figure 3.5 Screenshot of CSU Fullerton Campus Tree Map.
Source: CSU Fullerton

Case Study 2: CSU Fullerton Campus Tree Inventory

One of the most critical components of a new woody plants database for Maymont will be a robust data collection plan. The process by which plant traits and locations will be gathered will resemble the methodology developed by researchers at California State University Fullerton who relied heavily on an *enterprise GIS* system to create a campus tree inventory (Shensky 2013). By using enterprise GIS, which stores data on a central server rather than a personal computer, information may be added, edited, analyzed, and published simultaneously by many users.

Once the system architecture is established, the authors recommend deciding what types of data to collect, which will guide the design of attribute tables in the database. Common fields for tree inventories include tree genus and species, cultivar, DBH, and condition. Accession and de-accession dates, which track when a specimen is planted or removed, are also critical variables to collect. However, their plan makes it clear that the types of data gathered may vary greatly depending on an arboretum's distinctive features.

Project leaders for the CSU Fullerton tree inventory also highlighted a constant struggle between three competing interests during their planning process: *cost minimization*, *time minimization*, and *quality assurance*. The plan for Maymont's database will consider each of these important factors and strive to find a balance between them. Furthermore, the authors explained how difficult it was to maintain project momentum due to the significant amount of data to be collected, coupled with a revolving door of student researchers and volunteers. Because Maymont has already suffered from this problem before, special attention will be paid in the plan to ensure the database project is fully implementable and self-sustaining regardless of available staffing.

3.3 Advisory Committee Feedback

Because the proposed map would be used by citizens and groups outside of Maymont, it is imperative that outside representatives help guide the planning process. Therefore, an Advisory Committee of eight local experts was formed in order to learn how the map might be used as an educational tool throughout the Richmond region. Committee members were asked a series of questions about their background and expertise, suggestions for developing the map as a learning device, and the specific design of the map interface. The full questionnaire is included in the Appendix.

Members of the Committee represented a variety of occupations with either direct or indirect involvement in the horticultural community. Several were professors at local universities, some were professional arborists, and others served as volunteers for tree-related organizations. Half had existing relationships with Maymont in some capacity, and a few had attempted smaller-scale tree-mapping projects in the past.

A central theme throughout almost all of the members' comments regarding public engagement was ease of use. The map application should be designed from the ground up to be simple and easy to view for all ages and all levels of technological familiarity. Members also thought the map should specifically target educational audiences in the community by integrating current environmental curriculum, and helping academics identify plants relevant to their research. The map could also be used as a learning tool for horticultural students and tree stewards in training. The overall goal of the map, however, would be to build public support for the appreciation and preservation of urban trees.

Committee members expressed mostly similar views about the map's initial design. They agreed that the most important fields for each tree were its common and botanical names, along with the specimen's origin (native or exotic) and age. Other informative tree traits could be preferred habitat, soil and water requirements, care suggestions, and species that use the plant as a natural host. Most members suggested that the tree should have information that put it in greater context: Why was it planted there? Why is this specific tree important?

Most members highly preferred small "pop-up" windows that display information about a tree when it is selected, as opposed to a static sidebar which might be difficult to view on small screens. Within these pop-ups would be the basic fields about the tree, along with a link to an existing web database with more information about the specific species. However, some members expressed concern that these links might become inactive if the host site changes its URL. Several members also suggested that users should be able to query and search for specific trees by typing in species names.

The most contentious aspect of the map appeared to be whether or not the application should incorporate public submissions of data. While some members argued that users should be able to upload their anecdotes, photos, and comments to enrich the map, others were concerned that Maymont would not be able to easily control users' content. If public input is allowed, it will most certainly need to be moderated and filtered – but Maymont may not have the resources to do it thoroughly and effectively.

4. Vision

Vision Statement

The comprehensive incorporation of GIS and accompanying technologies into Maymont's management operations establishes a future where the Estate's outstanding natural and historical amenities are prominently featured as invaluable local assets, and thus preserved for the enjoyment of many generations to come.

Source: Harrison Williams

Goal 1:
Create a new database and mapping application for Maymont's Arboretum that fulfills the internal tracking and maintenance needs of the organization.

The first goal focuses on redesigning the current database into a powerful, robust, and sustainable system that supports many different uses. The following five objectives are essential for making the database a strategic tool for managing Maymont's collection of woody plants.

Objective 1.1:
Migrate existing woody plants database to a robust platform that supports spatial data.

In order for Maymont's trees and other natural assets to be properly mapped, their corresponding digital records must be catalogued in a software package capable of storing and displaying geographic information.

Time to implement: Months 1-2

Strategy 1.1.1:
Install the necessary programs onto internal computers: PostgreSQL, PostGIS, and QGIS.

Strategy 1.1.2:
Export database from Access into a new PostgreSQL database.

Objective 1.2:
Join existing shapefiles into new database and synchronize data.

Integrating the geographic points already logged for hundreds of Maymont's trees will provide a strong foundation for the Arboretum map.

Time to implement: Months 1-2

Strategy 1.2.1:
Generate a unique tree ID code (*TreeID*) by combining the three identifier fields in both the shapefile attribute table, and the database's Arboretum table: *Species code*, *Specific type*, *Tree number*.

Strategy 1.2.2:
Import the shapefile containing all current tree points into the database using PostGIS.

Strategy 1.2.3:
Use *TreeID* as key to link the shapefile's attribute table to the database's Arboretum table.

Strategy 1.2.4:
Correct field names and data types to be consistent and accurate.

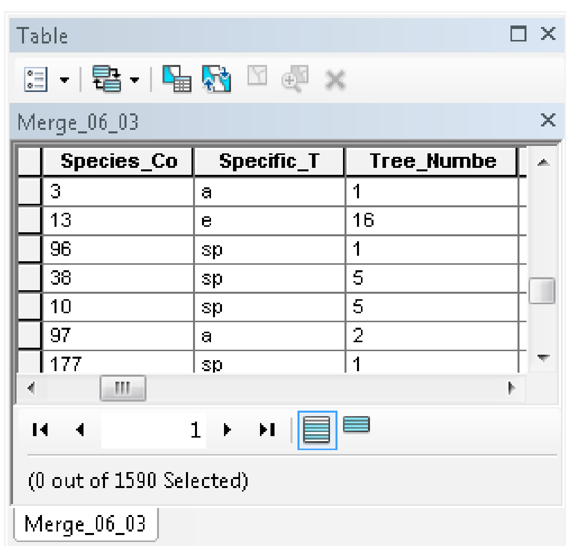


Figure 4.1 The three ID fields for Strategy 1.2.1.
Sources: Maymont, Author

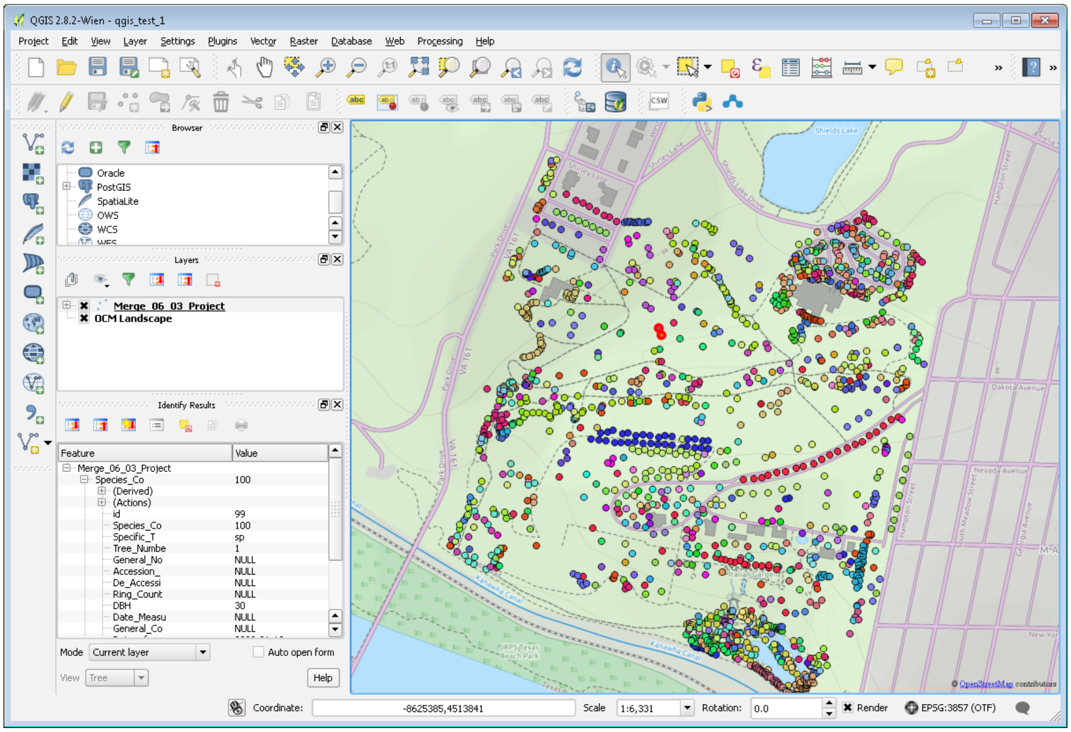


Figure 4.2 QGIS desktop application.
Sources: Maymont, Author

Objective 1.3:

Build a user-friendly desktop mapping platform for horticulture staff to access and edit data.

To make the entry and editing of data more simple and intuitive for horticulture staff, QGIS will act as the front-end software interface.

Time to implement: Months 2-3

Strategy 1.3.1:

Create a new map document in QGIS that pulls its layers from the new database.

Strategy 1.3.2:

Set “map bookmarks” to correspond with the existing paper map tiles.

Strategy 1.3.3:

Utilize a GUI (graphic user interface) application to manage and edit the database. (**TeamPostgreSQL**, a free database viewer/editor, is one potential option.)

Objective 1.4:
Develop reports and queries for staff to track, manage, and assess Arboretum's condition.

In addition to supporting the spatial component, the database must allow staff to search, query, and pull reports from the tables to assist in day-to-day maintenance of the Arboretum.

Time to implement: Months 3-4

Strategy 1.4.1:
Make a list of all current reports and queries used in the Access database.

Strategy 1.4.2:
Export the commands as SQL files to be imported into the new database.

Strategy 1.4.3:
Consult with horticulture staff to determine if any additional reports or queries should be added.

Objective 1.5:
Draft a series of manuals for the operation and maintenance of the new system.

Not all of Maymont's staff and volunteers are experts in GIS or database management. Therefore, a set of clear instructions must be written that help laypersons navigate the new software packages.

Time to implement: Months 1-4

Strategy 1.5.1:
Gather all existing instructions and documents associated with the tree mapping project.

Strategy 1.5.2:
Write step-by-step instruction manuals that explain how to:

- Collect tree points using the GPS device.
- Upload and merge new shapefiles into the database.
- Manually edit the traits and position of trees in the QGIS application.
- Run queries and pull reports from the database.

Goal 2:

Design and develop an interactive web map application to inform and engage the public about the Arboretum.

Once the new database has been established, an interactive web map on Maymont's website will be published that allows the public to digitally explore the Arboretum. This map's success hinges on the following four objectives.

Objective 2.1:

Implement a pilot map on Maymont's website as a proof-of-concept.

The first step in developing an online Arboretum map will be to deploy a stripped down, but operational, web interface that displays the location and information for every tree for which geographic data currently exists.

Time to implement: Months 2-3

Strategy 2.1.1:

Download and install the **QGIS Cloud** plugin for QGIS. The service automatically uploads a map document and its features to a database on the company's servers.

Strategy 2.1.2:

Customize the map interface to allow users to easily find and view the most important traits about each tree.

Strategy 2.1.3:

Provide a link on Maymont's website to the pilot map, and offer a form for users to submit comments and suggestions.

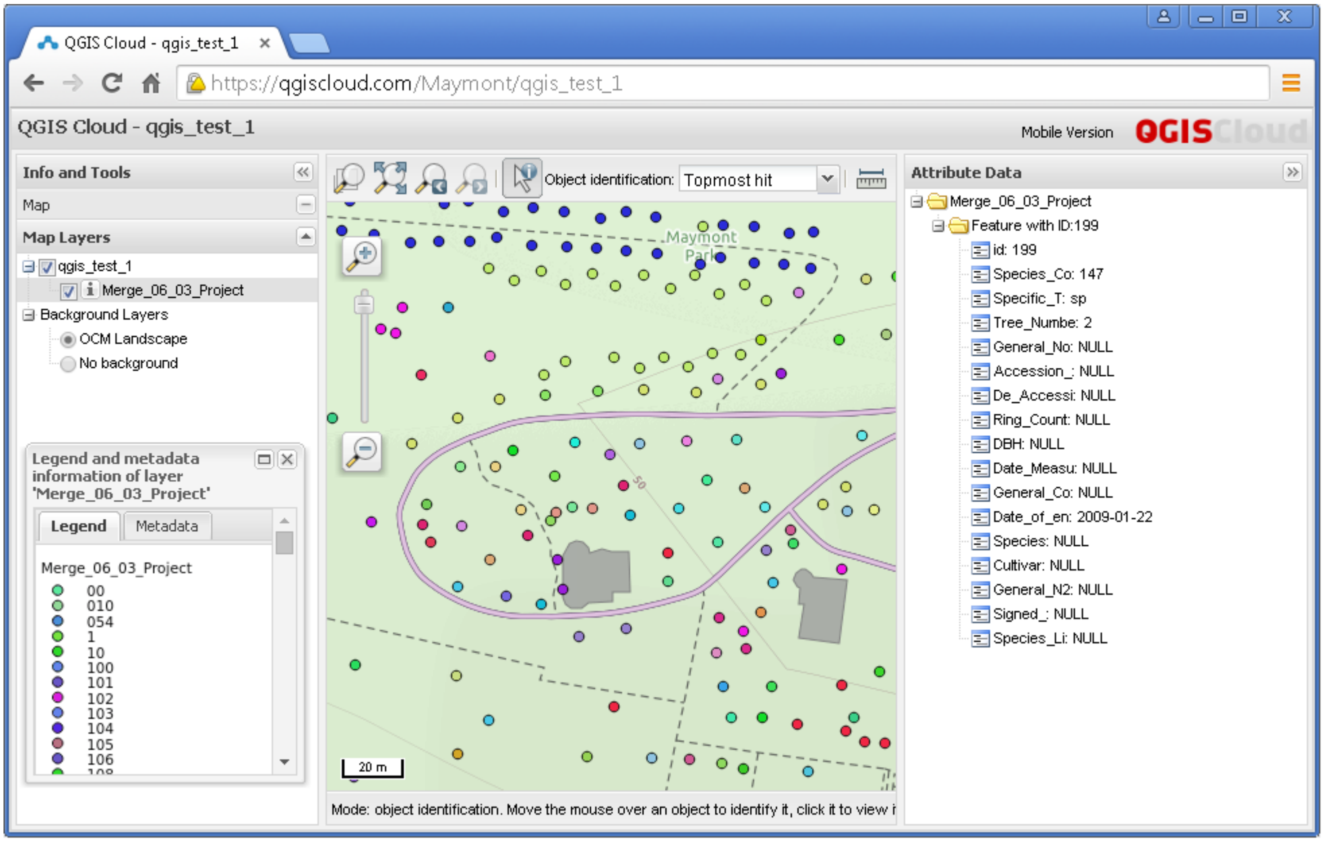


Figure 4.3 QGIS Cloud web map using Maymont tree data.
Source: Author

Objective 2.2:

Begin designing a custom, purpose-built, interactive web map to succeed the pilot version.

Because the pilot QGIS Cloud map has a limited set of tools and features, a new web map for the Arboretum must eventually be designed that has the necessary capabilities to be a powerful vehicle for education and outreach.

Time to implement: Months 3-5

Strategy 2.2.1:

Incorporate suggestions from the Advisory Committee and user feedback from the pilot map to compile a prioritized list of design features and tools for the new map.

Strategy 2.2.2:
Create a new QGIS map document that includes the database's Arboretum data, along with relevant base layers that enhance the end user's experience.

Strategy 2.2.3:
Utilize free, open-source code libraries to assemble a web map application that will take the place of the QGIS Cloud map.

Strategy 2.2.4:
Migrate the Arboretum database, QGIS map document, and map application code to a server.

Strategy 2.2.5:
Embed the web map code into a dedicated page on Maymont's website.

Objective 2.3:
Ensure user-friendliness and simplicity within the application.

The new Arboretum web map should be designed with a diverse user base in mind, including all possible ages, backgrounds, and technical abilities.

Time to implement: Months 4-5

Strategy 2.3.1:
Before the new map is published on Maymont's website, allow a small but diverse focus group to use the application and provide meaningful feedback.

Strategy 2.3.2:
Ensure that the map is operable on mobile devices, so that users without desktop computers have access, as well as on-site guests exploring the Estate on their phones or tablets.

Objective 2.4:
Offer a space for the public to submit their own stories and experiences to the map.

Including a participatory element to the map will encourage users to feel connected to the Arboretum. However, user submissions must not be automatically added; instead, targeted campaigns will ensure high-quality contributions.

Time to implement: Months 5-6

Strategy 2.4.1:
Develop a series of promotions to raise awareness of the new map. Possible campaigns include tree photo contests, favorite Maymont memories from guests, and interesting botanical facts about specific plants.

Strategy 2.4.2:
Include a submission form on the map's webpage that requires users to include their name and e-mail address. All submissions will be reviewed and edited before they are considered for publishing.

Strategy 2.4.3:
Disseminate these campaigns on Maymont's blog and various social media outlets.

Goal 3:

Promote the web map as an educational resource for the local community and beyond.

The interactive Arboretum map should become more than simply a static display of data points. By publically disseminating a massive amount of information to anyone with an internet connection, the map has the potential to become an essential tool for environmental and botanical education.

Objective 3.1:

Identify community partners to help advance the map's mission.

Encouraging local organizations to become more active in Arboretum stewardship will help bolster and legitimize the map's usefulness.

Time to implement: Months 3-6

Strategy 3.1.1:
Inform groups that already have volunteer relationships with Maymont about the map.

Strategy 3.1.2:
Designate map maintenance tasks that could be completed by volunteers.

Strategy 3.1.3:
Solicit research proposals from local schools and universities to utilize tree data.

Objective 3.2:
Begin holding public tree tours using the interactive map.

Maymont should actively demonstrate how guests can use the map to become informed about and engaged with the Arboretum.

Time to implement: Months 6-7

Strategy 3.2.1:
Encourage all future tree tours to incorporate using the map on a mobile device.

Strategy 3.2.2:
Begin cataloguing "self-guided" tours with unique themes that may be incorporated into the map application.

Strategy 3.2.3:
Inspire youth involvement by developing a set of "badges" children can earn for locating a specific series of trees with an educational theme.

Source: Harrison Williams

Figure 4.4 i-Tree Eco logo.
Source: itreetools.org

Objective 3.3:
Calculate and publish the Arboretum's environmental benefits.

Not only is Maymont's Arboretum impressive for its sheer size and diversity, but also for its remarkable environmental benefits, which have not yet been estimated. By determining the value of the Arboretum as a natural asset in an urban setting, the public will be encouraged to support greening measures around the city.

Time to implement: Months 5-6

Strategy 3.3.1:
Utilize **i-Tree Eco**, a free program produced by the U.S. Forest Service, to analyze the tree database and determine the Arboretum's many environmental benefits: carbon sequestration, runoff reduction, pollution abatement, etc.

Strategy 3.3.2:
Incorporate these figures into promotional and fundraising materials to reinforce Maymont's incomparable value to the region.

Goal 4:
Expand the database and map to incorporate many more of Maymont's natural and historical assets.

To truly capture the Maymont Experience, the map and database must begin to include features beyond the Arboretum. By doing so, the relationship between Maymont's natural and historical amenities will be strengthened. Visitors will fully appreciate the planning and stewardship necessary for Maymont to be the remarkable showplace it is.

Objective 4.1:
Log any and all remaining trees using into the database.

Many new trees have either been planted or removed since prior efforts to map the Arboretum ended in 2009. Therefore, Maymont should update the database to reflect current conditions.

Time to implement: Months 2-4

Strategy 4.1.1:
Run a report in the database to list all trees that were not joined to the existing tree shapefile.

Strategy 4.1.2:
Organize a staff and volunteer effort to geotag every tree without geographic coordinates.

Strategy 4.1.3:
Integrate the new shapefiles into the database using PostGIS.

Objective 4.2:
Identify and prioritize new features to be added.

Maymont has many assets that deserve to be mapped alongside the Arboretum, including habitats, wildlife exhibits, and historical buildings. Consolidating these features into the map is a necessary step for providing a digitized Maymont Experience.

Time to implement: Months 5-8

Strategy 4.2.1:
List, categorize, and prioritize all assets that should be added to the map.

Strategy 4.2.2:
Create a new database for each category of features (e.g., buildings, habitats).

Strategy 4.2.3:
Utilize existing City of Richmond GIS data for structures and trails.

5. Implementation

The next page shows **Table 5.1**, which outlines the implementation schedule for the plan. Each goal and its objectives are represented by a colored bar that represents the proposed timeframe for each set of strategies. As the table demonstrates, the plan may be potentially completed within one year. This schedule is dependent on a number of different factors: internal commitment to the project, volunteer availability, and unanticipated technologic challenges are only a few.

The majority of strategies will be completed by Maymont staff and volunteers, precluding the need to hire consultants and contractors. Furthermore, with the exception of a $75 monthly fee for the QGIS Cloud service, this plan does not place any additional financial burden on Maymont.

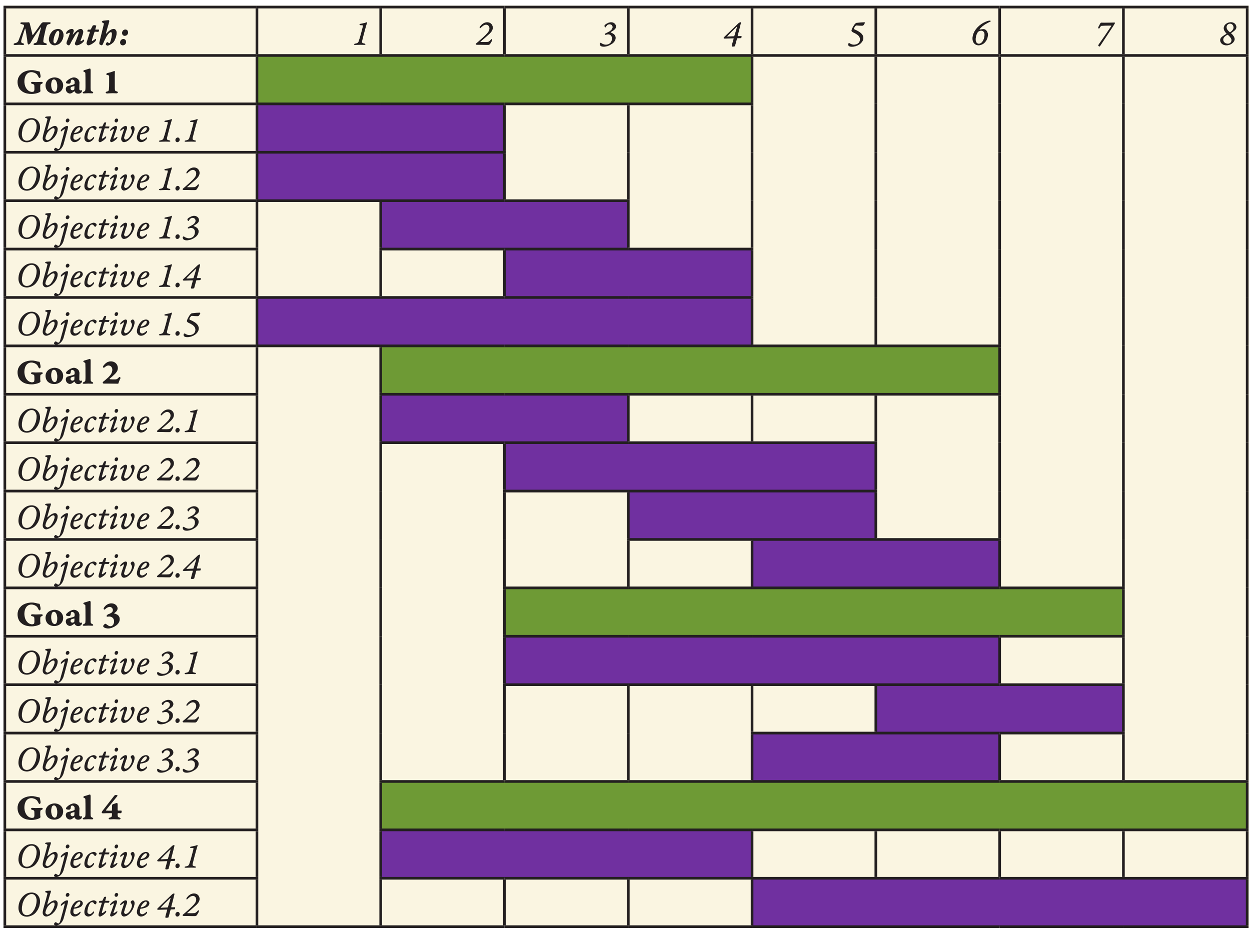
Completion of **Goal 1** is scheduled to take four months from the beginning of the plan's implementation. Since its primary objective is to develop the new database system, the remainder of the plan hinges on its success. Between all four goals, **Goal 2** requires the most advanced technical skills to design and publish the interactive map. Because Maymont will not have a staff member or volunteer working on this project full-time, that portion is expected to take at least five months.

Goal 3 has its start date reserved until the third month to allow the basic database and map structure to be established. Finally, **Goal 4** stretches over the longest time period – seven months – because the collection of new tree points can begin relatively soon, but digitizing new types of data will require much more planning.

No plan can account for every possible issue or problem the future may bring. However, *Mapping the Maymont Experience* aims to be flexible and practical by proposing incremental strategies. Because staff and volunteer efforts fluctuate in all non-profit organizations, this plan emphasizes collaborative cooperation so that the entire project is not abandoned should its main architect(s) no longer be able to work on it.

Maymont has an outstanding opportunity to situate itself as a top-tier public garden by developing a new Arboretum map. Should it pursue the recommendations outlined in this document, Maymont will guarantee that its natural and historical features are consistently recognized as invaluable local assets. These amenities will be available to all via new technologies, and preserved for the enjoyment of many generations to come.

Table 5.1: Implementation Schedule



References

Alliance for Public Gardens GIS. "About Us." 2012, http://www.publicgardensgis.ucdavis.edu/about

Alliance for Public Gardens GIS. "Guide to GIS for Public Gardens." 2013, http://publicgardensgis.ucdavis.edu/wp-content/uploads/2012/12/Guide-to-GIS-for-Public-Gardens-March-2013.pdf

American Planning Association (APA). "Great Places in America: Public Spaces 2011," 2011, https://www.planning.org/greatplaces/spaces/2011

Blackwell, Amy H. "Transforming the South Carolina Botanical Garden." (dissertation, Clemson University, May 2013).

Brown, Greg and Delene Weber. "Public Participation GIS: A new method for national park planning." *Landscape and Urban Planning* 102 (2011): 1-15.

City of Richmond. "RVA Green: A Roadmap to Sustainability." 2012, http://www.richmondgov.com/Sustainability/documents/RVAGreen_ARoadmapToSustainability.pdf

Demers, Michael N. *Fundamentals of Geographic Information Systems, 4th ed*. Hoboken, NJ: John Wiley & Sons, Inc., 2009.

Gough, Meghan Z. and John Accordino. "Public Gardens as Sustainable Community Development Partners: Motivations, Perceived Benefits, and Challenges." *Urban Affairs Review* 49(6) (2013): 851-887.

Marquez, Angel. *PostGIS Essentials*. Birmingham, UK: Packt Publishing, 2015.

Maymont Foundation. "Capital Campaign." 2015, https://maymont.org/support/capital-campaign

Maymont Foundation. "Interpretive Master Plan." Internal document, 2011.

Maymont Foundation. "Maymont Strategic Plan 2008-2013." Internal document, adopted Jan. 17, 2008.

Maymont Foundation. "Shared Values." Internal document, no date.

Obe, Regina O. and Leo S. Hsu. *PostGIS in Action*. Stamford, CT: Manning, 2011.

Shensky, Michael G. "Designing field data collection methods for developing a university enterprise GIS database: an assessment of the California State University, Fullerton tree inventory." (master's thesis, California State University, Fullerton, 2013).

Wallace, Timothy R. "The University of Wisconsin-Madison Arboretum Map." *Cartographic Perspectives* 66 (2010): 31-39.

Appendix

Advisory Committee questionnaire:

MAYMONT
An American Estate

VCU
VIRGINIA COMMONWEALTH UNIVERSITY
L. Douglas Wilder School of Government and Public Affairs

Mapping the Maymont Experience
Advisory Committee Questionnaire

September 2015

Contact:
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Description

Mapping the Maymont Experience is a plan requested by the Maymont Foundation to outline the steps necessary to publish an interactive map on the Foundation's website that showcases its rich assets in history, habitats, and horticulture – known collectively as the "Maymont Experience."

The first step in this process will be to utilize existing data for Maymont's Arboretum (including tree locations, tree species, and accession dates) to produce a trial map displaying this Arboretum information in an easily accessible interface that allows the public to explore one of the best collections of trees in the nation.

Your answers to the following questionnaire will help guide the design of this Arboretum map so that it cultivates a sense of stewardship among both visitors and potential visitors, along with professional and academic communities.

Background

Please briefly describe the following in one to two sentences:

1. Your position and responsibilities at the organization, business, or institution you represent:

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2. Existing partnerships or collaboration you have with the Maymont Foundation, if any:

3. Prior experience with digital mapping tools, if any:

Public Engagement

The proposed Arboretum map should be a platform for the public to learn about the design, diversity, and environmental importance of Maymont's tree collection. Please answer the following questions about public engagement:

4. What features need to be included to encourage public interest in the Arboretum?

5. How might your organization benefit from a digital map of Maymont's trees?

6. How could this map help different groups and communities collaborate with one another?

Map Design

It is crucial that the map be easy to use and navigate, so that users do not need highly technical skills to learn from it. Please answer the following questions about the map's design:

7. In your opinion, what are the most important pieces of information to display about the trees?

8. How would you prefer users view information about a specific tree? (For example, a pop-up balloon or a separate sidebar, etc.)

9. Along with trees, what other types of geographic data would you find useful as the map becomes a more inclusive representation of the "Maymont Experience"?

10. Do you think there should be an option for users to submit their own experiences and content? Explain why or why not.

Additional Comments

Please use the space below to provide any further suggestions or comments for this plan.

Thank you for your time and participation!

Mapping the Maymont Experience