FALL 2024

Defensores de la Cuenca: Inventory Management

COURSE

BMGT490H: Capstone Professional Practicum

PALS

An initiative of the National Center for Smart Growth
Kathryn Howell, NCSG Executive Director
Kim Fisher, PALS Director

AUTHORS

Nour Eloseily
Alexis Faucette
Patricia Guillen
Stirling Supple

UNDER THE SUPERVISION OF

Prof. David Ashley

Dr. Gisela Bardossy

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Abel Olivo, *Executive Director*

Abraham Lopez Trejo, *Programs Director*

Laura Sweeney, *PALS Graduate Assistant*

ABOUT PALS

The Partnership for Action Learning in Sustainability (PALS) is administered by the National Center for Smart Growth at the University of Maryland, College Park (UMD). It is a campus-wide initiative that harnesses the expertise of UMD faculty and the energy and ingenuity of UMD students to help Maryland communities become more environmentally, economically, and socially sustainable. PALS is designed to provide innovative, low-cost assistance to local governments while creating real-world problem-solving experiences for University of Maryland graduate and undergraduate students.

Defensores de la Cuenca:

Final Paper

Defensores de Quest

Nour Eloseily

Alexis Faucette

Patricia Guillen

Stirling Supple

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I. Introduction

Client

Defensores de la Cuenca (Watershed Defenders) is a Latino-led nonprofit organization that connects Latinos and Spanish speakers to nature through shared experiences and opportunities to preserve and defend the Chesapeake Bay watershed for a healthier mind, body, and soul. It aims to build a network of Latino leaders who expand environmental stewardship among the Latino community, highlighting nature's benefits to one's well-being. Through family-friendly events and tree-planting programs, Defensores de la Cuenca provides a platform for the Latino community to share their passion and talent for nature and the environment.

Through this project, the Quest team gained a comprehensive understanding of Defensores de la Cuenca's operational workflow for their tree ordering process. This process begins with securing funding and grants from local and government sources to purchase native trees for underserved communities. Tree ambassadors, recruited from the local community, are then hired to identify eligible tree hosts. Tree hosts are at the heart of Defensores de la Cuenca's mission to foster environmental stewardship and equity in underserved communities; they are surveyed by ambassadors to identify the desired and best-fit trees for their homes. From there the executive team coordinates with their supplier, Clear Ridge Nursery, to place bulk orders, which are processed and delivered to Defensores' inventory management site within 24-48 hours. Once received, the trees are organized and prepared for delivery to tree hosts' homes, ensuring a seamless and impactful distribution process that aligns with the organization's mission.

Problem Statement

After analyzing our client's operations, the team identified three points of focus: tree ordering, tree storage, and tree planting. In their tree ordering process, Defensores de la Cuenca purchases trees in bulk amounts. The main concern with this system is that without a formal process to determine which trees have been ordered, the client is at risk of purchasing extra trees, leading to cost inefficiencies.

Next, in the current tree storage system, the client doesn't take inventory of the trees stored in their nursery. Ideally, trees are stored for no longer than two weeks, however, without an inventory process, there is potential for trees to be left in the nursery for a long period of time, making them no longer viable to be planted and wasting resources.

Lastly, in the tree planting system, a vital part of the client's process is ensuring that tree hosts properly care for their trees. Due to the number of hosts Defensores de la Cuenca communicates with, the team found it important to ensure the client has a system to reduce the time it takes to locate a tree host.

The team's goal is to address these challenges by focusing on cost reduction, inventory accuracy, and time efficiency, ultimately enhancing Defensores de la Cuenca's ability to carry out its mission effectively. By implementing these improvements, Defensores can continue to expand its impact, fostering environmental advocacy and instilling cultural pride within the Latino community, leaving a legacy of stewardship and connection to nature.

II. Scope

Defensores de la Cuenca presented the team with an opportunity to create an automated system to track their tree planting process. The main goal of this interface is to create a dynamic internal inventory system that will focus on three areas: cost reduction, inventory accuracy, and time efficiency.

The interface has two main features that will consolidate Defensore's inventory information. The first is an inventory page that the client can use to track how many trees have been requested, how many have been ordered, where the trees have been planted, and for how long the trees have been planted. These inventory pages will be created as a dashboard using Apps Script. Since Defensores currently uses a Google Form to intake information from the tree hosts that is then automatically populated to a Google Sheet, using Google Apps Script allows the team to more efficiently connect the main Google Sheet to the dashboard. This method will also lead to fewer changes in the current system, to avoid any confusion.

The second feature in the interface is a map, which will add a visual aspect to the system. The map's main purpose is to give the client quick access to vital pieces of information based on five key features: name, address, tree ambassador, phone number, and total trees ordered. The map will be created and implemented into the dashboard through Google Awesome Table, which will populate directly from the Google Sheet that Defensores currently uses.

To ensure the interface's seamless transition between the team and Defensore de la Cuenca, the team will provide a user's guide detailing how to use the dashboard to find information efficiently. The user's guide will include a video explanation of populating the spreadsheets on the interface, as well as how to troubleshoot errors that may occur.

III. Approach

Stakeholder Interviews

To better understand the inventory management challenges, the team began by interviewing the executive members of Defensores. Early in the partnership, through weekly meetings, the team identified the pain points in the current inventory management system. After pinpointing the key needs, the team conducted further stakeholder interviews, focusing on the executive member most involved with the inventory management—Svetlana. These discussions led to the decision to create a dashboard for the inventory tracking tool. Moreover, the interviews with Svetlana helped the team identify the crucial functionalities and features that would maximize the dashboard's value.

Through a stakeholder interview with an executive member, Amanda, from Clear Ridge Nursery, Defensores de la Cuenca's supplier, the team gained valuable insights into their tree ordering and delivery process. Orders typically begin with an email or phone call, where Defensores specifies the type and size of trees needed, often native species like maples, oaks, magnolias, redbud, and river birch in five- to seven-gallon sizes. Amanda explained that the nursery checks inventory and sends a proposal before converting the order into a sale invoice. Once confirmed, trees are removed from inventory, and preparation begins. Smaller orders are ready within 24 to 48 hours, while larger orders, such as ~500 trees, may take three to four days. Delivery, which is standard for Defensores, is scheduled to their Bladensburg location, with shipping fees based on mileage. Payment must be completed before delivery.

Amanda emphasized that quality assurance is a critical part of the process. Trees are inspected for pests, damage, or other issues at multiple stages, including pulling, loading, and delivery. They are tarped to ensure they arrive alive and in excellent condition. While tagging services are available for customization, Defensores typically opts not to tag every tree. Grants managed on Defensores' side often fund these orders, but the nursery isn't directly involved in grant processes. Amanda's insights highlighted the efficient collaboration between Defensores and Clear Ridge Nursery to ensure the delivery of high-quality, native trees that support their environmental initiatives.

The team conducted a final stakeholder interview with Danny Laurence, the Vice President of Engineering at Team Engine at the University of Maryland. Laurence gave the team advice on how to best approach creating the dashboard, which helped the team refine the dashboard options.

Dashboard Research

After interviewing the executive team to understand their priorities for the inventory tracking dashboard, the team explored various dashboard creation tools, focusing on three options: Tableau, Power BI, and Looker Studio. While they are similar, the team wanted to identify which one would meet most, if not all, of the Defensores' needs.

The dashboard needs to focus on three areas: cost reduction, inventory accuracy, and time efficiency. Additionally, the tool needs to visually track the exact location of each tree planting and include filtering options.

With these priorities, the team researched each tool's functionality to ensure all requirements were met. They focused on specific features: first, whether the dashboard allowed the executive team to update information, improving organization and accuracy; and second, whether it could generate a dynamic map that automatically updated with new data that could be filtered by category, allowing for greater efficiency as trees are planted. Finally, the team considered the cost of each tool. As a nonprofit organization, Defensores has limited funds and resources. Thus, the team focused on finding a tool that could provide the necessary functionality while minimizing costs.

The team researched several dashboard tools with cost and functionality in mind. Tableau, at $70 per month for nonprofits, would add an $840 annual expense, making it expensive. Power BI, at a more affordable $3 per month, seemed promising but had significant limitations, such as restricted map functionality (e.g., no filtering capabilities) and limited dynamic capabilities for real-time data updates. Looker Studio, available at no cost through Google Suite, which the client has access to, was also considered but offered minimal map functionality and lacked the dynamic features the client required.

Because these tools didn't fit the client's needs, the team decided to create the dashboard through Google Apps Script, which gave Defensores more flexibility in what could be added to the dashboard and keep the same structure they have for tree planting. The Google Apps Script would connect to a Google Sheet of the responses, gathered from a Google form, from people who would like a tree. From there, the dashboard will consolidate that information with the grants and tree orders information that is currently scattered across different sheets. This approach will increase organization and efficiency.

Additionally, the map would be created through a Google tool called Awesome Tables that can show the locations of each tree planted and can be filtered based on the tree host's name, address, tree ambassador, and total trees.

Dashboard Development

Once the method to create the dashboard was selected, the team began the dashboard development process.

The first step in dashboard development was creating a low-fidelity wireframe (Appendixes B through E). The low-fidelity wireframe captures the dashboard's main features as outlined by the client. This wireframe served as a starting point and a reference throughout the dashboard's development, helping the team ensure it met the client's needs and adhered to the objectives outlined in the scope.

Once the client approved the wireframe and identified features to change or add, the team began to develop the dashboard using the Google Apps Script platform. The first step was to ensure that the data from the Google Sheet of tree requests was populating the dashboard. Once the data was populating properly, the team added features that would interact with this data to create real-time changes. Additionally, the dashboard's overall structure was created. Working on the low-fidelity wireframe dashboard before a high-fidelity dashboard wireframe was approved allowed the team to meet the end of the semester deadline.

Once the structure was created and populated with data, the team created a high-fidelity dashboard wireframe to better map specific features and how they would show up on the dashboard (Appendixes F through J). It allowed the clients to see the end design and structure of the dashboard, giving them an opportunity to make changes or additions that would better meet their needs.

Once the high-fidelity wireframe was confirmed, the team continued creating the dashboard on Google Apps Script, gathering feedback from the team through the weekly meetings. The team completed dashboard development which then went through the final stage of stakeholder testing.

Stakeholder Testing

Because the team would provide the client with tangible deliverables, it was important to conduct stakeholder testing as the dashboard progressed, from the initial wireframe to the high-fidelity wireframe, and progress on the actual dashboard. At weekly client meetings, the team presented their progress, demonstrating how the dashboard would enable real-time updates and dynamic interactions, allowing the client to track and adjust data seamlessly as new information became available. Additionally, the meetings were an opportunity for the client to give feedback and suggestions. Providing the client with dashboard updates ensured the team

was on the right track to meet the project scope and provide a useful quality tool at the end of the semester.

The final step in stakeholder testing was giving the clients the finalized dashboard for comments on functionality, design, and overall usability to ensure it met expectations and addressed their needs effectively. In this final round of stakeholder testing, the team focused on finishing touches and small changes. Once the team had completed all necessary testing and updates, the dashboard was ready to be transitioned to the client.

User Guide Development

For a smooth transition and handoff, the team created a user guide in both a written and video format that helps the client understand the dashboard basics and how to implement relatively straightforward changes to it. The team worked with Defensores to include their priorities in the guide, ensuring it would most effectively aid in navigating and updating the dashboard once handoff is complete.

IV. Final Deliverables

Throughout the semester, the Defensores de Quest team has worked to create quality and impactful deliverables that address the client's needs as outlined in the problem statement—to more efficiently manage and organize their inventory so they can pursue their mission. Along with the client deliverables, the team also prepared course deliverables throughout the semester, starting with a Status 1 Presentation and ending with a Final Presentation and Final Poster to be presented at the University's biannual QUEST conference and a Final Paper that explains the work completed over the semester.

At the end of the semester, Defensores de Quest will leave the client with two tangible deliverables: a fully functioning dashboard with a map and a user guide to help with small adjustments or additions to the dashboard.

The dashboard aims to consolidate the client's inventory information, which is currently scattered across various Google Sheets. This consolidation helps address inefficiencies and confusion caused by longer pre-processing times. The dashboard will automatically pull all tree requests, enabling the client to update their status, check if the request falls within an underserved area (a key requirement for most grants), and add relevant notes.

New tree requests are dynamically added to the linked Google Sheet as users complete the associated Google Form. Data from the Google Sheets will automatically populate the table on the Tree Requests page. The table relays basic information about the tree request—who made the request, how many trees they want, and the ambassador who helped them.

In addition to that information, the dashboard adds three new columns: Status, Underserved, and Notes. The Status column allows the client to select the stage of each request in the tree planting process. The Underserved column indicates whether a tree request address is in an underserved area, a requirement of many Defensores' grants, as defined by environmental justice standards. The Notes column allows them to add any notes about the tree request. Searching and filtering capabilities allow users to more quickly and efficiently identify specific tree requests.

Finally, the Tree Requests page contains an inventory tracker that consolidates the information on trees ordered, trees requested, and trees planted. The table tracks as new trees are requested, planted, and as trees are removed from the inventory holding area. This table allows the executive team to see their progress toward completing the tree requests, making sure they are keeping up with requests and reducing the risk of trees not being planted at tree host locations. Additionally, the inventory tracker helps the executive team track how many trees are still held in the inventory holding area, reducing the likelihood of trees being left behind and dying. Overall, the inventory tracker provides a way for the executive team to stay organized and manage their tree planting process and inventory.

To prioritize grant funding, tree requests in underserved areas are added on a separate page. This page displays similar information to the main table and adds information on the quantity and types of trees requested. Additional fields are added to assign relevant grants and add notes. The grants that can be selected will be the grants the client has added to the Grants page. Using a dashboard form, the client can input grant details such as name, number of trees required, total funds awarded, applicable zip codes, and, if applicable, end dates. Once submitted, the table automatically tracks the number of trees planted and the total remaining for each grant.

Like the Grants page, the Tree Orders page allows the client to input orders through a form that is then populated in a table. That information will then be used to determine how many trees are in the holding area and how many have been taken out to be planted, displayed on a different table.

Finally, the Follow-Up page, a recent client request, helps track post-planting activities. Once a tree request's status changes to "planted," it's added to this page. The client can record details such as the planting date, check-in dates, the number of trees that died, and any relevant notes. The dashboard supports up to four check-ins per tree, but the user guide provides instructions for adding additional check-ins if needed.

To implement a visual aspect into the dashboard, the team has included a map that will allow the client to access vital pieces of information quickly. The map populates directly from Google Sheet that Defensores currently uses to sort information on the tree hosts. When the client views the map on the dashboard, red location pins mark the locations of tree hosts who have made a request. Clicking on a location pin, leads to information on who the tree host is, how to contact them, which tree ambassador worked with them, their location, and the total number of trees requested. Using keywords, the map can also be searched for a specific tree host. Beneath the map are filters that allow the client to locate a tree host by searching their name, address, or phone number, or finding hosts based on their tree ambassador or the total number of trees ordered.

The final deliverable is a video and written user guide demonstrating how to operate the dashboard, update table data, and understand the impact of changes made directly in the linked Google Sheets. This guide enables the client to make minor adjustments without overhauling the dashboard.

The video explains the dashboard's direct link with the Google Sheets and how dashboard changes are reflected in Google Sheets and vice versa. This ensures that if there's an issue with the dashboard, the dashboard information is still stored and accessible by the executive team. Additionally, the video guide will show how to make relatively straightforward and simple changes to the dashboard such as adding new columns to the tables, customizing the statuses, and adding new tree types to the order form.

The executive team also asked that the video guide show how to add new options to the order form, since they hope to sort tree types by size, and how to add a new page to display other information. Finally, the video guide will show how the client can use AI to implement further changes beyond those covered.

In the written format, the user guide will have two main sections. The first section will explain the dashboard's basic functionality. If the client has a question on how to navigate any area of the dashboard, they can reference the user guide for assistance. Also, if there's a change in who manages the dashboard, this section will help a new user understand its functionality and ensure a seamless transition.

The user guide will also describe Google's Awesome Table Map and how updating the Google sheet populates the map. The guide will also outline pricing details and the benefits of premium features, which include the ability to embed code for a more personalized map. As Defensores de la Cuenca expands, investing in a premium map version may deliver increased organization and efficiency.

V. Impacts

The team's design seeks to maximize impact for the client. At the start of the semester, the team analyzed the organization's process flow and came up with the idea of a dashboard to increase the client's program productivity. When interviewing stakeholders on the executive board, the team found that one woman was spending hours every week manually inputting data. In their brainstorming, the team sought to streamline this procedure. The team implemented the dashboard and the map, enabling the client to cut in half the time to input and organize data. This will be revolutionary to their workflow and allow time to be allotted to other things.

In addition to time savings, the team analyzed how the process would be affected by any change. Currently, trees are stored in a nursery before they're planted. The client often doesn't know which trees are stocked and which need to be ordered. This leads to long waiting periods between the trees being delivered and planted, and trees are lost or go bad in the holding facilities. With the dashboard and map, the client will be able to track a tree's important milestones—when it's ordered, planted, etc. This inventory tracking will save the organization from tree spoilage, give customers more accurate delivery estimates, and create consistent tracking patterns.

Implementing the dashboard and map will save trees from spoilage and consequently save ~$60 per tree, based on information from the client's invoices. The savings will allow that money to be spent elsewhere, larger order quantities, and quicker service for customers.

These impacts will help improve the organization and help it grow. The dashboard and map will save time and money, enhancing the client's ability to fulfill their mission of connecting underrepresented communities to the environment and providing Latino families in the Chesapeake Bay watershed area with essential resources.

VI. Next Steps

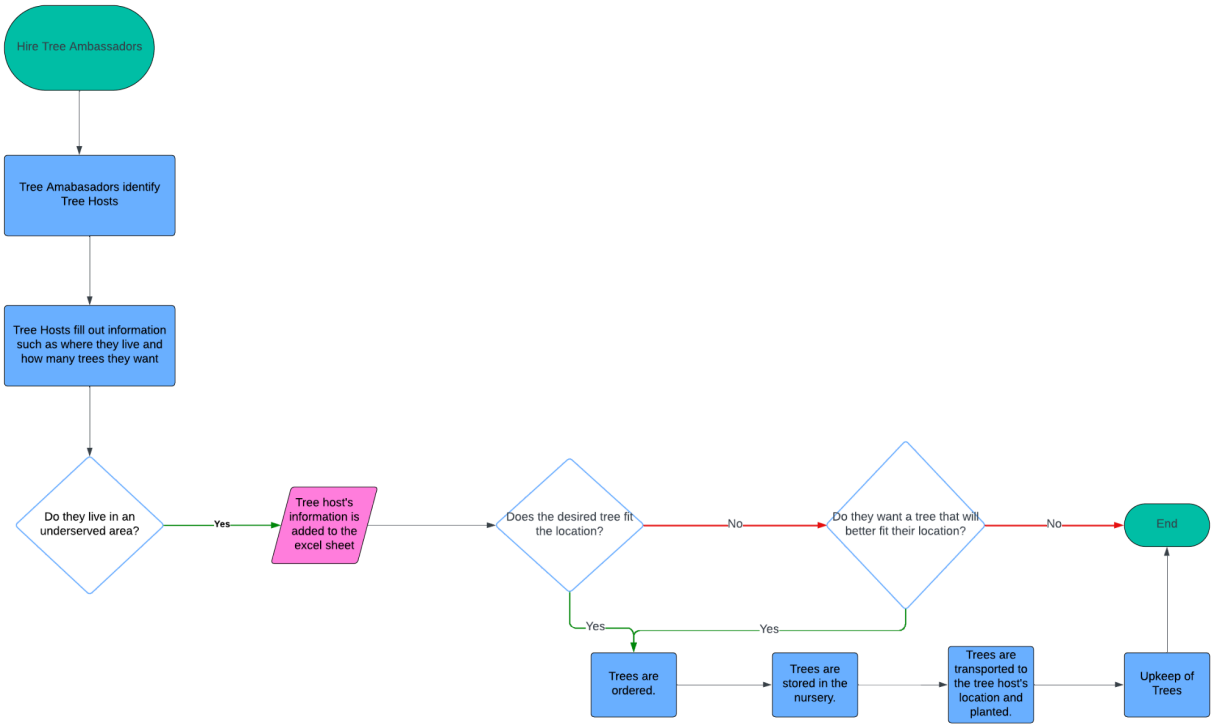
To officially conclude the project, the team has finalized all dashboard components and handed it off to Defensores de la Cuenca. The dashboard code has been added to their Google Sheet of tree requests, and the accompanying user guide has been provided in both written and video formats.

Defensores can now use the dashboard and integrate it into their tree planting workflow. The user guide has been designed to enable them to independently manage and update the dashboard as their needs evolve, including adding new tree types, creating additional forms, or implementing new features.

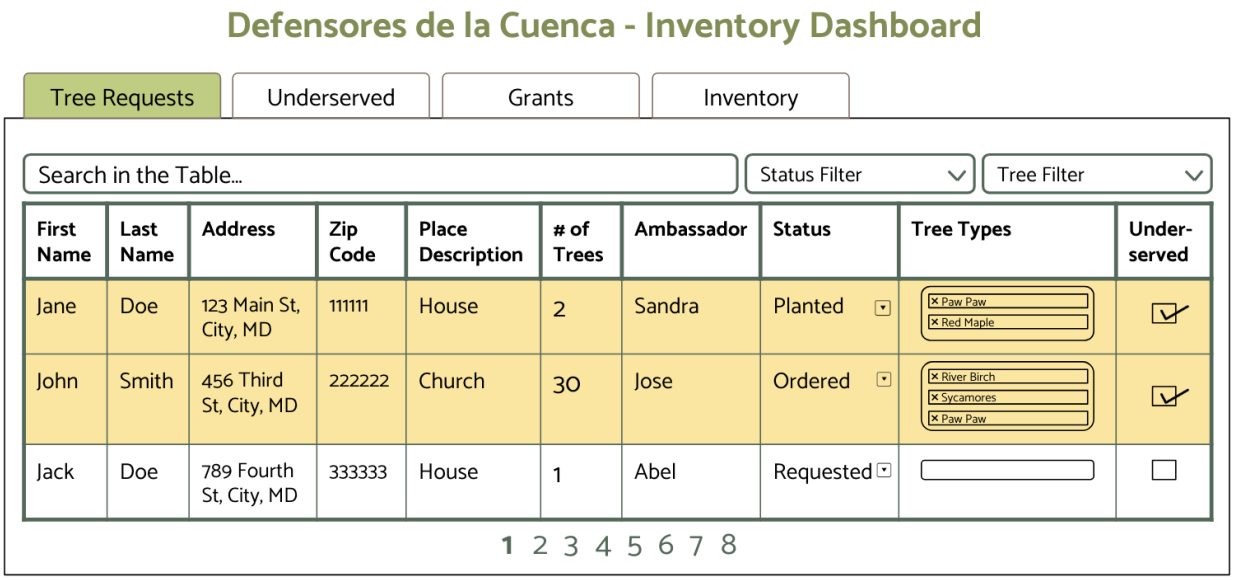
While the dashboard is ready for immediate deployment through Google Apps Script, the team will remain available to answer last-minute questions or provide clarifications as Defensores begins using the tool. The dashboard and map are ready to streamline operations, enhance efficiency, and ensure a seamless transition into the organization's day-to-day processes, aiding Defensores in their mission to bring nature to Latino communities.

VII. Appendix

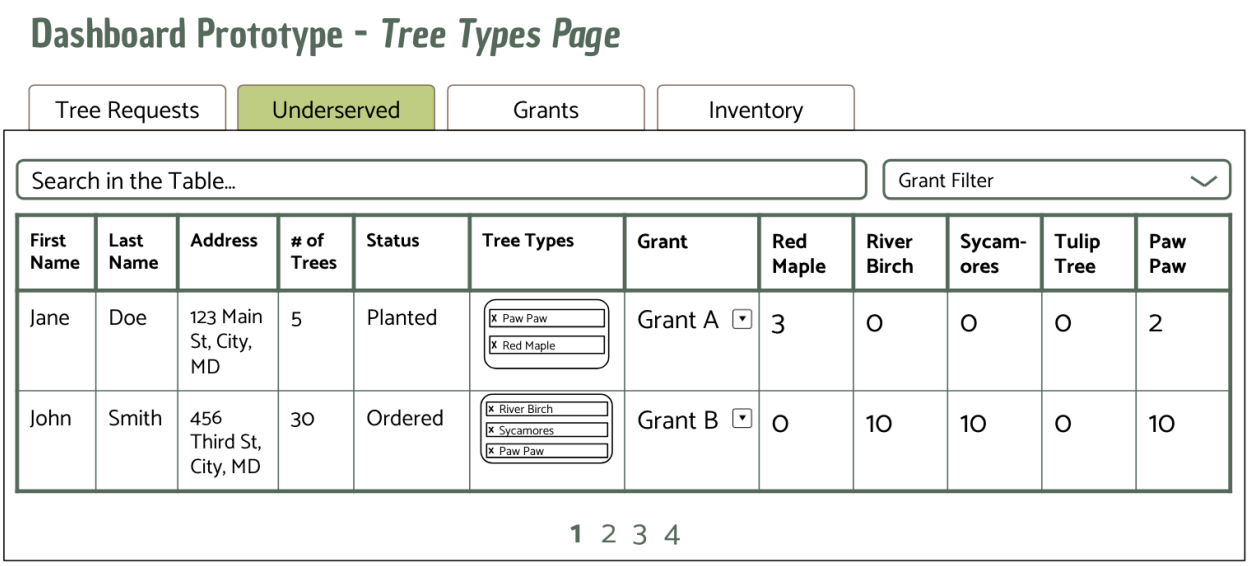
Appendix A: Process Flow Diagram



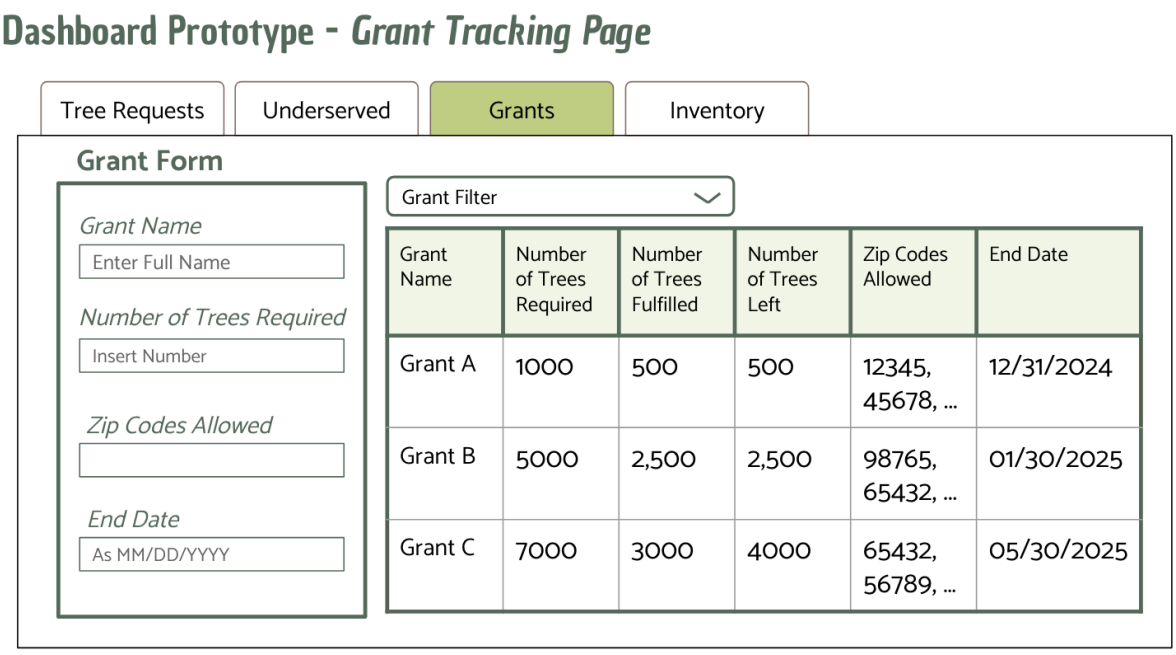
Appendix B: High-Fidelity Wireframe - Tree Requests Page



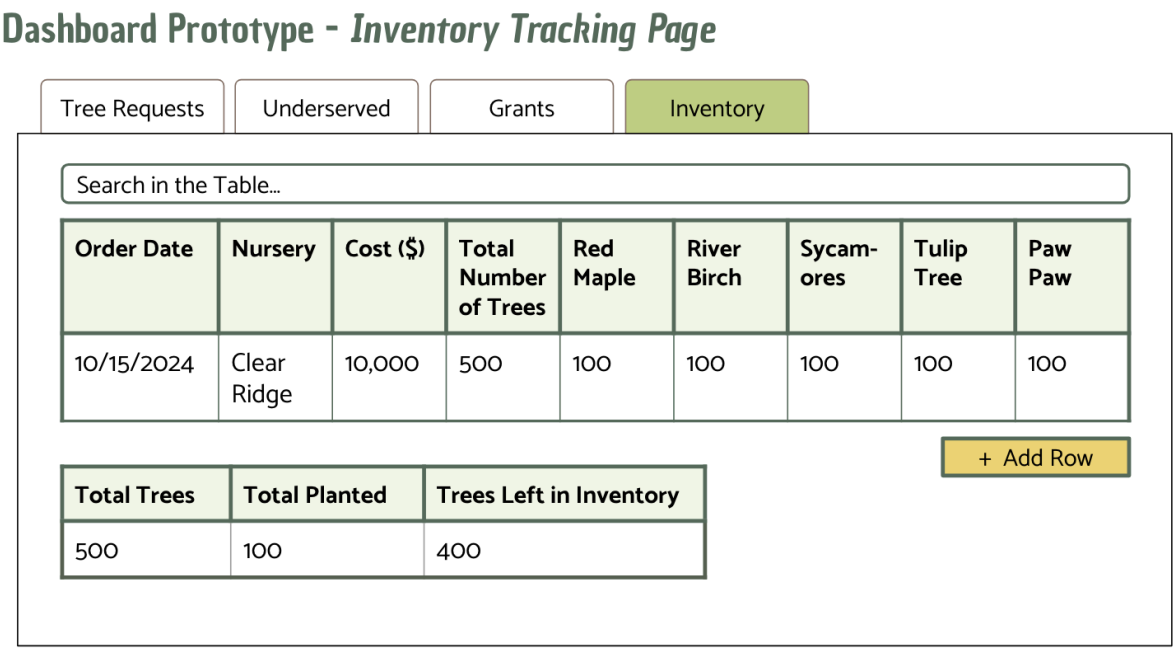
Appendix C: High-Fidelity Wireframe - Underserved Tree Requests Page



Appendix D: High-Fidelity Wireframe - Grants Page

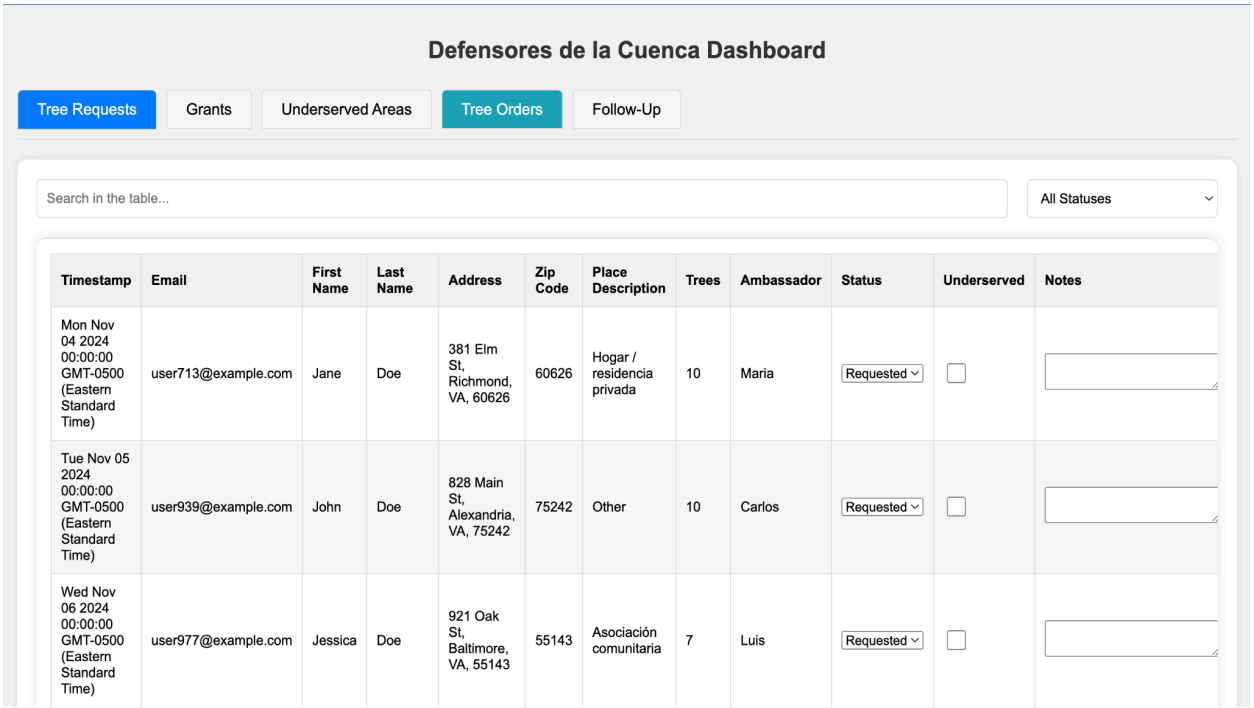


Appendix E: High-Fidelity Wireframe - Inventory Page



Appendix F: Final Dashboard - Tree Requests Page

(The information in this dashboard is not real and used only to show the dashboard's functionality.)



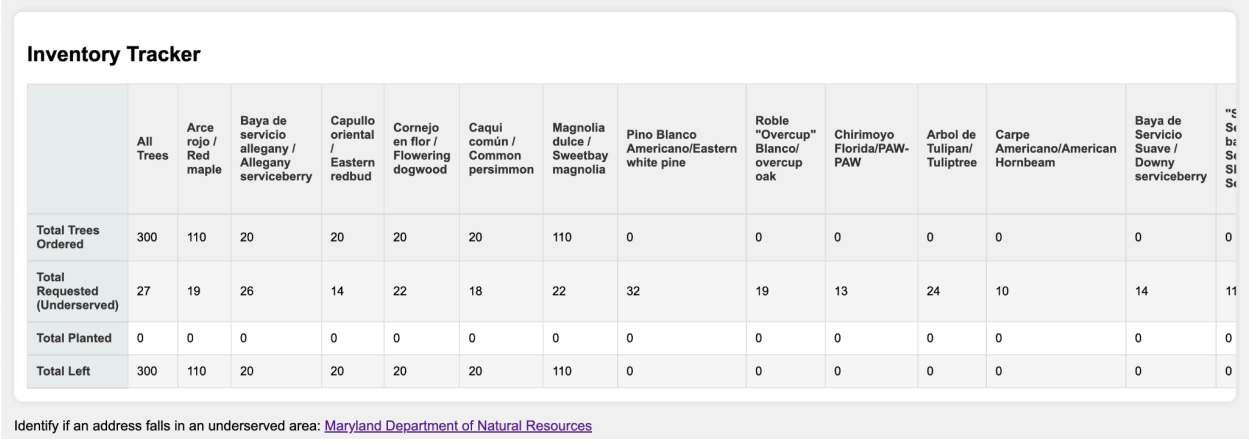
Defensores de la Cuenca Dashboard

Tree Requests | Grants | Underserved Areas | Tree Orders | Follow-Up

Search in the table... | All Statuses

Timestamp	Email	First Name	Last Name	Address	Zip Code	Place Description	Trees	Ambassador	Status	Underserved	Notes
Mon Nov 04 2024 00:00:00 GMT-0500 (Eastern Standard Time)	user713@example.com	Jane	Doe	381 Elm St, Richmond, VA, 60626	60626	Hogar / residencia privada	10	Maria	Requested	☐	
Tue Nov 05 2024 00:00:00 GMT-0500 (Eastern Standard Time)	user939@example.com	John	Doe	828 Main St, Alexandria, VA, 75242	75242	Other	10	Carlos	Requested	☐	
Wed Nov 06 2024 00:00:00 GMT-0500 (Eastern Standard Time)	user977@example.com	Jessica	Doe	921 Oak St, Baltimore, VA, 55143	55143	Asociación comunitaria	7	Luis	Requested	☐	

Appendix G: Current Dashboard - Inventory Tracking on First Page

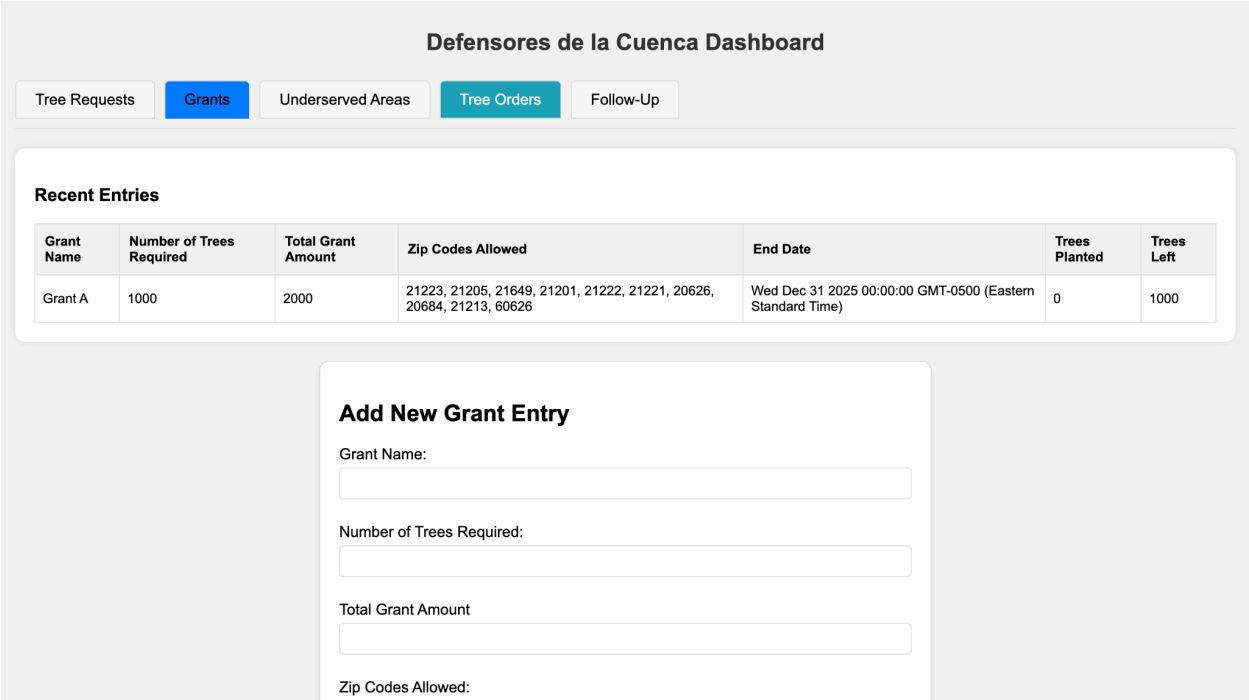


Inventory Tracker

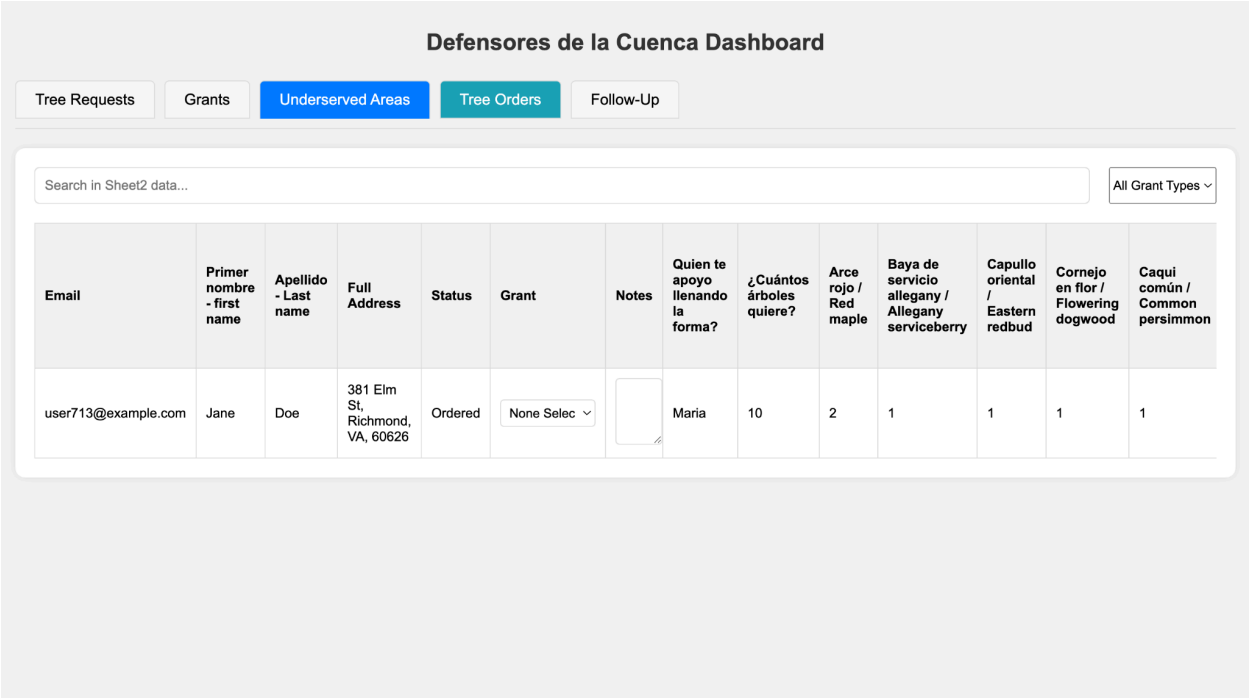
	All Trees	Arce rojo / Red maple	Baya de servicio allegany / Allegany serviceberry	Capullo oriental / Eastern redbud	Cornejo en flor / Flowering dogwood	Caqui común / Common persimmon	Magnolia dulce / Sweetbay magnolia	Pino Blanco Americano/Eastern white pine	Roble "Overcup" Blanco/ overcup oak	Chirimoyo Florida/PAW-PAW	Arbol de Tulipan/ Tuliptree	Carpe Americano/American Hornbeam	Baya de Servicio Suave / Downy serviceberry	"S Se ba Se Sl Se
Total Trees Ordered	300	110	20	20	20	20	110	0	0	0	0	0	0	0
Total Requested (Underserved)	27	19	26	14	22	18	22	32	19	13	24	10	14	11
Total Planted	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Left	300	110	20	20	20	20	110	0	0	0	0	0	0	0

Identify if an address falls in an underserved area: Maryland Department of Natural Resources

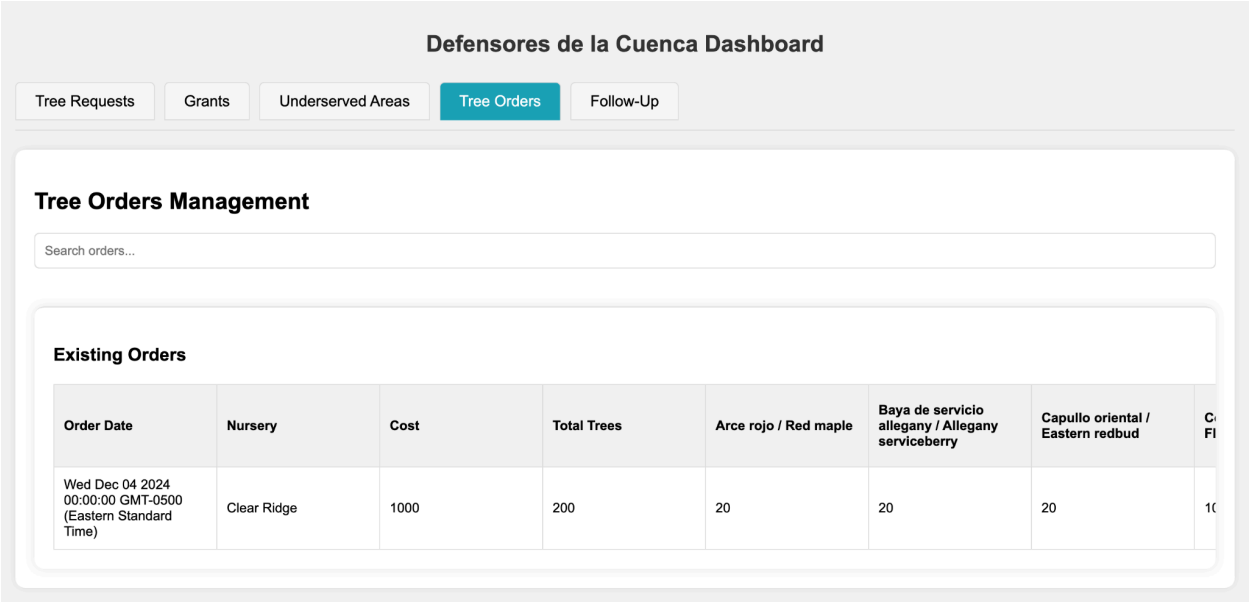
Appendix H: Final Dashboard - Grant Page

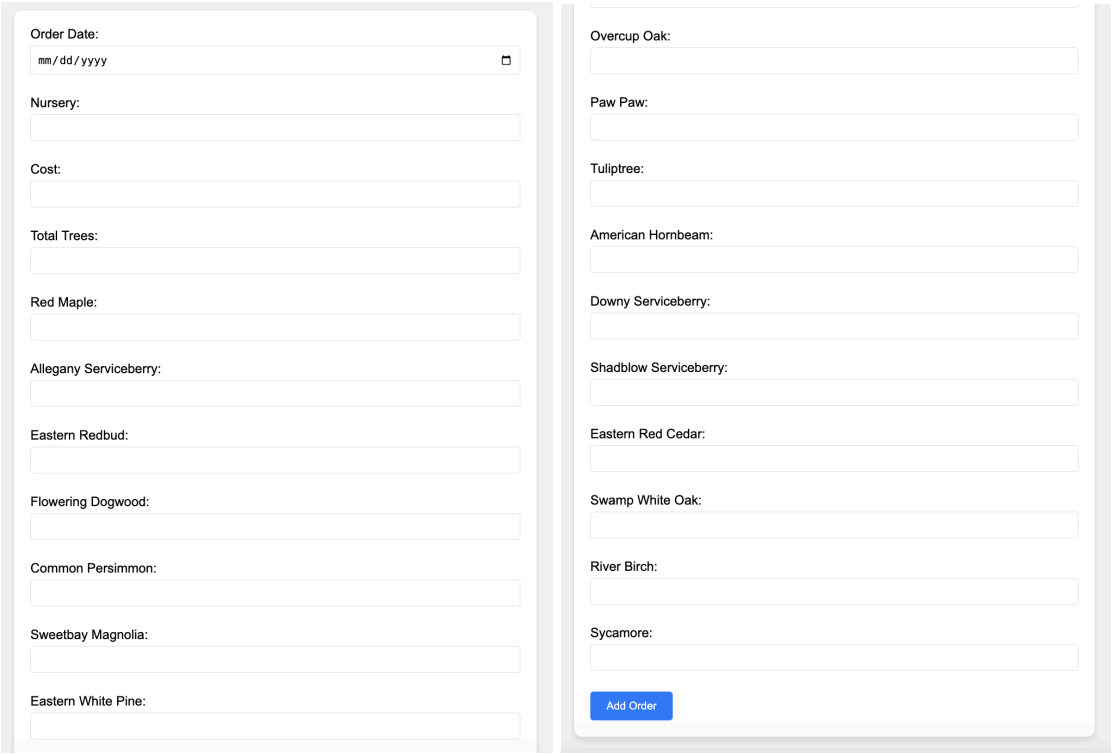


Appendix I: Current Dashboard - Underserved Areas Page

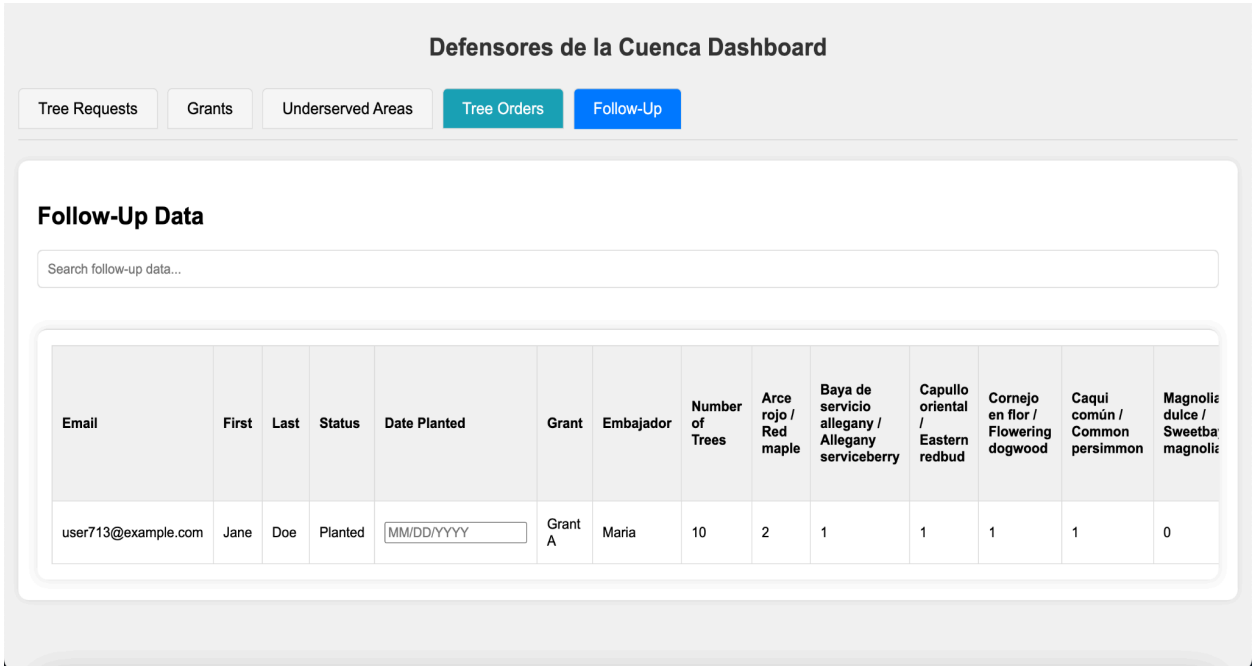


Appendix J: Final Dashboard - Tree Orders Page

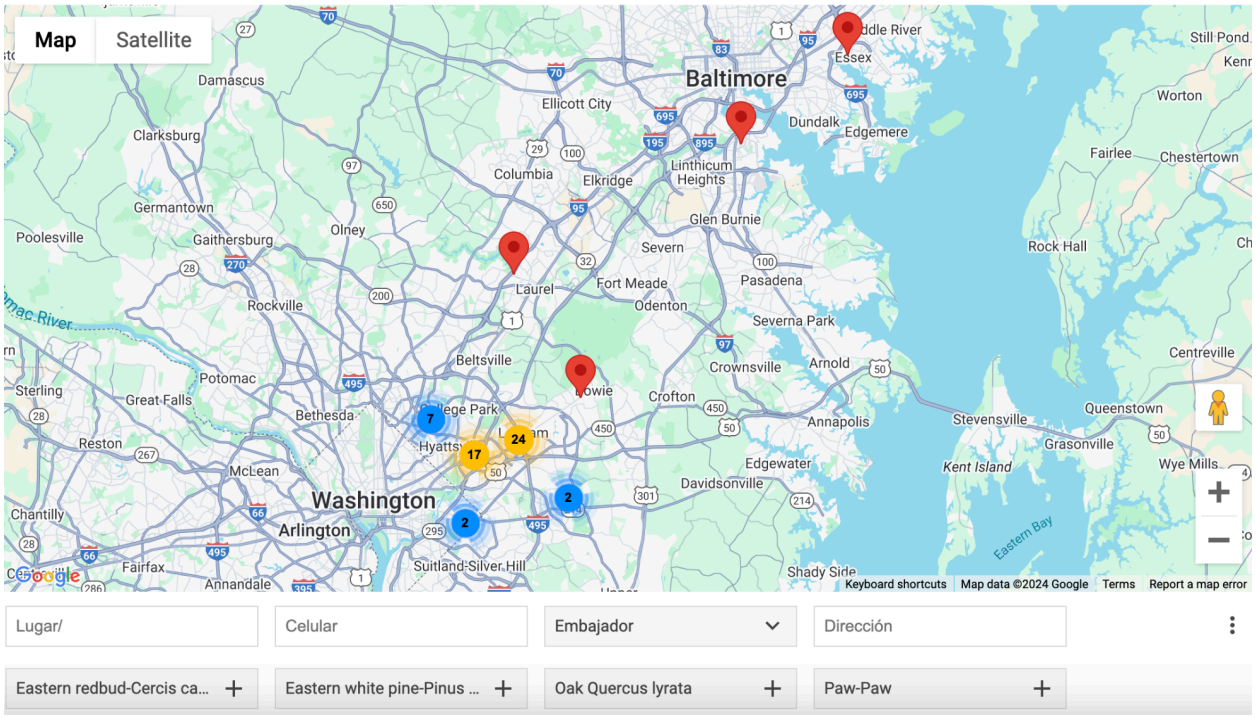




Appendix K: Current Dashboard - Follow-Up Page



Appendix L: Dashboard Map



Appendix M: Cost Breakdown per Tree

City of College Park.xlsx

	A	B	C	D	E	F
1	6	10 gallon	Acer Rubrum Red Sunset	$80		
2	9	7 gallon	Amelanchier arborea MS	$48		
3	4	7 gallon	Betula nigra	$48		
4	2	7 gallon	Carpinus caroliniana	$48		
5	5	7 gallon	Celtris occidentalis	$48		
6	2	7 gallon	Cercis canadensis	$55		
7	12	10 gallon	Cornus florida	$85		
8	4	7 gallon	Diospyros virginiana	$48		
9	5	10 gallon	Juniperus virginiana	$80		
10	16	7 gallon	Juniperus virginiana	$48		
11	4	7 gallon	Magnolia virginiana	$48		
12	4	7 gallon	Platanus occidentalis	$48		
13	3	10 gallon	Thuja 'Green Giant'	$65		
14						

Average Cost of Trees:

(80+48+48+48+48+55+85+48+80+48+48+48+65)/13 = ~60