

Gardenizer

Problem and solution overview

We approached this project attempting to solve the problem of planning highly space-efficient, multi-season gardens. While a number of garden planning applications exist, most prohibit plant overlap and assume a single plant will occupy a given space over the course of a calendar year. We intended to help gardeners in urban areas with long growing seasons like Seattle optimize their space usage in a smaller garden. Our plan is to provide an application for the user to help them quickly find plants that work in their garden, to see what previous crops they've planted, and to journal how plants perform throughout the year.

Contextual inquiry participants

We selected contextual inquiry participants based on a professed interest in gardening in the city and some experience planning gardens from year to year. Since many many gardening tasks are season-dependent (for example, harvest), many of the tasks were not directly observable. We asked participants to walk through their planning process, talking through tasks and answering questions about their workflow. We also asked participants to share any plans and notes from this or other years' gardens.

Amanda

Amanda grew up in Sequim with a large garden that needed daily maintenance. When she moved to Seattle she chose her townhouse based on available gardening space and filled it with custom-made raised beds and wall-mounted grids. She took the master gardener course series last spring and is currently a master gardener intern working through her volunteer requirements.

Jen interviewed Amanda in Amanda's garden while she performed spring maintenance tasks such as weeding and clearing the garden. Amanda described her planning process, showed Jen around her garden, and shared her garden planning grid from the previous year.

Amanda practices square-foot gardening and uses a square-foot grid to create her garden plans. She does practice some succession planting, but generally just marks off space for future use. Amanda's garden is mostly in the shade and she's been challenged by finding plants that thrive in her garden. She's identified appropriate plants largely through trial and error, and would love to be able to trade vegetables with her neighbors with more sun-lit

gardens. Amanda particularly enjoys the social aspect of gardening, and loves that working in her urban garden gives her the chance to meet and talk to her neighbors.

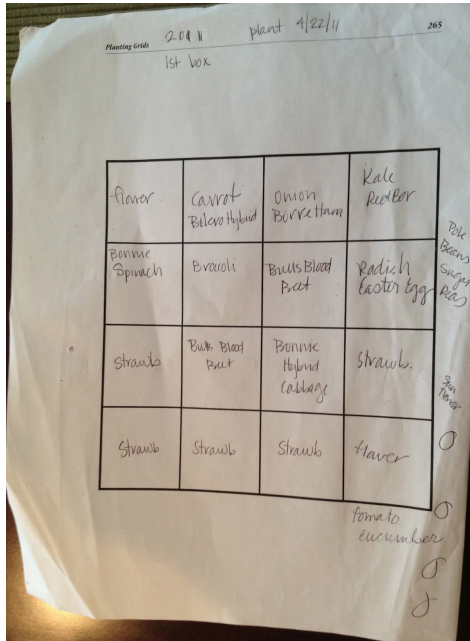


Figure 1. Sample planning sheet from Amanda.

Karen

Karen gardens in front of her townhouse, growing mostly vegetable beds. She is a beginning-level gardener and gets most of her information from Sunset Magazine. She prefers to grow things that she likes to eat, concentrating on high-yield crops.

Karen's interview took place in Jen's house in the same townhouse complex Karen lives in (Karen has a 4-month old daughter and felt more relaxed meeting outside her home). Karen showed Jen the notebook she uses for garden planning, walking Jen through her process for planning the year's planting and the priorities she considers when selecting plants. She considers the amount of space available first, then what things she would like to eat, finally narrowing her choices by what she thinks will grow successfully in Seattle's climate. Karen would like a way to place plant-sized images in a model of her garden ("maybe like a paper doll garden!"). She would also like a better way to keep track of what she planted, where she bought it from, and how well it did in her garden.

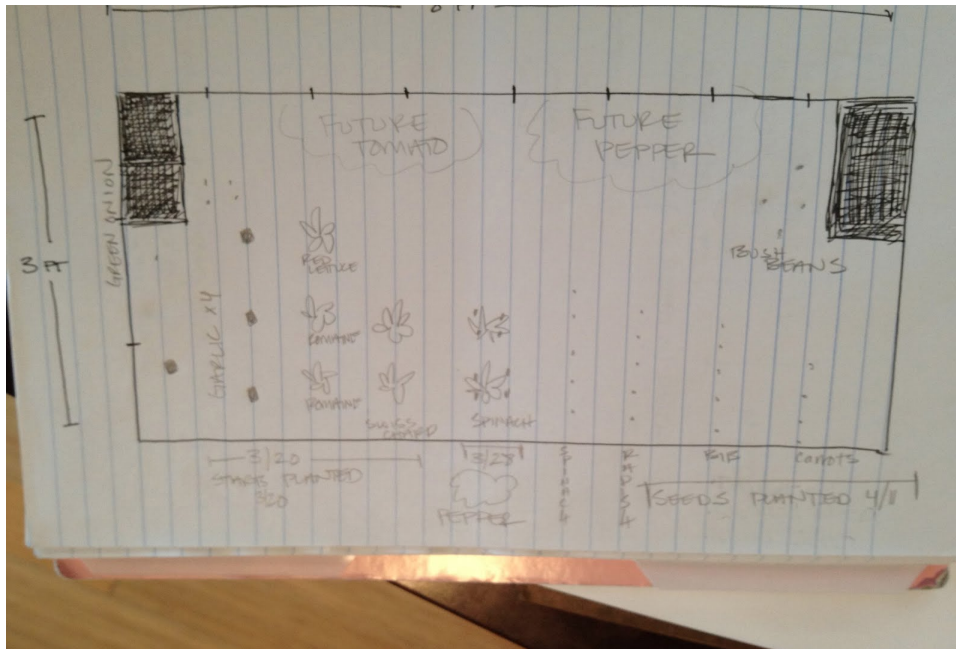


Figure 2-1: Sample hand-drawn garden planning sheet from Karen.

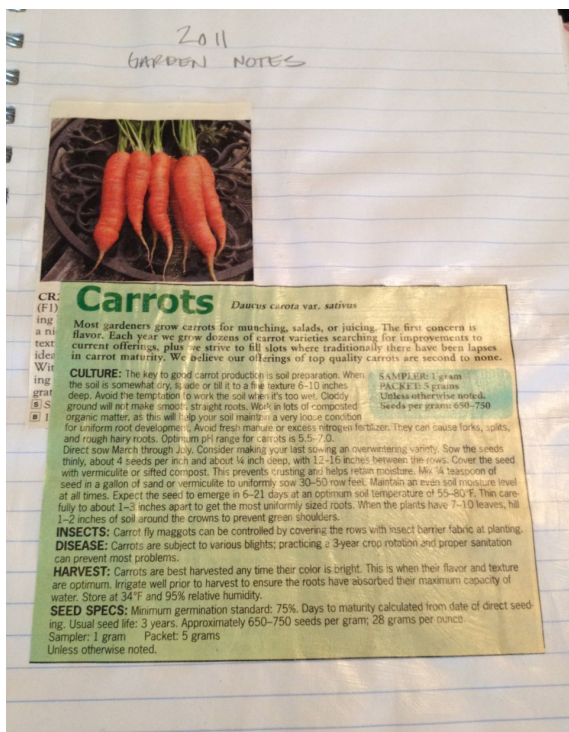


Figure 2-2: Sample plant info / notes sheet from Karen created from magazine cutout.

Brunson

Brunson has been slowly building a garden with his wife around his house in Ballard. He performs a lot of the gardening tasks and planning, but says his wife is the primary planner. In preparation for the interview, Brunson spoke with his wife about some of her desired application

features.

Jesse spoke with Brunson away from his home, discussing how a typical yearly planning cycle works. Brunson typically starts the year by deciding on a new section of the existing yard to convert into a garden. Plants will be selected for the new plot based on light levels and what is desired to be grown for food over the next year. Existing plots will also be planned during this time.

Brunson uses square-foot gardening, and typically plants a mixture of things in 3-by-3 foot squares (nine square feet). He was primarily interested in ways to aid timing of planting, and journaling features for tracking plant performance year to year.

Contextual inquiry results

We identified several common tasks shared between our contextual inquiry participants.

One task, perhaps the most critical in a garden planning application, is the selection of which plants should be planted in which parts of the garden. The participants used very similar criteria in selecting plants, using very similar methodologies. The participants started out with an idea of what kinds of food plants they'd like to grow, based on prior knowledge of what can be grown in the local climate, and what they would like to eat over the course of the year. They then analyzed their existing empty garden space, noting light levels, and any other features for planting (walls and fences, in particular). All participants broke their garden into sections, two of them by square foot, and selected a single crop for those sections (figures 1-2). All expressed some desire for interplanting within a square, but felt like it was difficult to plan, and were anxious about trying it. Participants then looked at what had previously been planted in the location, and factored in basic crop rotations - legumes fix nitrogen, tomatoes drain nutrients, etc. The plant itself was chosen based on all of these inputs.

Another task closely related to plant selection was the selection of when to plant. This was driven partly by harvest, and also by local conditions. Participants took notes about how long specific plants took to ripen in their previous plantings, or looked at time-to-harvest from the seed or plant provider. This, along with soil temperatures, informs when things should be put into the ground. Participants shared concerns that sometimes harvests were too close together, and that being able to stagger when plants matured would be desirable.

The other task participants shared was determining when plants should be watered. This varied a bit between participants. One had a timed irrigation system, while the others watered by hand, but all only watered when they felt like the weather had been dry enough for the plants to need it. They all felt like it was very ad-hoc, and could potentially be made more efficient.

Finally, all participants used some sort of journaling to track what had been planted year-to-year. Some were more detailed than others, but all had some paper-based tracking system. Comparing historical notes to the participants' description of their note-taking process showed

a mismatch between available records and their desire to keep historical data. Enabling more record-keeping and helping make these records available year-to-year might supplement our participants' garden planning.

Each participant also had some unique planning tasks or constraints as well.

Karen's garden is along the sidewalk and she is concerned about pets relieving themselves on edible plants. She blocks out the corners of her garden in her paper maps and reserves that space for inedible flowers.

Amanda was very interested in social planning. She really liked the community aspects of gardening, and especially wanted a way to plan crops communally for sharing at harvest time.

Brunson had a few specific planning concerns. He really wanted a way to plan out indoor starts, since he had trouble timing getting them in the ground. He also was very interested in seed saving, and didn't really know very much about the correct way to go about this, or the correct way to journal his results.

Task analysis questions

1. Who is going to use the system?

Our garden planning system is designed for use by beginning to mid-level gardeners that have some familiarity with basic gardening techniques, but may not always have a clear idea of what they'd like to plant or how to best maximize space usage. We assume our users know how to plant and prepare gardens, but do not have a fixed crop list for each year. Master gardeners could use our system for planning where to plant, but would find less utility out of the journaling and search features.

2. What tasks do they now perform?

These gardeners currently rely on traditional paper and pencil planning methods, creating personal systems involving hand-drawn garden maps and lists of historical planting dates. These gardeners typically use magazines and websites to collect information about plants and their care. Plants are selected based on what they wish to eat, and what kind of garden space is available.

3. What tasks are desired?

Our gardeners would like to be able to plan and visualize their garden more effectively, as well as track their progress for future planning. While their current methods are helpful, they had difficulty fully envisioning their year plan and notes tended to be lost from year to year. They would like to be able to identify plants that will grow well in the amount of time and space allocated, and to have advice for co-planting crops in a single space.

4. How are the tasks learned?

Our gardeners used books and websites to learn about planting techniques; in particular, square-foot gardening (a technique popularized with a book) was cited by all of them. Knowledge about garden planning was also acquired from friends or family members with an interest in gardening. Drafting of garden space and note taking was developed ad-hoc by each gardener.

5. Where are the tasks performed?

These planning tasks are typically performed at leisure in the participant's home. Research of plants and gardening techniques is performed indoors, while garden analysis is performed outdoors. Some plant research was also performed when shopping for seeds or plants.

6. What's the relationship between customer & data?

Our gardeners own the data they are using, since it reflects their own personal gardens. Some of the data, especially about which plants have been successful, is shared with others, but most of it is not interesting to other people. Despite not being shared, it's not very sensitive data, and wouldn't need to be kept extremely secure. The data needs to be accessible at home, in the garden, and at garden stores.

7. What other tools does the customer have?

Our gardeners used primarily pen-and-paper for garden planning, plus research materials. No other tools were cited.

8. How do customers communicate with each other?

Our gardeners liked to exchange gardening notes with other gardeners. As mentioned in the data section, they shared plant data most enthusiastically. They also liked to share information on how well plantings worked, and general gardening techniques, some of which fall under garden planning.

9. How often are the tasks performed?

Our gardeners typically performed one big planning session a year, with some additional planning as garden space was freed up by harvests. Maintenance was a daily task, depending on the season and weather. Journaling was performed as needed.

10. What are the time constraints on the tasks?

Most planning and maintenance tasks accommodate a wide time window, allowing gardeners to select days with appropriate free time and weather. One exception is watering, which some of our participants perform daily during the hottest part of the summer. In terms of dependencies, planning must occur before planting, and planting must occur before watering. Journaling occurs throughout the process.

11. What happens when things go wrong?

The gardeners we spoke to also employed trial and error in their learning process, discovering

over time which plants thrived, which took too much work, and which they enjoyed eating. Failed crops were often looked at as interesting learning experiences, though they could be frustrating. Our gardeners typically chose not to replant species or varieties that did not do well during a season.

Task descriptions

Sally lives in Seattle and has a small raised-bed garden in her front yard. While she doesn't consider herself, she is on her third summer of vegetable gardening. She prefers to buy seeds and plants locally and likes low-maintenance plants that provide plenty of food for herself and her friends. While her focus is vegetable gardening, since the garden is in her front yard, anything aesthetically pleasing is a plus.

Task 1: Interplanting

Sally knows she wants to plant carrots, radishes, and tomatoes. She knows that some of these plants grow faster than others, and that some need to be planted at different times. She wants to plan out her garden with these plants to use the minimum amount of space possible. She remembers that last year one of her tomato plants did particularly well and would like to look up which variety she planted.

Task 2: Finding New Plants

After placing all the vegetables she had in mind, Sally has a 4 foot by 2 foot space available at the end of her garden. One half of the space is completely sunny, while the other half has partial shade. This section is on the far side of the garden, so anything planted there will not shade the remainder of the garden.

Task 3: Records and Maintenance

Sally works full time and leads a busy social life, so sometimes she has trouble keeping track of garden maintenance. She would like help tracking her garden's growth over the summer, as well as help knowing when to perform garden chores. In particular, Sally would like periodic reminders to water based on recent weather and would like planting and thinning tasks to be added to her calendar. Sally would like to be view information about the expected development of plants in her garden and any relevant growing tips and would like to be able to record how the plants do in her garden so she can plan for next year.

Initial sketches and storyboards

Storyboard 1

Our first storyboard attempted to provide a detailed interface for garden planning that would support interplanting use cases, auto-calculate shade areas based on the landscape map and knowledge of the participant's latitude, and provide detailed note-taking options. We attempted to design interfaces to address some of the use cases our participants mentioned that they can't

meet well with their current tools.

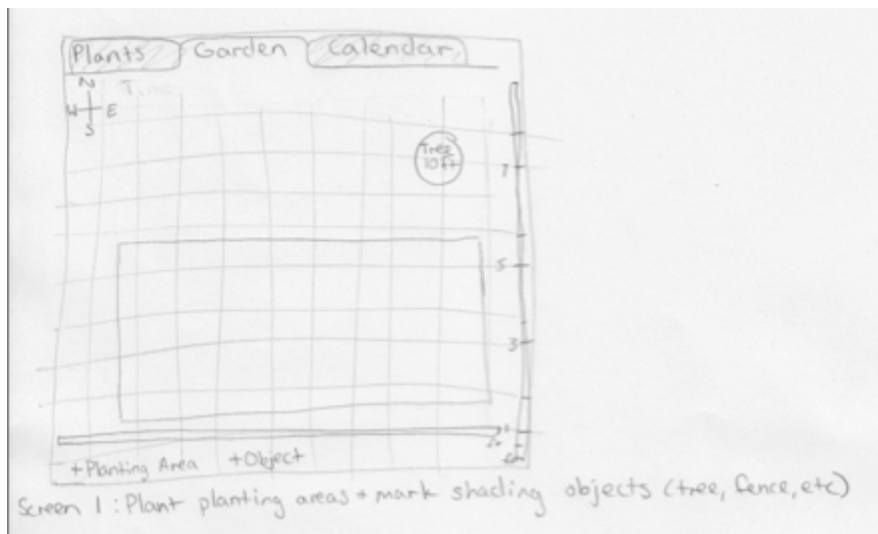


Figure 2.1: Edit garden layout.

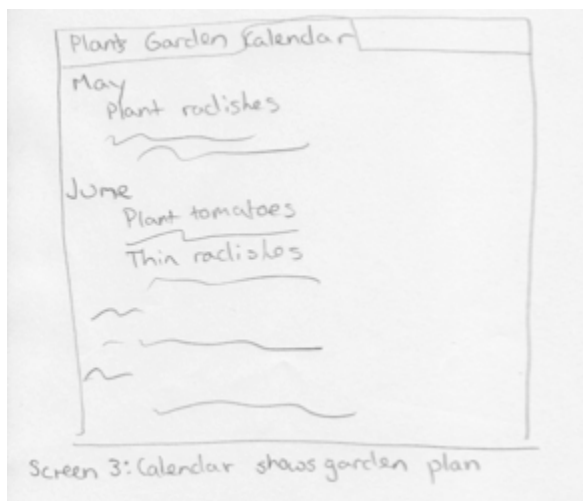


Figure 2.2: Calendar.

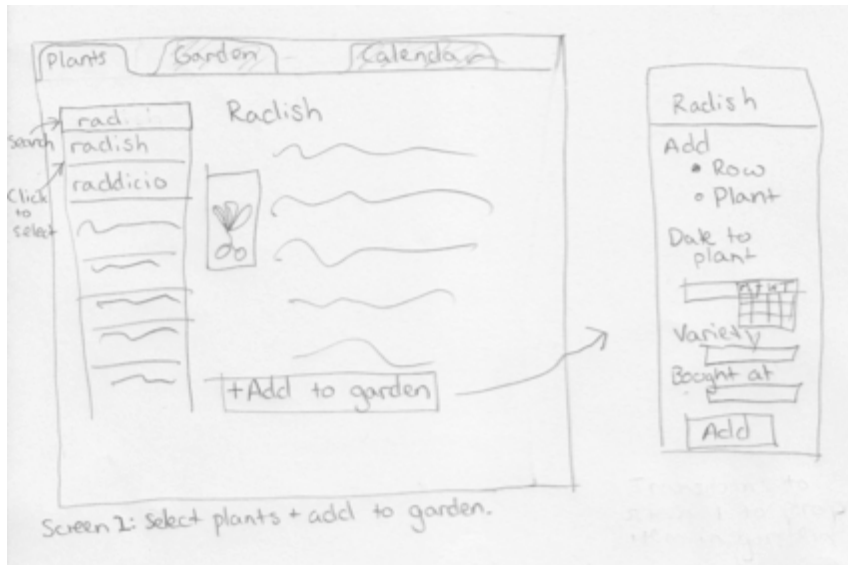


Figure 2.3: View plant information and add to garden.

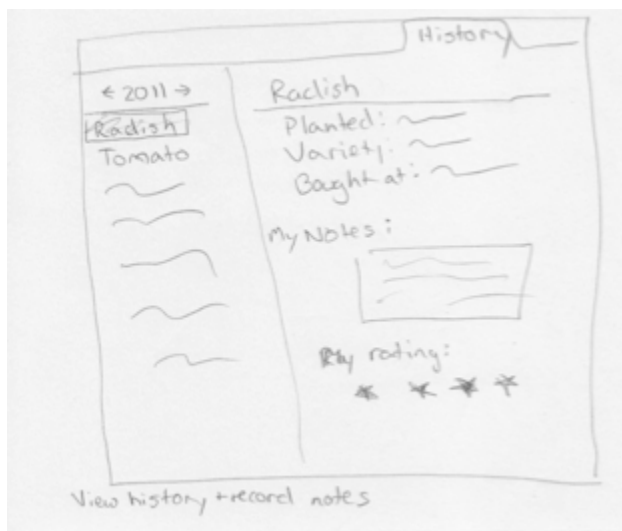


Figure 2.4: View history.

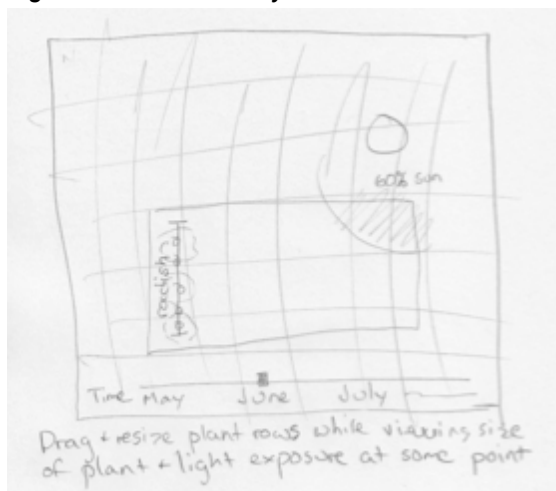


Figure 2.5. Arrange plants.

Storyboard 2

Our second storyboard provided a more beginner interface, allowing participants to explore plants more by requirement and quickly populate them in a square area. This storyboard also included more a more freeform note-taking interface that more closely matched what our participants are really using.

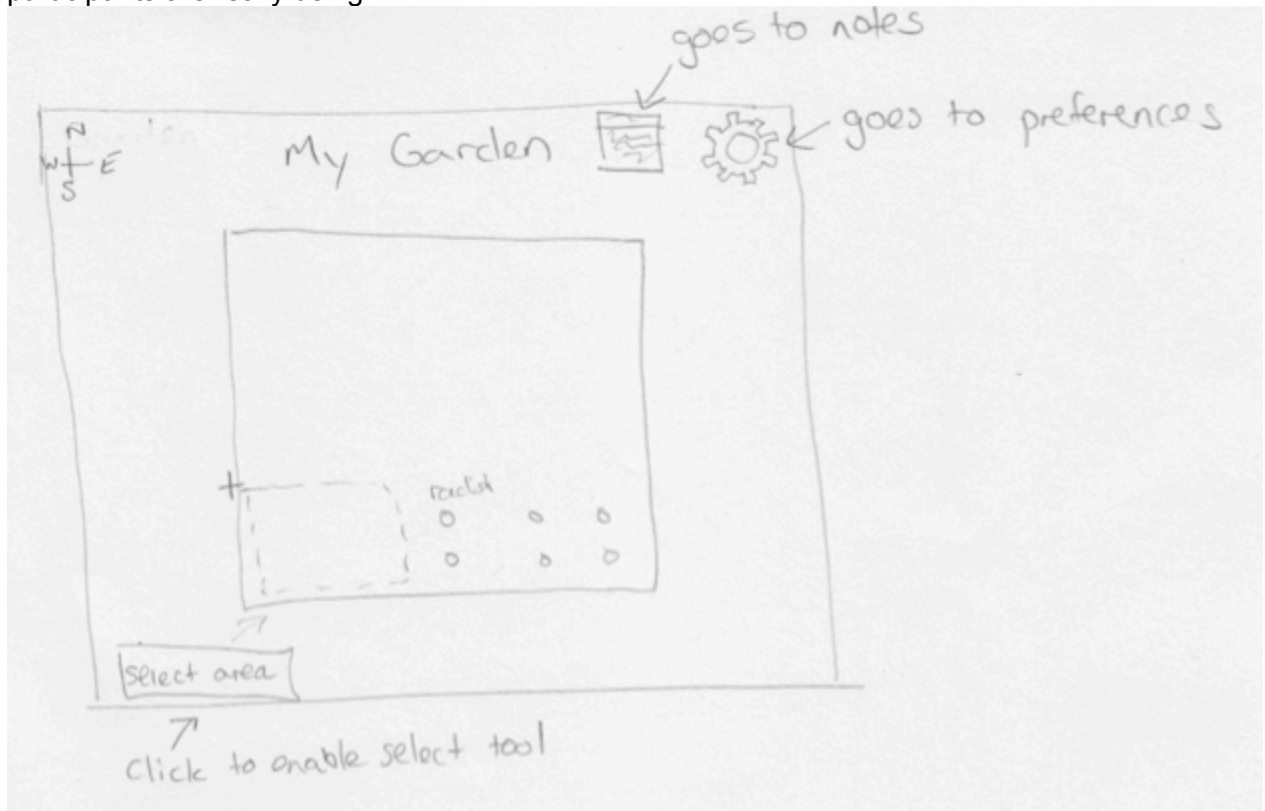


Figure 3.1. Select plant area.

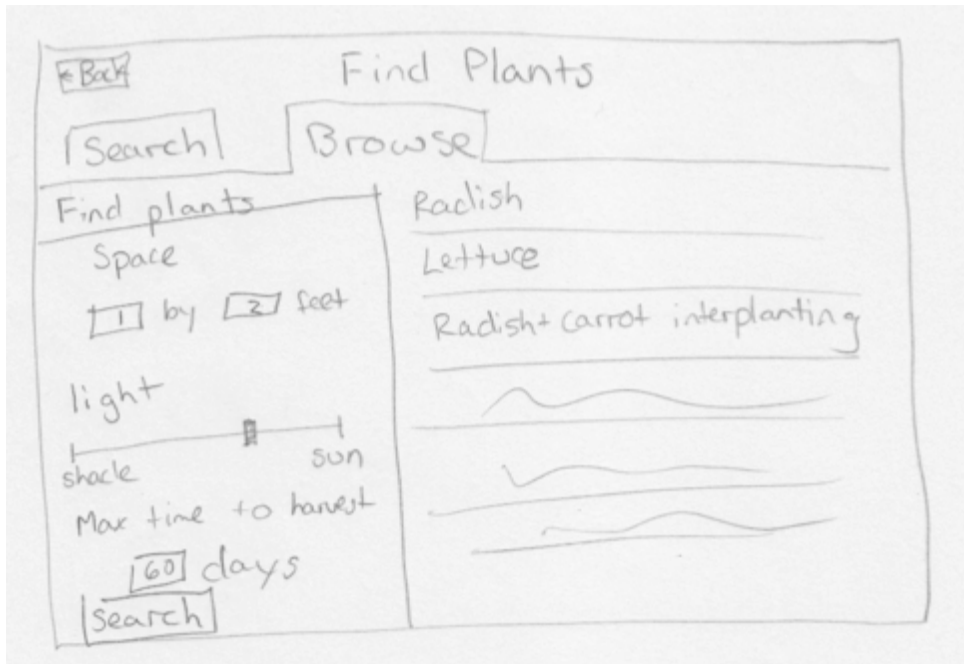


Figure 3.2. Search for plants by requirements.

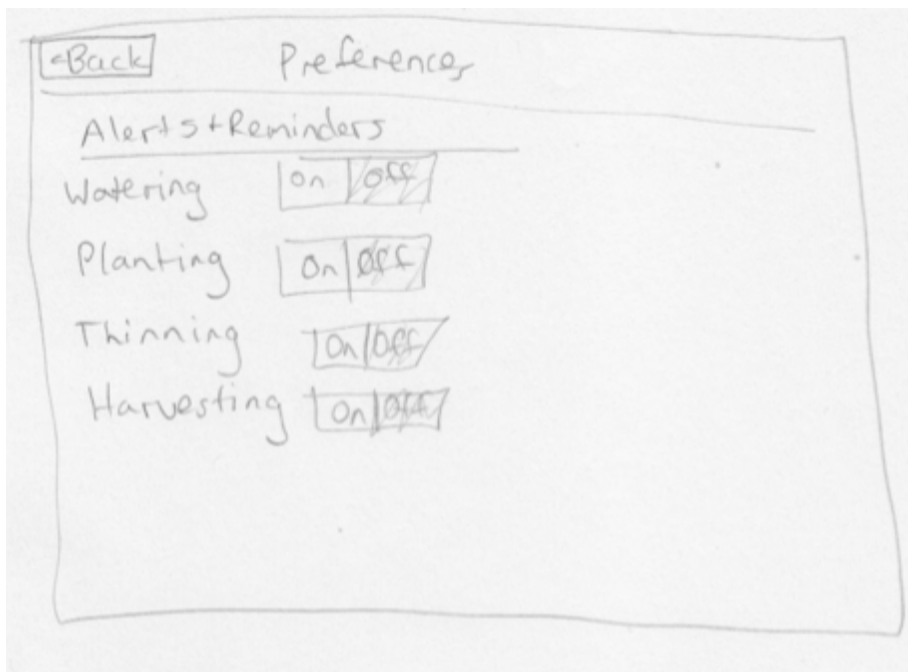


Figure 3.3. Alerts preferences.

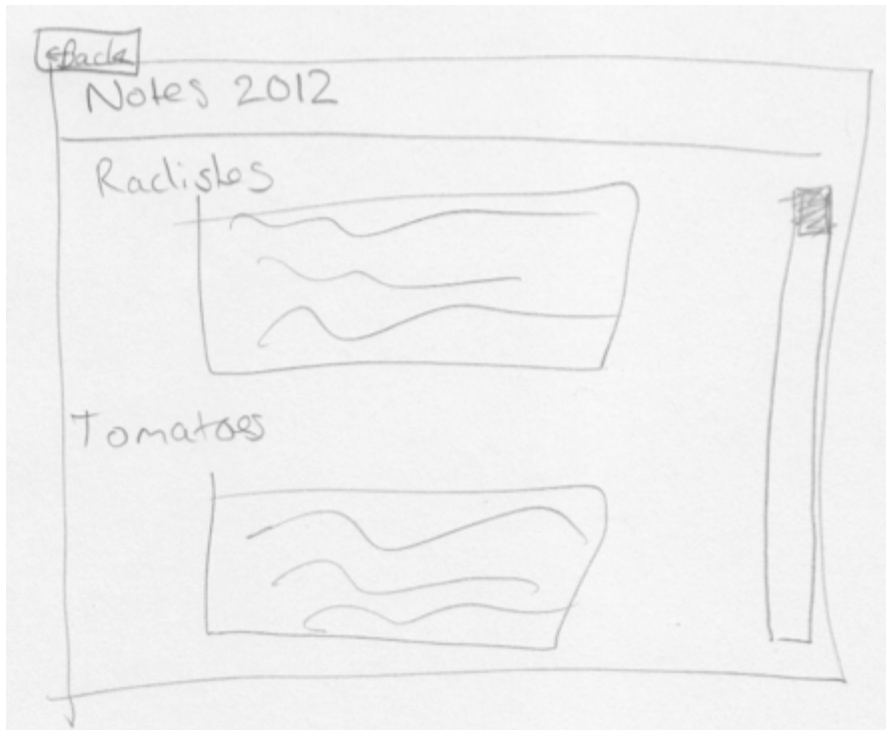


Figure 3.4. Note-taking.

Storyboard 3

Our final storyboard took a more graphical approach, attempting to make better use of screen real estate by using icons and multiple map modes.

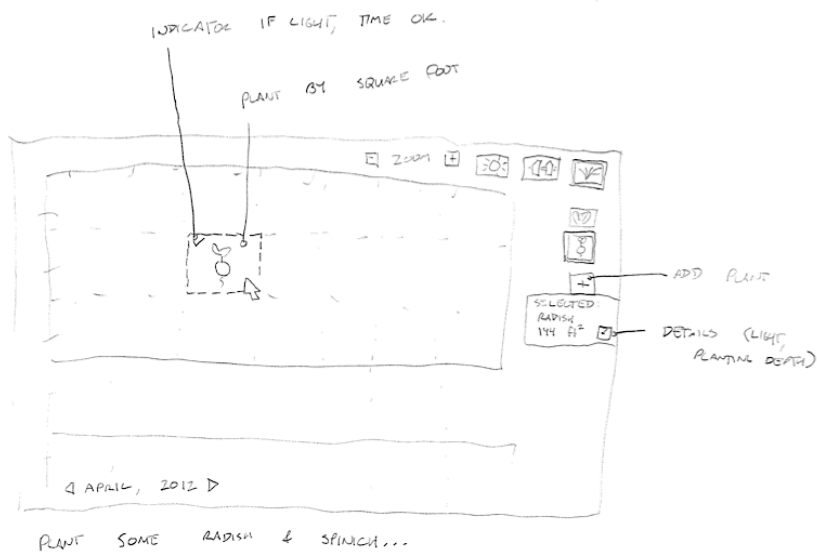


Figure 4.1: Plant placement.

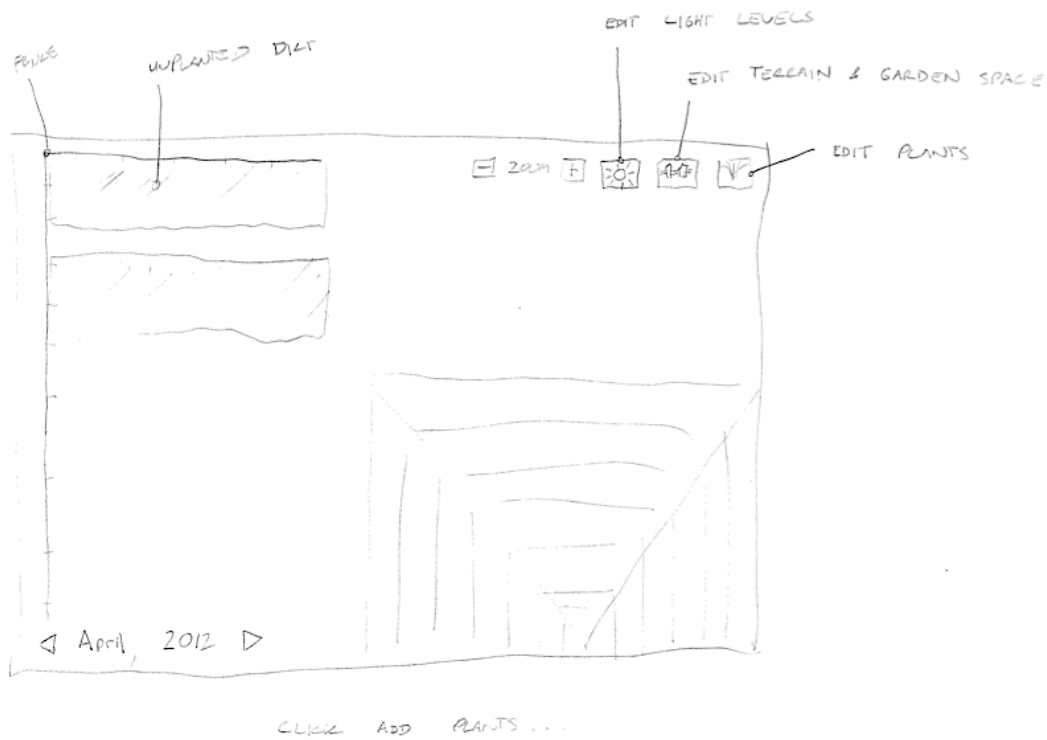


Figure 4.2: Terrain planning.

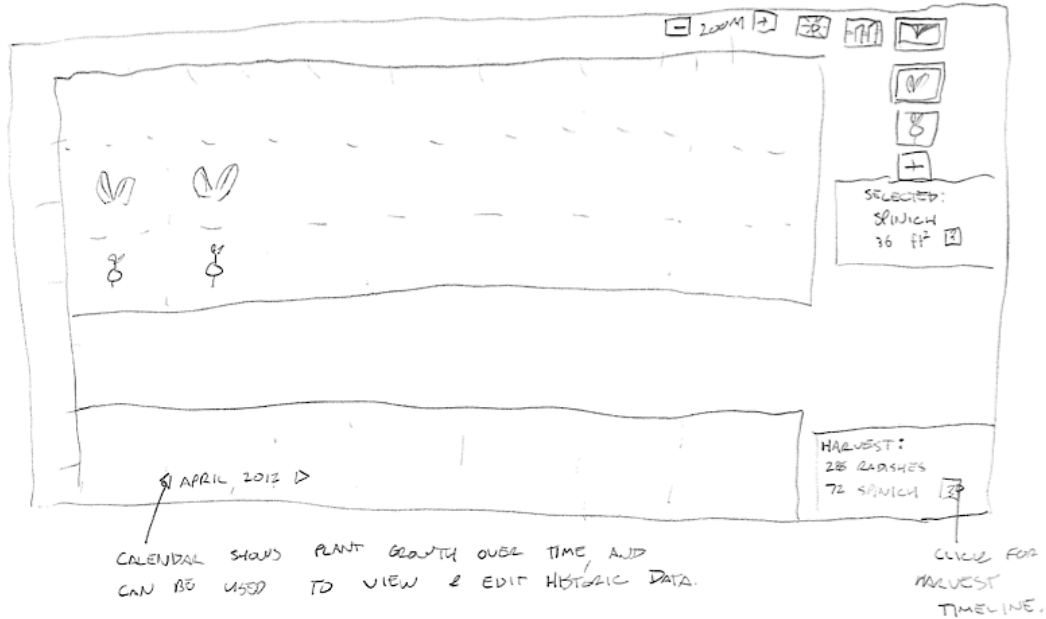


Figure 4.3: Plant growth over time.

Selected interface design

For our final interface, we decided to select the garden planning interface from storyboard 3 combined with the plant selection and notes sections from storyboard 1. We felt that these interfaces balanced the current workflow of our participants with potential new features they expressed interest in exploring.

All of our participants used paper and pencil planning for mapping their garden, so we wanted to provide a clear map of the physical planting space and a view of the plants at any given time (figure 5.1). This overview serves as the main screen in our interface. The map supports interaction in either a landscape planning mode, where users can edit the terrain and sunlight, and a planting mode, where users can add and edit plants in each garden bed. We selected Storyboard 3 for these views because we felt that the icons were clear and the interface was well-organized and made the best use of screen real estate. The ability to add non-garden features like a house or fence also mirrored our participants' hand-drawn maps.

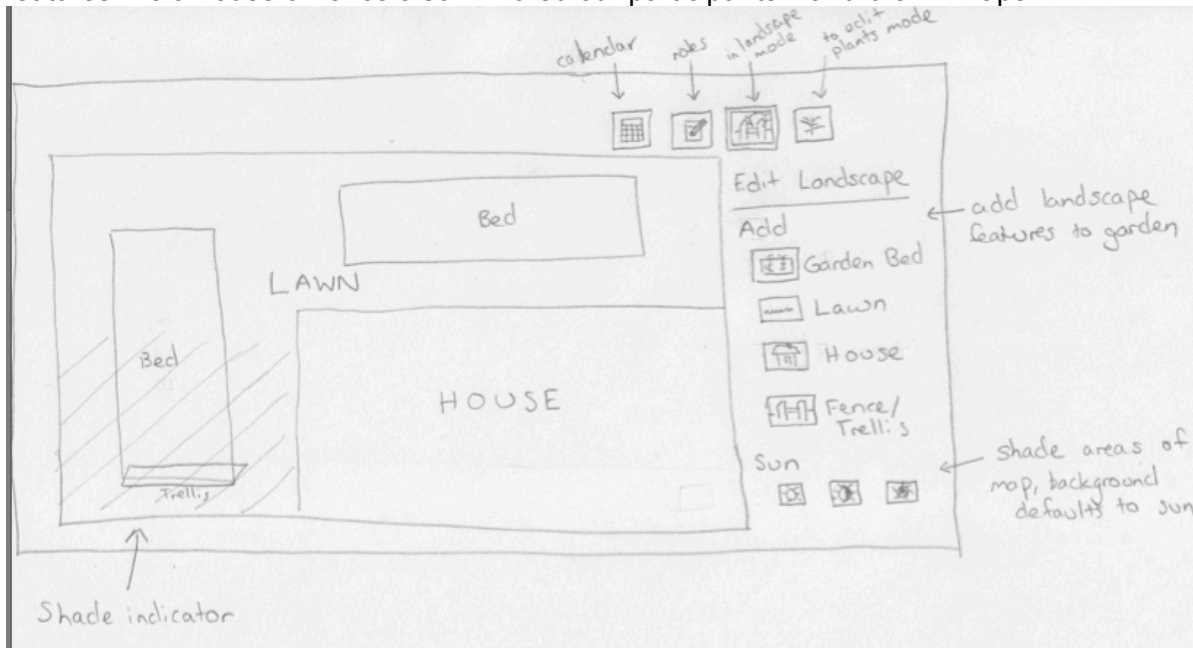


Figure 5.1: Garden map in landscape editing mode.

The above figure shows this in landscape editing mode. This mode is where a user would sketch out the basic layout of their garden, with additional terrain features for visualization and planning help. We included a fence / trellis option, since a couple of our contextual inquiry participants planted climbing plants, and mentioned using existing terrain features (e.g. fences) for them. This mode also allows a user to indicate light levels in their garden, which are used during plant selection to find appropriate plants for an area of the garden.

From this page, a user can click into “edit plants” mode (figure 5.2), using the top-right plant icon. This lets a user choose plants from a palette, and place them in the garden. While placing plants, a “fitness” indicator is shown which describes if the current plant is recommended in the spot selected - for example, if the light level is appropriate for the plant.

Both Amanda and Karen plant more than once in the same space during a year, but don't have a good way to represent this on their current paper maps. To support this use case, we added a timeline selector to the map so that the garden can be viewed at various points during the

year. An additional calendar view summarizes time-based gardening tasks over the year, such as planting and harvesting each planned crop (figure 5.5).

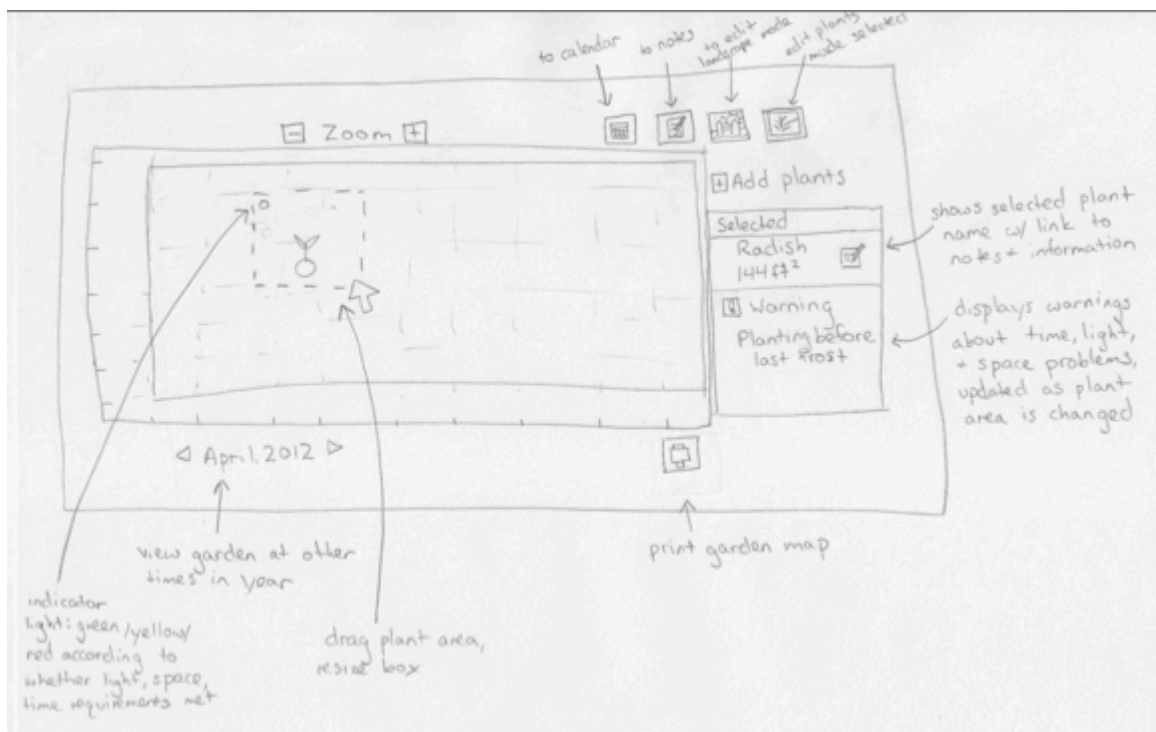


Figure 5.2: Garden map in plant editing mode.

Since our participants often carry these maps into their garden, we provided a print button so that disposable maps could be carried outside and gotten dirty without any risk of injury to long-term records or electronic devices.

Both the edit plants and the edit landscape views have buttons which take the user to the calendar or the notes views. From within the edit plants view, a user can add new plants to the palette with the "Add plants" button.

We attempted to support the participants' interest in exploring new plants, while limiting the risk of frustration. We did this by creating an interface where users could explore new plants based on their available garden space. New plants can be found by light, space, and time requirements (figure 5.3), and indicators on the garden (figure 5.4) display any potential incompatibilities. We also added a clear calendar view and an optional reminders feature to help our gardeners keep track of gardening tasks throughout the year (figure 5.5).

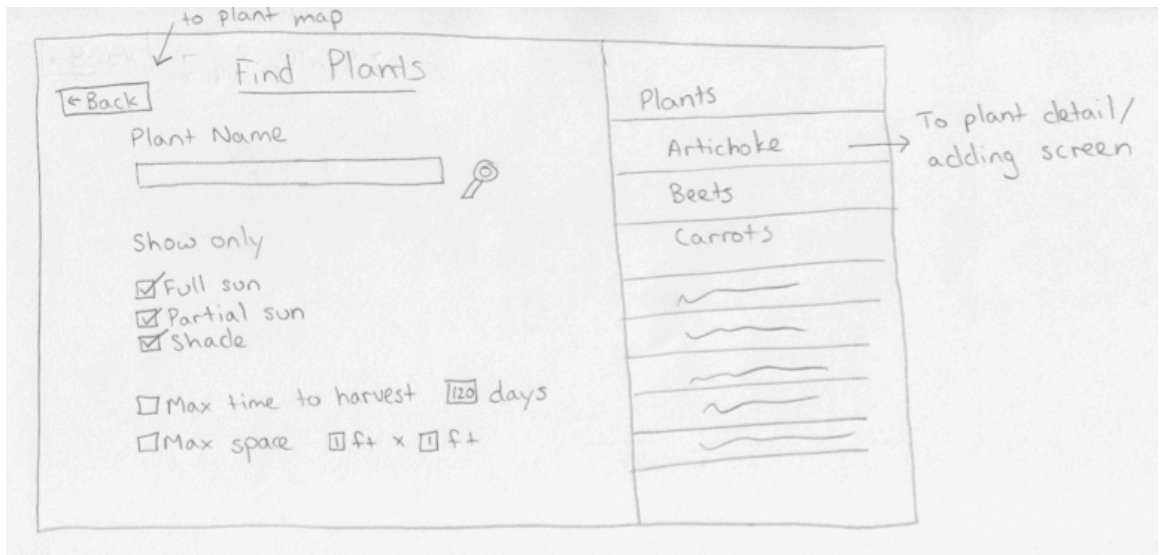


Figure 5.3: Finding plants.

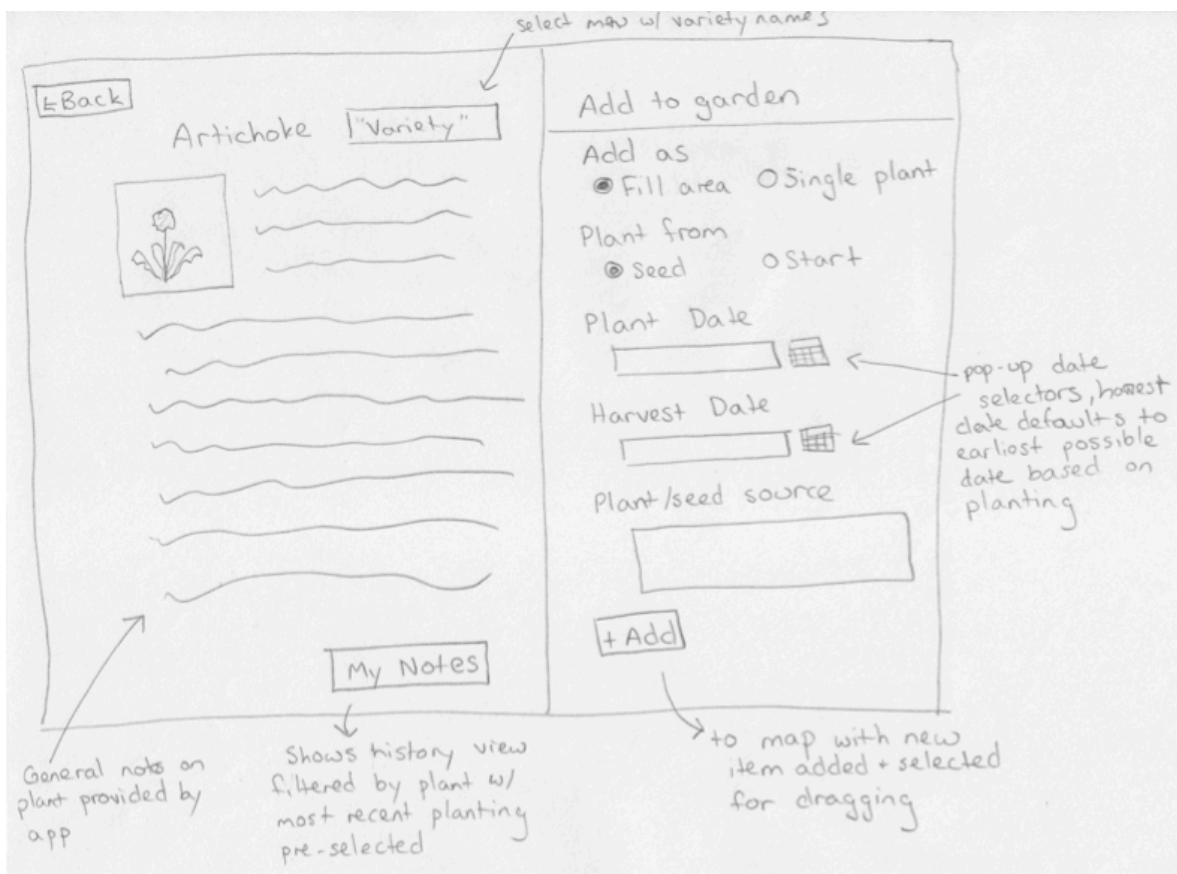


Figure 5.4: Plant information view and adding interface.

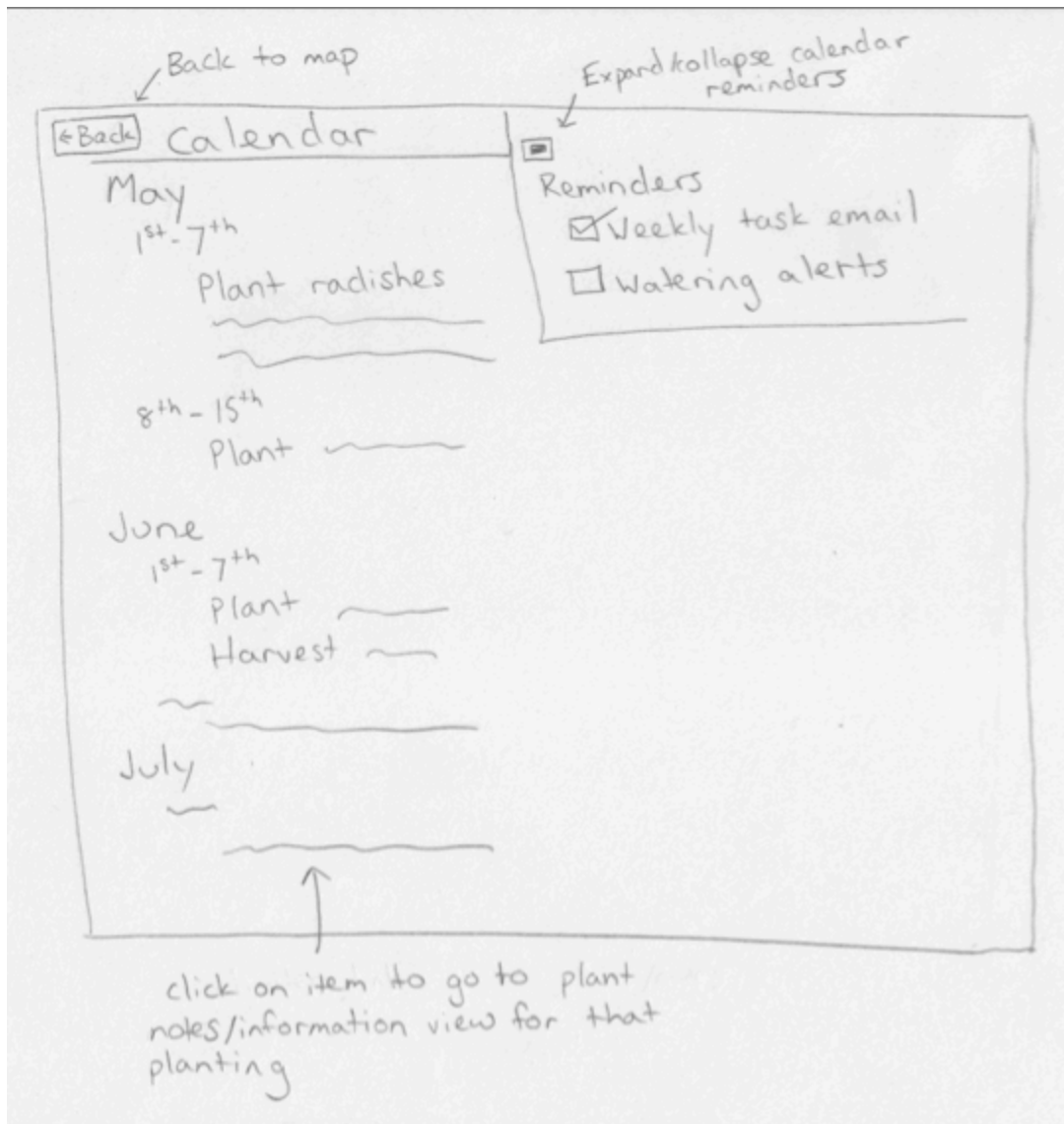


Figure 5.5: Calendar and alert preferences.

The above calendar view includes an option for sending reminders to the user. We included a weekly task option, which would generate a weekly report for the user for high-level gardening tasks, such as planting and harvesting. We also included a separate option for daily watering reminders, which would be triggered on weather conditions and plants' water needs.

All of our participants expressed interest in tracking a number of variables across years to inform future gardening. Based on examining participant notes, it appeared that this information is desired, but often goes unrecorded or is lost. To aid recording of such information, we chose a more structured notes interface (figure 5.6) with clear prompts for plant/seed source, notes, and an overall rating of how well the plant did. We included these prompts both in the original planning phase, when the gardener is mostly likely to remember which variety was planted and where it was procured, and later during the maintenance / harvesting calendar, when the plant's progress can be best observed.

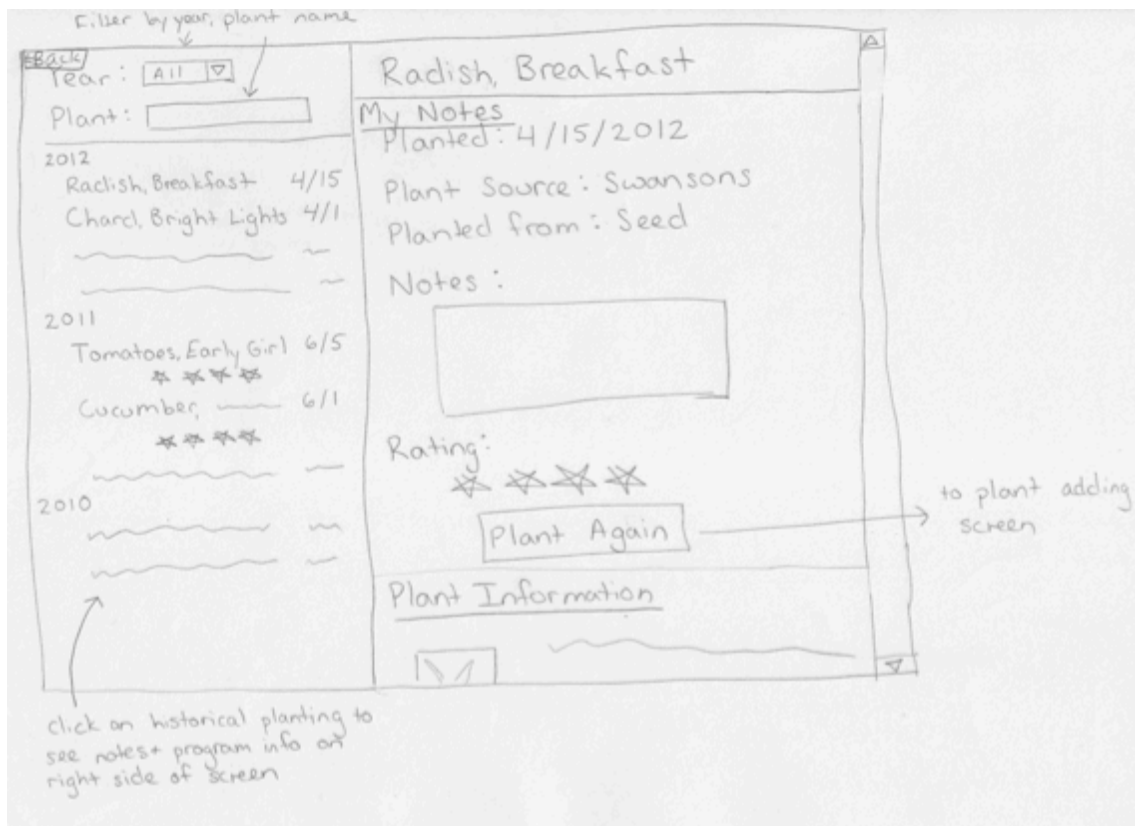


Figure 5.6: Historical notes.

Scenarios

Scenario 1

Sally opens the main interface and selects the planting view. She clicks add plants, then begins to filter the plants by name, entering “carrot” first. She clicks on the “carrot” result, then selects “add by area.” She enters a planting date of this weekend, accepts the default harvest date, and clicks the add plant button. She’s taken back to her map view with a new square on the screen with a carrot icon. She drags this into the correct location and shape for her desired row, then returns to the add plants menu to add radishes in a similar fashion. She adjusts this row as well, then drags it into the carrots area so there is a large overlap. She notices that a light icon on the carrot and radish areas both turn red and a warning about overcrowding appears on the right side of the screen. Sally slowly drags the radishes, decreasing the overlap until the indicator light turns green.

Sally returns to the planning interface a third time and finds tomatoes in the list. She knows that last year’s tomatoes did particularly well, but she can’t remember which variety she planted or when. She clicks the “my notes” button in the tomato information screen and is taken to the historical view. The view has tomatoes preselected and Sally sees a list of all her historical tomato plantings on the left with her most recent planting from last summer expanded on the right. She notes that she planted Early Girl tomatoes in mid-June and that she bought the plant start from the farmer’s market. She clicks the “plant again” button on this screen, returning to the add plants view with her variety and date preselected. She chooses to add a single plant,

and arranges it in her garden. Sally scrolls through the timeline selector at the bottom of the screen, noting that she can see the carrots and radishes growing together, the radishes then being harvested as the carrots stay in the ground, and the tomato plant later being added to the garden.

Scenario 2

Sally opens the main interface and selects the planting view. She clicks add plants, then begins to search for something to plant in the sunny section of her remaining space. She filters the list by full sunshine and a 2 x 2 area and scrolls through the list of matches for something interesting. She sees “zucchini” towards the end of the list. Remembering the delicious zucchini bread her mother makes, she clicks on that item to find a bit more information. Sally reads in the notes that zucchini is especially prolific, and she’s thrilled to find something that will produce lots of food, so she decides to add it to her garden. She selects a single plant, sets a plant date of next weekend, and allows the harvest date to be autopopulated. She selects the “add” button and is taken back to her map-based planting view for next week. She sees the new zucchini icon on in her garden and drags it into the appropriate spot.

Next, she clicks the add plants button again, this time searching for a plant that will tolerate partial shade and ultimately selecting a variety of loose-leaf lettuce. She knows she probably wants to plant more than one lettuce plant, but isn’t sure how many will fill the space, so she selects the fill area option. She’s returned to her map view and sees a lettuce icon inside a select box. She moves the box into the unfilled section of her garden, carefully dragging the borders until the indicator light turns green, letting her know the lettuce won’t interfere with her full-grown zucchini.

Scenario 3

To perform task three, Sally launches the application, then selects the calendar icon, taking her to the calendar view. She sees the current week at the top of the page and notes that it indicates that she should thin her radishes next week, as well as plant more lettuce. She remembers that she has a particularly busy week next week and might forget about the garden, so she opens the reminder preferences pane and turns on watering reminders. Now she will receive an email reminder based on the weather anytime her plants are likely to require watering.

While she has the application open she decides to note that the cilantro she harvested this week did particularly well. She clicks the “harvest cilantro” item in the calendar under this week, which takes her to the plant notes page for that planting. She rates the variety as four stars, and writes a note that this variety made especially good salsa.