CollectionSearch

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1. Executive Summary

Our project focuses on user research and user testing to create a new design for the search interfaces of the UC and Jepson Herbaria and the UC Botanical Garden (hereafter referred to as institutions).

- We found that many scientific search interfaces are difficult to use. This was true both for first time users and experience users of the search tools.
- We engaged in user research and user testing to inform a new design. Our research included many types of users, and prioritized the needs of the primary persona of the curator.
- We created a prototype for searching collections that is simple and easy to use. This prototype reduces the number of search options and simplifies the experience for users.

2. Problem Statement

The existing websites of the UC and Jepson Herbaria (http://ucjeps.berkeley.edu/consortium/) and the UC Botanical Garden (http://bnhm.berkeley.edu/query/index.php?ucbg=true) are not optimized to be used by people outside of the respective institution. We received feedback on overwhelming information, lack of good visual design and complicated navigation for the two websites. There was also a rising need to show user the data from both institutions since there is a lot of overlap of specimens between them.

We took on the project to improve the search interface and define a way to show results from both institutions given the existing database structure and technical feasibilities.

We spent significant time with secondary and primary research in order to formulate our problem statement. We state the users’ problem as:

*How can we find relevant information quickly with minimum effort?*
Figure 1 UC and Jepson Herbaria existing website Screenshot - Search
The Consortium of California Herbaria is a gateway to information from California vascular plant specimens that are housed in participant herbaria.

Please cite data retrieved from this page. Data provided by the participants of the Consortium of California Herbaria (ucppl.berkeley.edu/consortium/; Fri May 10 12:17:54 2013).

**Accession Results** — 2000 records retrieved. *(That's the default maximum. Contact rilmoe@berkeley.edu for help with bigger searches.)*

Results for search: Scientific name=acer; Source=ALL;

Map/download results: BerkeleyMapper with layers (184 records with coordinates [those with a light green checkbox]; Map without layers; Map with red or black points: ☐ ☒ | County map; XML export.

Select all records — Select records with coordinates — Retain selected records as tab-separated list

About the records displayed: Records are from botanical specimens. Collection dates may range from the mid-19th Century to the present. Applicable taxonomy and geographic distributions may have changed since collection. Curation of specimens varies by institution and accuracy of data varies by collector.

Click on accession number to display detailed record; click on column header to sort data (ّ sorts by family); click in leftmost checkbox to select record. Help

A yellow roll in the column headed “?” for records with coordinates, indicates an issue with respect to coordinate accuracy, range or identification. Use these records with caution as they have been identified as being possibly erroneous for one or more aspects of the data. Other records may contain undetected errors. Read more ...

<table>
<thead>
<tr>
<th>Specimen ID</th>
<th>Determination</th>
<th>Collector</th>
<th>Collection Date</th>
<th>Collection Number</th>
<th>County</th>
<th>Locality</th>
<th>Elevation in meters</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHSC63184</td>
<td>Acer</td>
<td>William C. Overton, Jr.</td>
<td>05 03 1982</td>
<td>Yolo</td>
<td>City of Davis, US Davis campus, across road from Hiram bridge, east of parking lot with orange trees, tree SE (?1) corner of little brown shingled building that once housed Arbe Hidaps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCD10429</td>
<td>Acer</td>
<td>W. C. Overton, Jr.</td>
<td>05 02 1992</td>
<td>s.n. Yolo</td>
<td>Yolo County: city of Davis, UC Davis campus, across road from Hiram bridge, east of parking lot with orange trees, tree SE (?1) corner of little brown shingled building that once housed Arbe Hidaps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCSC4708</td>
<td>Acer</td>
<td>Randall Morgan</td>
<td>Oct 30 1999</td>
<td>Santa Cruz Plymouth Street</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCSC6845</td>
<td>Acer</td>
<td>R. Morgan</td>
<td>2 Jul 2001</td>
<td>3755 Santa Cruz 1000 Western Dr</td>
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<td></td>
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<td></td>
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<td>CAS1132543</td>
<td>Acer</td>
<td>William C. Overton, Jr.</td>
<td>3 May 1982</td>
<td>s.n. Yolo</td>
<td>City of Davis, UC Davis campus, across road from Hiram bridge, east of parking lot with orange trees, tree SE (?1) corner of little brown shingled building that once housed Arbe Hidaps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSAS57019</td>
<td>Acer</td>
<td>Freda Dzsmers</td>
<td>May 27 1976</td>
<td>Los Angeles 32 Transverse Ranges; Verdugo Mountains region Verdugo Mountains Region: Backyard of 566 Palm Drive, northwest Blanca.</td>
<td></td>
<td></td>
<td>152</td>
<td>Comment</td>
</tr>
<tr>
<td>UCDS5408</td>
<td>Acer</td>
<td>Jean Shepard</td>
<td>07 23 2004</td>
<td>s.n. Yolo</td>
<td>CA: Yolo Co.; UCD Campus Courtyard behind Buchler Alumni Center</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DS00880</td>
<td>Acer</td>
<td>Samuel Bonsal Parish</td>
<td>June 20, 1901</td>
<td>5128 San Bernardino Snow Canyon, San Bernardino Mts.</td>
<td></td>
<td></td>
<td>1911</td>
<td>Comment</td>
</tr>
</tbody>
</table>

Figure 2 UC and Jepson Herbaria existing website Screenshot - Results
Figure 3 UC Botanical Garden existing website Screenshot - Search
### Berkeley Natural History Museums

**Query Result Page**

**Map Results**  
- Latitude/Longitude  
- Botanical Garden Location  
- UC Botanical Garden

**Browse**  
- View All Specimens  
- Group by Name  
- Group by Collection

**Options**  
- Modify Current Query  
- Download Data  
- View SQL

**Search for:**  
- Records from UC Botanical Garden
- Scientific/Object Name like acer

**Notes (Please be patient while the application completes your request...)**

Your query was truncated to 100 rows for one or more specified museums (How to View All Records in this Set)

<table>
<thead>
<tr>
<th>Specimen Account</th>
<th>Museum</th>
<th>Scientific/Object Name</th>
<th>Common Name/Object Description</th>
<th>Country</th>
<th>State/Province</th>
<th>County</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer pseudosieboldianum (Pax) Kom.</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Honshu</td>
<td>Chiba</td>
<td>1985</td>
</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer saccharum Hayata</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
<td>1999</td>
</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer pseudosieboldianum (Pax) Kom.</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
<td>1999</td>
</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer saccharum Hayata</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
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</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer pseudosieboldianum (Pax) Kom.</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
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<tr>
<td>UC</td>
<td>UC</td>
<td>Acer saccharum Hayata</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
<td>1999</td>
</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer pseudosieboldianum (Pax) Kom.</td>
<td>Japanese Maple</td>
<td>Japan</td>
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<td>Tokyo</td>
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</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer saccharum Hayata</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
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<td>UC</td>
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<td>Acer pseudosieboldianum (Pax) Kom.</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
<td>1999</td>
</tr>
<tr>
<td>UC</td>
<td>UC</td>
<td>Acer saccharum Hayata</td>
<td>Japanese Maple</td>
<td>Japan</td>
<td>Chiba</td>
<td>Tokyo</td>
<td>1999</td>
</tr>
</tbody>
</table>

*Figure 4 UC and Jepson Herbaria existing website Screenshot - Results*
3. Historical Background

Both the Herbaria and Botanical Garden were founded at the end of the 19th century. For most of their respective history, records have been kept on paper in binders and in cabinets. These practices continue in the present day, since a large portion of the specimen records have yet to be digitized. The Herbaria is in the midst of an ongoing initiative to import high quality image scans of specimens, and both collections are migrating from legacy databases to the Collection Space management system. Data quality management and control over data sharing are concerns of both institutions.

3.1. Collection Space

Collection Space (hereafter referred to as cSpace) is an open-source collections management application that meets the needs of museums, historical societies, and other collection-holding organizations. This system is used by collections at Berkeley including the Phoebe A. Hearst Museum of Anthropology as the Walker Art Center in Minneapolis and the museum of the Moving Image in New York, among others. The development of this system was funded by a three-year grant from the Andrew Mellon foundation. One of the architects of this project, Patrick Schmitz, is a graduate of the UC Berkeley School of Information. Chris Hoffman is a representative of the UC Berkeley Information Systems and Technology department that manages the deployments on campus including the Herbaria and Botanical Garden.

3.2. The UC and Jepson Herbaria

The University and Jepson Herbaria of the University of California at Berkeley are two collections of pressed plants housed together along with research labs, libraries, and archives. Together the Herbaria hold about 2,200,000 specimens, and it is one of the 20 largest collections in the world. All plant groups are represented in UC, which has a worldwide scope and particular strengths in marine algae, bryophytes, pteridophytes and flowering plants. Jepson Herbaria comprises a separate, privately endowed collection of about 96,000 specimens of vascular plants of California. In addition to the collections, the Herbaria contain supporting library and archive materials as well as modern laboratories for all types of plant studies, ranging from morphology/anatomy to cytogenetics to DNA sequencing. The herbaria is in a process of digitizing specimens and runs a production system on cSpace.

3.3. The UC Botanical Garden

The UC Botanical Garden is a non-profit research garden and museum for the University of California at Berkeley, having a notably diverse plant collection including many rare and endangered plants. Established in 1890, the Garden, which is open to the public year round, has over 13,000 different kinds of plants from around the world, cultivated by region in naturalistic landscapes over its 34 acres. The botanical garden is in the process of migrating its data to cSpace.
4. Process

We followed an accepted user experience design process as outlined in *A Project Guide to UX Design* by Russ Unger and Carolyn Chandler. This text incorporates the following elements:

- Project Scope and Proposal
- Business Requirements
- User Research
- Personae Development
- Concept Ideation
- Storyboarding
- Visual Elements
- Interaction Design
- Task Flows
- Wireframes
- Mockups
- Prototyping
- User Testing

We also include the following elements:

- Application architecture
- Competitive analysis
- Click comparison
- Feature recipes
- Feature prioritization
4.1. Ethnography

Ethnography is a scientific method for understanding the customs of individuals and cultures. As outsiders to the world of botany, this method enabled us to understand a group of users with their own scientific language and culture.

4.1.1. Contextual Inquiry

We engaged in contextual inquiry to field data from users. We alternated between roles of interviewer and note-taker when speaking to individual interviewees. Some interviews were conducted in person while others were conducted via phone or web-conference. All of the interviews followed a format of an introduction, a few brief questions, followed by an in depth observation of the user in context. Our aim was to gather as much raw data as possible from the interviews, and later on we summarized and synthesized our findings from each user.

See Appendix 5.1 for interview goals, script and questionnaire.
See Appendix 5.2 for the profile of users we interviewed.

4.2. Competitive Analysis

4.2.1. Process

In our research of the garden and herbaria, we discovered several institutions with similar archives and search interfaces. We conducted an analysis of the features of the search tools in order to visualize the competitive landscape. This information is also relevant to curators who validate their collection data by cross checking with peer institutions.
### 4.2.2. Table

<table>
<thead>
<tr>
<th>Function</th>
<th>UC and Jepson Herbaria</th>
<th>UC Botanical Garden</th>
<th>Harvard Herbaria</th>
<th>Missouri Botanical Garden</th>
<th>New York Botanical Garden</th>
<th>Denver Botanical Garden</th>
<th>JSTOR Plants</th>
<th>The Plant List</th>
<th>Cal Flora</th>
<th>IPNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Search Page</td>
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<td>Search by Collector</td>
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<td>Search by Date Range</td>
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<tr>
<td>Search by Common Names</td>
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<td>Search by Location in List</td>
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<td>Filter by Database</td>
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<tr>
<td>See Results on Map</td>
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<td>Display Exact Location</td>
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<td>Sort Results</td>
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<tr>
<td>Show Images in Results</td>
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<td>Links to External Sites</td>
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<td>Relational Links</td>
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<td>Export Results</td>
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<tr>
<td>Feedback</td>
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</tbody>
</table>

**Figure 5 Competitive Analysis**
4.2.3. Summary

Both the Herbaria and the Botanical Garden have the majority of features. However, the number of features does not necessarily correlate with the feedback from users as to usability or satisfaction with the overall search experience. In retrospect, a feature that stands out from the group is the Sorting of Results, which we found later on in the design phase to be a core feature for our user group.

4.3. Design Process

4.3.1. Personae Development - Version 1

Based on the insights from contextual inquiries, we figured that there are following kinds of users for the search interfaces of Herbaria and Botanical Garden:

1. Administrative Curators
2. Administrative Staff
3. Senior Researchers
4. Junior Researchers
5. Gardeners
6. Landscape Architects
7. Archivists
8. Others

From the above, we decided to focus on Administrative Curator as the primary persona and Administrative Staff and Senior Researcher as secondary personae because they are the ones who use the search interfaces maximum out of all listed users.

We made three personae and listed their goals, tasks, skills and opinions on search interfaces. The goal to develop these personae was to help us get into the shoes of the user and design the product. These personae helped us make design decisions in every iteration.
Gail McVaugh

“People often ask me if we have a specimen or facts about the collector’s field notebooks. Sometimes I scan parts of our collection that are not yet digitized and email them”

Age: 40 years
Occupation: Herbarium Curator

English Proficiency: Expert
Lives in: Cambridge, MA

Goals
- To support scientific research
- To share information with other professions and the public
- To maintain an accuracy of database

Pain Points
- Lack of centralised repository of information for a collection
- Lack of way to handle updates to records
- A lot of collections is inaccessible

Tasks
- Analysis of data
- Sharing reports and analysis with requesters
- Specimen lookup management of collections

Skills
- Taxonomic Knowledge
  - Novice: 0
  - Expert: 10

- Computer Proficiency
  - Novice: 0
  - Expert: 10

Ideal Experience
- Ability to format search results in different ways
- Ability to do advanced analysis and querying
- Ability to easily share search

Search Activities
- Duration of Individual Search
  - 1 minute
  - 5 minutes

- Frequency of Search
  - Weekly
  - Daily
  - Hourly

- Time spent searching in 1 day
  - 0 hours
  - 2 hours
  - 4 hours

Figure 6 Persona A - Version 1
Persona B - Secondary

Samantha Cooper

“I do all the loans, I mount specimens on paper, I database the specimens... Well, I pretty much do everything around here”

Age: 35 years
English Proficiency: Expert

Occupation: Administrative Staff
Lives in: Denver, CO

Goals
- To maintain the accuracy of fields in the database
- To maintain loan records
- To database new specimens

Pain Points
- Scientific names are confusing
- Loans process is complicated
- Websites do not handle typographical errors

Skills
- Taxonomic Knowledge
  - Novice: 0
  - Expert: 10
- Computer Proficiency
  - Novice: 0
  - Expert: 20

Tasks
- Database entry
- Digitization of specimen records
- Accession of specimens
- Loaning specimens

Ideal Experience
- Search entries have auto-complete
- Website shows suggestions for new search if entered query returns no results
- Results are returned in just few seconds

Search Activities
- Duration of Individual Search
  - 1 minute
  - 1.5
  - 5 minutes
- Frequency of Search
  - Weekly
  - Daily
  - Hourly
- Time spent searching in 1 day
  - 0 hours
  - .75
  - 4 hours

Figure 7 Persona B - Version 1
**Persona C - Secondary**

**David Pfister**

"I've not found an incredible website where everything is perfect... what you have to do is go in and grit your teeth and find what you need"

---

**Goals**
- To discover new specimens
- To help protect endangered species
- To understand the effects of climate change

**Pain Points**
- Information scattered across many websites
- Obscure website navigation
- No standardised search interface

**Tasks**
- Plant identification
- Check for citations in publications for specimens
- Pre-production research for field work

**Skills**
- Taxonomic Knowledge: Novice 0, Expert 10
- Computer Proficiency: Novice 0, Expert 10

**Ideal Experience**
- Having relational links to Collectors, Specimens, and Locations
- Ability to do advanced analysis on plant images and find related

**Search Activities**
- Duration of Individual Search: 1 minute 4, 5 minutes
- Frequency of Search: Weekly 0, Daily 1.5, Hourly 4 hours

**Age:** 55 years  
**English Proficiency:** Intermediate  
**Occupation:** Principal Researcher  
**Lives in:** Berkeley, CA

---

*Figure 8 Persona C - Version 1*
4.3.2. Task Flow Analysis

For each persona, we defined the list of steps they go through for each of their tasks (mentioned in their profiles above). This helped us understand the process of users’ searches and their emotions through each step. We wanted to plot a journey map for them, and focus on reducing steps and making the interaction better.

Here are the steps for each task of each persona:

**Gail**

1. Analysis of data from search results
   - Gail navigates to the search page by clicking on bookmark
   - Gail enters a scientific name in the search field
   - Gail enters some filtering criteria
   - Gail sorts the results by column
   - Gail clicks on a record to view detail
   - Gail then navigates back to the main results page
   - Gail exports the results to a file

2. Sharing reports and analysis with requesters
   - Gail follows all of the steps above
   - Gail may do some analysis in Excel with the data export
   - Gail then checks for analog records in the collection that are not in the database
   - Gail may scan some documents to a file
   - Gail then composes an email to the requester and attaches the files
   - Gail may also print out a copy of reports for internal or external use

3. Specimen lookup management of collections
   - Gail navigates to the search page by clicking on bookmark
   - Gail enters a scientific name in the search field – do we have ____?
   - Gail enters some filtering criteria if too many results appear, alternatively she may create a more generic query if no results appeared
   - Gail reviews the main results page checking for the presence or absence of records

**Samantha**

1. Data entry – entering new records and completing missing fields
   - Samantha navigates to the collections website
   - Samantha uses a barcode scanner to enter the accession number into the search field
   - Samantha clicks search or presses Enter button on keyboard
   - Samantha then check the results for names, collector, number, and date
   - Samantha clicks in the fields and types in any missing information
2. Loans

- Samantha navigates to the collections website
- Samantha uses a barcode scanner to enter the accession number into the search field
- Samantha enters loan information in the corresponding fields
- Samantha prints out a copy of the loan information
- Samantha files a copy for internal records
- Samantha packages the loan material for mailing

**David**

1. Pre-production

- David navigates to the site by a bookmark
- David searches for scientific name
- David reviews the results page
- David clicks on the record link to view detail
- David goes back to main results
- David goes back to main search and refines query
- David modifies name and add filters to query
- David reviews the results page
- David clicks on a record
- David clicks to view an image of the record
- David clicks back to the results page
- David exports the results to a file

2. Post production

- David navigates to the site by a bookmark
- David searches for scientific name
- David reviews the results page
- David clicks on a record
- David reviews the detail information
- David clicks on an image link to compare a specimen with something he’s collected
- David clicks on the “collector” link to view other specimens collected by that person
- David makes a comment to correct or add information in the database, or annotate the specimen with a new identification
- David then navigates to another site by a bookmark
4.3.2. Existing Problems and Emotions

We identified in the list of steps (mentioned above) the problems that users face with existing products and plotted the emotion they have when faced with those problems.

This helped us gain empathy for users and know what needs to be made better.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Feeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null results</td>
<td>✓</td>
</tr>
<tr>
<td>No associated search</td>
<td>✓</td>
</tr>
<tr>
<td>Bad navigation</td>
<td>✓</td>
</tr>
<tr>
<td>Bad visual design</td>
<td>✓</td>
</tr>
<tr>
<td>Lack of clarity of accuracy of names</td>
<td></td>
</tr>
<tr>
<td>Doubt about reliability of data</td>
<td>✓</td>
</tr>
<tr>
<td>Insufficient knowledge of taxonomy</td>
<td></td>
</tr>
<tr>
<td>Needless repetition of effort</td>
<td>✓</td>
</tr>
<tr>
<td>Too much unimportant information</td>
<td>✓</td>
</tr>
<tr>
<td>Changing names of specimens</td>
<td>✓</td>
</tr>
<tr>
<td>No icons for better understanding</td>
<td>✓</td>
</tr>
</tbody>
</table>

Figure 9 Table of problems and emotions of users

4.3.3. Journey Map

Based on the contextual inquiries, we mapped the journey of interaction for the primary persona- Gail. We plotted the best and worst case scenarios when Gail performs a search using elements of existing products. We wanted to avoid the worst case scenario and implement a design that takes the user through the best case scenario. This would ensure that the user’s experience was always positive when using our proposed solution.
Figure 10 Journey Map of Primary Persona - Gail
4.3.4. How might we statement

Based on the above design brainstorming, we figured that the main question for users right now is:

“How might we find relevant information with minimum effort quickly?”

We focused on this question to ideate on the design of the solution.

4.3.5. Feature Ingredients and Recipes

To solve the problem, the first step was to brainstorm on a list of features that can be implemented to solve each aspect of the problem.

Based on our brainstorming session, we listed the “ingredients” that can be combined to form a “recipe” that will solve the current problem of finding relevant information with minimum effort and quickly.

The header row of each column is the category of feature and the rows beneath it enlists the possible ways (“ingredients”) of implementing that feature.

<table>
<thead>
<tr>
<th>Kind of Search</th>
<th>Sharing</th>
<th>All information in one place</th>
<th>Quick input</th>
<th>Provide relevant information</th>
<th>Have many kinds of output</th>
<th>Save time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyword</td>
<td>Twitter</td>
<td>Browser plugins</td>
<td>Autocomplete</td>
<td>Search history</td>
<td>File</td>
<td>Saved Searches</td>
</tr>
<tr>
<td>Facets</td>
<td>FB</td>
<td>Dashboard</td>
<td>Voice</td>
<td>Show relevant score</td>
<td>RSS Feed</td>
<td>Scheduled search</td>
</tr>
<tr>
<td>Map</td>
<td>Forum</td>
<td>Federated source</td>
<td>Email</td>
<td>Relational links</td>
<td>Tweets</td>
<td>Immediate results</td>
</tr>
<tr>
<td>Timeline</td>
<td>Email</td>
<td>Federated source</td>
<td>SMS text</td>
<td>Related searches</td>
<td>Map</td>
<td>Prefetch data</td>
</tr>
<tr>
<td>Do nothing</td>
<td>File</td>
<td></td>
<td>Touch (button)</td>
<td>Related searches</td>
<td>KML file</td>
<td></td>
</tr>
<tr>
<td>File matching</td>
<td>Citations (Monthly)</td>
<td>Upload (file, picture, URL)</td>
<td>Database record</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Applications (PDF, Email)</td>
<td>Picture (Flickr, Pinterest)</td>
<td>Bar code</td>
<td>Web page</td>
<td>Citation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 11 List of Ingredients
We voted on these “ingredients” and made “recipes” of design solutions with different combinations of most voted ingredients for each feature.

<table>
<thead>
<tr>
<th>Recipe 1</th>
<th>Recipe 2</th>
<th>Recipe 3</th>
<th>Recipe 4</th>
<th>Recipe 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>View on map</td>
<td>Sharing pictures</td>
<td>Webpage output</td>
<td>Email sharing</td>
<td>Facets input</td>
</tr>
<tr>
<td>Share by email</td>
<td>Results as you click</td>
<td>Map output</td>
<td>Webpage output and saved searches</td>
<td>Sharing pictures</td>
</tr>
<tr>
<td>Saved search</td>
<td>Relevant score</td>
<td>RSS Feed</td>
<td>Show relevant links</td>
<td>Browser plugin</td>
</tr>
<tr>
<td>File output</td>
<td>Touch/Click input</td>
<td>Show relational links</td>
<td>Email and MS Excel upload</td>
<td>Touch/Click input</td>
</tr>
<tr>
<td>Facets and keyword</td>
<td>Dashboard</td>
<td>File upload input</td>
<td>Toolbar of bookmarks of all search pages</td>
<td>Relevancy score</td>
</tr>
<tr>
<td>Autocomplete</td>
<td>Map based output</td>
<td>Forum share</td>
<td>Facets and Map as input</td>
<td>Map and webpage output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search criteria from external applications (PDF, email)</td>
<td></td>
<td>Saved searches</td>
</tr>
</tbody>
</table>

Figure 12 List of recipes

4.3.6 Feature Prioritization

The recipes were innovative but did not help us determine the importance or feasibility of implementing them. Hence, we made a feature prioritization wherein we listed each ingredient of each feature. Each of us in team scored them based on their importance to Gail in carrying out her tasks (referring to the tasks, goals and pain points of Gail’s persona) and its technical feasibility for implementation.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Importance to Gail (primary persona) - Suhani</th>
<th>Importance to Gail (primary persona) - Tim</th>
<th>Importance Average</th>
<th>Technical Feasability within Project - Suhani</th>
<th>Technical Feasability within Project - Tim</th>
<th>Feasability Average</th>
<th>Overall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>view on map</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>4.75</td>
</tr>
<tr>
<td>facets</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>show relational links</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>show relevant links</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>share results by email</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4.25</td>
</tr>
<tr>
<td>saved search</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4.25</td>
</tr>
<tr>
<td>sharing pictures</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>4.25</td>
</tr>
<tr>
<td>autocomplete</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>file o/p</td>
<td>4</td>
<td>5</td>
<td>4.5</td>
<td>2</td>
<td>5</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>touch/click i/p</td>
<td>5</td>
<td>2</td>
<td>3.5</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td>webpage o/p</td>
<td>5</td>
<td>2</td>
<td>3.5</td>
<td>5</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
</tr>
</tbody>
</table>
We averaged the scores and came up with the list of highest scored features to be included in the final design. Here’s the list of features to be implemented:

1. View results on map on webpage
2. Input search criteria using facets and selected regions on map
3. Have click- and keyword-based inputs
4. Show relevant and relational links in results page
5. Have the ability to share pictures and results data by email
6. Have a feature to save searches
7. Have auto-complete in input fields
8. Ability to output results to a file

4.3.7. Design Principles

We came up with design principles based on aforementioned design sessions to guide all our future designs. The principles were:

- Always make help available
- Display fewer elements and more white space
- Be more visual and less text dependent
- Always Keep the User Informed
- Most Frequent Activity should be Most Accessible
- Handle all errors and tell the user gently
- Prevent re-typing
4.4. Iteration 1

4.4.1 Wireframe Design (Version 1)

Based on design decisions, we came up with the first version of our proposed solution. In the figures below, each page, a web screen, has a letter on top right corner. Top left corner mentions how the user can land on that page. For example, Screen B will pop up when user selects “Select on Map” in Screen A.
Figure 15 Wireframe - Version 1 - Screen B
Figure 16 Wireframe - Version 1 - Screen C
Figure 17 Wireframe - Version 1 - Screen D
Figure 18 Wireframe - Version 1 - Screen E
Figure 19 Wireframe - Version 1 - Screen F
Figure 20 Wireframe - Version 1 - Screen G
Figure 21 Wireframe - Version 1 - Screen H
4.4.2 User Testing

We tested the paper wireframe with users. Please refer Appendix 5.2 for profile of users who tested this version.

Please refer Appendix 5.3 for sample questions asked during user testing sessions.

4.4.3. Top Insights from Testing

They are:

1. Auto-complete is important
2. The 3 tabs in results page is confusing. How to see all information (record details, images and locations on map) together?
3. Social sharing is not welcome
4. The map based search (selecting a region on map to search based on location) is not important
5. The Exporting dialog box is complicated with multiple options

4.4.4. Personae Development - Version 2

Based on user testing, we figured that some of the tasks and goals of personae need to be corrected and that we were missing one persona - administrative curator who works outside of the UC institutions. We added this persona and named him Alex, and refine other three personae.
Persona A - Primary

Gail McVaug

"People often ask me if we have a specimen or facts about the collector's field notebooks. Sometimes I scan parts of our collection that are not yet digitized and email them."

Age: 40 years
English Proficiency: Expert
Occupation: Herbarium Curator
Lives in: Cambridge, MA

Goals
- To expand the herbarium's collection
- To support scientific research
- To share information about collection with other institutions

Tasks
- Making reports on information about collection
- Specimen lookup in collection
- Analysis of record details in collection

Pain Points
- Ingesting new information into database is difficult
- A lot of the collection is inaccessible
- Creating and sharing reports is difficult

Skills
- Taxonomic Knowledge
  - Navie: 5
  - Expert: 10
- Computer Proficiency
  - Navie: 1
  - Expert: 10

Ideal Experience
- Ability to easily share search results
- Ability to quickly do advanced queries
- Ability to do automated querying (no manual work)

Search Activities
- Duration of Individual Search
  - 1 minute: 3
  - 5 minutes: 1
- Frequency of Search
  - Weekly: 1
  - Daily: 1
- Hourly: 4
- Time spent searching in 1 day
  - 0 hours: 1
  - 1 hour: 1

Figure 22 Persona A - Version 2
Figure 23 Persona B - Version 2

Alex Ginsburg

“A major part of my routine is to search various sources on web to find information or to verify existing data in our collections.”

Age: 42 years
English Proficiency: Expert

Occupation: Administrative Curator at Botanical Garden
Lives in: New York, NY

Goals
- To maintain completeness of data in collection database
- To maintain accuracy of data
- To stay informed of latest research

Pain Points
- Lack of centralised repository of information
- Lack of visual information, especially images and maps
- Complex search interfaces

Tasks
- Verify data (Cross-referencing of data with external sources)
- Track collectors and their expeditions
- Finding data to fill missing information in collection database

Ideal Experience
- Ability to search based on selected region on a map
- Automated discovery of updates to a collection
- Ability to easily export results in useful formats

Skills
Taxonomic Knowledge
Novice 6
Expert 10

Computer Proficiency
Novice 6
Expert 10

Search Activities
Duration of Individual Search

- 1 minute: 8
- 5 minutes: 2

Frequency of Search

- Weekly
- Daily
- Hourly

Time spent searching in 1 day

- 4 hours
- 2 hours
Persona C - Secondary

Samantha Cooper

“I do all the loans, I mount specimens on paper, I database the specimens... Well, I pretty much do everything around here”

Age: 35 years
English Proficiency: Expert
Occupation: Administrative Staff
Lives in: Denver, CO

Goals
- To maintain the accuracy of fields in the database
- To maintain loan records
- To database new specimens

Pain Points
- Scientific names are confusing
- Loans process is complicated
- Websites do not handle typographical errors

Tasks
- Database entry
- Digitization of specimen records
- Accession of specimens
- Loaning specimens

Skills
- Taxonomist Knowledge
  - Novice 1
  - Expert 20
- Computer Proficiency
  - Novice 1
  - Expert 20

Ideal Experience
- Search entries have auto-complete
- Website shows suggestions for new search if entered query returns no results
- Results are returned in just few seconds

Search Activities
- Duration of Individual Search
  - 1 minute: 1.5
  - 5 minutes: 1
- Frequency of Search
  - Weekly
  - Daily
  - Hourly
- Time spent searching in 1 day
  - 4 hours
  - 0 hours

Figure 24 Persona C - Version 2
Persona D - Secondary

David Pfister

"I’ve not found an incredible website where everything is perfect... what you have to do is go in and grit your teeth and find what you need"

Age: 55 years
English Proficiency: Intermediate
Occupation: Principal Researcher
Lives in: Berkeley, CA

Goals
- To discover new specimens
- To help protect endangered species
- To understand the effects of climate change

Pain Points
- Information scattered across many websites
- Obscure website navigation
- No standardised search interface

Tasks
- Plant identification
- Check for citations in publications for specimens
- Pre-production research for field work

Skills
- Taxonomist Knowledge
  Novice
  Expert
- Computer Proficiency
  Novice
  Expert

Ideal Experience
- Having relational links to Collectors, Specimens, and Locations
- Ability to do advanced analysis on plant images and find related

Search Activities
- Duration of Individual Search
  1 minute
  4 minutes
  5 minutes

Frequency of Search
- Weekly
- Daily
- Hourly

Time spent searching:
- 0 hours
- 1.5 hours
- 4 hours

Figure 25 Persona D - Version 2
4.4.5. Storyboards
This time, we sketched the storyboards for the primary personae to envision how our product would fit into their lives.

Figure 26 Storyboard for Gail
Figure 27 Storyboard for Alex

I need to validate this data

What do other links say?

Hmm... That's interesting

Let me put feedback to add more data
4.6. Iteration 2

4.6.1 Prototype Design - Version 2

Based on insights from previous user testing, refined personae and storyboards, we listed the features that need to be added/removed/modified. Based on the list, we designed a new prototype using JustInMind.

Here’s a link to the prototype:
http://people.ischool.berkeley.edu/~suhani/SearchPortal/index.html#/screens/d12245cc-1680-458d-89dd-4f0d7fb22724

Here are screen shots of the prototype:

![Search Portal](image)
Search Portal

Enter Keyword

Endangered
Not Endangered
Has Images

Elevation
0 mt
100 mt

Related Images

Figure 30 Prototype - Version 2 - Results
### Acer pictum

**Details**

<table>
<thead>
<tr>
<th>Accession No.</th>
<th>12345</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>Native to California</td>
</tr>
<tr>
<td>Endangered</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Institution</td>
<td>UC Botanical Garden</td>
</tr>
</tbody>
</table>

**Collection**

<table>
<thead>
<tr>
<th>Collector</th>
<th>J. H. Stuart</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>C10938</td>
</tr>
<tr>
<td>Date</td>
<td>23 May, 1987</td>
</tr>
<tr>
<td>Notes</td>
<td>Lorem ipsum dolor sit amet</td>
</tr>
</tbody>
</table>

**Location**

<table>
<thead>
<tr>
<th>City</th>
<th>Berkeley</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>Alameda</td>
</tr>
<tr>
<td>State</td>
<td>California</td>
</tr>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Latitude</td>
<td>36.556431</td>
</tr>
<tr>
<td>Longitude</td>
<td>139.170999</td>
</tr>
</tbody>
</table>

| Elevation | 56m |

**Taxonomy**

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phylum</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Sapindales</td>
</tr>
<tr>
<td>Family</td>
<td>Aceraceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Acer</td>
</tr>
<tr>
<td>Species</td>
<td>Pictum</td>
</tr>
</tbody>
</table>

**Common name:** Maple
4.6.2. User Testing

We tested the prototype with users. Please refer Appendix 5.2 for profile of users who tested this version.

Please refer Appendix 5.3 for sample questions asked during the user testing sessions.

4.6.3 Top insights from Testing

They are:
1. Having lesser number of options in Advanced Search makes it more usable
2. Having pop-up is annoying. Users want a quick detailed view of specimens for easy comparisons between results
3. The Related Images section is confusing. It is unclear where the images are coming from and how they are related to results
4. The map based results is a cool feature but it is not useful. It emphasizes location aspect of specimen too much
5. Users missed the spreadsheet view of results. It is a better view for them to conduct their tasks

4.7. Iteration 3

Based on insights from previous user testing, we listed the features that need to be added/removed/modified. Based on the list, we designed a new prototype using Keynote.

Here’s the link of the demo: http://www.youtube.com/watch?v=4x_P9Z4g0oQ

Here are the screen shots:
Figure 32 Prototype - Version 3 - Basic Search
Figure 33 Prototype - Version 3 - Advanced Search
**Collection Search**

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Collector</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Boon</td>
<td>1894</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Boon</td>
<td>1894</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1895</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1897</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1894</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1895</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Jepson</td>
<td>1934</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Jepson</td>
<td>1934</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Jepson</td>
<td>1934</td>
</tr>
</tbody>
</table>

**Figure 34 Prototype - Version 3 - Results**
### Collection Search

#### Basic
- **Genus**
- **Species**
- **Location**
- **Collector**
- **Year**

#### Search
- Garden
- Herbarium

### 234 Results

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Collector</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1894</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1894</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1896</td>
</tr>
<tr>
<td>Acer pictum</td>
<td>California</td>
<td>Smith</td>
<td>1897</td>
</tr>
</tbody>
</table>

- **Elevation:** 20 m
- **Latitude:** 38.556
- **Longitude:** 139.170
- **Collectors:** Smith, Jepson

---

**Figure 35 Prototype - Version 3 - Hovers on results**
Acer pictum

Collector: Smith, James
Date: May 1, 1897
Location: United States / California / Alameda
Latitude: 36.556
Longitude: 139.170
Elevation: 20 m
Garden ID: UC100111
Herbarium ID: UCB0329193
**Acer pictum**

- **Collector**: Smith, James
- **Date**: May 1, 1897
- **Location**: United States / California / Alameda
- **Latitude**: 36.556
- **Longitude**: 139.170
- **Elevation**: 20 m
- **Garden ID**: UC100111
- **Herbarium ID**: UCB0329193

**Figure 37** Prototype - Version 3 - Adding comments in Record Detail Page
4.8. Design Recommendations

Overall, based on all our user research and testing, and design process we followed, here are our top design recommendations for future designs for the search portal.

1. Minimize the effort required of your users
2. Empower your users with fewer options
3. Focus on the tasks of the primary personae
5. Appendix

5.1. Contextual Inquiry goals, script and sample questions

Goals for the interviews

- Know how user interact with search websites
- What problems do they face with search
- What solutions do they have
- What issues do they see with the solution
- Know their responsibilities at work to understand more about how the tool fits into their work life

Sample Script

Introduce ourselves
We are 2nd year ISchool students. We’re working on our final project this spring. We want to know about the search interfaces of the websites and how we can improve it. Thank you so much for agreeing to be a participant of this user study.

Introduce process
We will be asking you a few questions on the usage of the tool and about your work. Just general questions. We may ask you to give us a tour of the tool and/or your workplace. Since we are novice, we will ask specific questions on the museum and the databases to better understand the museum's practices. Your patience will be highly appreciated.

At any point during the conversation, you may refuse to answer a question or stop the process if you would like to. We will be using this data for our final project only. It will not be shared with any 3rd party people without your consent.
Can we audio record this interview? It is only so that we don’t miss any points but we will be taking notes all the while.
Any questions before we start?

Questionnaire

Sample questions for museum staff

About work
1. What kind of work do you do at the museum?
2. Could you describe us your usual daily schedule? Could you describe us a day when things don’t go this way? What things change in the schedule?

About their use of website
1. What role does the search tool play in your work?
2. How often do you use this tool to search?
3. How do you go about searching? Can you show us step by step for a sample search?
4. What issues do you face with this tool?
5. What are the different databases mentioned on the website? Why are they separate?
a. How does one know which specimen to search in which database?
   How are the specimens categorized? Why?
   How do you handle change in names? Does the tool search based on both names?

About their assumptions of other users
1. Who are the different users of this tool
   a. Within museum
   b. outside museum
      How does this tool help them with their work?
      How do you think they are using it?
      Do you see any issues they may encounter while trying to use this tool?
      How do you think we can find such users? Can u connect us to them?

Sample questions for users not in museum

About work
1. What kind of work do you do?
2. Which websites have you used for search on plants? Which do you like most and why?
3. Which website do you not like and why?

Example search (for each website)
4. What role does the search website play in your work?
5. How often do you use this website?
6. Take us through an example of kind of search you do on the plant search websites
7. What kind of information were you looking for?
8. Did you find that information?
9. What did you input to get desired results?
10. How do you feel about the navigation?
11. How do you feel about the display of results?
12. How do you check if the information is valid?

End interview
Thank you so much for your time. We had a lot of great insights into the tool and its functionality. In case of any further questions, we will contact you through email. Thanks again!
## 5.2. User profiles table

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Occupation</th>
<th>Company</th>
<th>Location</th>
<th>Contextual Inquiry Participant?</th>
<th>Wireframe Testing Participant?</th>
<th>Prototype Testing Participant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amy Kasameyer</td>
<td>F</td>
<td>Archivist</td>
<td>UC &amp; Jepson Herbaria</td>
<td>California, USA</td>
<td>Yes</td>
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</tr>
<tr>
<td>Anna</td>
<td>F</td>
<td>Admin Assistant</td>
<td>UC &amp; Jepson Herbaria</td>
<td>California, USA</td>
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<tr>
<td>Claire</td>
<td>F</td>
<td>Lab Manager</td>
<td>UC &amp; Jepson Herbaria</td>
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<tr>
<td>Cynthia Powell</td>
<td>F</td>
<td>GIS analyst</td>
<td>Cal Flora</td>
<td>California, USA</td>
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<tr>
<td>David Ackerly</td>
<td>M</td>
<td>Professor (Integrative Biology)</td>
<td>UC Berkeley</td>
<td>California, USA</td>
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<tr>
<td>Dr. Andrew Doran</td>
<td>M</td>
<td>Administrative Curator</td>
<td>UC &amp; Jepson Herbaria</td>
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<td>Ellen Dean</td>
<td>F</td>
<td>Botanist</td>
<td>UC Davis</td>
<td>California, USA</td>
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<tr>
<td>Emily Dennis</td>
<td>F</td>
<td>Visitor Services Assistant</td>
<td>UC Botanical Garden</td>
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<tr>
<td>Geneiveve Walden</td>
<td>F</td>
<td>PHD student (Department of Integrative Biology)</td>
<td>UC Berkeley</td>
<td>California, USA</td>
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<tr>
<td>Holly Forbes</td>
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<td>Assistant Curator</td>
<td>UC Botanical Garden</td>
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<tr>
<td>Julie Shapiro</td>
<td>F</td>
<td>Curator</td>
<td>Harvard Herbaria</td>
<td>Massachusetts, USA</td>
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<tr>
<td>Kenichi Ueda</td>
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<td>Founder - Developer</td>
<td>iNaturalist</td>
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<tr>
<td>Name</td>
<td>Gender</td>
<td>Title</td>
<td>Institution</td>
<td>Location</td>
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<tr>
<td>Michelle Koo</td>
<td>F</td>
<td>Biodiversity Informatics &amp; GIS Scientist and Researcher</td>
<td>The Museum of Vertebrate Zoology, Berkeley</td>
<td>California, USA</td>
<td>Yes</td>
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<tr>
<td>Mike Bevans</td>
<td>M</td>
<td>Photographer - digitization</td>
<td>NYBG</td>
<td>New York, USA</td>
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<tr>
<td>Paul Licht</td>
<td>F</td>
<td>Director</td>
<td>UC Botanical Garden</td>
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<tr>
<td>Scott Knoiecko</td>
<td>M</td>
<td>Architect</td>
<td>Beatrix Farrand Society</td>
<td>New York, USA</td>
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<tr>
<td>Susan Eubank</td>
<td>F</td>
<td>Librarian</td>
<td>Los Angeles Arboretum and Botanical Garden</td>
<td>California, USA</td>
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<tr>
<td>Tony Kirchgessner</td>
<td>M</td>
<td>Database Administrator</td>
<td>NYBG</td>
<td>New York, USA</td>
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</tr>
</tbody>
</table>

Figure 38 Table of User Profiles
5.3. **User Testing sample questions**

The list of sample questions asked to users during User Testing sessions for wireframe and prototypes:

1. What are your first thoughts on the prototype?
2. What do you think this button will do?
3. What do you think about this feature?
4. How would you find such and such information?
5. Take us step by step through your process of conducting search
6. Is this what you expected?
7. What do you like about this prototype? Why?
8. What do you not like about this prototype? How can it be better?
9. Does this prototype help you in your tasks?
10. Would you use this search tool?