

## Enhancement of the Sustainable Fruit Orchard

### Grant Type

Mini Grant

### Application Type

Final Application

### Project Manager 1 Name

Louis Gusky

### Project Manager 1 Status

Student

### Project Manager 1 Email

ljgusky@arizona.edu

### Project Manager 1 Department

Sustainable Plant Systems

### Project Manager 2 Name

Josiah Jackson

### Project Manager 2 Email

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### Project Manager 2 Status

Student

### Project Manager 2 Department

Biosystems Engineering

### Project Manager 2 Role

Co-lead

### Project Advisor Name

Matthew Recsetar

**Project Advisor Email**

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**Project Advisor Department**

Biosystems Engineering

**Fiscal Officer**

Darren Shevchuk

**Fiscal Officer Email**

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**Fiscal Officer Department Name**

Biosystems Engineering

**Requested Funding Amount**

*Only enter this number after completing the budget sheet (the budget template will round up your request).*

*Mini Grants may request \$250 up to \$5,000.*

*Annual Grants may request \$5,001 up to \$100,000, and up to three years of funding.*

**Year 1:**

\$4600

**Year 2:****Year 3:****Official Project Name**

Enhancement of the Sustainable Fruit Orchard

**Primary Project Category**

Water

**Secondary Project Category**

Food

**Background and Context**

*Please provide relevant background about your organization/team including your mission and/or expertise. Lay out the rationale for the proposed project, focusing on the issue that your project would address. This section is meant to give us more information about you and the context for the project, while the questions below provide space to go into detail about your proposal's plan and specifics.*

**Response:**

We are interns working with Dr. Recsetar within his aquaponics greenhouse located at CEAC Greenhouse 3118, Allen Rd. and a newly implemented Fruit Orchard developed through the Sustainable Citrus Plus Project which was funded through a Campus Sustainability Fund mini-grant in 2022. In 2022, the fruit orchard was successfully implemented with the planting of 5 fruit trees (peach, plum, pluot, tangelo, and 2 lemons), installation of irrigation, as well as a rainwater water holding tank coming off the installed gutter system. We found that it could be expanded or improved upon in a few different ways. These implementations can be successfully executed by combining students with backgrounds in Sustainable Plant Systems and Biosystems Engineering. With our combined knowledge within these fields, Dr. Rex, Josiah, and I will be able to create a better environment for the trees as well as gather research and data and ensure the longevity of the orchard into the future. We have plans to make the orchard more sustainable and more efficient with some of its resource use and we also plan on creating a barrier to protect the trees from animals who feed on the fruits and chewed through the irrigation line last year.

**Project Description**

*Please provide a thorough description and explanation of your project. Be explicit in what your team is proposing. What are the goals of your project? What will your project's outcomes be? Outcomes should be SMART—specific, measurable, achievable, realistic, and timely. Describe how each objective will be achieved with the anticipated timeframes for each, including any key dates for when certain elements must start or be completed.*

**Response:**

This project is meant to upgrade the fruit orchard by protecting the trees as well as providing them with the best possible living environment. First, we would like to address frost prevention as well as sun protection. We also want to implement a method of crop loss prevention from animals and humans. Another enhancement will really benefit the system is gutter covers to prevent gutter screens from clogging. During this past summer, during a big storm, one of the gutter screens had become clogged with pollen and overflowed onto the ground, resulting in a loss of about 100 gallons of rainwater. Additionally, we would like to create a live feed website with soil moisture data and camera access to view either the whole Fruit orchard to monitor foot traffic of humans and animals as well as to be able to provide a live view of the trees. This is mostly for monitoring reasons but we loved the idea to include a live video on the website. We also plan to use the aquaponics system biosolids as organic soil amendments for the fruit trees, and use the soil moisture data to figure out an optimized watering schedule. Josiah and I are planning to create a pitched shade structure to protect the Lisbon Lemon trees and Peach tree from the hot summer sun. We would do so by anchoring 2 poles into the ground at a 45-60 degree angle just west of the tree so that it's shaded in the afternoon/evening hours. The creation of the website will be outsourced from campus web services. Once we have the soil moisture meters we can set up the computer to relay the data to the website.

First on the agenda would be to order the parts we need to make the previously laid out changes. Once we have the materials we will be able to begin the addition of parts and structures. The Gutter guards will be easily assembled with some small screws a drill and a small 6 foot ladder at the greenhouse. We will also need to set up the soil moisture sensors to be able to send data, then we can place those in the respective fruit tree planters. Once we have these set up we can go further with the setup of the webpage with the live data and camera view of the orchard. We will then paint the tree trunks with white tree paint to protect them from sunburn and pest damage and begin the construction of shade structure for the peach tree (and lemon trees) and deployment of an adjustable shade cloth. Once all of this is completed we will install a barrier fence around the fruit tree orchard to deter wild animals and people from taking the fruit and from chewing the wiring of the soil moisture probes or irrigation tubing.

## **Budget Narrative**

*Use this section to provide supplemental justification for the items you are requesting on your budget sheet. Please break down your justifications into the budget categories: Personnel or operating budget. Do not list out each expense or repeat notes made in the budget template, but instead address why the line items are being requested and the purpose they will serve, providing elaboration when necessary.*

*If you are requesting funding for personnel, use this section to elaborate on the position you are creating and how the budget and timeline was established for it. If you plan to hire students, describe in what capacity.*

*Describe relevant details thoroughly (wages, responsibilities, duration of job, extent of involvement, how you will solicit/ market these opportunities etc.).*

*Ensure the descriptions match the line items in the budget sheet.*

*If matching or supporting funds are secured for the project, identify the source and amount in this section, and detail the impact of the matching funds on your overall budget.*

### **Response:**

\$650 is budgeted for gutter covers which will prevent clogging and loss of rainwater. \$275 is budgeted for an outdoor (NEST) camera to display a live feed of the fruit orchard on our proposed webpage. \$1,000 will cover the cost of building and installing fencing around the trees to better deter animals and people who took all of the fruit from this previous year. \$250 is budgeted for shade structure and screen for the peach tree. \$150 is requested for miscellaneous supplies including pruning shears dedicated solely to the trees in the orchard, a high limb saw to prune and maintain the trees as they grow, harvest tools and baskets and any other small tools that might be required for the 1st harvest this coming winter. \$475 is requested for winter tree covers for the citrus trees and pest screens for the stone fruit trees. \$50 is requested for white tree paint to paint the trunks to prevent sunburn and pest damage. \$1200 is requested for purchasing and installing 4-6 soil moisture probes, a mini PC and monitoring system (arduino). \$200 is requested to install official University signage designating the sustainable fruit orchard. \$250 is requested for the website development from campus web services.

## **Project Feasibility and Logistics**

*The Campus Sustainability Fund will only fund projects that have completed the necessary work to ensure they can succeed, be completed in the grant's timeline, or have an accurate budget.*

*Please provide a description of the work that has been completed so far to make this project feasible. Have all relevant partners been contacted/coordinated with? Have you received consent or authorization to complete your project (such as from Housing and Residence Life, Facilities Management, Parking and Transportation, etc.)? Please identify them in your response.*

*If you are making modifications to campus, do you have authorization or official quotes from Facilities Management to accurately identify the cost of labor and supplies?*

### **Response:**

Dr. Recsetar and I have planned the project out with guidelines and a flexible project plan. With the need to order pieces of equipment and technology, our installation and application of certain materials won't necessarily have a set schedule but installation of shade structure, soil moisture monitoring system, and tree paint will occur by the end of the semester to ensure the health of the trees. The fence will be installed in the fall to protect the ripe fruits. We also came up with a plan to include a web page that will provide an overview and history of the project and a summary of the sustainability of the project, and also want to include live soil moisture data for research purposes, and a live feed camera so we can check in on the orchard. This website will be created by Campus Web Services and once we have the sensors, the analyzing of the data and graphing should be quick and easy. For the other project components, whatever is delivered first will be what is installed first, whether it be the camera, the gutter guards, or the hydrometers, and the other things will follow, however, we will attempt to stick to the planned schedule in the project description. We are not modifying campus so do not need authorization to further our project from Facilities Management. To complete the website, however, we will need the soil moisture meters installed first, other than that, order of completion is not a major issue.

## **Environmental Sustainability Outcomes**

*Please provide a description of how you expect your project to advance environmental sustainability on campus. A definition of environmental sustainability is provided on our Guides and Tips page.*

### **Response:**

The project will help save additional water at the greenhouse. The Sustainable Citrus Plus Project previously implemented a water retention tank that captures water coming off the greenhouse. This was then used to irrigate the trees, however, the gutters didn't have guards and were constantly

getting clogged causing water loss. With the implementation of gutter guards, we will more effectively collect rainwater to use within the fruit orchard. The previous team implemented scheduled watering, but we will be utilizing soil moisture sensors to more efficiently irrigate the trees as well as building a vertical/pitched shade structure which will also help the soil around the least shaded trees retain more moisture. This will save water, as well as provide a better environment for the trees who are susceptible to heat and sun damage. We are also working on removing all weeds in the fruit orchard, not only are they taking nutrients from the trees, but are also major vectors for pests. We will be using manual labor to take care of these weeds to ensure we are staying sustainable and protecting the local ecosystem by avoiding spraying weeds. We will continue to use dried aquaculture biosolids as a soil amendment combined with aquaponic system effluent in order to eliminate the use of commercial fertilizer as was outlined in the previous project. With these implementations it will allow us to grow strong trees that produce healthy and flavorful fruit that can supply lemons, peaches, plums, pluots and tangelos to students for years to come.

## **Social Sustainability Outcomes**

*Please provide a description of how you expect your project to advance social sustainability on campus. A definition of social sustainability is provided on our Guides and Tips page.*

### **Response:**

Students of all backgrounds will be able to gather information and knowledge about sustainable fruit production from this project. Students who work within the fruit orchard and interns within the aquaponics greenhouse will be familiar with the setup and production of these fruit trees. There will also be an option to view data and live feed video online via a web page which will also describe the project and possibly link to a few articles regarding sustainability. This project is also working with the campus pantry to help provide students with healthy and fresh fruit for years to come! It will also allow skill-building opportunities through the website and on-site internships, as well as boost community engagement, especially in terms of sustainable agriculture. This project can truly showcase how sustainability is happening at the University of Arizona and serve as a model for individuals in the community looking to grow sustainable fruit.

## **Student Leadership & Involvement**

*Please provide a description of how your project will benefit students on campus regarding the creation of leadership opportunities or student engagement. What leadership opportunities exist within your proposal? If you plan to seek student involvement, include relevant details thoroughly and how you will solicit/ market these opportunities.*

### **Response:**

By starting this project it will ensure the existence of internship opportunities for students who want to further their expertise in an agricultural setting, especially within sustainable agriculture. This fruit orchard if kept up year after year will be able to produce massive amounts of fruits that can help supply the campus pantry with fresh sustainably grown fruit. With the enhancements that we have in store for the orchard, it should be on a solid path of healthy fruit production, while providing education and positions for undergraduate students looking to fulfill their internship hours or graduate students who are focused on Fruit tree research or sustainable agriculture. In addition, the website will contain information on potential involvement with the sustainable fruit orchard including additional harvesting and volunteer opportunities.

## **Education, Outreach, and Behavior Change**

*What opportunities does this project provide for members of the campus/community to learn about sustainability? How will your project educate the campus community and/or incorporate outreach and behavior change, particularly beyond the "sustainability choir?"*

*Please provide a description of how you expect your project will communicate its impacts to the campus community.*

### **Response:**

We plan on using a webpage that will provide information about the enhancements of the fruit orchard and also show data, a graph of soil moisture content. We will be receiving data from 5-6 soil moisture sensors, which will be translated to a data sheet, and finally to a graph that will be visible to visitors of the website. We are also going to be placing a camera on site to view the fruit orchard. This will allow us to watch the growth patterns of the trees as well as keep an eye out for any intruding wild animals interested in our fruit as well as monitor the overall area of the orchard. For the sign we were hoping to create a metal sign with a U of A logo and the title "Sustainable Fruit Orchard". It could also say something along the lines of "Made possible by the Campus Sustainability Fund". This will be used to first, mark the orchard area, but hopefully also deter people from taking the fruit off the trees.