A Guide to Maintaining the Raised-Bed Garden at the Rosebud Continuum Sustainability Education Center

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Executive Summary

The Rosebud Continuum Sustainability Education Center (Rosebud Continuum) receives waves of different Patel College of Global Sustainability (PCGS) students each semester as well as different volunteers and visitors periodically. Because the center's undertakings focus on the food-water-energy nexus, there are a variety of different topics that each of the students, volunteers, and visitors will partake in or learn about depending on the project of interest. Some of these projects already incorporate on-site educational content available to the visitors, for example, entry signs with information on how to eliminate wasteful junk mail from being sent to you, "how it works" tags on the biodigester models, and Zappar interactive codes on the composting toilets. The existing raised bed garden section of the center can benefit from the addition of an educational maintenance guide for future students and visitors to use, learn from, and even amend.

The development of the maintenance guide is specific to the existing raised bed garden at Rosebud Continuum; however, the general information principles can likely be implemented at any individual private or community level raised bed garden with similar climate conditions. In developing the maintenance guide, three different fast-growing cultivars (microgreens, radishes, and spinach) were planted from seed in a small section of an existing wooden raised bed for demonstration and experimentation. The cultivation and associated maintenance implemented during this demonstration was analyzed for successes and for future improvement recommendations. Some of the successes achieved during the demonstration included producing a well-drained and fertile soil favored by the crops, waste elimination, and water use minimization. It is important to note that sustainability principles are evident throughout the onsite demonstration. Some of the recommendations formed during the process include the purchase and use of soil pH testers and structural reconfiguration of the beds to ensure accessibility for all.

The benefit of developing a site-specific guide is that students and volunteers are provided with information resources available right on the property. For example, this information includes the tools and equipment available on site for creating soil and fertilizer, for planting, and for finding uses for any waste that may have been created in the process. Additionally, the guide provides sustainability insights related to raised-bed agriculture which are key to the principles of Rosebud Continuum and may not necessarily be implemented in other raised-bed gardens that visitors may have interacted with outside of the center. Ensuring that

students and visitors apply best-management practices in sustainable ways can ensure that the property is respected and that the center's core values are met. Because new discoveries, advances in technologies, and innovation are unending, especially in sustainability, we encourage future students and volunteers to update this guide.

Overview of the Project

Topic

Serving as a sustainability education and research center, the Rosebud Continuum Sustainability Education Center (Rosebud Continuum) is a 14-acre property in Pasco County, Florida that implements alternative food production methods (Smith, 2021) among many sustainability endeavors. One of the alternative methods used is sustainable raised-bed gardening, a method that can be used in private backyards or even in dense urban environments. The Rosebud Continuum's raised-bed garden consists of cinderblock beds, wooden beds, and a combination of wooden beds and trellises. This analysis focuses on the maintenance of the Rosebud Continuum's existing raised-bed garden while evaluating the maintenance success and proposed improvement recommendations. While the field operation for this guide was conducted only on one of the existing wooden beds, the maintenance methods explained in this analysis may translate to the other existing raised-bed mediums. In addition to guiding future students and volunteers in the maintenance of Rosebud's raised bed garden, this analysis aims to point out a variety of sustainability principles involved with raised bed gardening.

Introduction

Some early evidence of raised field agriculture, known and practiced as raised-bed gardening in modern times, has been traced to pre-Hispanic cultures of Latin-America including northwest regions of South America and southern regions of Central America (Janusek & Kolata, 2004). It is thought this method was developed to overcome certain environmental challenges such as flooding prevention in lowlands, frost protection, and moisture level control. Similar agricultural concepts also developed in other parts of the world to meet region-specific conditions and challenges. For example, Hügelkultur, a term coined by German and Eastern European cultures having used it for centuries, is a raised field agriculture method that was developed to utilize woody debris for food production rather than simply burning it (Feineigle, 2012). One of the Rosebud Continuum's many ideals is not only to implement current and evolving technologies, but also to embrace and practice the best knowledge from the past (Rosebud Continuum Sustainability Education Center, n.d.).

Raised-bed gardening is often associated with supporting urban food security while promoting community interaction and discourse through its use in community gardens (Luke, 2014; Pollard et al., 2018). While the obvious goal of this agricultural method may be to produce food alone, especially in open-land scarce areas, health and civic engagement are two other major outcomes (Drake & Lawson, 2015). The threat of rising food prices, not only in urban regions, due to climate change is a food security issue that may be mitigated using community gardening (Pollard et al., 2018). These are also crucial in food insecure areas where the only other access to fresh foods is limited to those who have the means of travelling long distances. Despite these benefits, raised-bed agriculture through community gardening has received some governmental pushback. A popular example of such pushback in the United States is the case of Ron Finley, a south-central Los Angeles gardener and founder of the Ron Finley Project, who battled the city's zoning laws through the legal system to be able to grow food in city-owned dirt patches adjacent to private homes. His current organization is a gardening training facility aimed to combat food insecurity and to promote "guerilla farming" in efforts to persuade city officials to allow these types of community agriculture operations (Ron Finley Project, n.d.).

In the greater scope of global sustainability, raised-bed gardening is a small but valuable piece out of all the solutions that must be implemented to mitigate for our growing environmental concerns. Changing global climates will disturb current regional and global food production systems, and because all humans need to eat, it is likely that that we may see a shift towards individual communities and people finding ways to feed themselves to account for the disruptions in our traditional food systems. Florida specifically is highly susceptible to some of the worst predicted effects of climate change due its peninsular nature, predominant dependence on highways and cars, lack of efficient and accessible recycling operations, rapid growing population, and vast wetland-reducing development. While the focus on global sustainability and environmental advancements should be focused on reversing human-accelerated climate change, some argue that due to our current reality we should be focusing on ways to adapt to the certain forthcoming effects of climate change. Naturalist Ginny Stibolt (2009) encourages Florida residents to use raised bed gardening as a tool to individually reduce environmental impacts, make the best use of natural resources, save time and money, reduce carbon dioxide and increase oxygen, offset excessive heat, increase natural habitats, and prepare for disasters like hurricanes, fires, and drought.

The existing raised-bed garden at the Rosebud Continuum is a valuable education model for a community member or organization that may aim to implement a community agriculture operation in their city, apartment complex, private home, business, or other setting.

The upfront costs and initial upkeep of a raised-bed garden operation could be higher than a few trips to the local grocery store, but the long-term production of food, health, community, and other ecological services should outweigh the initial monetary costs given the proper maintenance. Additionally, maintaining a raised garden can enlighten the gardener or community of gardeners on the food-water-energy nexus, and on the challenges faced and solutions needed to implement sustainability principles.

Review of Literature

Raised beds offer significant advantages for soil management versus traditional gardening methods. Having the soil raised up provides better drainage, preventing water-logged and compacted soil from hindering root growth (Starbuck, 2003). This improved drainage is especially useful for perennial plants that need extensive root systems (Cogger, 2017). Constructing a raised bed can be done in areas with poor soil quality, contamination, or in areas with no soil, such as rooftops and urban environments (Cogger, 2017). Soil creation and amendment using composts and supplemental organic matter can substantially improve soil quality (Mitchell, 2017). Because the soil is raised up, it warms up earlier in the season, stays warm later into the fall, and is easier to manage in the rainy weather of the offseason because of its improved drainage, all of which make for an extended growing season (Mitchell, 2017). Raised beds can be more productive than in-ground gardens due to the better soil quality and the ability to plant more densely since no space is wasted on walkways (DelValle, 2013). Healthy soils are fundamental in maintaining a sustainable garden by reducing a gardener's attention time, energy, and money (Stibolt, 2009). Soil quality is fundamental to a plant's success, and is easier to manage in a raised bed, however the barrier between a raised bed and the surrounding soils offers additional advantages.

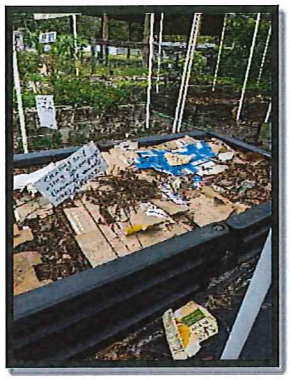
Distancing the garden bed from ground and having established pathways offers gardeners better control over what goes into and out of the bed, which reduces pests and weeds, and improves water, nutrient, and soil conservation. Water can be applied only to the garden beds and is not wasted on pathways; in addition, plants grown closely together decrease evaporation due to increased shading at the plant's base (Mitchell, 2017). In a study comparing large-scale production in raised beds versus conventional cropping systems in the arid soils of central Mexico, (Lichter, 2008) found that growing in raised beds increased water infiltration, reduced soil erosion, broke up soil borne pathogen cycles, and reduced weed pressure. The isolated nature of the raised bed from the ground is advantageous as it reduces nutrient competition between the target crops and the surrounding larger trees (Stibolt, 2009). Whether at a large or small scale, the control over the environment given by using raised beds can

reduce many of a gardener's traditional problems, and in certain situations—areas with poor soil quality, prone to erosion, or with major weed and pest issues—a raised bed can be tremendously helpful, however there are some drawbacks to using raised beds.

Several of the advantages offered by raised beds come with downsides, involving soil temperature, maintenance, and potentially, pest problems. Because the soil heats faster in raised beds, it dries out more quickly, and while these are advantages in the spring and fall, in the summer this can damage the plants (Starbuck, 2003). Importing non-native soils to use in raised beds can cause issues with pests or be of poor quality, but if you can make your own soils out of some native soil and organic matter you can avoid this problem (Cogger, 2017). Sustainable and cost-effective native materials in Florida that can create better quality soils are leaves, pine needles, and wood chips from tree trimmings (Stibolt, 2009). Raised beds require significant time and cost for the initial construction and soil buildup (Cogger, 2017). Maintaining raised beds requires periodic additions of organic material to prevent nutrient loss and rebuild soils as they subside and the added materials decompose, however over time fewer and fewer inputs are required (Starbuck, 2003). Soil quality can be lost over time with no additives, but simply retaining the plant residues (everything left after harvesting) within the beds at the end of the season can prevent this issue (Lichter, 2008). Crowded plants in raised beds can foster diseases or attract insect populations; to reduce these issues you can grow multiple types of plants (intercropping) and rotate plantings frequently (Mitchell, 2017). With each environmental problem there are effective solutions, but one aspect of raised beds is entirely unrelated to the soil, the human element.

Gardening can be backbreaking, labor-intensive work, but with raised beds accessibility is greatly improved, especially for those who otherwise might be unable to participate in gardening. Having garden beds raised several feet above the ground reduces how far you must stoop over to reach them, improving access for those with bad joints or impaired abilities (DelValle, 2013). Walkways between raised beds can be made wide enough for wheelchairs, or for several people, for example, groups of children, to work in the beds at the same time (Mitchell, 2017). Benches can be built along the sides of the beds to allow for seated access to the beds. Some raised bed gardens can even be built on rolling carts so that they can be rolled into sunny areas during the day and moved to shady, more comfortable areas when tended to by the gardener (Stibolt, 2009). Raised beds offer a solution that makes gardening accessible to nearly all people.

Guide:



Step 1: Reducing Weed Pressure (optional)

A barrier of newspaper or cardboard can be laid down a few weeks before you want to plant, or below your new soil layers if weeds are an issue. Moisten the barrier to aid in decomposition. Alternately consider doing this after your season if weeds have been an issue.

Note: you may use this de-**composting bed**, or other compost piles, **during your regular crop maintenance to dispose of unwanted weeds and wilting leaves.**

Step 2: Soil Building – Fill & Water Retaining Material

Many materials can be used to build new layers of soil. In raised beds in the first few years the soil subsides as it decomposes and so it must be built back up again.

At Rosebud, an easy method is to start with a filler such as sand, which can help water infiltrate, and creates space to hold water. Ask the Bishops for help in locating tools, wheelbarrows, and materials. See Tip 1.

Step 3: Soil Building - Organic Material

Alternate layers of sand and organic material, such as leaf mulch, worm castings, ground-up food scraps, mushroom compost, aged bark/mulch, hay, rotted grass clippings, animal manure, and traditional compost from food scraps and decomposed plants.

Note: a goat enclosure is located just west of the raised bed garden. Collect goat manure for soil fertilizer. Consider experimenting with the aquaculture effluent if available.

Step 4: Soil Building – Completion

Feel free to mix and match organic materials. After adding sufficient material so that the level of your new soil is where you want it, mix the layers together and into the existing soil with a pitchfork or shovel.

Be sure to include a balance of nutrient dense materials like manure and filler like dry hay, leaf mulch, or other dried plant matter. We used sand, a mix of manure and hay, ground up moldy carrots, and leaf mulch.

Note: a food grinder is located at the entrance of the goat enclosure near *El Dragon* biodigester. Use the grinder to create your own nutrient source for the soil composition.

Step 5: Let it Rot Together

Let your new soil decompose for at least a week or more so that soil microbes can start to break down the organic material.

During this time, you can start your plants in the greenhouse if necessary.

Step 6: Plant Planning

Plan out what plants you'd like to grow, do they require being started in a greenhouse and then transplanted into the beds?
See the below guide for planting in Florida at different times of year. September and October are ideal times of year to start many Florida crops.

Plants with low germination rates are good candidates for starting in a greenhouse so that when you transplant them in, you can fill your entire bed and no space is wasted on seeds that don't germinate. Potting mix and trays are available in the Rosebud hoop house.

Note: The greenhouse contains a small seed bank that may be available for your use. Consult with the Rosebud folks if you are interested in using the on-site seeds. Feel free to contribute any extra seeds you are left with after your season.

Central Florida Vegetable Planting Calendar

January	Arugula, Beets, Broccoli, Brussels Sprouts, Cabbage, Cantaloupes,Carrots, Cauliflower, Celery, Collards,Corn, Cucumber, Eggplant, Kale, Kohlrabi, Lettuce,Mustard,Onions, Peas(english), Peppers,Potato,Radish,Spinach,Squash, Swiss Chard,Tomatoes,Turnips,Watermelon	**July**	Okra, Peas(Southern), Pumpkin
February	Arugula, Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Cantaloupes, Carrots, Cauliflower, Celery, Collards, Corn, Cucumbers, Eggplant, Kale, Kohlrabi, Lettuce,Mustard, Okra, Onions,Peas, Peppers, Potato, Radish,Spinach, Squash(Summer&Winter), Swiss Chard, Tomato, Turnips, Watermelon	**August**	Beans, Carrots, Eggplant, Okra, Onions, Peas, Peppers, Squash(Summer&Winter), Tomato
March	Arugula, Beans,Cantaloupes, Carrots, Corn, Cucumbers, Kohlrabi,Okra, Onions,Peas, Peppers, Potato(Sweet), Radish, Spinach, Squash(Summer&Winter), Swiss Chard, Watermelon	**September**	Arugula, Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Collards, Cucumbers, Eggplant, Kale, Lettuce,Mustard, Onions, Peppers, Radish, Spinach, Squash(Summer&Winter), Strawberry, Swiss Chard, Tomato, Turnips
April	Beans, Corn, Okra, Peas,Potato(Sweet), Squash(Summer&Winter), Swiss Chard	**October**	Beets, Broccoli, Cabbage, Carrots, Cauliflower, Collards, Kale, Kohlrabi, Lettuce,Mustard, Onions, Radish, Spinach, Strawberry, Turnips
May	Okra, Peas(Southern),Potato(Sweet), Swiss Chard	**November**	Arugula,Beets, Broccoli,Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Collards, Kale, Kohlrabi, Lettuce, Mustard, Onions, Peas, Potato, Radish, Spinach, Swiss Chard, Turnips
June	Okra, Peas(Southern),Potato(Sweet)	**December**	Arugula,Beets, Broccoli,Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Collards, Kale, Kohlrabi, Lettuce, Mustard, Onions, Peas, Potato, Radish, Spinach, Swiss Chard, Turnips

Retrieved from: https://www.flgardening.com/florida-vegetable-planting-calendar/

Note that the primary season for starting crops is September – March.

Step 7: Planting!

Carefully map out your rows of plants. Consult the seed packets for the optimal spacing and depth to plant seeds or transplant seedlings. Try to maximize your space. Generously water the seeds. Label your plants, including the date of planting if possible.

Consider planting companion crops that mitigate pests. For example, Basil and Marigolds are both natural insect repellents and can be mixed in at the edges of beds or underneath tall plants.

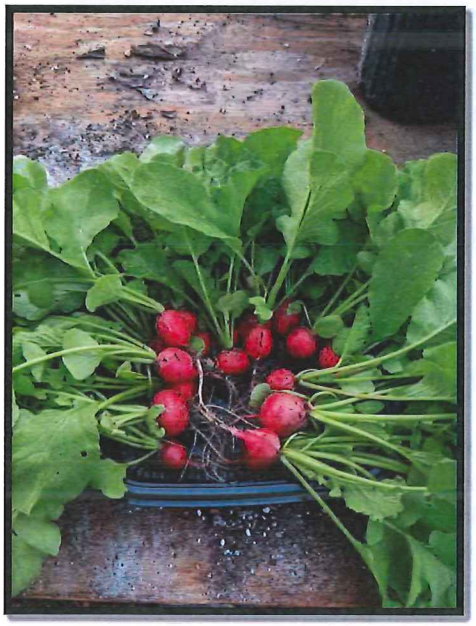
Some plants should not be planted together so check this as well. Some plants could be planted in groups instead of rows. This practice can help eliminate unnecessary tending such as watering and weeding between traditional rows.

Step 8: Taking care of your baby plants

Lookup how frequently your plants need to be watered and plan a watering schedule. Try to water only on your plants to avoid wasting any water. Talk to the folks at Rosebud as they may be able to help you with the watering. Remember if it rains, no need to water.

Weed between the rows and around the plants. Lookup the baby versions of your plants if you have trouble identifying what is a weed and what is your plant. See Tip 2.

Some plants may need special attention, such as trellises for tomatoes, peas, or cucumbers, that can be added as the plants get too tall to stand on their own.

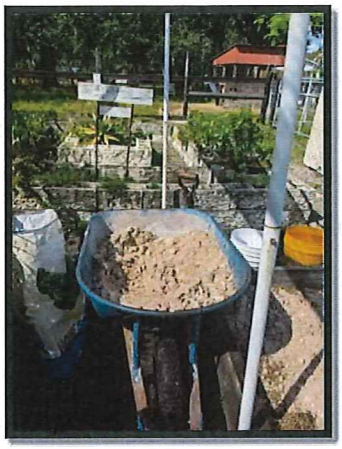


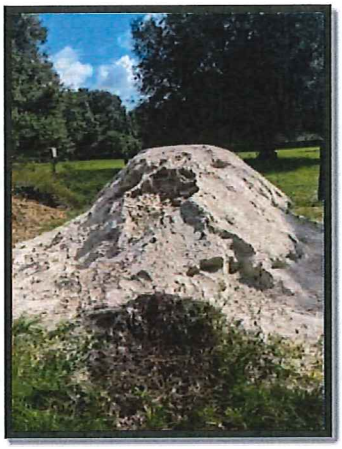
Step 9: Enjoy your harvest

Try to ensure you harvest your plants at the optimal time.

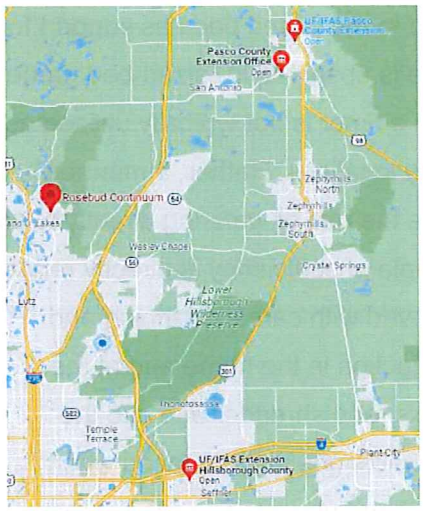
Some plants can be harvested continuously, such as greens, chard, lettuce, tomatoes etc., and some all at once, like radishes or beets. Fruits or squashes can rot or attract animals if left too long. Some plants become tough, like Okra, or bitter, like Basil, if left too long, or if they start flowering and seeding.

Tip 1: Sand and mulch piles may be available for use around the property. Rakes, shovels, and wheelbarrows may be available in the shed east of the greenhouse.





Tip 2: Make sure weeds are gently pulled so that the room system is also removed. A common mistake is pulling too quickly often resulting in breaking the weeds so that the roots remain.



Tip 3: Take advantage of the free and low-cost services offered at the Hillsborough and Pasco County UF/IFAS Extension offices such as pH, soil fertility, and micronutrients tests conducted at their labs. Learn more at https://sfyl.ifas.ufl.edu/.

Applied Sustainability Strategies

The Rosebud Continuum's raised bed operation is sustainable given appropriate attention and utilization of the available surrounding resources. The operation meets the economic, societal, and environmental principles of sustainability through educational demonstration. The existing garden is an economic benefit alone given that no initial costs are required, therefore any financial burden would likely be for minor structural repairs. The site contains a supply of shared seeds eliminating associated costs to volunteers. Furthermore, construction equipment can be found throughout the property which minimizes or eliminates material and transportation costs. The societal principle of sustainability is accomplished through the different projects on each of the raised beds which are ongoing and monitored by volunteers and students. Currently, one of the beds is tended to by elderly volunteers. Social responsibility is demonstrated through the accessibility of hands-on community participation, although a section of the raised bed needs improvement in this regard. This weakness will be elaborated in the guide's recommendations section. Finally, environmental principles are evident in this operation from its composition to its yield production and byproducts. The base below the raised beds is a permeable material which promotes moisture retention and usage in the raised beds rather than runoff and excessive evaporation. The weeds, or non-target plants, growing in the raised beds are used as organic debris material to create compost which minimizes waste; however, a key principle of the Rosebud Continuum center is that there is no such thing as food waste, rather there is material to be turned into something else. While each of these sustainability principles are independently observed at the raised-bed garden, they are all correlated and promote the successes of each other and the overall operation.

Sufficiency principles of sustainability are also applied in the raised beds as support for the center's value of eliminating waste. The restraint principle is observed in raised-bed gardens specifically through the method of watering. Drip irrigation on a timer is not typically utilized as it could contribute to overwatering and watering in unnecessary locations. Rather, a manned watering approach through a hose or a watering can promote the use of watering directly to the plants in need while minimizing waste. The zero-waste principle of sufficiency is directly related to the center's value of producing no waste and can be achieved with careful planning and subsequent maintenance. A great way to integrate waste reduction in the home and at the Rosebud garden is to take food scraps from home to the site's food shredder and use the resultant organic solution as fertilizer for the garden. Some challenges may be faced when attempting to implement zero-waste practices. For example, if one plans to use food scraps from home to create fertilizer on site, the quality and type of food scraps should be carefully

considered as to not introduce harmful substances into the garden. Another example to keep in mind is if materials from outside of the Rosebud Continuum are used, such as seeds and gardening equipment, any related packaging material should be carefully examined to determine how and if it can be repurposed instead of becoming landfill material.

Proposed Recommendations

Our recommendations for improving and maintaining the raised bed gardens at the Rosebud Continuum Sustainability Education Center include further building up the soils within the beds, carefully planning and managing which crops are planted, and offering possibilities for expanding or renovating the beds if there is the space and desire to do so. These recommendations are intended to enhance the soil quality to improve plant yields, help future students properly maintain the beds, and if renovations are made, improve accessibility into the beds. We also want to respect the current operations at the Rosebud raised beds as several groups are currently involved in maintaining them.

Of chief concern for any raised bed is its soil, and while after several years the soil within a raised bed can require only minimal amendment, presently the soils at the Rosebud gardens require modest enhancements before planting. A diverse mix of organic material can be used for building up the soil, such as leaf mulch, worm castings, ground-up food scraps, mushroom compost, aged bark/mulch, rotted grass clippings, cow or chicken manure, and of course traditional compost from food scraps and decomposed plants (Brown, 2018; Cogger, 2017). Common recipes for soil include mixing existing topsoil, traditional compost, sand, and additional varieties of organic matter previously mentioned. Sand can improve water filtration, and with enough added organic matter, can make a decent substitute for added soil. Prior to our planting, we added successive 1" layers of sand, with 1" layers of a blend of compost, leaf mulch, manure, and ground up partially rotted carrots to the existing soil in the beds and gently mixed the sand, organic matter, and soil. A similar mix using available organic materials should be suitable for further soil amelioration in future seasons and can be applied prior to any planting if the soil level has subsided below the top of the raised beds. After working the soil, planting can begin.

A clear plan for planting, with timing and spacing accounted for is essential to the success of a crop. For maintaining the Rosebud gardens, this aspect presents the most significant challenge. Fortunately, plants can be grown nearly year-round in Florida, and in Central Florida, planting in September and October, there are many options, including but not limited to beets, broccoli, carrots, celery, cucumber, eggplant, radishes, strawberries, turnips, and any leafy greens, such as arugula, lettuce, spinach, chard, etc. (Kipp, 2021). Students

should consult a planting calendar for Central Florida before deciding what and when to plant. Most seed packets include the germination times and days until harvest, so the timeline for planting and harvesting can be arranged with the semester and students' availability. Some plants, such as marigolds and basil, can be used as natural insect deterrents and can be interspersed with other crops. Taller plants should be located on the north ends of the beds to prevent shading the other plants as they grow due to sun coming from the south, especially prevalent in late fall and winter. These practices should help students succeed in maintaining the beds and could be applied in expansions or renovations of the raised beds.

One of the principal advantages of raised beds for its gardeners is accessibility. The Rosebud gardens already practice this principle, as the raised beds are used by the Learn Your Function (LYF) group for therapeutic gardening. While most of the beds are decently spaced out, the cinderblock, "lasagna" garden has narrow pathways that make it difficult to enter. Leaving at least four to five feet for walkways would help considerably. Raising the beds even higher, to 3' high could also improve accessibility for those who are not able to bend down easily. Naturalist Stibolt (2009) suggests that accessibility optimization for gardeners who use wheelchairs, scooters, or walkers can be achieved by implementing solid footing materials (such as pavers), elevating raised beds approximately 24-27 inches from the ground, and having the beds be no more than three feet wide. Future expansions of the raised beds should be mindful of these uses. Finally, it could be useful if the folks who are given the opportunity to improve the garden's configuration verify with the Bishops for any potential unused building materials that need to be repurposed as they could be implemented in this project.

Conclusion

The raised bed gardens at Rosebud offer a unique experience to students from PCGS to gain hands-on experience in growing their own food. While at first glance growing your own fruits and vegetables may seem simple, the process of maintaining the raised beds teaches you about soil management and formation, water usage, organic pest control strategies, plant development, and waste reuse, providing critical knowledge of what is required to make agriculture sustainable. The sustainability challenges faced by today's farmers are viewed through the microcosm of the raised bed. In addition, as a shared community resource in a suburban environment, the Rosebud raised beds offer a window into the rewards and challenges of working with a community. Climate change will put significant strain on our agricultural system, requiring innovative solutions such as community agriculture in non-traditional spaces like rooftops or abandoned lots, where a lack of soil or poor-quality soil make

raised beds an ideal choice. In addition, the raised beds offer an accessible solution that can allow anyone to become involved in the food growing process. Lastly, economic, societal, and environmental principles of sustainability are demonstrated by the garden.

The agricultural process and how to make it sustainable is encapsulated in the tending of a small, raised bed. Soil is at the heart of the process, and building soil teaches you how we can recycle substances we would otherwise consider waste, demonstrating its critical role in both the end of life and rebirth of all plants, and by extension, all our food. Weeds, insects, animals, and plant diseases all threaten crops, but are part of the natural process, and living with them sustainably is an important skill all farmers need to develop. These "pests" need to be reframed as parts of the ecosystem, and the agricultural space can be built so that human's goals can be achieved in harmony with the natural environment. Learning how to create this human-controlled slice of nature offers students an invaluable lesson in how raising our food can benefit or harm the local ecosystem.

With growing populations and development constantly encroaching on natural lands, the need for agriculture to take place in nontraditional spaces has increased. Similarly, people recognize the harm being done by the current agricultural system and the benefits of growing your own food and want to take control of the process themselves. Raised beds can be setup in nearly any space, and soils created from such a wide variety of substances that anyone can likely find something they can use. People with any level of experience and ability to farm can participate in raised bed gardening, making it the most egalitarian form of farming. As people become involved in agriculture, they make different decisions about where to get the rest of their food they can't grow themselves; they may be more willing to travel longer distances or pay higher prices to buy food that doesn't damage its local environment. Our guide will help introduce PCGS students to the process of building and maintaining a sustainable raised bed garden, lessons they can take anywhere else in the world to start their own gardens.

The sustainability nexus of economic, social, and environmental factors is all addressed through the raised bed garden at Rosebud. Through the reuse, recycling, and sharing of resources and tools, the garden can be economically efficient as the main remaining cost is the labor of participating students. By partnering with the existing community involved in the gardens, the societal principle of sustainability is met, with many students and volunteers work on different aspects of the garden and at different times throughout the year, the community is self-sustaining. The environmental principle of sustainability is demonstrated at the gardens by using organic fertilizing and pest control methods, minimal water usage, and through the recycling of materials that may otherwise be trashed—organic wastes, sand, and other

materials. Satisfying these principles is urgent for our food system, and every step we can take towards a more sustainable system with raised bed gardens like the one at Rosebud is of utmost importance.

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