

The Coastal Carolina University Arboretum and Botanical Garden

Dr. Cagalanan and the students of
ANTH/GEOG Human Landscapes F2019¹ and SPROUT²

¹Samantha Balough, Trevor Bird, Kristian Clark, Savannah Cody, Larry Erb, Dorothy Erb, Hannah Graham, Ava Hall, Taylor Kennedy, Reanna Kuiken, Caroline Martin, James Otto, Victoria Peck, Emma Tegg, Katherine Van Dermark, Ozyria Whitley

²Billie Rogers (President), Skylar Ellis (Secretary), Alex Rose (Treasurer), Robert Mealy (Recorder)



The establishment of an arboretum, botanical garden, and outdoor classroom on Coastal Carolina University's campus will provide opportunities for innovative experiential learning; club activities and other student, faculty, and staff engagement; and community outreach. These projects and associated activities will expand CCU's green campus initiatives while involving students in its contributions to the global sustainability agenda. They will put the University on a short list of academic institutions in South Carolina with living laboratories that enhance the academic experience and quality of life on campus, creating a CCU legacy that produces proud and dedicated alumni and attracts future generations of students.

CCU ARBORETUM AND BOTANICAL GARDEN

Supporting the Mission of CCU

Coastal Carolina University recognizes its responsibility to be a role model for the community and to ensure sustainable stewardship of resources entrusted to it. Its mission is to build citizens who are responsible and productive members of the university, surrounding community, state, nation, and world. The university aims to do this by promoting a global perspective and engaged learning through innovative course offerings and delivery methods.

An arboretum, botanical garden, and outdoor classroom on CCU's campus will be living laboratories that will promote the protection of and education about nature. Moreover, they will provide exciting opportunities for experiential learning for Coastal students; integrated education and research for academic programs across campus; fun and unique volunteer and club activities; and meaningful outreach and education for the broader community. These projects will reflect CCU's dedication to engaged learning and collaboration, all while promoting global sustainability goals and giving CCU students the opportunity to be part of the global effort to address grand challenges related to the environment – protecting biodiversity, combating deforestation and land degradation, promoting sustainable agriculture, and halting climate change. Establishing these areas on campus will further Coastal Carolina University's promotion of sustainability and earth-friendly practices, making it an even greener campus.

University models for CCU

Around the country, universities have botanical gardens and/or arboretums to expand experiential learning opportunities for their students on campus and increase their community outreach off campus. Botanical gardens at Duke University, University of California in Santa Cruz, University of Washington in Seattle, and University of Tennessee, and arboretums at the University of Illinois, Pennsylvania State University, University of California at Santa Cruz, North Carolina State University, University of Hawaii at Manoa, Connecticut College, University of Arizona, and Harvard University support a wide range of programs across disciplines from the natural and plant sciences to the social sciences, humanities, arts and education. These spaces promote integrated teaching and research, contribute to conservation of vast and unique collections of biodiversity, and provide areas for club activities and social enjoyment on campus.

The impacts of these schools' arboretums and gardens extend beyond their respective campuses as well. For example, Pennsylvania State University's arboretum is used for public education through guided tours and children's programs. The University of Tennessee holds holiday themed nights in their garden for the broader community. The University of California at Santa Cruz's Arboretum hosts the California Naturalist Program, a community education program open to all that aims to train volunteer naturalists and citizen scientists to actively engage in conservation, restoration, and environmental education.

There are only a few universities in South Carolina with arboretums and/or botanical gardens. The University of South Carolina and the Medical University of South Carolina have arboretums; Furman University, Coker College, and Clemson University have botanical gardens. As such, Coastal Carolina University could demonstrate leadership in our state by promoting sustainability through educational beautification installations.

Opportunities for engagement with the CCU Arboretum and Botanical Garden

There are many opportunities for on-campus engagement with the arboretum and botanical garden. Faculty in academic programs across the colleges at CCU, such as Anthropology and Geography, Sociology, the natural sciences, Interdisciplinary Studies, and Honors have expressed

CCU ARBORETUM AND BOTANICAL GARDEN

interest in using the spaces for experiential learning in courses related to ecology and sustainable development, methods of environmental monitoring and observation, and ethnographic research. Additional opportunities include independent studies, work-study, and internships. In fact, two students will be undertaking projects during the Spring 2020 semester. One student will be mapping trees across the entire campus. Another will be designing the food forest component of the botanical garden. Even children in the Early Childhood Development and Literacy Center at CCU will benefit from outdoor, hands-on learning activities in the arboretum and botanical garden. As Jamie McCauley, Assistant Professor of Sociology, said: "I see value in this project because it will allow students and faculty to engage with each other in nature. It will provide more on-campus experiential learning opportunities and model sustainable development locally and globally, and build a campus identity around sustainability."

The vision of having an arboretum and botanical garden on campus originated from SPROUT, a student club whose mission is "to promote awareness of sustainable agriculture and other ways of sustainably interacting with landscapes; provide interactive and hands-on educational experiences about the importance of sustainable agriculture and other environmental activities; bring together students from any major across campus, and educate fellow students at CCU and the broader community about ways to sustainably engage with the environment." SPROUT will be actively involved in the establishment and management of the arboretum and botanical garden, and in leading educational tours. The Anthropology and Geography club will be involved, since the garden fits into their activities of foraging for food and using plants and products to recreate ancient pre-historic and historic recipes in the name of experimental archaeology. The Outdoor Adventure Club could also hold outdoor activities in the arboretum and botanical garden.

University Grounds has been actively engaged in the development of this proposal and is prepared to identify sources for planting material, provide space to propagate plants in their greenhouse, and offer guidance to students working in the arboretum and botanical garden. Sustain Coastal will be another logical partner. Jeremy Monday, Interim Director of Custodial Services and advisor for the student Eco Reps with Sustain Coastal, put it succinctly: "All of these projects offer a unique opportunity for students to connect with our campus in ways we have yet to provide." The garden's sustainable food production component could be linked to provisional services on campus as well (e.g., the food pantry, CCU Food Crew, farmers' markets).

The arboretum and botanical garden will also serve as educational spaces through which CCU will engage with the broader community. Through informational signage, which could include QR codes linked to a continually developing online tree and plant database (which has already been started and currently has 85 species of trees and plants), these areas will provide information about the trees and plants on campus for all visitors. Local elementary and high schools could visit the arboretum and botanical garden on fieldtrips. Local adults through OLLI could have continuing education opportunities outside to learn about sustainability, horticulture and silviculture through the activities and research being conducted in the arboretum and botanical garden by students and faculty. CCU students, likely through the SPROUT club, will be trained as the field trip/visitor tour guides and could create educational brochures for adults and coloring books for children. A website could be maintained with information about visitor opportunities, links to the tree and plant database, and any publications that students and faculty involved may develop. Partnerships with Horry Georgetown Technical College's forestry program are being explored, wherein HGTC students can visit CCU's arboretum to study trees. Perhaps a program could be developed for HGTC forestry graduates to continue on to a four year degree as students

CCU ARBORETUM AND BOTANICAL GARDEN

at CCU in programs that allow them to expand on their forestry training and continue their hands-on work in the arboretum. There are even global opportunities for engagement to be pursued. For example, Dr. Cagalanan is bringing CCU students on a field trip to a university in the Philippines for a hands-on research experience on forest restoration. The establishment of an arboretum and botanical garden at CCU could provide the opportunity for a student exchange program between CCU and this university, and other universities around the world with similar ecology-related programs.

Importantly, these areas on campus will create aesthetically pleasing spaces for relaxation and socializing on campus. Today's college students experience more stress than ever (Burwell, 2018). The arboretum and botanical garden will offer a valuable refuge and space to support mental well-being.

Marketing and Legacy for CCU

Through the establishment of an arboretum, botanical garden, and outdoor classroom, Coastal Carolina University will model sustainability with living laboratories on campus, and could help motivate other universities in South Carolina and across the country to undertake similar endeavors. The arboretum area across from the Welcome Center at Baxley Hall will show the college's commitment to sustainability to visitors as soon as they enter the campus. This area will showcase specifically native tree species in South Carolina, but the entire campus could become one large arboretum through low-cost tagging of trees (MUSC promotes their entire campus as an arboretum in this way). Food from the garden could be used in the dining halls and marketed as special campus-grown produce, a compelling talking point for tour guides to tell potential students and their families. The arboretum and botanical garden will be legacies left behind by the students, faculty, and staff who establish and work in them, creating a special point of pride for CCU alumni. In short, these projects will establish CCU as a leader in innovative sustainability curriculum and experiential learning; promote campus, community, state, nation, and global outreach; and make CCU a top choice institution for future generations of college students seeking a meaningful and transformative undergraduate experience.

Acknowledgements

We would like to thank SPROUT, Steve Harrison, Jeremy Monday, Tim Shank, and John Brong for their continued support in the development of this proposal and commitment to participating in the mission that it sets forth. We would also like to thank the students of Dr. Cagalanan's ANTH/GEOG 120 Cultures and Environments Fall 2019 classes for their expressions of interest in these projects. We extend our thanks to Jeff Karwoski, who visited from Pennsylvania to share his expertise in landscape design and tree management and helped develop the designs for the arboretum and botanical garden. We thank Michelle Rashid for taking the time to create a promotional video. We would also like to thank the administrators and faculty on campus who have expressed enthusiastic support for these projects, including Dean Claudia Bornholdt, Carolyn Dillian, Dan Abel, Darcy Coughlan, Jamie McCauley, Jennifer Mokos, and Philip Whalen.

References

Burwell, Sylvia Mathews (November/December 2018). "Generation Stress: The Mental Health Crisis on Campus." *Foreign Affairs*. Retrieved at: <https://www.foreignaffairs.com/articles/united-states/2018-10-11/generation-stress-mental-health-crisis-in-schools>.

CCU ARBORETUM AND BOTANICAL GARDEN

CCU Arboretum



Plan and estimated costs:

1 year plan:

- Fencing: wooden split rail fences (estimates range from \$3,552 to \$6,250)
- Walkways: crushed clam shells (\$1 per sq. ft = \$3,400)
- Identification signs (In and around campus; For 50 signs = \$370)
- Welcome sign (For large sign, \$700-\$1800)
- Addition of more native species to beds 2 & 3
- Dune border
- Shrubbery

5 year plan:

- QR codes on identification signs
- Addition of even more native species within arboretum
- Addition of border trees and shrubs if necessary

CCU Botanical Garden



Plan and estimated costs:

1 year plan:

- Plan and establish beds (Raised beds \$1500 for 10, 4ft x 8ft double height beds including soil and miscellaneous charges)
- Pathways (crushed clam shells \$1 per sq. foot, total \$5000)

5 year plan:

- Pergola (\$2000 for a 12 by 12 vinyl pergola kit, or \$3000 for a 10 by 10 cedar pergola, not including labor)

ARBORETUM

Sustainable Development Goal 3: Good Health and Well-being

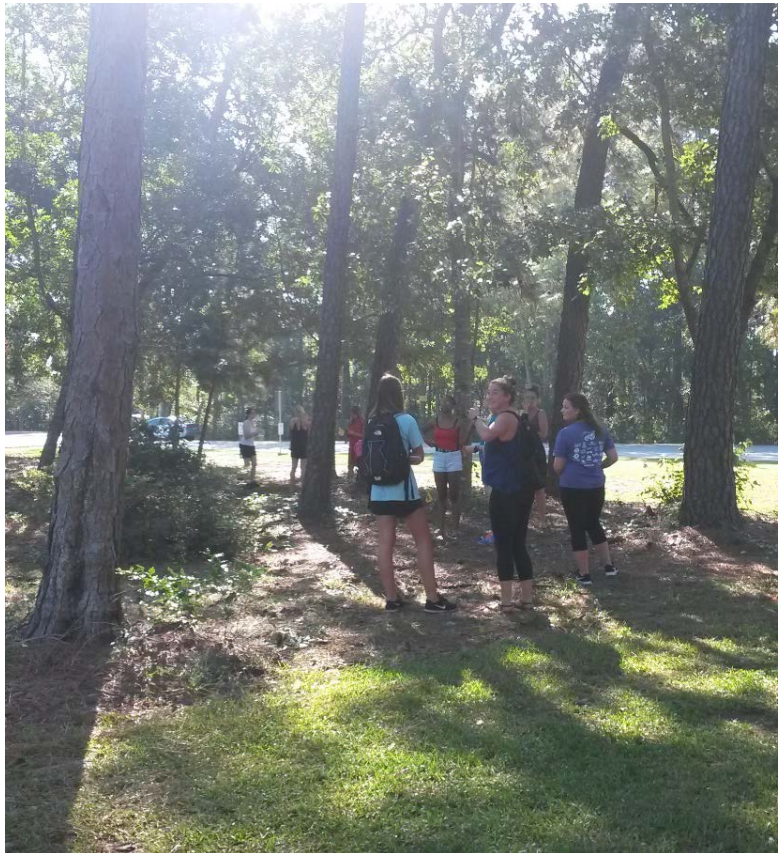
Emma Tegg

TARGET 3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.

TARGET 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Trees play a crucial role for people and the planet. The presence of trees and urban nature, exhibited by the campus arboretum, improves mental well-being whilst providing good physical health. Trees provide a plethora of direct and indirect benefits to human health and wellness (Donovan, 2017). Benefits extend to increasing youth's attention and test scores, to decreasing local air pollution and beyond (Turner-Skoff and Cavender, 2019).

An arboretum can immediately improve the mental and physical health of individuals in the community. Studies show that students with views of trees are more likely to succeed in school and increase physical activity (Turner-Skoff and Cavender, 2019). Arguably one of the most important and ongoing benefits for human health that urban forests can provide is the interception and reduction of air pollution as a regulating ecosystem service (McDonald et al., 2016). It is estimated that from the contiguous United States, urban trees remove 711,000 metric tons of air pollution each year (Nowak et al., 2006). By removing air pollution from our local area, trees aid in the prevention of diseases such as chronic bronchitis and cognitive development problems in children, vastly improving our health. Planting a range of native trees in suitable locations can reduce particulate matter and other forms of air pollution, reducing



mortality and morbidity in the community. Residents of tree-lined communities have fewer cardio-metabolic conditions than their urban counterparts (Kardan et al., 2015). The presence of 'green spaces' in the form of an arboretum encourages walking and physical activity, which directly relates to physical and mental health in both the short and long term.

Well-maintained trees present in an on-campus arboretum improve the social capital as well as the ecology of a community almost immediately. Trees support community ties and reduce crime rates, directly corresponding to communal mental well-being (Turner-Skoff and Cavender, 2019). By reducing pollution and decreasing aggression in local areas, trees positively impact mental well-being by strengthening community ties for decades to come. In relation to Goal 3, trees provide critical cultural ecosystem services at present and into the future by allowing communities to thrive in a safe environment. Furthermore, trees are strongly linked to reduced negative thoughts, reduced symptoms of depression, and increased life satisfaction (Dongying et al., 2018). Students with views of trees are more likely to succeed

ARBORETUM

in school, helping sustain mental well-being (Turner-Skoff and Cavender, 2019). Moreover, trees provide a range of health benefits such as the ecosystem service ‘ecotherapy’, whereby the act of planting and caring for trees makes people happier and communities more liveable (Summers and Vivian, 2018).

Overall, trees promote health and social well-being by removing air pollution, reducing stress, encouraging physical activity and promoting social ties in the community (Troy et al., 2016). Trees provide fundamental supporting services that are the backbone to a healthy and sustainable community. Support your local trees and help achieve these global societal goals.

Sustainable Development Goal #4: Inclusive and Equitable Quality Education

Hannah Graham

TARGET 4.7: By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.

Coastal Carolina University’s arboretum could contribute to Sustainable Development Goal #4 “Quality Education” in multiple ways. The creation of an arboretum on Coastal Carolina’s campus would provide opportunities for students across Horry County to have a hands-on learning approach outside of the classroom. This arboretum could potentially serve as a low-cost field trip for students attending schools in low income areas. Coastal Carolina could partner with neighboring schools by allowing Coastal Carolina students to give on campus presentations at the arboretum to students visiting on field trips. This opportunity would be beneficial to Coastal Carolina students by allowing them to practice presenting their information and data gathered from the arboretum and its research area to students of various age ranges. This arboretum would be beneficial to visiting students by allowing them to be introduced to local and relatable information that they would otherwise not have access to. While visiting the arboretum and botanical garden students could be introduced to the idea of sustainable development and see how it can be used every day. This would directly relate to target 4.7 by giving students insight to sustainable development and then allowing them to promote it in their own schools or lives. Overall, the proposed arboretum on Coastal Carolina University’s campus would bring in a wide range of opportunities that would allow students of Coastal Carolina University and also from across the county to learn about and promote sustainability.



ARBORETUM

Sustainable Development Goal #7: Trees and Efficient Energy

Samantha Balough

TARGET 7.3: By 2030, double the global rate of improvement in energy efficiency.

TARGET 7.B: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries.

Trees are crucial for energy efficiency. The heat island effect describes the higher heat index of urban areas when compared to less developed areas nearby. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness, and water pollution. Installing trees and vegetation is one of the most efficient and reliable ways to reduce the effects of heat islands. Shade is one of the primary factors in lowering heat, but trees also cool the surrounding air with evapotranspiration. Evapotranspiration is the process in which soil and plants transfer water from the ground back into the atmosphere. The additional water in the air causes the surrounding areas to be cooler. The relationship between vegetation and temperature is also impacted by the albedo effect. The albedo effect is a process that considers the reflection and absorption of sunlight and its effects on global temperatures. Trees and vegetation have a higher “albedo” than concrete or asphalt, meaning that plants reflect more of the warming infrared sunlight than concrete or asphalt. Much of the area surrounding the arboretum site on Coastal Carolina University’s campus is asphalt and concrete. The arboretum is one way that Coastal Carolina has a hand in lowering global temperatures and increasing energy efficiency on a local and global scale.

Financially, the cooling and energy related costs towards warming and cooling buildings is also affected by the presence or lack of trees and vegetation. In the summer, the shade and evapotranspiration cool the surrounding areas. Large deciduous trees planted on the east, west, and northwest sides of a building can reduce summer air conditioning costs by up to 35% (“How to plant trees”). During the winter, deciduous trees lose their leaves and allow sunlight to shine through and warm areas that were once being cooled by shade. Coniferous trees or evergreen trees, on the other hand, work as a wind barrier during the winter, saving approximately 25% of energy used for heating in surrounding buildings (“Happy Arbor Day”; “How to Plant a Windbreak”). Trees and vegetation lower energy costs and are valuable infrastructure for increasing energy efficiency.



ARBORETUM

Sustainable Development Goal #8: Decent Work and Economic Growth Savannah Cody

TARGET 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programs on sustainable consumption and production, with developed countries taking the lead.
TARGET 8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
TARGET 8.9: By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.

The aim of Sustainable Development Goal (SDG) 8 is to “promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”. Three of the targets of this goal are addressed by our arboretum.

Target 8.4: The arboretum is likely to attract more people, locally and non-locally, to the campus. This is likely to lead to more revenue and profits being made due to people wanting to visit or attend as students after seeing the new environmental improvements. Usually, economic growth leads to environmental degradation, but the arboretum will have the opposite effect because our campus would have something unique that not all college campuses have. It would be exciting for the public to come and see how we are progressing environmentally.

Target 8.5: The arboretum would promote a decent workplace for all students and faculty, regardless of gender, on campus. A study conducted in 2016 (Court, 2010) looked at the effects of natural elements and sunlight on employees. Sunlight exposure had a positive effect on job satisfaction and organizational commitment. Based upon this study and its results, work ethic, performance, and satisfaction are likely to increase for the students and faculty that spend time at the arboretum.

Target 8.9: The native tree arboretum highlights the local culture and products of the region. The Angel Oak is one of the most known trees in South Carolina’s culture. Since this is a native tree arboretum, the community would want to come see the trees to see what else they could identify, which would make the local community feel more unified with the campus. It would be an exciting opportunity for people to see what they already know about native trees and to also learn more about the local culture with regard to trees.

In conclusion, the arboretum would be beneficial for the university because it will bring an increased awareness to the school and emphasize our image as a green campus. It would be a great selling point to potential students, the staff and students would have an open and inviting work environment on campus, and the local community would also feel invited to the campus.

Sustainable Development Goal #10: Reduced Inequalities Ozyria Whitley

TARGET 10.2: By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.

Sustainable development goal number ten addresses social, political, and economic inequalities. By 2030, the idea is to reduce these inequalities and let everyone have equal opportunity and accessibility to all things. This involves providing assistance for people who, generally, have not had the same privileges as the majority population. At Coastal Carolina University, it is our mission to make it known that the arboretum and outdoor classroom are places for all students, faculty, staff, community, and visitors.

ARBORETUM

The arboretum and outdoor classroom will address this goal by allowing all people to have access to them at any time. They can be used by clubs, unofficial groups, and campus organizations for health and wellness exercises, religious and spiritual practices, general meetings, study groups, and for educational purposes by community members and students from other academic levels and schools. If requested, translations to the most commonly spoken languages on Coastal Carolina University's campus could be provided on the website for the articles pertaining to sustainable development goals, plant descriptions, and labeled arboretum and outdoor classroom maps.

Accessibility efforts will be made for those who are visually and physically impaired, so that they may receive the same benefits from the arboretum and outdoor classroom that everyone else will. This includes making pathways that are accessible via wheelchair and walker access, and having visual aids like the braille writing system on the tree species placards and welcome signs.

Sustainable Development Goal #11: Sustainable Cities and Communities

Kristian Clark

TARGET 11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries.

TARGET 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

TARGET 11.7: By 2030, provide universal access to safe, inclusive, and accessible green and public spaces, in particular for women and children, older persons, and persons with disabilities.

This goal aims to ensure that growing cities across the world are able to support themselves and the surrounding environment. Some indicators for these targets are 11.3.1, ratio of land consumption rate to population growth rate and 11.7.1, average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities. With the arboretum in place, Coastal Carolina University will be able to better support SDG 11. The arboretum will be a public space highlighting trees native to the area. Not only will this be educational and informative to all visitors to the arboretum about the local area and why they should be protected, but it will also increase tree cover on campus. Increased tree cover in an area not only provides a natural habitat for several animal and insect species, including bees, birds, deer, and others, but it also assists in carbon sequestration, which is a global concern. This arboretum will contribute to the goal targets and indicators listed above by addressing the ratio of land consumption in this local area, providing a free, easily accessible location to enjoy nature in the area, as well as showcasing the natural heritage of this region. By utilizing paths through the site, this area will be accessible to all visitors.



As a region where native trees and plant species can be highlighted, as well as an area where students can relax or even sit and do homework, we hope to bring an area to campus where students can immerse themselves in an important part of the natural landscape of this region, without having to leave the familiarity of campus. This will increase the natural

ARBORETUM

connection that people both from here and from other places will have to this unique region, and it can deepen the cultural connection as well by highlighting the important natural aspect of the area.

Sustainable Development Goal #13: Climate Action Ava Hall

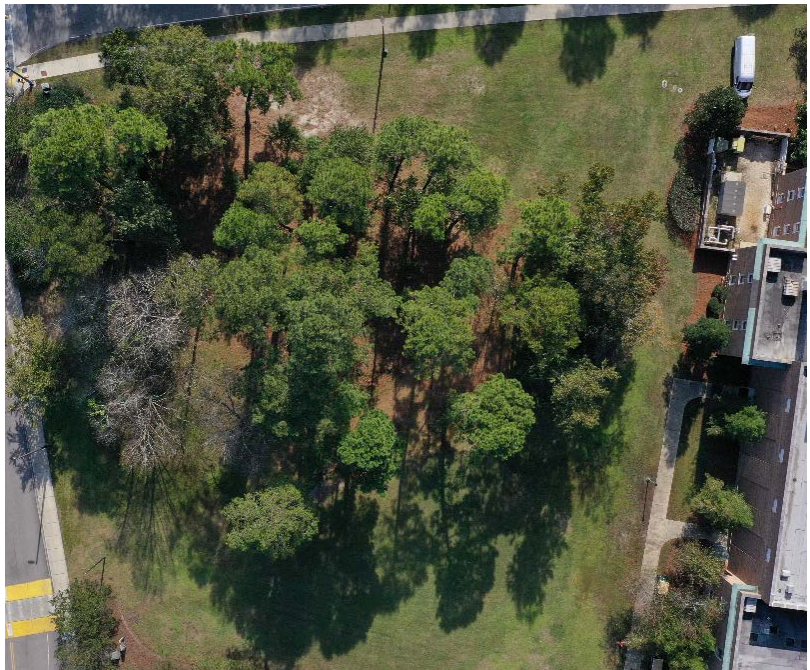
TARGET 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

TARGET 13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

Sustainable Development Goal 13 aims to take action against climate change. This goal recognizes that there is an urgent need for each country to take action globally to reverse the effects of global warming. The damages that have already been done have made long-lasting impacts on the climate system, which will strengthen natural disasters around the world.

At Coastal Carolina University, on the coast of South Carolina, hurricanes and other natural disasters are prone to happen. With many tropical storms that visit our coastline and the frequency of hurricanes, Coastal Carolina University is always prepared to keep the facility, staff, and students safe. The campus is equipped to protect everyone and anything in the case of an emergency. The arboretum at Coastal Carolina University supports the Sustainable Development Goal 13, Climate Action. The arboretum will protect existing trees on campus, which are important for sequestering carbon. Introducing more trees that are native to South Carolina will have biodiversity benefits as well. By planting more trees, the university is combating climate change by increasing carbon sequestration, improving air quality, helping prevent effects seen from natural disasters in the area, as well as allowing many opportunities to provide education about the importance of the native arboretum and how it relates to climate action.

The arboretum will contribute to Target 13.1 and its indicators by strengthening CCU's campus in the event of natural disasters, such as tropical storms and hurricanes. The addition of more trees to the arboretum area will help prevent flooding on campus because the trees help aid the soil in water retention. The indicators for Target 13.1 focus on reducing the impacts of natural disasters on a local level, and CCU's arboretum is a step towards reducing these impacts in the local area. Target 13.3 aims to improve awareness of climate change and reduce its impacts. The arboretum on campus is an educational area welcome to the public to learn about the importance of native tree species and how trees can help improve air quality and mitigate climate change impacts. Lastly, as the arboretum grows throughout the years, it will be an area actively combating climate change with the incorporation of new trees, which will always be protected by CCU.



ARBORETUM

Sustainable Development Goal #15: Life on Land

Caroline Martin

TARGET 15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

TARGET 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.



Sustainable Development Goal #15: Life on land requires protecting, restoring and promoting sustainable healthy forests and restoring degraded land and soil. Building an arboretum will allow Coastal Carolina University to create a research site and educate its students about how we can achieve these goals. In our plans to expand and grow the arboretum, we can educate our students about how to sustainably manage forests that have been degraded and hopefully spark passion into the work that will happen here. By doing research and restoring underused space with tree cover, we will be able to implement these practices all over campus. Moreover, by partnering academic and non-academic stakeholders, including grounds personnel, we can all work together to create a sustainable campus.

While this project is still in its early years, we have many ideas that will involve students, faculty and staff, and the broader community to

build a sustainability movement led by Coastal Carolina University that includes environmental education/research, activism, and advocacy. The arboretum will make campus and the world a better place.

Sustainable Development Goal #16: Peace and Justice

Taylor Kennedy

TARGET 16.6: Develop effective, accountable and transparent institutions at all levels.

TARGET 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels.

In a time where insensible crime, human trafficking, unjust discrimination, and international terrorism are more prominent than ever, it is critical for society to truly work together for a common goal in the promotion of peace, justice, and strong institutions. Encouraging efforts to overcome such global corruption provides a better societal foundation for the successful implementation of all Sustainable Development Goals, and in turn, creates a more productive and peaceful society. Without the unification of society working for a decrease in violence and a creation of justice, the negative impacts of this global violence can continue to invade and prevent the overall health, safety, and well-being of future generations to come.

Peace, justice, and strong institutions comprise the 16th Sustainable Development Goal, and this goal is accomplished through community action and opportunity. Through the initiation of inclusive societies and reciprocal respect for people of all races, ethnicities, religions, and cultures-- peace, justice,

ARBORETUM

and strong institutions become possible. Through the formation of our arboretum, we are striving to initially activate cultural ecosystem services by providing an educational, aesthetic, and peaceful haven for CCU students, faculty, and staff of all different backgrounds. Within the first few years of our arboretum's presence on campus, we are aiming for our arboretum to become a "go-to" spot on campus for relaxation, fellowship, education, and environmental interaction. An additional short-term goal for our arboretum is that it will serve to provide various educational opportunities for local schools in Horry County. We hope that schools will visit on field trips to learn more about the native trees in SC and the importance of ecosystem services and sustainability. When thinking about the long-term goals for our arboretum, we hope to introduce more native tree species to provide a more plentiful arrangement of trees for our local society to learn about and enjoy.

Through our arboretum, we hope that we can foster an effective, accountable, and transparent institution for all people as proposed in target 16.6. We feel that the arboretum will give various groups and clubs on our campus the opportunity to be held accountable for the success and sustenance of its future so that our community on and off CCU campus can continue to benefit from its ecosystem services. On the same note, by providing an opportunity for all who are interested around campus to get involved with our arboretum, we are ensuring a responsive, inclusive, participatory, and representative atmosphere from all levels of CCU as presented in target 16.7. Students will have the chance to get hands-on with the arboretum—whether that be through research, maintenance, or even outdoor class time. Faculty and staff will also have the chance to get involved through any desired research, outdoor class time, or for their own education/relaxation. Furthermore, we aim to extend these non-discriminatory practices to the public as we plan to make our arboretum accessible and enjoyable to all as found in target 16.B. Within our arboretum, we plan to have easily accessible pathways with clearly understandable signs identifying each tree species. We will also encourage everyone to learn and enjoy through the experience of the CCU arboretum because we feel that it is important for everyone to be provided the same opportunities for peace, justice, and strong institutions.

This 16th Sustainable Development Goal is critical to the ultimate success of all Sustainable Development Goals because through the fulfilment of peace and equality among societal institutions, quality healthcare and education, fair legal policies, and comprehensive environmental protection can be provided and supported for all. More specifically, within our arboretum, we have the opportunity to foster connection among different groups of people with their environment and promote an overall peace (Kooser).



It is our goal through our arboretum here at Coastal Carolina University to extend our welcome to all CCU students but also to our surrounding community members in hopes that we maintain an inclusive environment for people to interact with and learn more about their natural environment through our

ARBORETUM

facilitation of a cultural ecosystem service. The CCU arboretum will provide a unique space where our local community members, from both on and off campus, can feel more connected to their environment and each other.

References

Arboretum SDG #3

- Donovan, G. H. (2017). Including public-health benefits of trees in urban-forestry decision making. *Urban Forestry and Urban Greening*, 22, 120– 123.
- Kardan, O., Gozdyra, P., Misic, B., Moola, F., Palmer, L. J., Paus, T., & Berman, M. G. (2015). Neighborhood greenspace and health in a large urban center. *Scientific Reports*, 5, 11610.
- McDonald, R., Kroeger, T., Boucher, T., Longzhu, W., Salem, R., Adams, J., ... Garg, S. (2016). Planting healthy air: a global analysis of the role of urban trees in addressing particulate matter pollution and extreme heat. *The Nature Conservancy*, 1– 129.
- Nowak, D. J., Crane, D. E., & Stevens, J. C. (2006). Air pollution removal by urban trees and shrubs in the United States. *Urban Forestry and Urban Greening*, 4, 115– 123.
- Dongying, L., Zhou, D.B. Slavenas, X., Sullivan, M.W. (2018). Moving beyond the neighborhood: Daily exposure to nature and adolescents' mood. *Landscape and Urban Planning*. 173. 33-43.
- Summers, J.K. & Vivian DN. (2018). Ecotherapy – A Forgotten Ecosystem Service: A Review. *Front Psychol*, 9:1389.
- Troy, A., Nunery, A., & Grove, J. M. (2016). The relationship between residential yard management and neighborhood crime: An analysis from Baltimore City and County. *Landscape and Urban Planning*, 147, 78– 87.
- Turner-Skoff, J., and Cavender, N. (2019). The benefits of trees for livable and sustainable communities. *Plants, People, Planet*.

Arboretum SDG #7

- “How to Plant Trees to Conserve Energy for Summer Shade.” *How to Plant Trees to Conserve Energy for Summer Shade - Climate Change at Arborday.org*, <https://www.arborday.org/trees/climatechange/summershade.cfm>.
- “Happy Arbor Day! 4 Ways Trees Can Save Energy: IGS.” *PublicWebsiteSitefinity*, 26 Apr. 2017, <https://www.igs.com/energy-resource-center/blog/happy-arbor-day-four-ways-trees-can-help-save-energy>.
- “How to Plant a Windbreak to Conserve Energy.” *How to Plant a Windbreak to Conserve Energy - Climate Change at Arborday.org*, www.arborday.org/trees/climatechange/windbreak.cfm
- Image: “The Urban Heat-Island Effect.” *Urban Heat-Island Effect - Climate Change at Arborday.org*, <https://www.arborday.org/trees/climatechange/heatIsland.cfm>.

Arboretum SDG #8

- Court, A. (2010). The effects of exposure to natural light in the workplace on the health and productivity of office workers: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports*, 8(16), pp. 1-19. doi: 10.11124/jbisrir-2010-574.

Arboretum SDG #16

- Kooser, Allison. “Promoting Peace and Justice through Community and Opportunity: Exploring SDG16.” *Opportunity International*, <https://opportunity.org/news/blog/2017/july/promoting-peace>.
- “Peace, Justice and Strong Institutions - United Nations Sustainable Development.” *United Nations*, United Nations, <https://www.un.org/sustainabledevelopment/peace-justice/>.

Sustainable Development Goal #2: Zero Hunger

Larry Erb

TARGET 2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round.

A new trend in gardening that is becoming very popular is the use of raised garden beds. Why are raised beds becoming so popular? There are numerous benefits that raised beds can provide to help meet the Sustainable Development Goals of Goal 2, Zero Hunger.

One benefit of raised beds is the point that they can be easier to maintain, and in turn you are usually able to produce more vegetation. More vegetation produced comes from having more accessible maintenance, less soil being compacted, better soil aeration, fewer pests and it is easier to weed. All these will help to produce more produce.

Another major benefit of using raised garden beds is the fact that they are portable. You can put wire mesh on the bottom of the beds. The design of your garden can be changed with portable beds. The beds can be moved to different parts of the garden depending on what vegetation you have planted. They can be moved to control the amount of sunlight, depending on the requirements of the plants.

Using raised garden beds makes it easier to grow smaller amounts. You might not require a whole row of the same plant. It is possible to grow more than one type of plant in the same row. In that way you can control the quantity of a plant you need.

Raised beds make gardening possible. There are many disabled people who would love to garden but gardening in a traditional garden might be too difficult because of physical limitations they impose. It can be very hard for some disabled people to bend over for prolonged periods of time. One way to elevate this problem is to place raised beds on a deck.

Raised garden beds help to make room for the roots and they also help to keep tree roots out of the garden. Because the soil is not compacted and it is better aerated, roots can spread out easier, helping to grow stronger and healthier. This also helps the plants fight disease better and helps to produce more fruit.



Sustainable Development Goal #3: Health and Well-being for All

Dorothy Erb

TARGET 3.4: By 2030 reduce by one third premature mortality by non-communicable diseases through prevention and treatment and promote mental health and physical well-being.

Gardening is more than a boring, back breaking hobby. Not only is it rewarding and fun, it can also be a catalyst for better health and wellbeing for you and your children. By gardening you are sustaining something very precious to this earth, you are sustaining YOU!

BOTANICAL GARDEN

Gardening may reduce the risk of heart attack and stroke. To improve your health, you should try and dedicate two to three hours of moderate exercise a week. What better way to achieve this than the fun and exercise you achieve through gardening? All gardening activities, such as digging and pruning, will give you a good workout while you are doing what you love.

Gardening engages the brain, including the areas responsible for sensory awareness, problem solving and learning. Gardening is not just purely physical, but it can be cognitive and can improve social interactions by explaining your beloved plants with your friends.

Gardening improves mental health and relieves stress. Research has found that after completing a stressful activity, working in a garden can reduce the stress hormone cortisol. Doctors believe in this so much that they have begun recommending “horticulture therapy” to patients suffering from depression and anxiety. Think about how useful this could be during exam week! You may be surprised at how much happier and relaxed you are after digging in the dirt.



Gardening improves hand dexterity and strength. By regular gardening, you keep your hand muscles strong and flexible without doing tedious and sometimes very painful hand exercises prescribed by a doctor. It has been found that after suffering a stroke, gardening is an effective way to rebuild dexterity and strength in the hands.

Gardening strengthens the immune system. Gardening may not sound like so much fun when you learn that there are germs and bacteria living in the dirt. The good news is that those tiny micro-organisms may help gardeners build up immunity against many diseases. Gardeners should be encouraged to put down their devices, unplug, and get outside and play in the dirt!

Gardening engages all senses. Those with disabilities learn the best when using all their senses. Gardening requires touching and feeling dirt, flowers, seeds, and produce; seeing the vibrant colors the plants produce; smelling the different produce and flowers; hearing the produce being removed from the plant; and best of all, tasting what you have grown!

Gardening encourages healthy eating. By eating the produce they have grown themselves, the students will be more prone to eat fruits and vegetables. They will develop a sense of pride in

BOTANICAL GARDEN

what they have grown and will, hopefully, learn to love eating more fruits and veggies, leading to healthier diets by having easier and cheaper access to fresh produce.

Gardening helps develop fine motor skills. Scooping up the dirt, planting the seeds, and watering all require fine motor skills. As children learn these skills, they are preparing themselves to improve their academic skills such as typing, writing and cutting.

Gardening is a hands-on experience with science! Gardening touches on biology, botany, and chemistry. Students can observe and experiment with plant propagation and development. They will begin to realize how basic things we often take for granted, water and sun light, are so important. Through hands-on learning about plants, students can be scientists in the making!

Gardening promotes family bonding. What better way for a family to bond during family weekend than to experience a picnic in the garden, pick some flowers for Mom, or just see the abundance of produce being grown? The parents will listen with pride as their students explain all the work and love that went into their garden.

Gardening makes everyone environmentally aware, and students will learn ways to take care of the earth while they garden. There are opportunities to research alternatives to the use of pesticides, best practices for composting and recycling, and how to minimize pollution. A garden can be a useful place to promote World Environment Day every June 5th.

Gardening develops applied math skills, from basic measurements of the depth of the soil and counting seeds, to tracking plant growth over time. Gardening can also be a great introduction to geometry, the garden being a living laboratory to observe the many shapes in nature and how they relate to plant or ecosystem functioning.

Gardening teaches patience. Everyone has a lot to learn from gardening, and patience is the hardest! As a society in the digital age, we are used to instant gratification, but with gardening we must learn to have patience while waiting for the first sprouts, shoots, leaves, flowers, fruits or vegetables to appear. The waiting makes gardening even more exciting!



Gardening teaches the ability to organize and plan. For example, high plants should not be placed around smaller plants as the inside plants will soon be deprived of the light they need to grow. A lot of planning goes into determining what needs to be planted when and where. Through planning and managing a garden, students learn important skills that can help them become more organized in their school work as well.

Happy Gardening!

BOTANICAL GARDEN

Sustainable Development Goal #4: Quality Education

Katherine Van Dermark

TARGET 4.7: By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

TARGET 4.A: Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.

One way to combat and improve on quality education is through integrating garden-based learning into lesson plans, organizing a primary school classroom for lessons outside, and finding ways to connect students' outdoor learning experience to the lessons being taught back in the classroom.



Coastal Carolina University is home to the CCU Preschool, Scholars Academy, and thousands of CCU students, creating a learning environment for students of all ages. Teachers across these levels can integrate class activities and projects in the Coastal Carolina botanical garden into their curriculum to help students who are struggling with reading, writing, math, and science concepts by giving them hands-on learning opportunities. This would be one of Coastal's next steps to extending the classroom beyond the walls of the building, something Coastal prides itself on doing.

BOTANICAL GARDEN

Sustainable Development Goal #9: Infrastructure and Innovation

James Otto

TARGET 9.1: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

TARGET 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.



Sustainable Development Goal 9 entails building innovative infrastructure in the botanical garden, which is crucial for it to be enjoyed by everyone. Accessibility is one of the most important aspects of the garden. Crushed shells for 5-6 foot wide pathways would enable a wheelchair or any assisted walking mechanism to be able to move around

without an issue. By implementing this we can eliminate the risk of the area not being open to people in wheelchairs, crutches etc. Multiple entrances will be made in order to get the attention of everyone no matter what side of the garden they are walking on. Finer details to enhance the garden experience can be added, such as having baskets available for people to pick fruits and vegetables.

Using innovative infrastructure is also very important when it comes to saving space. In our botanical garden we are looking into implementing a vertical garden, which will add an interesting and creative aspect to the area. A vertical garden makes it easier to water plants and it saves a lot of space while also adding a more attractive look to the garden. It would also illustrate an approach that could help make our campus buildings more sustainable. Building a vertical garden against the wall of a building is very good for the environment because it reduces the carbon footprint of a building by sequestering CO₂ and it also helps to filter pollutants out of the air. A vertical garden can be built as high as you want, resulting in growing a large amount of plants which would normally take up huge plots of land. Placing signs with information on the vertical garden, we can turn this area into an educational tool that many people can learn from and even implement. Other beds will have educational signs as well. For example, a shade garden will have signage with information about how using trees in a garden, to provide more shade or control water or wind exposure for plants with specific growth requirements, both helps the plants but also enhances sustainability through having more trees. By using the garden as an educational tool we open the door for a lot of people to help the environment and bring us closer to completing the Sustainable Development Goal of building innovative infrastructure to promote sustainable industrialization.

BOTANICAL GARDEN

Sustainable Development Goal #10: Reducing Inequality

Victoria Peck

TARGET 10.2: Empower and promote the social, economic, and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion, or economic or other status.

TARGET 10.3: Ensure equal opportunity and reduce inequalities of outcome.

Sustainable Development Goal 10 is about finding ways to reduce inequalities. Our botanical garden will tackle inequality on Coastal Carolina University's campus through accessibility and inclusivity. This will be done through a number of outlets, including architecture, design, and the plants that are used.

The first step towards reduced inequality is through accessibility, facilitating all students and faculty in their visits to the garden and their own personal experiences with it. The way it will be designed allows for students and faculty to enter the garden from any side and to not make them follow one specific path. There will be a main entrance but it will not be required that visitors enter the garden that way.



Accommodations for those in wheelchairs will be made. There will be a main path that is at least 5 feet in width so someone in a wheelchair has the space to turn around on the path without going into the grass or into the plant beds. The most cost effective options for the path would be either crushed shell or small stones that are finely packed together. These two options are the best because they are not extremely intrusive into the environment like concrete would be, they are more affordable than brick paths, and they will last longer than a wooden path.

Extra steps towards inclusivity through accessibility for those with visual impairments would be to have braille on any bed labels. We will also have beds with flowers and plants that can be touched like the lambs ear, along with very aromatic plants like gardenia and jasmine. Having plants with these other sensory aspects will give those who cannot traditionally experience the full visuals of the botanical garden to have other experiences and make their own connections.

Not only will the experience of the garden help reduce inequalities, but the output of the garden and the products grown can help with that too. The garden will be open to all students, faculty, employees, and visitors to the campus. The food grown will be collected and given to places like the food pantry and put in other locations where all who visit could enjoy the local grown products. We could also put a community-supported agriculture program in place, where a small membership fee allows members to get special access to a limited number of first picks of veggies, flowers, or herbs depending on what has been growing. The money from that would go back into supporting the garden and ensuring its continued availability to all on campus.

The Garden would become a community space that would help everyone relax and step away from the hectic nature of a college campus. The garden will be built in a way that makes all

BOTANICAL GARDEN

feel included and a part of the Coastal Carolina family. It will bring people together and encourage an environment of understanding and acceptance, which will lead to a more inclusive and equal campus experience.

Sustainable Development Goal #12: Responsible Consumption and Production

Reanna Kuiken

TARGET 12.2: By 2030, achieve the sustainable management and efficient use of natural resources.

TARGET 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

Goal 12 of the Sustainable Development Goals: Responsible Consumption and Production is an important goal that will be addressed through the botanical garden. The botanical garden at Coastal Carolina University will house many different species of vegetables and fruits. The addition of these foods could possibly serve as a healthy option for people to choose from in their daily lives. Not many students have fruits and vegetables accessible, and honestly the cheap foods we can afford are not necessarily good for our health. The food could serve as a light snack on the way to class, or a healthy alternative when low on money. Some students could find their passion for gardening here and it is very useful in aiding anxiety or stress by picking the food and maintaining it.

We had to consider many different ways that this garden can contribute to sustainable development goals. By adding the vegetable and fruit gardens we can incorporate healthy consumption and production techniques. In a few corners of the food beds will be pit and seed boxes that students can contribute to. Instead of throwing the seeds on the ground, the student will drop the seeds in the box so that they can possibly be replanted. By doing this, a student can get the sense of reducing their waste and participating in the regrowth of these plants.

A significant target for this sustainable development goal is “By 2030, achieve the sustainable management and efficient use of natural resources.” This garden teaches students how to properly recycle plant seeds and understand how to efficiently use these resources. This plan especially works with the help of the compost pile that will be near the garden as well. We also hope to include signs of encouragement throughout the food areas for the students. These signs could inspire students during their day to lend a helping hand to the garden. Contributing to a cause makes students feel helpful, included, and important, and that is the message we aim to get across.

Sustainable Development Goal #17: Strengthen Partnerships

Trevor Bird

TARGET 17.16: Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of sustainable development goals.

TARGET 17.17: Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.

The intent of Sustainable Development Goal 17 is to strengthen the means of implementation and revitalize global partnerships for sustainable development. In regards to Coastal Carolina University’s botanical garden, this goal means creating partnerships with groups and programs both on and off campus to promote eco-friendliness, sustainability and educational opportunities. Potential on campus partnerships include the SPROUT club, which is a club on

BOTANICAL GARDEN

campus centered around agriculture and sustainability, Sustain Coastal and other sustainability programs. The food pantry and Aramark are also potential partners, as the garden will feature fruit and vegetable beds, of which those two groups can benefit from. The Anthropology and Geography department as well as the Biology department may be potential partners as courses offered in those departments may have experiential learning opportunities in the botanical garden, as well as potential independent and work studies and internships. Potential off campus partners include Horry Georgetown Technical College, local elementary and high schools, and even OLLI, as all could benefit from educational opportunities offered by the garden. Another possible connection can be made with the Waccamaw Market Cooperative, which is one of the local farmers' markets in Horry county. The botanical garden at Coastal Carolina University stands to potentially make many connections with established organizations.



References

Botanical Garden SDG #2

Jennifer Poindexter, "Benefits of Raised Bed Gardening You May Have Never Considered," <https://morningchores.com/benefits-of-raised-bed-gardening/>.

Botanical Garden SDG #3

Choan, Sam. "4 Surprising Health Benefits of Gardening." *Organic*. 2/26/2018, 1-3.

Lopa, Jessica. "Benefits of Gardening With Kids." *Mommy University*. May 4, 2014, 1-14.

Botanical Garden SDG #10

"Design and Fund Accessible Gardens." *Nature Sacred*, October 11, 2018. <https://naturesacred.org/design-and-fund-accessible-gardens/>.

"Goal 10: Sustainable Development Knowledge Platform." United Nations. United Nations. Accessed November 6, 2019. <https://sustainabledevelopment.un.org/sdg10>.

"Want to Build Wheelchair Accessible Garden Path: The Home Depot Community." The Home Depot. Accessed November 6, 2019. <http://community.homedepot.com/howto/DiscussionDetail/Wants-to-build-wheelchair-accessible-garden-path-9065000000006x2>.