

2018 University of the District of Columbia Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Introduction

As the only public institution of higher learning in our nation's capital, and the only exclusively urban land-grant university in the United States, the University of the District of Columbia (UDC) and its College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) continue the effort to position the University as a leader in urban-centered education, research, and community outreach (cooperative extension) at the local, regional, national and international level. UDC is a historically black, relevant and progressive urban land-grant institution in and for the District of Columbia. UDC offers associate, baccalaureate, graduate and professional degree programs, as well as community education workshops, demonstrations and certificate programs to learners of all ages.

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) embodies the land-grant tradition of UDC. In addition to offering innovative academic programs in architecture, urban sustainability, urban agriculture, water resources management, health education, nursing, and nutrition and dietetics, CAUSES also offers a wide range of applied research and community outreach programs through its five land-grant centers: (1) the Center for Urban Agriculture & Gardening Education; (2) the Center for Sustainable Development and Resilience, which includes the Water Resources Research Institute; (3) the Center for Nutrition, Diet & Health, which includes the Institute of Gerontology; (4) the Center for 4-H & Youth Development; and (5) the Center for Architectural Innovation and Building Science, which includes the Architectural Research Institute.

The CAUSES mission is to "...offer research-based academic and community outreach programs that improve the quality of life and economic opportunity of people and communities in the District of Columbia, the nation and the world."

In CAUSES, we recognize that, like ecosystems, we are connected to people and places right here in our own neighborhoods, and to those half way around the world. Pollution travels, resources are not always consumed where they are generated, and job markets are increasingly global and knowledge-based. Given these realities, we aspire to teach people to think in systems, work in diverse teams, and focus on connectivity and innovation. We apply these principals to all of our programs including our Master's and Bachelor's degree programs, professional development certificates, and community workshops and events.

We are deeply committed to being relevant to the residents of the District of Columbia. Given our three-pronged approach of teaching, research and community outreach, we seek to make a measurable, positive difference in the lives of people right where they live and work. As a result, our programs focus on improving economic conditions, social and cultural circumstances, and the health of people and their living environments.

Given our location in an exclusively urban environment, we use the terms 'community outreach' and

'cooperative extension' interchangeably. Only a few of our constituents were familiar with the term 'cooperative extension' but found the term community outreach rather descriptive. As a result, we have been using the latter to describe the scope of our community education work as 'community outreach' to offer a term that is more familiar to residents and organizations in the District of Columbia.

Our research and community outreach programs are more than local. They also serve as a model for relevant learning far beyond our region. Our tag line, "Healthy Cities - Healthy People," captures these commitments. Key to our success has been the integration of our academic and land-grant programs, and the integration of relevant applied research (Agricultural Experiment Station - AES) and community outreach and education (Cooperative Extension Service - CES) responsibilities into every one of our Land-grant Centers. Land-grant universities have always sought to be relevant to the needs of their communities by focusing on research that makes a difference in the lives of local people and organizations in the regions they serve; and by offering education both on their campuses and in local neighborhoods.

Consistent with the priorities of the USDA, and the needs of residents and public, private, and non-profit sector partners in the District of Columbia, our goals are derived from key NIFA objectives, such as improving (1) mitigating climate change (2) food security and hunger, (3) combating childhood obesity and other food related health problems, (4) expanding alternative energy, (5) improving water management and water safety, and (6) improving food safety.

Finding solutions to real-life challenges requires collaboration across academic disciplines, hands-on work, and perseverance. For CAUSES, this means that we work together across many fields to find solutions to the aforementioned challenges. Yet given our location, our focus is exclusively urban. This exclusively urban focus sets us apart from all the other land-grant universities in the United States. We also create important alliances like urban agriculture and urban sustainability, and urban health and resiliency.

An important element of our ability to find solutions is the University's Agricultural Experiment Station, Firebird Farm, formerly, Muirkirk Farm. This is where innovative small scale food production methods, including the use of technology, are developed, tested, and improved before they are deployed into urban neighborhoods. Firebird Farm is quickly becoming a go-to place for urban farmers and gardeners and anyone who wants to learn how to make agriculture a viable profession in an urban setting.

Relatively few DC residents find us because they are motivated to become urban farmers. Most residents are initially motivated by the goal of improving their own health or that of their families; some are motivated by improving their quality of life; by advancing their economic opportunities; by making their neighborhoods safer; and some want to build capacity and expand the opportunities available to their neighbors and extended family.

Research in the tradition of the Land-grant University is not enough when urban populations are the focus. We must work with coalitions across the city to link urban agriculture to health, urban sustainability, water management, and resiliency. We have accomplished this through our Urban Food Hubs concept that was pioneered by Dr. Sabine O'Hara, Dean of CAUSES and Land-grant Programs (O'Hara, S. 2015. Food Security: The Urban Food Hubs Solution. Solutions January-February, www.thesolutionsjournal.org; O'Hara, S. 2017. The Urban Food Hubs Solution: Building Capacity in Urban Communities. Metropolitan Universities Journal. Vol. 28 No. 1 (Winter), DOI: 10.18060/21477).

The Urban Food Hubs concept offers a comprehensive approach to urban food security that incorporates the whole value chain of food through four integrated components: (1) food production; (2) food preparation; (3) food distribution; and (4) closing the loop through waste and water recovery.

To date we have implemented four Urban Food Hubs across the District of Columbia. Three of them are located in food desert neighborhoods in Wards 5, 7 and 8. Moreover, we are applying the urban food hubs

concept and its four components to other projects that we are implementing in partnership with community based organizations across the District of Columbia.

In addition to providing non-credit bearing learning and capacity building programs in the tradition of the cooperative extension service, the CAUSES Urban Food Hubs also strengthen UDC's academic programs. Through programming offered by the five Land-grant Centers of CAUSES, the Urban Food Hub locations offer learning and leadership opportunities by providing students with hands-on, practical service learning experiences, internships and research opportunities that (a) foster relevant experiential learning and (b) facilitate employability and skills development. Given our three-pronged approach of teaching, research and community outreach, we seek to make a measurable, positive difference in the lives of people right where they live and work.

Our vision is to be a world leader in designing and implementing top quality, research-based academic and community outreach programs that measurably improve the quality of life and economic opportunity of people and communities in the District of Columbia, and urban communities across the nation, and the world.

0. College Wide Initiatives

Some of our College-wide stakeholder events in FY 18 were located at our Urban Food Hubs locations, others used partner locations including the following:

Firebird Research Farm Open House

The College of Agriculture, Urban Sustainability, and Environmental Sciences' (CAUSES), Center for Urban Agriculture and Gardening Education (CUAGE), hosted its annual open house at UDC's Firebird Research Farm on September 28, 2018 from 2:00 p.m. until 6:00 p.m.

Attendees learned harvesting techniques for eggplant, cucumbers, tomatoes, peppers, and more. We pulled out old plants to prepare for fall crops and cleaning around the farm. Participants were allowed to take home one bag of FREE produce at the end of the event.

We also gave tours of our aquaponic and hydroponic systems throughout the day, which includes discussions about the farm's sustainable systems and methods that reduce strain on the environment, as well as the research conducted at the farm.

9/11 Day of Service

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES), of the University of the District of Columbia (UDC), partnered with The Mission Continues for the 2nd Annual 9/11 Day of Service. This years' service day will take place on September 8th at UDC's Bertie Backus Urban Food Hub, located in Ward 5. The food hub has aquaponic and hydroponic systems, a native plant nursery and garden beds for the community.

Participants worked together to beautify the food hub to better serve the Ward 5 community. Participants also upgraded some of the site's current amenities and built additional ones. Some of the upgrades included

- Building raised bed gardens for the community garden component of the Food Hub
- Building a wood deer proof fence
- Trench drains for the hoop houses
- Add additional growing space for the native plant nursery
- Build café tables and chairs for an outdoors kitchen

East Capitol Urban Farm Spring Launch

April 28, 2018 we hosted the spring launch of the 2018 growing season at the East Capitol Urban Farm, which is our Urban Food Hub in Ward 7. The Ward 7 community joined CAUSES to celebrate the start of the third growing season at East Capitol Urban Farm. The day featured tours, seedlings, gardening, workshops and volunteer opportunities led by CAUSES team members.

East Capitol Urban Farm is focused on improving food security and sustainability through food production, food preparation, food distribution, and waste and water management. East Capitol Urban Farm is the result of a major local, federal, public and private collaboration between CAUSES, the District of Columbia Housing Authority, Urban Waters Federal Partnership, several District of Columbia government agencies, community organizations, churches, and businesses to transform a vacant, three-acre parcel of land into the city's largest urban farm. East Capitol Urban Farm aims to teach residents how to grow some of their own food and to increase access to locally and sustainably grown produce and fish for the Ward 7 community.

2018 Earth Day Celebration

On April 14, 2018, the College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) at the University of the District of Columbia (UDC) partnered with The Mission Continues in celebration of 2018 Earth Day. Volunteers joined us as we worked together to contribute new additions to East Capitol Urban Farm (ECUF), located in Ward 7. Our efforts on Earth Day prepared ECUF to operationally host more events for local youth, the community, and education leaders. Some of the new amenities included:

- Additional green infrastructure (swales and rain gardens)
- A stem education lab for youth
- Sink installation
- Walkways around garden plots
- A handicap garden plot area
- Community message boards
- Prepped community gardens
- Shelves for the aqua hoop house

Study Abroad In Senegal

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) at the University of the District of Columbia (UDC) conducted a study abroad trip to Dakar, Senegal entitled Building Resilient Communities: Applied Ecological and Sociocultural Approaches for Sustainable Development. The study abroad trip took place from March 9-18, 2018.

The program took 10 students to review highlights of ecological and sociocultural research and consider how Senegalese culture influences the way people view themselves, their environments and how those things contribute to their health and well-being. The course focused on the installation of a permaculture garden. Students gained a better understanding of interconnectedness, differences and diversity in a global society, particularly as it relates to Science, Technology, Engineering, Agriculture, Art, and Mathematics (STEAM).

2018 Mid-Atlantic Regional CCL Conference

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) partnered with Citizens' Climate Lobby (CCL) to host the 2018 Mid-Atlantic Regional CCL Conference on January 26-27, 2018. Attendees engaged in conversations with politicians, scientists, medical professionals, community activists, environmental justice experts, and many others; Attendees also learned about resources for climate change adaptation and mitigation and develop skills to help create the political will for a livable world.

UDC Gleaning Day

The College of Agriculture, Urban Sustainability, and Environmental Sciences' (CAUSES), Center for Urban Agriculture and Gardening Education (CUAGE), hosted a gleaning day at Firebird Research Farm, on Saturday, November 18, 2017, from 10:00 a.m. until 1:00 p.m.

Participants were able to harvest all of the plants in the fields. The produce was donated to So Others Might Eat (SOME), an interfaith, community-based organization that exists to help the poor and homeless of our nation's capital. Volunteers who helped with the harvest were also able to take home one grocery bag of produce.

2017 National Food Recovery Dialogue

The nation's largest student movement against hunger, the Food Recovery Network, hosted its second annual National Food Recovery Dialogue (NFRD) on November 4-5, 2017 at the University of the District of Columbia. The College of Agriculture, Urban Sustainability, and Environmental Sciences (CAUSES) was a proud sponsor.

The National Food Recovery Dialogue seeks to engage a diverse student network with the policymakers, organizations, and individuals making a change in the food waste realm and environmental justice landscapes. Their goal is to highlight the intersectionality of the food waste realm, learn about the cutting-edge food justice initiatives taking place across the country, and have an amazing time doing it!

The keynote address was delivered by Dr. Jessica Felix-Romero, Communications Director of Farmworker Justice. Other featured speakers included: Stacy Carroll, Director of Sales & Partnerships at Hungry Harvest; Kaimana Chee, Executive Chef of Uncle's Hawaiian Grindz; Dr. Jonathan Deutsch, Professor of Culinary Arts and Food Science at Drexel University; Tony Hillery, Founder and Executive Director of Harlem Grown; Spike Mendelsohn, Chef Ambassador to CARE International and Chef Contributor to DC Central Kitchen; and Jenn Yates, Food and Agriculture Systems Consultant.

Ward 8 Community Compost Bin Build Day at P.R. Harris Urban Food Hub

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES), of the University of the District of Columbia (UDC), is hosted a Community Compost Bin Build Day at UDC's P.R. Harris Urban Food Hub, located in Ward 8 on July 11, 2018. Members of the community were encouraged to come out to learn, build and fellowship. Together they built compost bins and filled them with food waste to help "close the loop" for food waste recycling in the District.

UDC Green Roof Tours

The College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES), of the University of the District of Columbia (UDC), hosted a series of green roof tours: July 21, August 24, September 21 and September 22. Participants were able to learn about sustainable agriculture from Sandy Farber Bandier, UDC GreenRoof/Greenhouse Coordinator and learn about green roof design from David Bell of BELL Architects.

Our 20,000 square foot green roof is the food production site of the Van Ness Urban Food Hub. The roof showcases four types of production: (1) high revenue plants (i.e., herbs, greens); (2) high nutrition plants that can cover the entire range of dietary needs (i.e., tomatoes, peppers, chards, cabbages); (3) pollinizer plants to ensure bee health in our urban environment; and (4) low maintenance plants that help capture rain, reduce runoff and cool the building in the summer and provide insulation in the winter. In addition to food production, the green roof is also used to conduct research on plant varieties that thrive in roof environments.

Green Building Professional Seminar Series

On May 30, 2018, the Department of Consumer and Regulatory Affairs' (DCRA) Green Building Division,

in partnership with the University of the District of Columbia's Center for Architectural Innovation & Building Science, hosted a free seminar on Green Materials & Technologies. Attendees learned about exciting materials, design decisions and the implementation of products and technologies including the first WELL Certified office in DC! Our speakers brought a unique perspective to the decision-making process during design and implementation of construction projects in the District.

Speakers included:

Ed Weinmann

Architectural Specialist | Ernest Maier

Lois Arena

Director of Passive House Services | Steven Winter Associates

David Cordell

Associate Principal | Perkins+Will's

1. Research and Extension Activities

1. Climate Change Mitigation

1.1.1 Relevant Research

The following section summarizes our research activities in the area of climate change mitigation.

1.1.1.1 Reducing Impacts of Solar Radiation on a Crop Producing Green Roof, and Modifying Roof Microclimates through an Adjacent Crop Producing Green Facade

The District of Columbia has millions of square feet of roof area. This roof area negatively impacts the urban environment and climate in several ways: the roof surface area absorbs a significant amount of heat, and is the greatest factor in residential energy consumption in certain climates (Kliman, 2001). Light colored roof coatings can ameliorate this problem by reducing the heat absorption; however, these coatings require regular maintenance, darken with dirt accumulation and age, and do nothing to address the increased runoff created when the previously vegetated site was replaced by an impermeable surface. These reflective roofs, coupled with the higher thermal mass of typical building materials like concrete and brick, are significant factors in the urban heat island in urban environments such as the District of Columbia.

Vegetated, or green, roofs can mitigate the effects of the urban heat island and water runoff in several ways. By improving the thermal performance of a building, a green roof can reduce the annual load for cooling the building (Garrison, 2012). A smaller mechanical system translates into reduced CO₂ emissions. The plants also reduce the radiation reflected back into the atmosphere from the roof. Finally, water retention and evapotranspiration of rainfall helps reduce runoff. These green roofs can contribute to an urban environment in other positive ways. A well-designed green roof can have a park-like setting, and serve as a nice amenity for building users. A green roof can also be used to grow crop producing plants. In this configuration, the roof serves as an important component in helping to ensure food security in an urban environment.

One of the challenges with fully utilizing the roof for cultivation of plants is the fact that many roofs have a penthouse for the mechanical system. This penthouse has solid vertical walls that reflect the sunlight and heat back onto the roof. The reflected light and heat is deleterious to the growth of many plants - particularly crops. This study is conducted to determine the viability of using a three dimensional modular lattice system to support crop-producing vines that would cover the walls and reduce this reflected sunlight and heat. The research project is a parallel study that would utilize two existing green roofs - the one on the UDC campus, and one at a k-12 independent school located due west in McLean, Virginia. The UDC

roof will test conditions and impacts in a dense urban environment, five floors above grade. The Virginia site will test conditions and impacts in a heavily vegetated suburban environment, two floors above grade. The test areas will be divided into three sections. The lattice on one section will support dense vine crops. The lattice on the second section will support moderately dense vine crops. The third section will serve as the control, with no lattice or vines. The roof area adjacent to the walls will be planted with micro greens.

Measurements will be taken at regular intervals away from the wall to determine temperature, relative humidity, and solar radiation. It is anticipated that the dense vine crops will provide shading and reduce the reflected sunlight by as much as 20%. It is further anticipated that the air temperature adjacent to the vines will be reduced by 2- 8°C (Connelly, 2012). These two variables should provide a better environment for the plants located in the adjacent shallow beds, and result in a higher crop density. With thriving crop producing vines, and an increase in the usable roof area for planter beds, the overall potential for increased food production on the roof is significant. The ability to increase food security, while also mitigating the urban heat island and reducing the harmful runoff, simply by using existing roofs in the District has an enormous potential to positively impact the overall sustainability of the city. Furthermore, this condition of reflected heat is not limited to roofs with penthouses or partial floors on the same level.

The results of this study will have relevance to the creation of urban farms, and even the homeowner with the garden plot. Student participation will provide hands-on learning experiences for college level and k-12 students, and there are numerous outreach opportunities through the activities of the Center for Urban Agriculture and Gardening Education, Cooperative Extension Service of UDC. The primary goal of this study is to determine whether the installation of a green facade, constructed with a commercially available three-dimensional modular trellis system, can successfully reduce the reflected heat and light from building penthouses located at the same level as the green roof on the adjacent roof surfaces/planters. Solar insolation values and temperatures at the roof penthouse walls and regular intervals away from the wall will provide valuable data regarding the potential of the facade to impact the microclimate on the adjacent roof. By altering the density of the foliage on the green facade, the research will measure and observe whether the reduction reflected light and heat and modifications to the microclimate are sufficient to allow for the successful production of crops, such as micro greens, on the roof surface adjacent to the wall. The data will also provide information regarding the ideal density of the green facade. Further, the study will test the viability of crop producing vines in this type of installation.

A series of measurements will document the magnitude and extent of microclimate modification from the green facade. Crop densities will also be measured on the adjacent green roof. The magnitude and extent of the impact that will be determined by this study are important variables that can be used in the implementation of new green roofs, as more urban environments tackle solutions to food security. Further, by comparing the results of the two different microclimate conditions of the study sites, it may be possible to make inferences on a broader scale. The potential to ameliorate the deleterious impacts of radiant and solar gain from vertical building surfaces on adjacent horizontal garden plots is significant. Urban gardens and farms throughout urban areas - including the Urban Food Hubs being implemented across the District by UDC - will be able to benefit from the knowledge of strategies that will allow for greater flexibility in design, and maximum use of the available land. It is anticipated that the results gained from this study can be disseminated not only in research publications, but also in many of the extension activities of the CAUSES Center for Urban Agriculture and Gardening Education.

One of the challenges with fully utilizing a green roof for cultivation of plants is the fact that many roofs have a penthouse for the mechanical system. This penthouse has solid vertical walls that reflect the sunlight and heat back onto the roof. The reflected light and heat is deleterious to the growth of many plants - particularly crops. The primary goal of this study is to determine whether the installation of a green facade, constructed with a commercially available three-dimensional modular trellis system, can successfully reduce the reflected heat and light from building penthouses located at the same level as the green roof on the adjacent roof surfaces/planters. The results will provide valuable information for both the

design and installation of crop producing green roofs, as well as the design and creation of the typical household garden.

The ability to increase food security, while also mitigating the urban heat island and reducing the harmful runoff, simply by using existing roofs in the District has an enormous potential to positively impact the overall sustainability of the city. Furthermore, this condition of reflected heat is not limited to roofs with penthouses or partial floors on the same level. The results of this study will have relevance to the creation of urban farms, and even the homeowner with the garden plot.

The following occurred during the reporting period:

- Removed 900 square feet of sedum from UDC green roof
- Replaced soil at both study sites (9 cubic yards - 40,000 lbs. total) - involved removal of existing lightweight extensive green roof medium and installation of lightweight agricultural mix.
- Installed drip irrigation at both sites
- Installed sensors (temperature, relative humidity, and solar radiation) at both study sites - including constructing stands for control system and all dataloggers; established that systems were working and collecting data
- Installed planters for vine crops at both study sites
- Planted three (3) different vine crops (Pole Beans (*Vigna unguiculata*); Gourd 'Luffa' (*Luffa aegyptiaca*) - 'Dishrag Gourd or Vegetable Sponge'; Gourd 'Cucuzzi' (*Lagenaria siceraria*) - ' Italian Edible Gourd' or ' Longissima' or 'Indian Squash' at both study sites, and monitored growth to determine best option for achieving the desired vegetation densities on vertical surfaces in the study
 - Planted/grew/harvested approximately 400 swiss chard plants on the UDC green roof to confirm ideal spacing, plant growth rate, viability of growing edible greens in shallow agricultural medium
 - Made initial observations of limited data, indicating a variation on microclimate in plots adjacent to different facade configurations

Regarding training and professional development, the project provided the following:

- Student researchers learned about relevant/related studies through literature review
- Student researchers and Principal Investigator have learned about datalogging equipment and software, and how these tools can be used to collect data relevant to their design work
 - Approximately 30 volunteers - including UDC students and faculty, community volunteers, master gardener students, Potomac School students, staff and alumni - helped with the following tasks, during which time the Principal Investigator explained the purpose of the study, the research methodology, and hypothesis for results:
 - Removal of sedum, re-planting a portion at the non-study portion of the green roof at the Potomac School study site
 - Removal of existing extensive roof growing medium
 - Installation of lightweight agricultural mix growing medium
 - Planting seeds for approximately 600 swiss chard plants, as well as 16 pole bean plants, 8 'luffa' gourds and 8 'cucuzzi' gourds in greenhouse
 - Installation of planters with pole beans and gourds at both study sites
 - Planting approximately 400 seedlings in research plots on the UDC roof
 - Harvesting approximately 400 chard plants (and distribute to student researchers, faculty and staff at UDC)

Not enough data was collected this research year to yield results worth disseminating. It is anticipated that the data from the upcoming growing season will be adequate for analysis and dissemination of results.

Two undergraduate and three graduate student researchers participated on this project.

For the next reporting period, we plan to do the following:

- Plants will be started in late spring in greenhouse
- After last frost, seedlings will be planted at both study sites
- Data will be collected for entire growing season at both study sites, rotating/replanting horizontal plots of greens as necessary
- Data from both sites will be analyzed incrementally and at the conclusion of the growing season
- Two (2) graduate students will be employed to assist with planting and data collection
- Volunteers will be enlisted to assist with planting and monitoring of sensors at both study sites.

1. Community Outreach and Education (Cooperative Extension)

1.1.2.1 Benefits of the Green Roof

In addition to providing a resource for crop production, the UDC green roof provides a great benefit from the standpoint of the built environment and climate change. Multiple studies have shown that there are benefits from green roofs for reductions in both winter heating and summer cooling. A planted roof provides an added layer of insulation. In the winter, the added insulation helps hold the heat inside the structure. In the summer, this insulation helps keep the heat out. This insulation is particularly important, as during the summer an exposed area of a black roof can reach 176 °F, while that same area beneath a green roof would be only about 81 °F. In addition, the evapotranspiration from the plants reduces the air the temperature immediately above the roof. This lower exterior temperature thereby reduces the temperature differential between the exterior and interior of the roof system, and ultimately the energy load on the building for cooling from anywhere between 6% and 49%. On a broader climate scale, the vegetative coverage has a much lower solar radiation value than the typical roof membrane, so the reflection back into the atmosphere is reduced with a green roof. This reduced solar energy radiation correlates directly with a reduction in the urban heat island. Other structural benefits of green roofs include a reduction in stormwater runoff, and noise reduction. For a building that is 40 years old and in an urban environment, like those on the UDC campus, these benefits translate into a more sustainable campus as well as a reduction in operational costs from lower utility bills (electricity and water).

The roof is an important tool for education and outreach. Faculty across the College of Agriculture, Urban Sustainability and Environmental Sciences - in disciplines ranging from architecture to nutrition to environmental science - take students on tours of the roof as part of their classes. The tours include information about the physical construction and climate/energy benefits of the roof, as well as the food security and urban agriculture component. This information is also disseminated during the many public tours of the roof that are given throughout the year.

The concept of climate change is foreign to many communities of low socioeconomic status. Twelve workshops were offered that included education on climate change and its impacts. 85% of participants articulated an increase in knowledge in their understanding of climate change. 85% of participants also stated that they would change their behavior in response to the knowledge gained on the topic of climate change.

These are encouraging results. Additional projects to increase literacy about climate change and sustainable development are in preparation to build on the success of the community education programs offered in 2017.

1. Global Food Security and Hunger

1.2.1 Relevant Research

The following section summarizes various research activities in the area of food security and hunger to include: Agroforestry and Polyculture; Urban Food Hubs; Green Roofs; Farmers Markets; Urban Production; Sustainable Agriculture; Ethnic and Specialty Crops; and Aquaponics.

1.2.1.1 Determining Effects of Nitrogen Fixing Plants on Nutrient Density and Productivity in Agroforestry and Polyculture Systems

Like urban centers around the world, Washington DC is faced with challenges in providing fresh, healthy food to its residents, especially the underserved and low-income populations. Five percent of all households in the District have very low food security, while a total of thirteen percent have food insecurity. DC ranks second worst in the nation, exceeded only by Mississippi for the highest number of households with children that cannot afford enough food (20). Over 34,000 people live in areas classified as "food deserts," living more than a mile away from a supermarket (USDA ERS 2014). Most of these areas are in Wards 5, 7, and 8, where 95% of the population is African-American and more than one third of the households have yearly income below the federal poverty line of \$22,000 for a family of four (19). In the face of these statistics, the District of Columbia is looking for ways to improve access to fresh, nutrient dense food for all of its residents.

The District of Columbia is embedded in lush East Coast temperate forest. As issues of sustainability and food security are addressed, practical solutions to creating and increasing local productivity are being considered. The mayor of the District of Columbia has created a food policy council. Recently, the DC Urban Food Farm and Food Security Act of 2014 passed. Under this act, the mayor will identify urban plots to lease out to qualified applicants, offer tax credits for land owners who lease their land to growers, and work to promote buying locally grown food in order to support urban food production within the District (3). While this is a big step in helping to increase the availability of locally grown food, it is important that sustainable agricultural practices are a part of this change.

Sustainable and organic farmers throughout the nation are warming up to and embracing ideas such as permaculture, agroforestry, restoration agriculture, edible landscaping, rooftop gardening, and farming the woods. All of these models have the core concept of working with native plants and forestlands to produce sustenance crops that have marketable potential incorporated into a closed-loop system of agriculture. Urban runoff and agricultural waste are leading contributors of nutrient, bacterial, and toxic pollution to area waterways including the Anacostia Watershed and the Chesapeake Bay (11). Agroforestry and polyculture systems use nitrogen fixing trees and bushes along with cover crops to provide nitrogen. Polycultures and closed loop systems of food production have the potential of significantly lessening pollutants by decreasing agricultural inputs and limiting potentially toxic outputs. Agroforestry and polyculture systems rely on nitrogen fixing trees and bushes along with cover crops to provide nitrogen. Assessing the impact of nitrogen fixing plants on the resiliency and productivity of the system provides alternatives to standard nitrogen inputs. Determining nitrogen contributions from trees and bushes vs. cover crops will help provide information that growers can use to create efficient low-input and closed-loop nitrogen cycling.

Traditional large-scale growing practices have a significant environmental impact and also are not possible within urban settings. Agroforestry and/or polyculture, i.e. the cultivation of multiple crops in a closed loop system, is rising in popularity as growers and homeowners look for sustainable, low input methods of production for both sustenance and market crops. Such solutions can be applied to backyards or abandoned city lots. While there is a lot of potential for these types of systems to be successful at providing food and restoring ecosystems, it is still a new concept and requires some shifting from traditional practices. In order to demonstrate viable polyculture crops for the Mid-Atlantic region, we plan to

design a ¼ acre plot that will consist of a variety of species including fruit and nut trees, fruit bushes and vines, and plants that are beneficial as ground cover, for nutrient building properties, or to attract beneficial insects. By using a wide range of plants, it will help to ensure that regardless of the season or environmental fluctuations, something will be flourishing and providing sustenance for the grower and creating a system where the plants complement rather than compete with each other.

Polyculture systems have other benefits for urban areas. Through design, the edges of the plot can be used as a noise barrier for those situated near high traffic roads or to block the view for those located near undesirable vantages. They also help to protect an area from sunlight and wind. Hedgerows are beneficial for the other plants in the guild by hosting pollinator and predatory species that help ensure a good harvest and protection from pest species. Other plants, such as daffodils, are beneficial both to plants around urban houses and in the polyculture plot for deterring rodents from entering the house or feasting on the bounty growing in the plot (16). All of these benefits will help to enhance the beauty of the city and the health of those living here.

UDC CAUSES and Bread for the City began City Orchard at the Firebird Farm in 2011. The project consists of 540 apple and 120 Asian pear trees along with blackberries, blueberries, raspberries, and strawberries. Apples, while chosen for their familiarity and acceptability among urbanites as the premiere fruits, require much care and spraying because they are being grown in a temperate forested region. Though disease resistant strains were chosen for their potential to resist fire blight, other diseases such as cedar apple rust and apple scab make it almost impossible to produce aesthetically pleasing fruit without the use of chemical fungicides and other agents, which make apples one of the most toxic fruit on the market. This project makes clear that more work needs to be done in understanding and creating minimal input systems that are self-sustainable. Hence, this project will help identify potential perennial food crops that can help increase local food security while help reduce toxic agricultural and landscape runoff from chemical fertilizer use.

This project is contributing to the development of alternative food production methods that are practical for urban areas, such as Washington DC, to implement in backyards or on abandoned city lots. This will increase access to fresh, nutrient dense food that will help to improve the overall health of the citizens. Agroforestry and polyculture systems are designed to incorporate a variety of complementary plants to minimize the amount of inputs needed to maintain a healthy and productive plot. A polyculture plot at UDC Firebird Farm will be used for data collection on how different nitrogen fixing plants affect nutrient density and productivity, trialing various species to determine the best ones for the area, and also used as a model for education on how to establish successful polyculture plots in the city.

Project activities for the reporting period follow:

- Contractor researched zone-specific nitrogen fixing trees and shrubs that would be used in the research project.
- Contractor found land that measured ideal growing conditions against public display for demonstration purposes.
- Contractor did a survey of the terrain to establish water flow and erosion patterns.
- Contractor established list of land improvements to be made prior to project execution.
- Contractors are developing training guide for student interns

Our efforts focused on the contractor leading the project as well as beginning focusing on training student interns as research assistants.

For the next reporting period, we will request an extension to complete the project objectives. If granted the extension, the project should be in effect by mid-Summer 2019. Field conditions have improved since last year and the P.I. now has discretion to release payment for invoiced services provided by contractor. If

extension is denied, we will prepare the land and lay out the field (complete with trees and shrubs) as a demonstration plot for students and community members.

Project changes/issues:

- The change in the P.I. at the outset of the project created coordinating confusion that delayed action on initial purchasing.
- Broken pipe on the AES grounds continuously flooded the field selected for the project. The pipe was finally capped in summer 2017. These soil saturation conditions were detrimental to transplanting and sustained plant growth all year long.
- Series of wet spring and fall months during 2017 compounded field condition problems.

Revised Objective: The polyculture field, once established in its proposed layout, will serve as a demonstration plot for community members to observe during scheduled tours and Field Days. They will then be encouraged to replicate such a design on their own properties.

1.2.1.2 The Urban Food Hubs Solution

CAUSES recognizes that improving Global Food Security and Hunger is one of the most important goals of urban agriculture and urban sustainability. Without securing a steady and dependable supply of highly nutritious food, urban communities cannot claim to attain sustainability. With more than half of the world's population, and over 80 percent of the U.S. population now living in urban communities, food travels over longer distances resulting in declining nutrient density, high energy demand and greenhouse gas emissions associated with a transport intensive food system, increasing vulnerability of urban food supplies, and growing health disparities due to unequal access to fresh food.

Using the pioneering work of Dr. Sabine O'Hara, CAUSES has begun implementing the concept of Urban Food Systems Hubs that operationalize her work on Sustaining Production (O'Hara 1996, 1998, 2004, 2012, 2013). Sustaining Production expands the traditional success measures of production such as profit maximization and productivity to simultaneously consider reducing emissions (negative externalities) and improving sink capacities. The Urban Food Systems Hubs consist of the following components:

1. Food production through highly efficient small-scale urban systems, including hydroponics and aquaponics;
2. Food preparation through commercial kitchens that serve as business incubators;
3. Food distribution through networked farmers markets, grocery stores and restaurants; and
4. Waste management and recycling through food waste processing, composting, energy generation, and water management.

All four components of the Urban Food Systems Hubs offer business development and job creation opportunities. To capitalize on these opportunities, the Hubs serve not only as sustainable production facilities, but also as training sites especially in the food desert areas of Wards 5, 7 and 8 where unemployment is high and food related public health problems including diabetes, hypertension and obesity are prevalent.

Among the eight wards in the District of Columbia, Ward 8 is the most underserved and is located in the southeastern quadrant of Washington, DC, south of the Anacostia River. In 2012, the average household income in Ward 8 is \$38,000 and unemployment was close to 24 percent. This compares to an average household income of \$99,500 across all eight of the DC Wards and to an average \$162,000 per household in Ward 3, which is home to the highest household incomes in the District of Columbia.

Twenty percent of the population in Ward 8 is under the age of 18; 91 percent are African American, 1.5

percent are Hispanic, slightly more than 4 percent are Caucasian, and less than 1 percent are Asian. The percentage of college graduates in Ward 8 is 7.6 percent compared to an average of 22.5 percent across all eight Wards.

Preliminary results of the productivity tests and revenue calculations for the Urban Food Hubs sites in Ward 5, 7 and 8 indicate that urban food production is commercially viable. However, the type of production that yield a wide range of vegetables for local production may not reach the same level of productivity as the production of high revenue crops for value added production or direct marketing to high revenue niche markets. Further research will be needed to identify socially responsible business models that meet the multiple objectives of the urban food hubs project. The models must at the same time improve food security objectives and high revenue objectives to create the maximum number of jobs possible.

1.2.1.3 The Impact of Farmers Markets - Food Security, Regional Economy and Diet

Following a pilot study of the University of the District of Columbia (UDC) Farmer's Market in 2015, this three-phase, interdisciplinary research project examines and quantifies the impact of farmers markets on food security, regional economy, and dietary behavior of residents in Washington, DC. Each phase's research is built on the previous one, with the research focus of each subsequent phase narrower than the previous one (from national to regional, to regional/low-income families). Each phase of the research project and its corresponding objectives, methods, data collection and expected outcomes are summarized as follows:

Phase I (2016-17) We explored market relationships with food security at both the city and household level nationally. This phase will utilize public-use data and be completed through statistical analysis using a panel regression at city- and household-level on a national scale.

Phase II (2017-18) We implemented a randomized survey of 500 residents of DC and Washington DC Metropolitan Area provided through a contractor, in order to understand how people are interacting with farmers markets, as well as value and characteristics of all consumer food purchases. The survey results will be used to explore local dietary habits, environmental knowledge, participation in farmer's markets, as well as to quantify farmers markets' impact on Gross Regional Product (GRP), income, and employment. Overall, this will aid us in identifying and quantifying the barriers, economic and social, to participation and utilization of local food markets in the DC region.

Phase III (2018-19) We will conduct qualitative research on low-income DC households and more clearly define policies and incentives to promote low-income communities to utilize local farmer's markets. This objective will be completed through focus group discussions and in-depth interviews of low-income families in DC.

It is anticipated that the results from this research project will be published in four separate research articles that contribute to direct-to-consumer agricultural marketing, food security and nutrition and diet literature. The research articles will be presented at academic and extension conferences, as well as disseminated to the public through CAUSES outreach activities. The survey data obtained through the project will be maintained by UDC CAUSES' urban agriculture data hub as a public accessible baseline data for regional farmers' market usage, diet and health, and food security. In addition, this research project will present a unique opportunity for training CAUSES students in survey development and implementation on a broad scale.

Farmer's markets offer a unique way for urban residents to access local, affordable, and healthy vegetables. Research has shown that when farmers produce for local, instead of national or global markets, their customer base diversifies and available produce options for local residents increase (Halweil

2015). This diversification can also be good for local dietary and nutrition concerns. A case study in New York found that in local markets, farmers produced higher quantities of produce that matched dietary intake deficiencies of impoverished communities (Peters et al. 2003), while another study in 2013 indicated that helping SNAP participants participate increased low income nutrition significantly (Obadia and Porter, 2013). Our study region, the District of Columbia, is one of the fastest growing cities in the U.S. with vast disparities in socioeconomic and health status. In 2012, unemployment rates within DC vary from 3.9 percent in Ward 3 to 24 percent in Ward 8. Average family income varies from \$246,528 in Ward 3 to \$43,973 in Ward 8 (Neighborhood Info DC, 2016) and this disparity is still increasing.

Our research will directly address the Sustainable DC goals for 2032 of having five (5) times as many green jobs as now, cutting city-wide obesity rate, and aiding 75% of residents in accessing healthy, local food within ¼ mile of their home. In Phase III of our research, we will focus on identifying key barriers to farmer's market participation and how economic, social, and cultural factors relate to local food access. In DC, there are broad issues to accessing fresh, healthy food, especially in underserved and low-income regions. Many of DC's low income wards have extremely high unemployment rates. Thirteen percent (13%) of all households in DC have food insecurity, five percent (5%) with very low food security (increased by 1% in the past four (4) years). In 2008-2012, 30.5% of households with children in the District of Columbia indicated that they were unable to afford enough food. This is the second worst rate in the nation, exceeded only by Mississippi (Food Research and Action Center, 2013).

Nearly 200,000 DC residents live on neighborhood blocks where the closest healthy food retailer is more than three (3) times farther than the closest fringe food retailer. Nine of DC's Census tracts (with a combined population of over 34,000 people) are classified as "food deserts" where the majority of residents live more than a mile away from a supermarket (USDA ERS 2014). Most of these food deserts occur in Wards 5, 7, and 8, where 95% of the population is African-American and more than one third of households have yearly income below the federal poverty line (\$22,000 for a family of four). Black unemployment rates in DC are the highest in any U.S. State, with over 13.6% of black residents unemployed (Wilson, 2015). In 2010, 1 in 9 DC residents were classified as being in "deep poverty" or living on income half that of the official poverty level, most of whom live in Wards 7 and 8 (DC Fiscal Policy Institute 2011). These food access and unemployment issues can be addressed through local, direct to consumer produce markets. The missing part of this puzzle is how to address sociocultural and economic barriers to proliferate these markets.

Our research will work on increasing farmer's market participation and food security and ameliorating food and health-related socioeconomic issues throughout the city. Specifically, our project focuses on the NIFA goal of increasing overall food security. Additionally, our econometric study will focus on food miles and how far people must travel to get to local, fresh food locations, addressing the NIFA goal of reducing greenhouse gases. Our research will directly address the Sustainable DC goals for 2032 of having 5 times as many green jobs as now, cutting city-wide obesity rate, and aiding 75% of residents in accessing healthy, local food within ¼ mile of their home. In particular, our project focuses on identifying key barriers to farmer's market participation and how economic, social, and cultural factors relate to local food access.

Additionally, we conducted the broadest econometric study conducted in DC, detailing both how farmer's markets contribute to the national and local economy and how expanding markets will expand job opportunities at multiple levels. Finally, we will also be investigating the impact of farmer's markets on impoverished regions and food access, using focus groups and in person surveys. During the reporting period, our activities included the following:

Research:

Phase I:

State-level longitudinal analysis using farmer's market number as dependent and independent variables

are conducted. Preliminary findings show that 1) Washington DC among the state experiencing the most rapidly growth of farmers' market; 2) instead of being a solution for poverty and food insecurity as we hypothesized, farmers' markets are seen growing faster in higher-income states, and respond to faster economic growth. These preliminary findings suggest we look at the issues at city and metro levels, which we are doing currently.

Phase II

Questionnaire IRB approved. Through contractor (GfK knowledge Panel), we have collected 440 filled questionnaires in the Washington DC metro area. The data have been cleaned and ready for analysis; Research meetings were held periodically between PI and co-PIs; questionnaires were peer-reviewed by economists from George Mason University and Department of Interior through appointments and meetings.

Grant Management:

We hired two student research assistants (at different times) to collect and clean data on farmers' market operation numbers at the state, city and metropolitan levels. They were able to form a longitudinal table with food security index, farmers' market numbers, as well as demographic data from 2006-16. Implan software for economic impact analysis purchased. We purchased computers/tablets and accessories as we proposed extension activities.

During the next reporting period, we accomplished the following towards our research objectives:

- Improved Phase I paper by adding a similarity analysis of the cities and submit paper to a journal for publication and conferences;
- Analyzed the survey data in answering three questions: 1) Who shops at farmers' markets more? 2) What are the economic impacts? and 3) What are the impacts on health?
- Drafted two-three papers accordingly; submit these papers for publications and conferences;
- Outlined Phase III study, develop questionnaire and in-depth survey instruments, recruit focus groups, and obtain IRB approval for the study and hire a qualitative research assistant for this phase work;
- Conducted Phase III study.

The main audience of Phase I and II of this study is academic and related policy makers (e.g. USDA). The main audience for Phase III is communities in DC, the Washington Metropolitan area and the nation. Fact sheets disseminating findings are being produced.

440 completed randomized surveys on farmers' market usage (spending, frequency, shopping behavior, etc.), health, and demographic information were collected in the Washington Metropolitan area. Findings from this research were disseminated at a bi-monthly DC Farmers' Market Collaborative meeting. The 2018 UDC Van Ness Farmers Market was open May 5 - November 24, 2018. It averaged about 1500+ people per market day (an increase from previous years.) The vendors included 6 produce (4 affiliated with National Latino Farmers and Ranchers Trade Association); 1 bi-weekly fresh and smoked fish vendor, 1 egg and poultry vendor, 1 prepared food vendor, 1 mobile bike repair, and 5 craft vendors. The market was also the only drop-off location for Compost Cab in Ward 3.

For this reporting period, there were musical performances, cooking demos, and children's activities by several local school and agencies. The market was so successful, it was hard during peak market season to fit additional organizations/ performers due to lack of space.

One of the customers' favorite features at the market was the compost drop-off by Compost Cab. They started the market season off collecting 500-600 lbs/ week and finished with an average of 900lbs. During

their jack-o-lantern recycling the Van Ness location collected over half a ton of pumpkins on the first day. They were definitely a major attraction for the market. It will be important to keep them in a similar location for next year.

Using the Sticky Economy Evaluation Device (SEED) methodology, the UDC Farmers Market reported an annual combined economic impact of \$2,106,054.31 on its vendors, host neighborhood, and surrounding region.

Operating 28 days per year, the UDC Farmers Market enjoys \$423.36 in sales per square feet annually. This number is based on the estimated gross annual receipts of \$744,990.40. By increasing the number of consumers visiting the Market's neighborhood, the UDC Farmers Market increases the revenue collected by local businesses:

- Average gross receipts at businesses near the market (per market day): \$28,699.25
- Estimated gross annual receipts at businesses near the market from purchases made by market shoppers: \$803,578.95

The SEED evaluation team also learned that the UDC Farmers Market attracts approximately 1,500 shoppers per market day. This results in an estimated annual attendance of 30,800 shoppers. As part of the stated mission to promote "Healthy Cities-Healthy People", teach the principles of urban sustainability, and increase wellness for the residents of Washington DC, The University Of The District of Columbia, College of Agriculture Urban Sustainability and Environmental Sciences established a monthly farm stand at the UDC Bertie Backus campus. All of the produce for the farm stand was sourced from UDC Firebird Farm in Beltsville and the UDC Bertie Backus aquaponics and hydroponics systems.

The UDC Bertie Backus campus is located in the Fort Totten/Lamond Riggs neighborhood. This Ward 5 community has historically been classified as a food desert. The nearest dedicated grocery store is a Giant grocery store located on the Maryland side of the DC/MD border. In 2013 a Walmart with a grocery section opened in the neighborhood. The closest farm stands are located at the Brookland farmers market and the Petworth farmers market. Neither of these farmers markets is within walking distance for Bertie Backus residents. The pink areas on the map correspond to food deserts in the District of Columbia. The University of the District of Columbia's Bertie Backus farm stand filled a void in the Fort Totten/Lamond Riggs neighborhood. The farm stand operated from June-November and served 230 customers. The farm stand sold or distributed 619 pounds of produce and made \$1112.00. While the farm stand did not have an official SNAP certification, low income customers were offered produce for free, or at a very low cost. Residents in the Bertie Backus neighborhood would like to see the farm stand return next year on a weekly basis.

The most popular products at the farm stand were collard greens, swiss chard, red beets, tomatoes, cucumbers, and various lettuces. The collard greens consistently sold out 100%. In August the watermelon was very popular.

1.2.1.4 Assessing the Urban Production Potential and Nutrient Profiles of Two Crops Native to the Tropics

Our research aimed to mitigate the negative impact of climate change (NIFA goal) and regional population growth on food production by improving food security (NIFA goal) within a quarter mile of 75% of DC residents (Sustainable DC Initiative). Specifically, we used two tropical crops, roselle (*Hibiscus sabdariffa*) and sweet potato (*Ipomoea batatas*), to answer the following questions: 1) which cultivars are the highest performers in urban agricultural production; and 2) and what are the nutrient profiles of the highest performing cultivars of each crop? This information will benefit farmers and gardeners who are looking to improve production in urban areas. Ultimately, this information will also help consumers, who will have access to crops with higher nutrients.

Seven varieties of sweet potato greens and five genotypes of roselle were grown on a green roof in downtown Washington, DC and in field rows at UDC's Firebird Farm (Beltsville, MD) in 2017. In 2018 the sweet potato and roselle trials were repeated. However, a second field row of sweet potatoes was added to the project to determine whether leaf harvests affects tuber production (leaves were not harvested in this second row, whereas they were in the first). Also, two additional genotypes of roselle were added to the trials and one additional production systems was added (high tunnel production). Our primary focus was on yield and nutrient content of leaves (for sweet potato and roselle) and calyces (for roselle), which are edible, but tubers of sweet potatoes were also weighed and sent for nutrient analysis in year 2. Leaves were harvested multiple times each year, separated by whether they were marketable or unmarketable quality, and then weighed to determine yield. Calyces from roselle were collected once per year. Insect pests were also identified and quantified. The nutrient content of leaves, calyces, and tubers are currently undergoing nutrient analysis by collaborators at the Beltsville Human Nutrition Research Center (USDA-ARS).

Results show that the varieties of sweet potato did not produce different amounts of marketable leaves within a location. Tuber production did not differ among varieties, but was severely reduced by harvesting leaves.

Results show that genotypes of roselle produced different amounts of marketable leaves within all locations. Only two genotypes reliably produced edible calyces, a commercial Thai red genotype and a genotype that produces green calyces (hereafter, "green genotype"). The green genotype has been the focus of a mass selection breeding program in the DC area and shows the most adaptability to a range of growing systems and environmental conditions. This genotype had the fewest Japanese beetles in the field, which is the main pest of this crop in the mid-Atlantic.

1.2.1.5 Aquaponics System and Crop Production at Firebird Farm

Urban agriculture has been defined as the cultivation of crops and rearing of animals, including aquaponics, aquaculture and urban forestry, within and surrounding the boundaries of cities. The Center for Urban Agriculture and Gardening Education (CUAGE) focuses on a multifunctional approach to food production activities, as well as herbs, medicinal and ornamental plants for home consumption and for the market. CUAGE contributes to fresh food availability of urban dwellers, as well as to the greening of the nation's capital and teaches the productive reuse of urban waste. CUAGE will seek global relationships in urban and peri-urban agriculture. In developing countries, urban agriculture is recognized for the provision of local food, as well as recreational, educational and social services. An important aspect of urban and peri-urban agriculture is that it provides income and employment and contributes to local economic development, poverty alleviation and the social inclusion of the urban poor and women.

Aquaculture includes the production of fish seafood from hatchery fish to shellfish which are grown to market size in tanks, ponds, cages and raceways. It also includes productions of ornamental fish for the aquarium trade and growing plant species used in range of food, and pharmaceutical, nutritional, and biotechnology products. If you connect the fish tank water (fish waste) to water a hydroponics system, plants get an automatic food supply of almost everything they need to grow from the fish water and in turn the plants filter the water for the fish. The fish waste from the tank helps to grow different vegetables and/or crops organically. Plants grow fast because they get rich alive nutrients.

We have implemented aquaponics systems in two greenhouse facilities at the Firebird Farm. There are two 500 gallon water tanks in one greenhouse. The farm grows tilapia species. There are approximately 300 tilapia in both tanks of the aquaponics system of the farm. The fish weigh approximately three pounds each. Demonstration activities were conducted with stakeholders to include regular crop harvesting at the farm. We continue investigations and experiments on crop production, infrastructure and maintenance of

this sustainable method of food production for the District of Columbia and other urban areas.

A contained mini Food Hub for demonstration of different aquaponics plant side growing methods was approved upon. The aquaponics system has two 300 gallon tanks and connects to two hoop houses. Several different variations on plant growing systems were constructed.

1.2.1.6 Using Green Roofs as Research and Educational Training Spaces to Enhance Urban Specialty Crop Production

The urban population of the world has grown rapidly, from 746 million in 1950 to 7.2 billion in 2014. Within the United States, the Northeastern region is the most urbanized. Even within this heavily urbanized region, Washington, DC is notable because it has a population density greater than any state in the country and continues to grow by 1,000 residents per month. Supporting this population growth in a sustainable way is a primary challenge for Washington, DC, in part, because land for agriculture becomes increasingly removed from the city center, reducing access to locally grown food. Further complicating sustainable development and food production within the metropolitan Washington, DC area are the changing climatic conditions which increase severe weather events such as heat waves and deluges and alter normal temperature and precipitation cycles.

In 2016 we initiated a pilot project to explore improving food security as a mitigation strategy against the negative impact of climate change and regional population growth on food production. Specifically, we grew six varieties of strawberries and tomatoes on three green roofs to determine which varieties were the highest performers in urban agricultural production. In 2017-2018 we expanded this work by growing the varieties on three green roofs, but also in raised beds, field rows, and hydroponics and aquaponics systems at Firebird Farm in order to provide a comparison to green roof production.

We initiated variety trials with strawberries because of their high nutrient content and because of a collaborative project that was initiated with the Beltsville Area Research Center (USDA-ARS). Dr. Kim Lewers, a Research Geneticist from the USDA-ARS, specializes on strawberries and teamed with Dr. Matthew Richardson (UDC) to supervise an undergraduate research project. The six varieties used for this project were Sweet Ann, Seascape, San Andreas, Portola, Albion, and Monterey. Tomatoes were similarly chosen because of their high nutritional value and because of a collaboration with a non-profit partner. Growth of the strawberry plants was quantified as they became established in 2018. When plants started producing strawberries, we weighed the yield from each plant twice per week, separating the marketable yield from the damaged, diseased, and unmarketable yield. The marketable yield was scored using a 1-9 scale, which was developed by the USDA and takes into account anything that reduces the visual appeal of the crop.

Nine pounds of marketable strawberries were produced in the hydroponics and raised beds at Firebird Farm and 25.4 pounds of marketable strawberries were produced on the green roof at UDC's main campus in 2017. The other two green roofs did not produce berries because of extreme weather (early season heat). Yield was relatively low because we were maximizing plant growth in 2017. We harvested 3,789 tomatoes from Firebird Farm and UDC's green roof in 2017. Production at the other two green roofs was almost zero because of the same extreme weather that affected strawberry production.

In 2018 we again grew six varieties each of strawberries and tomatoes at three different green roof sites, one control site, and in hydroponic and aquaponics systems to assess productivity in urban, high heat environments. In addition to yield, samples were collected for nutritional analysis by collaborators at the Beltsville Human Nutrition Research Center (USDA-ARS) to determine differences among varieties and production systems. We trained six UDC undergraduate students in tomato and strawberry production, data collection, and educational outreach plus an additional 163 direct adult contacts were reached because they volunteered on production and data collection. We presented the project at one open house

at UDC's research farm, through four tours of UDC's green roof, and through UDC's Master Gardener class. The total number of people reached was 250.

Yield of tomatoes was low in 2018 because severe weather (precipitation) caused cracking, so we will be switching to different varieties in 2019. Also, one variety of strawberry was a low performer, so we will be replacing it in crop trials in 2019.

1.2.1.7 Cultural Techniques to Increase Yield of Winter-Grown Vegetables

In order to bring locally-grown food to DC residents, many gardeners and farmers are finding innovative ways to expand production in limited urban farm space. By extending the growing season, or by the addition of a new winter season, growers can expand production and meet demand in a time of low supply. Protective structures such as caps, cold frames, low tunnels, high tunnels, or low tunnels within high tunnels (double tunnel), have long been used to trap heat from solar radiation below glass or plastic for storage in the air, soil, and water within. Ground cover within protected structures will also contribute to the microclimate within protected structures and act to prevent moisture loss, improve soil quality, and act as a chemical-free method of weed prevention. Ground covers also act to modulate temperatures within structures by slowing both cooling as the temperatures drop and warming as temperatures rise during the day.

This project began August 1, 2018, so this report only covers a two-month period. In that time significant progress was made. One graduate student was recruited to join UDC's PSM Program in Urban Agriculture to help lead this project. Also, the experimental design was finalized, supplies and kale plants were ordered, and eight partner locations (operated by for-profit and non-profit growers) in Washington, DC were identified. At each partner location in FY19 kale plants will be established in two low tunnels, one of which will have ground cover, whereas the other one will not. Trials will also be established in a high tunnel at UDC's Firebird Farm (Beltsville, MD).

1.2.1.8 Farmer-to-Farmer Educational Collaborative: Permaculture Production Systems for Ethnic and Specialty Crop Research

More than 11% of Washington D.C., USA is considered a food desert. In 1980 Washington, D.C. officially twinned with Dakar, Senegal. Providing adequate and nutritious food in these cities have been challenging in urban areas where both sales and production are scarce and in rural areas where droughts, floods and anthropogenic pressures impact agricultural production. International farmer exchanges can increase the viability of permaculture ethnic crop production. Poverty is the most salient pressure and thus a challenge in the equation for achieving food security in these communities. This research project seeks to establish a farm educational training program that increases crop yield, knowledge and market demand for African and Caribbean ethnic crops.

The goal of this project is to create and sustain permaculture systems that increase the yields of ethnic crops by establishing international connections and informational exchanges.

Objective 1: The Farmer-to-Farmer Program will train 20 urban farmers a year in permaculture installation to increase knowledge and understanding in ecologically-based planning, site design and management for ethnic fruit, vegetable, and medicinal plant production;

Objective 2: The Farmer-to-Farmer Program will recruit and subsidize the travel of 20 urban farmers to engage in an ethnic crop permaculture projects to increase their knowledge and understanding associated with ethnic crop productions, inputs, and pest and disease management;

Objective 3: To collect baseline production and microclimate data in established permaculture plots to quantify yields of ethnic crops and the impact of climate and other environmental factors that limit growth; and

Objective 4: To develop a fact sheet that delineates the market potential, production, and economic returns on investment of ethnic crops that originated from Africa and the Caribbean.

Accomplishments and activities for FY 2018 follow:

Year one was as a baseline or preliminary assessment for pre-, mid-, and post-farmer assessments, yield amount, pest control methods, water use, nutrient management method, diversity of crop choice and permaculture design. Future assessments conducted in years 2 and 3 will be used to determine the statistical change over time for the increase or decrease of the above-mentioned variables.

The University of the District of Columbia, College of Agriculture, Urban Sustainability and Environmental Sciences (UDC CAUSES), launched its first study abroad program bringing eight UDC students and two CAUSES faculty to an exploration of ecological approaches to sustainable development in Senegal, West Africa. The trip connected UDC students with students from Cheikh Anta Diop (UCAD), the premier public University in Dakar, and the city of Dakar - DC's sister city. The trip explored opportunities and challenges of implementing sustainable development in international communities, as well as exploring indigenous ecological knowledge.

Following are brief summaries of the various events, meetings, and cultural activities that were a part of the students' journey and experiential learning:

Tour of Lahel and Permaculture Site: We arrived in the early afternoon at the Lahel permaculture site to conduct an assessment. The air was breezy and there was no water in sight. A large area filled with craters showed lots of water was there not too long ago. The soil appeared dry and lifeless but as we looked closer, there was life in small plants and tiny seedlings. The project site is in a meander of the Senegal River, with Mauritania on the other side. We discussed how a fence would allow for trees and other plants to grow, and create a barrier from the grazing animals. The idea of the permaculture food forest really became imaginable for some; others found it hard to conceptualize such lush greenery in the desert, especially in its current state in the dry season. However, that ecosystem looks very different in the rainy season, and could very well be a foraging food forest.

In the Lahel community, we assessed the permaculture plots funded by a collective of development agencies. While conducting the plot assessments, we also interviewed farmers about their yields, techniques, challenges, and distribution. Farmers were growing similar things in Lahel as they were in Guédé, e.g. onions, tomatoes, mint, and peppers. There were not many trees within the plot, which brought up questions about program initiation and permaculture vs. agriculture. Farmers explained their soils had high salinity, which can be a result of large amounts of coastal development. Introducing trees into growing culture and introducing more crop diversity can mitigate much of this problem. Women farmers discussed challenges such as plant disease, pest management and using natural remedies and repellants like neem. Conversations were had about soil health, salinity and how the introduction of low-tech strategies for soil amendment can be extremely helpful. And, since animal husbandry is common practice, more knowledge on nutrient cycling using animal waste can benefit the larger permaculture food forest when established.

Work at Future Lahel Permaculture Site: Our entire group broke up into work assignments based on backgrounds, interest, and assets that could move the project forward in unique ways.

Fence Team: The fence team represented resilience. During the time spent on their arm of the project they engaged in multi-stakeholder project management. Students had to work across language barriers, man powered tools and thus really got an understanding and appreciation for low-

tech solutions in sustainable development. This was a knowledge exchange that included developing means of communications that crossed at least two languages and applied technologies such as hand tools. This group worked most of the time through sandstorms allowing them to experience first hand desert ecosystems, the apparent and the hidden. We were also able to explore the role of cultural practices like wearing scarfs to protect their faces from blowing sand.

Propagation Team: The seed and propagation team represented life. This group was charged with starting up plant and tree seedlings for the permaculture site in Lahel. Using the Power Agronomy Seed Propagation Fact Sheet as a reference, this group helped to create a new fact sheet for plant propagation they conducted facilitated by our permaculture expert. And, the instructor provided knowledge on the distinctions of plant propagation in temperate vs. a tropical climate. This information was used in creating the plant care guides that include a key that lists plant functions, useful properties, and care. These fact sheets were translated to English, French, Wolof and Pular for deployment in communities to increase training. This group discussed the challenges of translation of technical concepts and how they could use these lessons to inform how future trainings are conducted.

Engagement Team: The engagement team represented sustainability. Before traveling to the community of Lahel, we met with community leaders, farmers, and entrepreneurs at the permaculture site. A delegation of leaders and the chief of the village from Mauritania also met us. They heard we were coming to do this work and traveled across the River to meet us and discuss their permaculture food forest project. We invited the delegation to come with us as we conducted our engagement in Lahel. We found it would be valuable to have a group be able to speak to the benefits, lessons learned, and growth. The purpose of this group was to engage the community in order to determine the viability and implementation capacity of the future Lahel permaculture site.

UNESCO Briefing: UNESCO Dakar briefed the UDC and UCAD group on work that was being done across the country using methods of statistical aggregation of data. UNESCO is working with government agencies to meet Millennium Challenge Goals by meeting the needs of individuals and communities that help them live and thrive in place. For educational purposes, this allowed students to see the value of data and its usefulness in comparison across larger and broader spectrums. The work that UNESCO is doing is very important but it also sparked interest and a line of questioning that focused on the local perspective and how disconnected levels of government management were to the realities on the ground. Students experienced first hand challenges of multi-national level operations and meeting multi-stakeholder goals. And, that funding mechanisms must be sustainable because the interplay between US domestic politics play critical roles in international aid.

Individual or face-to-face interviews were our choice of extension method because it has proven to be effective when used in both developed and developing countries. We met the farmers at home or on their farms and discussed issues of mutual interest, sharing with the farmer both information and advice. The atmosphere of our meetings were mostly informal and relaxed. The farmers were able to benefit from our exchanges in conversation and built confidence between our groups, critical for our long-term sustainability with the project. Though visits were short we were able to foster mutual respect and friendships. And, in the longer program farm visits will be part of the general plan of work and will be programmed into the monthly schedule of activities.

The students who participated in this program left with greatly increased understanding of international ecosystems, sustainable development, and applications of permaculture. Each student, in our final debrief, expressed how much they had learned and gained, as well as connections they were making with their classes. Some gained clarity on the true challenges in the application of sustainability policy or international aid. Others said they developed greater

perspective on the tensions of nonprofit operation and sustainability programming in communities. For some, the possibilities of a new professional path - international development - had opened due to the trip and our connections with professionals in those fields.

And, for all students, they also felt that the experience had been a transformative cultural moment as well. They reflected on the cultural implications of being descendants of enslaved Africans who had left this continent, and the power of returning to Africa to connect with their peers. Furthermore, they developed greatly improved cultural understanding, with deeper connections to their Senegalese counterparts. Conversations around gender equity, relationships, education and professional development were powerful for both UDC and UCAD students.

Students are eager to return to Senegal to continue the projects and research we began, and to establish innovative new ones. Both students from UDC and UCAD have expressed continuing to make connections between their experiences in Senegal and what is emerging in each of their classes. Students are also captivated and committed to continuing to explore these ideas now back in DC. Many of the same issues of access, growing in particularly challenging soils, and the importance of value-added processing also affect our communities in DC. Several of the students will be joining CSDR as research interns: for example, two will be joining on projects focused on developing value-added products within agricultural growing communities. Developing passionate and well-informed student research interns will be of enormous value to our Center.

There were changes that occurred with this research project. Dr. Milton was unsuccessful in securing enough students that could afford the expense of the trip. Also, many of UDC's students are employed full-time and were unable to take the time off from work to participate in this trip.

Dr. Ashley Milton and Ms. Caroline Howe managed the grant up until June 29, 2018. Dr. Milton, the Principal Investigator at that time, resigned from her position effective June 29, 2018. Between June 29, 2018-December 31, 2018, the grant was reassigned to Dr. Dwane Jones, Director of the Center for Sustainable Development and Resilience and former supervisor to Dr. Milton. Dr. Jones met with Dean O'Hara to discuss the grant where it was determined that the grant as written and awarded did not have enough financial resources to fund the objectives in the original proposal. The Dean recommended re-writing the grant so that UDC remains stateside and partners with Tuskegee University, a fellow HBCU and land-grant institution to accomplish the objectives, intent, and spirit of the grant.

Dr. Jones communicated with Robbin Shoemaker of USDA NIFA and Ms. Diane Hyman, Associate Dean for Operations, Office of the Dean, UDC, to discuss the potential of making the Dean's requested changes to the proposal. It was determined that as long as the intent and spirit of the proposal were met, and no significant changes to the budget were needed, UDC would be allowed to continue the proposal stateside in partnership with Tuskegee.

Dr. Jones and Dean O'Hara reached out to Tuskegee and initiated discussions to advance a knowledge exchange between UDC and Tuskegee. UDC will support Tuskegee to develop urban agriculture programs and Urban Food Hubs. Tuskegee will help UDC integrate rural agriculture principles and practices into UDC's urban agriculture programs.

Meetings were scheduled between the two institutions and UDC's Center for Urban Agriculture and Gardening Education was added to the agenda. After some internal discussions, it was deemed best to transfer the entire proposal from UDC's Center for Sustainable Development and Resilience to UDC's Center for Urban Agriculture and Gardening Education to maximize efficiency and effectiveness of the Center for Urban Agriculture and to capitalize on its expertise in agriculture, with such expertise not inherent in the Center for Sustainable Development and Resilience.

As of January 1, 2019, Mr. Mchezaji (Che) Axum, Director for the Center of Urban Agriculture and Gardening Education, became the principal investigator for the Farmer-to-Farmer collaborative.

1.2.2 Community Outreach and Education (Cooperative Extension)

Many of the food security initiatives described in the research section of this report, also have implications for our community outreach and education initiatives. Support for locally grown food and hyper-local food sector initiatives is growing across the District of Columbia. This includes a growing appreciation for locally grown food to a recognition that food that is grown closer to where it is consumed also has positive implications for reducing CO₂ emissions. Urban agriculture is catching on, and unlike large-scale cash crop operations, urban agriculture utilizes small spaces and focuses on specialty and ethnic crops. A growing number of DC residents subsidize what they buy at the grocery store through vegetables grown at community garden plots and in their backyards. Yet agricultural and gardening literacy is low, and DC residents are in need of technical assistance on a range of issues from crop propagation to plant selection, plant maintenance, nutrient management, soil remediation, and integrated pest management. These initiatives are especially important in those neighborhoods that lack access to a full-service grocery store.

CAUSES community outreach and education programs address the educational and capacity building needs of a wide range of residents and organizations from novice gardeners to experienced gardeners, schools, community organizations, and those interested in the commercial aspects of urban agriculture and urban sustainability. Community outreach and education activities for fiscal year 2017 include offering workshops, demonstrations, community events, site visits, workforce development certificates, and entrepreneurship programs.

1.2.2.1 DC Master Gardener Program

The DC Master Gardener Program was started as a means of extending the horticultural and pest management expertise of University of the District of Columbia to the general public. The program is designed to train volunteer horticultural educators. Participants receive 45-50 hours of basic horticulture training and then agree work in their communities on a master gardening project to teach District of Columbia Residents how to cultivate garden spaces, and manage landscapes designs suitable for the urban scape, to sustainable land use practices, using research-based information. This environmental horticulture approach reduces fertilizer and pesticide use resulting in improved soil and water quality. Benefits of the Master Gardeners Program for DC neighborhoods include the following:

- Enjoy a healthier environment by reducing fertilizer runoff into our watersheds and the Bay.
- Save money and reduce health risks by minimizing use of toxic pesticides.
- Improve soils and save landfill space by composting yard waste.
- Reduce water use through horticultural practices.
- Create beautiful and ecologically sound landscapes for local conditions.
- Learn ways to provide habitat for native wildlife and beneficial insects.
- Teaching the benefits of home food production and developing skills and knowledge in growing food, managing community gardens, or contributing to food banks or kitchens.

In FY 18, 79 Master Gardeners and Trainees provided 9,000 hours of horticultural expertise to the District of Columbia. The value of volunteer time is \$38.77 per hour according to www.independentsector.org with a total value of \$348,930.00 in savings to the District of Columbia. Forty-seven (47) Master Gardener Trainees completed 50 hours of basic horticulture training, a final exam and 50 hours of volunteer hours. Various Master Gardener projects through all eight wards have been established which includes the UDC Food Hubs, schools, parks, beautification projects, landscape design, youth gardens, local and national botanical gardens, and partnerships with non-profit organizations.

Master Gardeners also contributed over 600 volunteer hours to the success of the Ward 3 Food Hub including its award winning green roof and roof top greenhouse. The value of their volunteer hours equates to almost \$24,000 in savings to the University. Their duties included propagation of vegetables and companion plants, planting, weeding, irrigation, and harvesting. Produce was harvested and donated to DC food banks, including the UDC Student Food Pantry, the UDC Center for Nutrition, Diet, and Health, the East Capital Street farm stands. One third (1/3) of Master Gardeners continue their education in a horticulture related field and obtain employment.

1.2.2.2 Urban Agriculture Workshops and Certificates

Urban Agriculture is a global and growing pursuit that can contribute to economic development, job creation, food security, and community based capacity building. These positive impacts can, however, be limited by competition for scarce space with other forms of urban development, a lack of formalized land use rights, and health hazards related to food contamination. The use of green roof technology has the potential to alleviate some of the land-use pressures that urban agriculture faces. It would not only enable the use of land for development and agriculture, but may facilitate the formation of formal space and water use agreements and enable redistribution of ground level resources among urban farmers.

UDC/CAUSES also partners with local organizations such as Bread for the City to promote local food and nutritional security. Bread for the City assists CAUSES in managing the City Orchard at the UDC Firebird Farm. All of the fruit is donated to feed Bread for the City constituents--the vulnerable residents of DC who rarely have access to fresh fruit. The farm also donates produce to groups that feed underserved populations such as DC Central Kitchen, the Capitol Area Food Bank, and the DC Food Recovery Network. Partner organizations bring volunteers to Firebird Farm and regularly pick-up produce from the farm. The farm also produced food to support a 10-person Community Supported Agriculture (CSA) program with six (6) additional shares being donated to the UDC Student Food Pantry. The CSA model is used to support farmers for a whole growing season and give customers a weekly share of nutritious, locally grown produce.

The UDC Food Pantry was started in May 2017 to respond to the high prevalence of food insecurity among UDC students. The farm produced 3,022 pounds of specialty and ethnic crops that were distributed among a wide range of constituencies. During the reporting period, we have continued to work diligently and purposely to continue to build capacity for expanded research in aquaponics, sustainable agriculture, ethnic crops and specialty crops at our research farm in Beltsville, MD. At Firebird Farm, our goal is to research and test techniques in sustainable urban agriculture and to apply them to various urban setting in DC neighborhoods.

1.2.2.3 Using Green Roofs as Research and Educational Training Spaces to Enhance Urban Specialty Crop Production

The urban population of the world has grown rapidly, from 746 million in 1950 to 7.2 billion in 2014. Within the United States, the Northeastern region is the most urbanized. Even within this heavily urbanized region, Washington, DC is notable because it has a population density greater than any state in the country and continues to grow by 1,000 residents per month. Supporting this population growth in a sustainable way is a primary challenge for Washington, DC, in part, because land for agriculture becomes increasingly removed from the city center, reducing access to locally grown food. Further complicating sustainable development and food production within the metropolitan Washington, DC area are the changing climatic conditions which increase severe weather events such as heat waves and deluges and alter normal temperature and precipitation cycles.

In 2016 we initiated a pilot project to explore improving food security as a mitigation strategy against the

negative impact of climate change and regional population growth on food production. Specifically, we grew six varieties of strawberries and tomatoes on three green roofs to determine which varieties were the highest performers in urban agricultural production. In 2017-2018 we expanded this work by growing the varieties on three green roofs, but also in raised beds, field rows, and hydroponics and aquaponics systems at Firebird Farm in order to provide a comparison to green roof production. Community members and volunteers were included in this research activity and were informed of our ongoing work as well as results.

In 2018 we trained six UDC undergraduate students in tomato and strawberry production, data collection, and educational outreach plus an additional 163 direct adult contacts were reached because they volunteered on production and data collection. We presented the project at one open house at UDC's research farm, through four tours of UDC's green roof, and through UDC's Master Gardener class. The total number of people reached was 250.

1.2.2.4 UDC Community Compost Training Certificate Project

As part of the fourth component of UDC food hub concept - "waste and water recovery", CAUSES has strong initiatives to move toward zero waste by reusing its food hub wastewater, garden as well as food waste. Each UDC food hub site now has an aquaponics system and a community compost system, which allow fish wastewater and garden wastes to be reused in the hub. The UDC Community Compost project was incorporated as a strategy to manage the food hub's organic waste as well as the community members food waste by giving them the opportunity to turn them to valuable compost. In this way, we will dramatically minimize our garden and food waste as well as reduce the use of chemical fertilizer at our food hub sites. UDC CAUSES is determined to move toward zero waste in all its food hub sites.

During FY 2018, the UDC CAUSES team (Center for Sustainable Development and Resilience, CSDR) built a three-bin compost system to all UDC Food Hub sites including Firebird Research Farm. The construction of the bins was turned to a hands-on training for those in the community who showed interest to join our compost classes. The project also includes a community compost class to train the community about how to turn garden and food waste to valuable compost. The program started with informing and engaging the community to understand their needs and interest. Then, a comprehensive compost training manual was developed. Communities were informed 2 month before each class schedule. The UDC community compost certificate program was provided during six weeks in summer (once a week, 3 hours hands-on experience training class). Three UDC food hubs (Van Ness, P.R. Harris and B. Backus) received the training. Each class started with 1.5 hours theory and 1.5 hours hands-on training working with food waste. In Van Ness Food Hub site (Ward 3), we had 7 students, which 6 of them completed the program and certified. In P. R. Harris Food Hub Site (Ward 8), we had 12 students and 10 of them were certified. In B. Backus Food Hub Site (Ward 5) we had 15 students and 13 of them completed the program and were certified. In all three sites, certified students showed interest to continue their work on the compost project. In B. Backus site, the community established a compost COOP and working hard to develop their compost project. They would like to reach to a point that they could sell their compost.

1.3 Health, Nutrition and Childhood Obesity

1.3.1 Relevant Research

What follows is a summary of research activities in the area of Health Nutrition and Childhood Obesity as well as other preventable food related health impacts. Much of this research exemplifies the close collaboration between the academic programs and the land-grant programs in CAUSES. On the academic side, the Department of Health, Nursing and Nutrition houses the ACEND accredited undergraduate and graduate programs; on the land-grant side, the Center for Nutrition, Diet and Health leads our nutrition and health related research and community outreach efforts. However, other land-grant centers and the

academic programs in the Department of Architecture and Urban Sustainability contribute to our health and nutrition focused research and community outreach efforts.

1.3.1.1 Changing the Health Trajectory for Older Adults through Effective Diet and Activity Modifications

Adults at midlife and older age comprise the fastest growing population segment in the U.S. Baby boomers, who make-up much of this population shift, have higher rates of obesity, chronic disease and disabilities than previous generations. Older adults are at higher risk of developing arthritis, sarcopenia, diabetes, hypertension, hypercholesterolemia, age-related muscular degeneration, and cardiovascular disease (CVD) than younger adults. These conditions that are associated with disabilities, compromise physical capacity and loss of independence but are preventable by diet or/and physical activity, providing the basis for the proposed work of this transdisciplinary team.

Adults make daily choices without being aware of how that seemingly, inconsequential decisions may impact their health. Numerous biological, environmental and behavioral risk factors influence an individual's daily health choices. To better understand the factors influencing age-related diseases and health-promotion in midlife and older adults, this multistate research project will examine: (1) environmental factors influencing the adoption of health-promoting lifestyle changes and (2) evaluation of lifestyle interventions that lead to measurable outcomes. The projects under each of these study areas, either directly or indirectly, address overweight/obesity and chronic disease reduction in midlife and older adults. The major goals of this project are to:

1. identify biomarkers of successful aging and the impact of diet/physical activity on these biomarkers throughout the life cycle;
2. examine the community environment, including its traditions, culture, and beliefs, and how it can be used to promote healthy eating and successful aging; and
3. examine the effectiveness of novel interventions in influencing/promoting the attainment of a healthy weight via increased fruits, vegetables, and grains intake and physical activity for successful aging.

While three goals were identified under this multi-state research project, the research at the University of the District of Columbia focused on goal (2) examining the community environment, including its tradition, culture, attitudes, beliefs, and how it can be used to promote health eating and successful aging. More specifically, the researchers examined nutritional barriers that prevented the consumption of fruits, vegetables, and whole grains.

During this reporting period, the results of this research showed that older Americans who lived in Wards, 5, 7, 8 in Washington, DC lacked knowledge of the importance of eating more fruits and vegetables. Many members of these communities identified unhealthy foods (processed foods high in sugars and salt) to be healthy and less able to identify foods that are considered healthy. The research assistants reached 96 older adults and provide nutritional education once the older adult completed the survey.

Research assistants received training in developing a survey instrument, validation procedures, and uniform administration of the survey instruments. On the other hand, two of the four research assistants participated in the annual meeting where they were given an opportunity to make presentation regarding the progress of the research.

The four research assistant and the principal investigator published an article in the September 2018 edition of the American Journal of Undergraduate Research (AJUR), a peer reviewed journal designed to facilitate publication of undergraduate research.

We developed an informational brochure entitled "Final Report Nutritional State of Affair". This

informational brochure was designed as an easy to read guide for Councilmembers in Wards 5, 7, 8 with respect to how citizens of these wards view nutrition.

This project is focused on older adults, 55 and older, who live in Wards 5, 7, and 8 of the District of Columbia. We were successful in recruiting 96 participants.

For the next reporting period, this multi-state research project will partner with Iowa State University to conduct five (5) focus groups on physical activities in African Americans, Hispanics, and Asian population here within Washington, DC. The data will be used to compare results from a populations of older adults in a rural setting (urban vs. rural). Additionally, the planned focus groups in DC will use the same instrument that was used in Iowa.

1.3.1.2 Parental Practices Supporting Positive Eating Behaviors during Independent Eating Occasions

Among Early Adolescent Children it is necessary to further explore the impact of parental practices and its effects on early adolescent eating behaviors during independent eating occasions. In the first phase, formative qualitative research methods will be used to explore the behaviors around independent eating occasions among adolescents, including the extent to which they report how parents' rules, expectations, modeling and availability of foods influences their choices and behaviors.

Among parents, we will seek to identify the extent to which they are aware of the food choices and behaviors that their children make while they are eating independently. This data collection aims to understand the phenomena of eating related parental practices, how parents are motivated or impeded in practicing them, how they are successfully implemented, and if children's eating is impacted positively when parents utilize various positive practices.

In objective two, quantitative methods will be employed to identify associations between parental practices and food and beverage choices, eating behaviors, and weight among early adolescents with attention to examining independent eating occasions. An appropriate, validated instrument does not currently exist to measure these associations; therefore, we need to develop and test a questionnaire to determine which parental practices should be promoted.

Results from objective one and two of our study will provide a broader understanding of the influences that determine the frequency of positive parental practices and the effects of these practices on obesogenic behaviors of early adolescents. These findings will allow us to identify realistic strategies and motivators in order for parents to promote positive practices.

Ultimately, sharing how best to influence early adolescents' eating behaviors and particularly those when the parent is absent would be valuable in trying to shape healthful food intake among early adolescents to prevent obesity. The major goals of this project include:

Objective One - Explore and identify key parental practices (role modeling, making healthy foods available, and setting rules/expectations and other practices) that may impact eating behaviors and food choices during independent eating occasions and weight among low-income, multi-ethnic early adolescents.

Objective Two - Examine the association between key parental practices and positive eating behaviors during independent eating occasions among low-income, multi-ethnic early adolescents.

The following was accomplished during the reporting period for Objective One:

First the project team addressed this gap in the literature by developing and testing an individual interview data collection protocol, which was implemented across all states and the District of Columbia parent/early

adolescent dyads (n=51). The interviews were conducted with children and parents after the child took photos of all food and beverages consumed over a 24-hour period. The project team developed and tested an individual interview data collection protocol, which was implemented across all states and the District of Columbia (n = 51). The interviews were conducted with children and parents after children took photos of all foods and beverages consumed over a 24-hour period. Parent having primary responsibility for food acquisition and preparation for their early adolescent (11-14 years) and earning less than 185% of the poverty guidelines in the past year were interviewed. To ensure racial/ethnic diversity in sampling, quotas were set for race/ethnicity - 24% each for Asian, Black or African American, Hispanic, and White or Caucasian and 2% each for Native American and Hawaiian or Pacific Islander. The survey instruments were revised. Children (n = 46) reported on a total of 279 eating occasions over a 24-hour period with 172 as independent eating occasions (Banna et al., 2018). More than half (65%) were classified as "snacks". The most frequent foods consumed during independent eating occasions were sweet snacks (cakes, cookies) (15%), grains (bread, pasta) (13%), fruits (9%), salty snacks (chips) (8%), dairy (milk, cheese) (8%) and sugar-sweetened beverages (7%). Most independent eating occasions occurred at home (72%) while watching TV/surfing the internet (32%), hanging out with a friend (16%) or doing something else (21%).

Following are accomplishments for Objective Two:

The results of the parent and child interviews were used to develop a series of survey items to assess frequency of use of the practices identified from interviews and their associations with child intake. Cognitive interviews were conducted with 10 parent/early adolescent dyads to assess comprehension and clarity of the items. Revisions were made to both surveys based on feedback from parents and children.

Two students presented at local meetings. An undergraduate student presented on data collection methodology for her senior seminar at the University of the District of Columbia. The other student presented on "Eating behaviors of adolescent in Hawaii" at a graduate symposium, University of Hawaii. One graduate assistant and four undergraduate students were involved in data collection and literature reviews.

A manuscript entitled: "Perceived parent practices to influence independent eating occasions among early adolescents: a qualitative study of low-income parents and children" was submitted to the Journal of Nutrition and Behavior and currently under review. Presentation were made at three professional meetings - The academy of Nutrition and Dietetics annual conference (2018), Society for Nutrition and Behavior annual conference (2018), and a workshop on innovative technologies for dietary intakes measurements, Imperial College London, South Kensington (2018).

For the next reporting period, parent and early adolescent survey items will be tested for reliability and validity as part of the project among ~ 100 parent-child dyads, through an online Qualtrics panel. Parents of adolescents 11-14 years of age will be recruited through the Qualtrics panelist database; parents will be asked to have their adolescent child complete the adolescent survey.

Plans are to collect the pilot test data include survey administration in January 2019 and data analysis and further revision of the survey items from February- September 2019. Following revisions based on testing results, the survey will be conducted with a larger sample as part of the new project beginning October 2019.

Participants for this project included one graduate assistant (environmental science) and four undergraduate students (Nutrition, Health Education, Sociology). The target audience was low-income, multi-ethnic early adolescents and a caregiver.

Publications:

Gunther, C., Reicks, M., Banna, J., Suzuki, A., Topham, G., Richards, R., Jones, B., Penicka, C., Kojo Anderson, A., da Silva, V., Lora, K., **Monroe-Lord, L.**, Hongu, N., Wong, S. S., & Cluskey, M. (2019). Perceived parent practices to influence independent eating occasions among early adolescents: a qualitative study of low-income parents and children. *Journal of Nutrition Education and Behavior*, corrections submitted.

Richards, R., Jones, B., Anderson, A., Banna, J., Cluskey, M., Gunther, C., Hongu, N., Lora, K., Misner, S., **Monroe-Lord, L.**, Reicks, M., Topham, G., Wong, S. S. (2018). Parental practices and impact on weight among succeeders and strivers. *Journal of the Academy of Nutrition and Dietetics*, 118(9, Suppl 1), A-76.

Banna, J., Richards, R., Jones, B., Anderson, A., Cluskey, M., Gunther, C., Hongu, N., Lora, K., Misner, S., **Monroe-Lord, L.**, Reicks, M., Topham, G., Wong, S.S., Lim, E. (2018). Describing independent eating occasions among low-income adolescents ages 10-13 in the U.S. *Current Developments in Nutrition*, 2(11), nzy048, <https://doi.org/10.1093/cdn/nzy048>.

Presentations:

Richards, R., Jones, B., Anderson, A., Banna, J., Cluskey, M., Gunther, C., Hongu, N., Lora, K., Misner, S., **Monroe-Lord, L.**, Reicks, M., Topham, G., Wong, S. S. Parental practices and impact on weight among succeeders and strivers. Presented at the Academy of Nutrition and Dietetics annual conference and expo, October 16, 2018, Washington, DC

Banna, J., Richards, R., Jones, B., Anderson, A., Cluskey, M., Gunther, C., Hongu, N., Lora, K., Misner, S., **Monroe-Lord, L.**, Reicks, M., Topham, G., Wong, S.S., Lim, E. (2018). Describing independent eating occasions among low-income adolescents ages 10-13 in the U.S. Presented at the American Society of Nutrition annual conference and expo, June 2018, Boston, MA.

Anderson, A., Richards, R., Topham, G., Banna, J., Cluskey, M., Gunther, C., Hongu, N., Jones, B., Lora, K., Misner, S., **Monroe-Lord, L.**, Reicks, M., & Wong, S. (2018). Challenges in collecting pictorial data and identifying foods in dietary assessment of early adolescents. Presented at the workshop on innovative technologies for dietary intakes measurements, Imperial College London, South Kensington, September 17.

1.3.1.3 Merging Health with Culture: A Heritage Model for Improving Plant-based Food Consumption and Mitigating Health Disparities among Urban Minorities

Racial/ethnic minorities and immigrants represent the fastest growing urban population in the United States. Elevated rates of health disparities among immigrants who assimilate into Western culture and US born minorities suggest a need for alternative health promotion strategies.

In addition to the movement toward sustainable ethnic crop production in Washington DC, this project will support the implementation and evaluation of culturally relevant nutrition interventions that emphasize dietary guidelines without deviating from one's own identity. This project aims to combat obesity and other food related illnesses (NIFA goal) and reduce the obesity rate by 50% (Sustainable DC Initiative) by merging the promotion and maintenance of US Dietary Guidelines with a culturally relevant emphasis on a Heritage Health model. The goals/objectives of the project follow:

- Compare dietary intake, health behavior, and indicators of metabolic syndrome among first-generation racial/ethnic minority sub-groups residing in the US vs. US-born racial/ethnic minorities Health and Nutrition Examination Survey (NHANES) data.

- Implement the African/African American and Latino Heritage interventions for targeted DC residents using the six-week Oldways Ambassadors curriculum.
- Assess baseline and follow-up levels of acculturation, dietary intake of fresh plant-based foods, and indicators of metabolic syndrome among nutrition intervention participants.
- Explore perceptions of health status, connection to heritage, lifestyle customs, and how those factors impact food choices, physical activity, and adaptation within the urban environment.

Accomplishments and activities during the reporting period follow:

Goal: Provide experiential learning opportunities for three nutrition and dietetics students.

- One graduate assistant completed a literature review on relationship between acculturation, diet quality and metabolic syndrome among first, second and third-generation Hispanic groups.
- Two undergraduate interns completed 42 entries of pertinent peer review literature on previous studies and research gaps that will be used to build this applied project upon.

Goal: Implement the African American and Latino Heritage interventions for targeted DC residents using a six-week curriculum adapted from Oldways Ambassadors.

- Two undergraduate interns developed initial drafts of twelve lesson plans for the nutrition education component of the Health and Heritage intervention.
- We connected with a partnership organization (Terrific, Inc.) that will serve as a host site and provide target population access for the Health and Heritage intervention.
- e intervention and submitted the IRB application to keep this project moving forward.
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Activities:

- 1) Facilitating - 12 biweekly in-person and conference-call meetings with project interns for approximately one-hour per session
- 2) Mentoring-Weekly meetings with graduate intern (Thesis proposal) and consulting with undergraduate student (Research and Independent Study course)
- 3) Collaboration and Partnership Meeting-PI and Terrific, Inc. administrators.
- 4) Review of Literature spreadsheets with 40+ row entries in MS Excel and retrieval of requested NHANES data sets from Centers for Disease Control and Prevention.

Project participants included one graduate and two undergraduate students in Nutrition and Dietetics.

Opportunities for training and professional development provided by the project follow:

- The PI and project team have been engaging in individual study through annotated bibliographies from peer review literature pertinent to this project and use of Mendeley as an electronic organizing tool for compiled studies.
- One undergraduate senior on the project team is using one component of this project for her Research and Independent Study course this semester.
- One graduate student on the project team is using one component of this project for her Masters Thesis.

During the next reporting period, we plan to accomplish the following:

- Initiate an amendment to a currently existing MOU with Terrific, Inc., our new project partner and host site for the 8-week Heritage and Health intervention series (Spring 2019).

- Analysis of NHANES data sets with biostatistician consultant (Spring 2019).
- Begin participant recruitment, 8-week Health and Heritage curriculum and data collection (surveys and health indicators) upon IRB approval (Spring/Summer 2019).
- Qualitative: Human subject interviews (Fall 2019).
- Analysis of primary data sets and interview transcripts (Fall 2019).

Our target audience consists of urban minorities who racially or ethnically self-identify as Black/African American or Hispanic. We expanded our evaluation of peer review research on the impact of acculturation and heritage on diet, physical activity behaviors and health disparities associated with indicators of metabolic syndrome among these two groups who will be the most impacted by this work.

1.3.2 Community Outreach and Education (Cooperative Extension)

Over the past 30 years, obesity rates among children and adolescents have almost tripled throughout the United States. An estimated 17% of children and adolescents aged 2-19 years are obese. The Healthy People 2010 goal of 5% obesity among children was not met. Obesity in children is defined as a BMI greater than or equal to the age-and sex-specific 95th percentiles of the 2000 CDC Growth charts. Childhood obesity is associated with an increased risk for developing type 2 diabetes, high blood pressure, sleep apnea, and high blood cholesterol www.cdc.gov/nchs/data. Children who are obese are also more likely to become obese adults, further increasing their risk for obesity related diseases, including heart disease and certain cancers.

Obesity rates have affected low-income children at a disproportionate rate. Data published from the 2009 Pediatric Nutrition Surveillance System study showed that almost 1/3 of the 3.7 million low-income children aged two to four years old were obese or overweight. Obesity in low income children ages two to four years old has increased in the District of Columbia, from 10.9% in 1998 to 13.3% in 2008 (Center for Disease Control, Morbidity and Mortality weekly report, <http://www.cdc.gov/mmwr>) with more boys being obese as compared to girls.

The program objectives of the CAUSES Center for Nutrition, Diet and Health (CNDH) are:

- Demonstrate healthy cooking skills through modified techniques in food preparation.
- Teach food and health literacy skills.
- Provide instruction on safe food handling and storage techniques.

The Center for Nutrition, Diet and Health programs and activities addresses two of the five priority areas of the National Institute of Food and Agriculture (NIFA) as follows: Combating Childhood Obesity and Prevention programs include Farmers Markets Nutrition Education Program, SMART Nutrition for Seniors, Nutrition and Wellness Certificate program in partnership with 11th Street Bridge Park project, Nutrition Education for Preschoolers, Fitness by Faith, Pavillion of God, National Community Church, Unity Healthcare Wellness Program - Minnesota Avenue, District of Columbia Farmers' Markets, and Bodywise Health and Fitness Program - Physical Activity, and under Food Safety is Professional Food Managers Certification Program and food safety at farmers markets, in the classroom and community events.

FY 2018 program activities are described in the following section.

1.3.2.1 Bodywise Health and Fitness Program - Physical Activity

The Bodywise Program promotes health, wellness and fitness for DC residents 60 years of age and older. Regular exercise has been linked to reduction in premature mortality, functional decline, disability and coronary heart disease. Benefits achieved from the program include increase in cardiovascular efficiency, improved muscular strength and flexibility and increased knowledge of physical activity. The physical activities include water aerobics, yoga, low-impact aerobics, and movement/chair exercise. The program is designed to provide seniors with an opportunity to enjoy a better

quality of life. Over 500 seniors throughout the District are enrolled in the Bodywise program. Approximately 72 classes are offered monthly. Classes are taught by UDC Bodywise instructors and contracted instructors from LG Fitness, Inc. The classes were offered in six of the eight wards in 9 different sites including UDC, Wilson Aquatic Center, Takoma Aquatic Center, Phillip T. Johnson Senior Center, Allen House, The View at Edgewood, Arthur Caper and Overlook at Oxon Hill. The most popular class is water aerobics followed by low-impact aerobics and yoga.

During this reporting period, an unduplicated count of over 500 of the 560 seniors enrolled participated in the Bodywise classes generating 6152 contacts. In FY'18, 69 new Bodywise members in all 8 wards. The results of the most recent survey revealed that 82.5% of the participants believed they experienced increase in cardiovascular efficiency, 83.6% increased knowledge of physical activity, 88.3% improved muscular strength and flexibility, 69.2% believed they experienced improvements in quality of life, 63.1% increase in socialization, and 53.8% reduced stress and helped with relaxation.

The Senior Companion Program employs 72 stipend senior volunteers who assist with providing programs to other seniors in the community. During FY'18 the 72 volunteers provided 68,832 hours of volunteer work generating a total of 17,208 senior contacts in all 8 wards district-wide providing health and wellness activities. The 72 senior volunteers participated in a certificate program covering health and wellness topics monthly for 12 months. The certificate program was conducted by the CAUSES Senior Volunteer Coordinator.

1.3.2.2 11th Street Bridge Park - Nutrition and Wellness Certificate Program

The east side of our nation's capital is plagued by inequities in the social determinants of health, which are not conducive to lifestyle behaviors that can reduce rates of obesity and diet-related diseases.² Community mobilization of the members and stakeholders is a capacity-building process that has garnered potential in creating more sustainable change.⁴ Our highest income Ward (Ward 3) has access to an array of grocery stores, upscale restaurants, and attractive run/walk/bike paths within a one to two mile radius. On the contrary, Wards 5, 7, and 8 have limited grocery stores (four in Ward 5, three in Ward 7, and one in Ward 8) and safe open play spaces within walking distance according to the DC Office of Planning of the Government of the District of Columbia.

The purpose of the Nutrition and Wellness Certificate Program was to provide African American Ward 8 residents of Washington DC ages 18 to 25 with the tools to understand the essential role of nutrition and physical activity on health and well-being through a supportive environment that is conducive to improving eating and lifestyle behaviors, healthy food preparation skills, safe protocols for physical activity and exercise programs, and engagement in mobilizing the community through this process. The objectives were: 1) to gain awareness of health risks through body composition screenings; 2) to understand the connection between diet, fresh produce, and chronic disease prevention; 3) to improve food literacy and recognize marketing gimmicks on nutrition labels; 4) to learn to prepare garden-fresh food in healthy and palatable ways; 5) to understand the health risks associated with inadequate sleep; 6) to learn the different components of physical activity and health; 7) to meet the minimum national recommendations for physical activity for adults at 150 minutes of moderate activity or 75 minutes of vigorous activity; and 8) to demonstrate examples of moderate and vigorous physical activity, and distinguish between cardio, muscle strengthening, and flexibility exercises.

This initiative began as a work in progress with several stakeholder meetings and listening sessions with members of the Ward 8 Faith Council and other organizational representatives of this community in the prior year. This stage was essential for understanding their needs and establishing partnerships with local sites for an interdisciplinary project that included urban agriculture and sustainability trainings in addition to Nutrition and Wellness. The Nutrition and Wellness certificate program consisted of biweekly workshop sessions held at Union Temple Baptist Church and biweekly sessions at Wayne Place Transitional Facility

(Far Southeast Family Strengthening Collaborative, LLC) for 12 weeks. The series kicked off with health and body composition screenings. Participants gained insight on their "health numbers" and how those numbers could impact their risk factors. For instance, Body Mass Index (BMI) is often the most convenient method for assessing obesity risk although the results are not based on where the body fat is predominately located. However, the comprehensive body composition assessment allowed participants to see and understand their distribution of muscle to fat tissue, the influence of diet and exercise, and how results could impact their metabolism, heart disease, type 2 diabetes, and cancer risk regardless of the numbers on the scale. This program engaged participants in holistic health activities including discussion forums on nutrition education, healthy cooking demonstrations, fitness demonstrations, and pre and posttests of physical activity concepts. This program component encouraged participants to set goals and make informed decisions about their eating habits and other lifestyle practices. Topics included the following: 1) Assessing Health Risks -- Truth by Numbers; 2) Healing Properties of Plant Foods; 3) Lean Proteins and Clean Fats; 4) What's Sleep Got to do With It; 5) Health Deceptions in Food Marketing and Labeling.

Participants engaged in hands-on food demonstrations that introduced them to innovative food preparation techniques for the fruits and vegetables harvested from their urban gardens. They frequently commented that they would use the recipes they learned as a useful starting point to expand their knowledge and creativity. Some of the recipes included the use of kale in smoothies and the use of their fresh fruits and herbs to create homemade vinaigrette dressings. The Nutrition and Wellness Certificate Program was developed and led by Dr. Tia Jeffery, a registered dietitian/nutritionist and project specialist for the Center for Nutrition, Diet, and Health (CNDH), and Helen Naylor, also a registered and licensed dietitian in the Center for Nutrition, Diet and Health.

During program sessions, participants were challenged to consider their own contribution to finding solutions to food insecurity and nutrition problems that plague their community. They recognized the collective power they share including their collective political power to improve local and national food and health policies by electing officials who support their needs. They also recognized the power of example to their families and fellow community members. And last but not least, they recognized their own purchasing power, which is the power to choose to support their local farmers' markets and community gardens and refusing to buy the highly processed foods that perpetuate negative health outcomes and increase medical expenses. The nutrition and wellness classes concluded with a focus on understanding health as a treasure, and the Garden of Hope as a symbolic bridge that strengthens this most valuable treasure. Our next steps will build upon the health trainings accomplishments with the 11th Street Bridge Park faith community partners and beyond. This holistic approach aligns with the evidence-based connection between health and healing with spirituality. With wider capacity, a participatory certificate training plan will mobilize the congregation to lead in mobilizing their local communities as health promotion sites. Our goal is for underserved residents to have direct access to these resources and continued collaboration efforts with local partnerships that position us to empower our community to make informed decisions about their lifestyle choices. The Nutrition and Wellness certificate Program was duplicated at Union Temple Baptist Church and Wayne Place Transitional Facility (Far Southeast Family Strengthening Collaborative, LLC).

"The Nutrition and Wellness course sessions led by Dr. Tia Jeffery were both fun and informative. It was great to exchange ideas about the health benefits of eating well, making healthy choices, nutrition facts, fitness and ultimately how to sustain a lifestyle of well living. The highlights for me were the cooking demos and learning new recipes using simple but healthy ingredients. I would recommend this course to anyone interested in making positive changes toward a healthier life." ~ Dr. Koqwinda Chambers

1.3.2.3 Unity Healthcare Wellness Program - Minnesota Ave

Studies indicate a direct link between the environmental impact of education level and socioeconomic status on cardio-metabolic diseases and their associated risk factors.¹ CNDH has an ongoing partnership

with the Unity Health and Produce Plus programs for SNAP-eligible clientele in DC, funded by a non-profit, DC Greens. Participants with cardio-metabolic risk factors receive a monthly supply of fresh produce on the condition of their commitment to weekly attendance to group exercise and nutrition education classes. The CNDH Nutrition Specialist facilitated the nutrition education group sessions at a Unity Healthcare clinic on a bi-weekly basis. Participants learned food and health literacy skills, provided feedback on their challenges and progress in a supportive environment, and were exposed to various methods for preparing the fresh produce they received. Approximately 63 contacts were reached during this reporting period. They consisted of 100 percent African American, 97 percent female, and 3 percent male. Around 90 percent of the participants were satisfied with their exposure to new recipes, indicating that they would buy the produce and prepare the food at home more often.

1.3.2.4 Fitness by Faith Report

Close to half of the 10 leading causes of death among residents of Washington DC are diet-related.² The "church" is an organizational structure that individuals look toward as a foundation for spiritual healing and growth of mind, body, and spirit. In addition, one of the missions of faith-based organizations that align with the mission of cooperative extension is educating and serving local communities with resources to improve quality of life. The utilization of non-traditional venues as health promotion sites such as faith-based organizations have been fundamental for encouraging behavior change and positive outcomes.³ Therefore, this land-grant partnership with faith-based sites for implementing nutrition education and physical activity promotion with a train-the-trainer philosophy was a viable approach for the interdisciplinary connection between faith leaders and the community. Explore the battlefield for the mind when it comes to food and nutrition and how faith communities should guard their minds and become sites for health promotion outreach that mobilize their community with resources to guide them toward nutrition and physical activity behaviors that contribute to reductions in obesity and chronic diseases.

The objectives were: 1) Increased servings of fresh fruits and vegetables to recommended amounts among 80% of program participants by the end of the six-week series; 2) Improve physical activity to national recommended levels among 80% of program participants by the end of the six-week series; 3) Increase participant involvement in leadership efforts to encourage healthy eating, adequate exercise, and a health-promoting environment in the surrounding community. The Fitness by Faith series is a six-session interactive nutrition education program for faith-based organizations. This program focuses on integrating nutrition education from a science and Christian perspective. The classes are an hour and a half long and include participant activities and cooking demonstrations.

1.3.2.5. District of Columbia Farmers' Markets in low-income Communities

The UDC Center for Nutrition, Diet and Health nutrition educators, nutrition students and volunteers provided resources that promote higher usage and consumption of fresh fruits, vegetables, and herbs through nutrition education, food demonstrations, taste testing, recipes, produce guides and handouts to market shoppers at 15 different farmers markets located in diverse low-income, socioeconomically underserved communities with limited access to fresh and healthy local produce in Wards 1, 2, 4, 5, 6, 7 and 8 over a period of 6 months from May 2018 through October 2018. The materials accommodated a variety of literacy levels. The farmers markets were: DC Urban Green Farmers Market, Quarles Farmers Market, Deanwood Recreation Center Farmers Market, Overlook at Oxen Run Farmers Market, Barry Farms Recreation Center Farmers Market, Kenilworth Parkside Farmers Market/ Parkside at Circle 7, SW Farmers Market, 14th & Kennedy Street Farmers Market, Acadia's Mobile Market at Children's National Hospital, Ward 8 Farmers Market, Rhode Island Row Farmers Market, UDC East Capitol Farmers Market and Shaw Farmer Market. Most of the markets had a limited number of Produce Plus Vouchers available to low income market shoppers. Each week the nutrition educator demonstrated a recipe using produce sold at the market and provided nutrition education. A five-question survey was completed by market shoppers. The survey questions were : 1) are you planning on eating more fruits and vegetables, if no,

why, 2) after tasting the recipe, do you plan to make it at home, if no, why, 3) if the farmers market a good place to buy fruits and vegetables, if no, why, 4) Do you think contamination of food by germs is a serious food safety problem? and 5) Do you usually wash or rinse your fresh produce purchased at the Farmers' Market before eating them?

The results showed that the combined markets unduplicated contacts were 822 and the indirect contacts or combined markets reach was in excess of 30,000 diverse market shoppers. The unduplicated contacts were 24% male and 76% female. Of the 822 unduplicated contacts, 822 or 100% completed the five-question survey. The results showed that of the 822 individuals surveyed 98.3% plan on eating more fruits and vegetable and 96.1% after tasting the recipe, plan to make it at home, 99.2% responded positive to farmers markets being a good place to buy fruits and vegetables.

The Project Specialist for Health and Wellness conducted workshops and food tastings/demonstrations that included recipes using local foods at the Bellevue Library Farmers' Market located in a food desert in Ward 8 in the District of Columbia, where the residents have limited access to fresh produce.

The recipes sampled were: Pasta Veggie Salad, 3-Bean Salad, Radish Tomato Salsa, Summer Squash Salad, Tangy Savory Slaw and Mint-Citrus Water. In addition, the Project Specialist for Health and Wellness distributed behavior-oriented surveys to the Farmers' Market attendees after they tasted the fruit and/or vegetable recipe. The five (5) question survey asked the following questions: (1) After stopping by the CAUSES table, do you plan to eat more fruit and vegetables? (2) After tasting this recipe, do you plan to make it at home? (3) Do you plan to use your SNAP, WIC, Produce Plus, or Farmers' Market Nutrition Program benefits at this Farmers' Market today?

With an emphasis on questions one and two (1) after stopping by the CAUSES table, do you plan to eat more fruit and vegetables? And (2) after tasting this recipe, do you plan to make it at home? The results showed 97.8% (176) attendees responded yes and 2.22% responded no to question one and 96.3% (157) of the attendees responded yes and 3.7% (6) responded no to question two.

Nutrition education materials/fact sheets on the health benefits, recipes, food safety and storage of various vegetables were distributed to 72 attendees at the Farmers' Market. In addition, 216 copies of the newsletter Produce Safety Guide - Sampling Safety Volume 1, Issue and Produce Safety Guide - Preparing Safe Infused Water, Volume 1, Issue 2, were developed by the Project Specialist for Health and Wellness and was distributed to the Farmers' Market attendees. Future evaluations will include follow-up on use of recipes.

1.3.2.6 Other Community Outreach Activities

Residents of Washington DC are in need of the guidance that links them with education and programs to improve their access to services and evidence-based information about nutrition and health, especially those with health inequities and fewer resources. The purpose is to network and expand outreach among community residents and stakeholders of the District of Columbia to promote the nutrition education programs and build new relationships with stakeholders.

- **Preschool Nutrition Education (Fall 2018 - Spring 2019):** On a monthly basis, preschool children at Orr Elementary School in Ward 8 engage in interactive activities with the nutrition educator using Choose My Plate and healthy food demonstrations as learning models. Themes included food safety, dairy and calcium-rich foods, fruits, veggies, whole grains, and physical activity.
- **Senior Health and Wellness Fair (Summer 2018):** CNDH organized the fair and manned a booth for the Annual Senior Health and Wellness community fair in June of 2018. Out theme was Blue Zone Pathways to Healthy Aging, with an emphasis on promoting evidence-based lifestyle behaviors that are

common among individuals residing in what are known as "Blue Zones." Blue Zone countries are the five areas of the world with the highest quantity of active seniors and centenarians. Blue zone recipe samples and 80 Facts Sheets were distributed.

- Marion Barry Youth Leadership Institute Career Fair (Summer 2018): High school students participated in the Annual MBLI career fair to gain exposure to careers in a variety of professions.
- Barry Farms Recreation Center's Back-to-School Wellness Fair (Fall 2018): CNDH led a "Healthy Foods to Improve Learning" theme at this outreach event. 80 handouts and Facts Sheets were distributed and food demos that focused on smart choices for breakfast and snacks were interactively performed with the children. This was also an opportunity to teach food safety, in which hand-washing and use of gloves while prepping were emphasized.
- Mayor's Holiday Celebration for Seniors; CNDH led food demonstration and nutrition and health booth with nutrition education resources for 3,500 seniors.

The Nutrition Education for Preschoolers Program educates individuals to adopt healthier lifestyles in accordance with the "Dietary Guidelines for Americans" and "MyPlate". Public school, daycare center, and Head Start program teachers are trained to implement the Color Me Healthy curriculum and the 48-lesson curriculum in nutrition and food safety among children and their families, improving their ability to select healthy foods, safely handle food, and properly prepare and store foods. Children in participating preschool/prekindergarten classes receive nutrition education lessons that incorporate hands-on experience with fresh fruits and vegetables. Parents are offered nutrition educational sessions covering topics related to their child and to their personal health.

Five basic concepts are taught within the preschool/prekindergarten classrooms. These include: 1) Food safety/hand washing, 2) Vegetables, 3) Fruits; 4) Whole grains, Dairy and protein, and 5) Physical activity. We believe getting individuals to make positive changes around these topics will lead to healthier lifestyles and a reduction in obesity and overweight among the target groups. These topics are followed in order by the nutrition educator. One topic is taught each month, and the teachers continue the nutrition education during the remaining weeks of the month. Once all five concepts have been taught, the nutrition educator will cycle through them again using different approaches in order for the individuals to review and broaden their knowledge on each topic. In addition to the nutrition lessons in the classroom, parent workshops are held in order to address nutrition related questions and concerns.

The program is implemented by nutrition educators and graduate nutrition students. A nutrition educator/graduate nutrition student is assigned a number of D.C. public and chartered schools, daycare centers, and Head Start centers located throughout the District that serve low-income children ages two to five years old. The nutrition educator trains the teachers at each site on how to use research and evidence-based curriculum to incorporate nutrition, food safety, and physical activity education into lesson plans. The nutrition educator also works with the students in each classroom, as well as provides parent workshops on various health related topics. The nutrition educator partners and collaborates with the site's parent coordinator in order to set a date, time, and recruit parents accordingly for each meeting or workshop. The topics are taught in a variety of ways.

An example of an activity used to teach food safety/hand washing: Food safety/Hand Washing - a stuffed Elmo comes with the nutrition educator to the lesson to enforce the idea that "germs are bad." A story is told about Elmo going to school and forgetting to wash his hands before he eats, after using the restroom, and how his friends coughed and sneezed on him. Glitters, or "germs," are sprinkled on Elmo after each incident to show how the germs are spread. We then lay Elmo down to sleep, because he is sick. We then review how to cough, sneeze, and wash our hands correctly. Each student goes through the steps of washing their hands, using soap and warm water, to get rid of the germs.

The Project Specialist for Health and Wellness conducted other community outreach activities at the Annual Women's Day Celebration at Mt. Zion Baptist Church in Northwest (Ward 4) Washington, D.C. focusing on eating more fruits and vegetables; a health fair for seniors who reside at the Green Valley Apartments in North East (Ward 5), Washington, DC focusing on increasing their intake of fruits and vegetables; health and hygiene training focusing on personal hygiene and food safety when harvesting fresh produce for District residents interested in hydroponics and aquaponics.

1.3.2.7 The UDC Farmers' Market

Farmers' markets in urban areas are the most important type of direct agriculture marketing, and they play an essential role in the local food system, connecting growers, distributors and customers and helping residents easily gain access to fresh food in the urban setting. In 2018, there were a total of 58 farmers' markets in the District of Columbia [1]. The Center for Sustainable Development and Resilience (CSDR), College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES), University of the District of Columbia (UDC) (hereinafter referenced as CSDR CAUSES UDC), in collaboration with The National Latino Farmers and Ranchers Trade Association and Van Ness Main Street, operates the UDC Van Ness Farmers' Market (hereinafter referenced as "the Market") every Saturday from mid-May to late November, 8:00AM to 2:00PM. The Market is located at 4340 Connecticut Avenue N.W. (in front of UDC David A. Clark School of Law. The purpose of this economic impact study is to quantify the economic impact of the Market that goes far beyond the sales value. The 2018 UDC Van Ness Farmers Market was open May 5 - November 24, 2018. It averaged about 1500+ people per market day (an increase from previous years.) The vendors included 6 produce (4 affiliated with National Latino Farmers and Ranchers Trade Association); 1 bi-weekly fresh and smoked fish vendor, 1 egg and poultry vendor, 1 prepared food vendor, 1 mobile bike repair, and 5 craft vendors. The market was also the only drop-off location for Compost Cab in Ward 3.

This year there were musical performances, cooking demos, and children's activities by several local school and agencies. The market was so successful, it was hard during peak market season to fit additional organizations/ performers due to lack of space.

One of the customers favorite features at the market was the compost drop-off by Compost Cab. They started the market season off collecting 500-600 lbs/ week and finished with an average of 900lbs. During their jack-o-lantern recycling the Van Ness location collected over half a ton of pumpkins on the first day. They were definitely a major attraction for the market. It will be important to keep them in a similar location for next year.

Using the Sticky Economy Evaluation Device (SEED) methodology, the UDC Farmers Market reported an annual combined economic impact of \$2,106,054.31 on its vendors, host neighborhood, and surrounding region.

Operating 28 days per year, the UDC Farmers Market enjoys \$423.36 in sales per square feet annually. This number is based on the estimated gross annual receipts of \$744,990.40. By increasing the number of consumers visiting the Market's neighborhood, the UDC Farmers Market increases the revenue collected by local businesses:

- Average gross receipts at businesses near the market (per market day): \$28,699.25
- Estimated gross annual receipts at businesses near the market from purchases made by market shoppers: \$803,578.95

The SEED evaluation team also learned that the UDC Farmers Market attracts approximately 1,500 shoppers per market day. This results in an estimated annual attendance of 30,800 shoppers. As part of the stated mission to promote "Healthy Cities-Healthy People", teach the principles of urban sustainability,

and increase wellness for the residents of Washington DC, The University Of The District of Columbia, College of Agriculture Urban Sustainability and Environmental Sciences established a monthly farm stand at the UDC Bertie Backus campus. All of the produce for the farm stand was sourced from UDC Firebird Farm in Beltsville and the UDC Bertie Backus aquaponics and hydroponics systems.

The UDC Bertie Backus campus is located in the Fort Totten/Lamond Riggs neighborhood. This Ward 5 community has historically been classified as a food desert. The nearest dedicated grocery store is a Giant grocery store located on the Maryland side of the DC/MD border. In 2013 a Walmart with a grocery section opened in the neighborhood. The closest farm stands are located at the Brookland farmers market and the Petworth farmers market. Neither of these farmers markets is within walking distance for Bertie Backus residents. The pink areas on the map correspond to food deserts In the District of Columbia.

The University of the District of Columbia's Bertie Backus farm stand filled a void in the Fort Totten/Lamond Riggs neighborhood. The farm stand operated from June-November and served 230 customers. The farm stand sold or distributed 619 pounds of produce and made \$1112.00. While the farm stand did not have an official SNAP certification, low income customers were offered produce for free, or at a very low cost. Residents in the Bertie Backus neighborhood would like to see the farm stand return next year on a weekly basis.

The most popular products at the farm stand were collard greens, swiss chard, red beets, tomatoes, cucumbers, and various lettuces. The collard greens consistently sold out 100%. In August the watermelon was very popular.

Some of the qualitative quotes from our customers include:

"Coming to the Farmers' Market is my favorite part of Saturday. I make brunch from the food I bought from the market and bring back items I cooked for the farmers to taste! It is important that the produce is local, and the farmers are friendly."

"Omar (one of our vendors) is great. His produce really lasts a long time." "Omar uses no pesticides. That is why I come back to this market."

"The reason I come to this market is the compost (deposit). Please never take it away! It is also great to see the community and catch up with friends - I haven't seen my neighbors for a while but I just ran into one at the market and we got to catch up. It would be great to extend this market year round."

"I come to get the figs and quince, and drop off my compost. This market represents farmers of color, which I really appreciate. Could you add Tofu, fresh ravioli? There should be plenty of vegan customers in this area who will appreciate those."

"This market is not as good as the one at Sheraton Elementary School. The produce got rotten in 2-3 days. And where is the organic selection?"

References:

[1] Local Food Directories: National Farmers' Market Directory. USDA Agriculture Marketing Service. January 2018. <https://www.ams.usda.gov/local-food-directories/farmersmarkets>

[2] Since the market is on a busy street instead of an enclosed area, we assume that about 1/3 of the total pedestrians (1,000-2,400 per market day) are our shoppers.

[3] SEED online economic impact calculation is operated by MarketUmbrella.org with free access.

1.4 Alternative Energy and Capacity Building

1.4.1 Relevant Research

The following section summarizes our research activities in the area of alternative energy and economic capacity building in the new green economy.

1.4.1.1 The Five Pillars of Economic Development

Many underserved urban neighborhoods have been excluded from economic development success even in times of economic expansion. Economic development challenges are typically exacerbated in times of economic stagnation.

Washington DC is especially challenging in this regard. It is a tale of two cities. Wards 2 and 3 in the NW of the District have household incomes of \$110,000 per year, low unemployment rates of 4% or less and less than 10% of the population are African American; neighborhoods in Wards 7 and 8 east of the river have household incomes of \$35,000 per year, unemployment is close to 20% and over 80% of the population are African American. This bi-furcation distorts economic development success as averages within the District are not sufficiently descriptive of the realities of the city's most underserved neighborhoods.

Yet economic development success is possible. The key lies in identifying viable economic development strategies that strengthen the individual and community based assets of underserved communities and meet local needs. Using the pioneering work of Dr. Sabine O'Hara (O'Hara, S. and Vazquez, J. 2007) as its starting point, this alternative approach to economic development provides a bottom-up methodology to assessing a community's economic development potential that enables local residents to define and shape their own future. The research seeks to generate information about local needs and individual and community based assets in two Washington DC neighborhoods, Deanwood and Congress Heights.

The project has been completed and an extensive report is currently under review by community stakeholders. It is entitled "The Five Pillars of Economic Development: A Study of a Sustainable Future for Wards 7 and 8 in Washington, D.C." The report consists of the following sections:

I. Rethinking Economic Development

- i. Why we need a new approach to economic development
- ii. The Five Pillars approach
- iii. Engaging local neighborhoods

II. Taking Account of Where We Are

- i. Background information
- ii. Education
- iii. Health
- iv. Environmental Quality and Recreation
- v. Social and Cultural Amenities
- vi. Technology and Transportation
- vii. A Five Pillar Composite

III. A Community Based Vision of Successful Development Outcomes

- i. The focus group process
- ii. Telling the story of economic development

IV. Implementing the Vision

- i. Shorter term action items
- ii. Closing Persistent information gaps
- iii. The Sustainable DC Connection

V. Conclusions

Well over 50 indicators in the five pillar areas were collected at the level of the eight Wards of the District of Columbia rather than the aggregation level of the District. They reveal significant disparities between in eight Wards in almost all indicator categories, as well as compelling starting points for closing existing gaps.

Most compelling, however, is the community engagement approach that is so central to the Five Pillars approach to economic development. The vision of a successful development future must be the vision of the community. The approach taken to give expression to this local community vision was to write a collective story. This kind of story can be widely shared and invites broad dialogue from a wide range of stakeholders including those who do not commonly participate in development and planning decisions, and those who are less familiar with the use of quantitative indicators.

Starting point for the collective story was a focus group process conducted at community centers in Ward 7 and 8. Participants were randomly selected through a community outreach effort that included churches, schools, businesses, community centers, neighborhood associations, libraries, businesses, and door-to-door solicitations. The goal of this broad based approach was to get representation from a range of civic organizations and interest groups as well as a wide age spectrum of residents from the Deanwood neighborhood in Ward 7 and the Congress Heights neighborhood in Ward 8. A resident from the Deanwood neighborhood, who was also a graduate of the University of the District of Columbia, spearheaded the outreach efforts to recruit focus group participants. Additional UDC students and landgrant staff members assisted in the outreach and recruitment efforts by distributing flyers door-to-door, visiting schools, churches, and libraries, and making phone calls.

The story follows the five pillars areas and captures the future vision of residents and other stakeholder groups for their community with respect to education, health, environmental quality, social and cultural amenities and information and transportation. It begins as follows:

The year is 2030. The Deanwood and Congress Heights neighborhoods of Washington, D.C. are thriving communities that are sought after by residents and visitors alike. The neighborhood demographics represent a mix of young to middle-aged singles, families, and people of retirement age, and a diverse mix of races, ethnicities, and cultures that give the area its vibrancy. Both neighborhoods have benefitted from the trend toward urbanization that resulted in the continued growth of the DC metro region; but they also benefitted from deliberate strategies that made home ownership and rents affordable including housing co-ops, land trusts, and rent subsidies. The newly forged connection between the two historical neighborhoods created a more robust demand for a range of services. In addition, the local demand of neighborhood residents is now supplemented by a steady stream of visitors from the DC metro area and from across the nation and the world. Job growth has occurred largely from within around key initiatives like hospitality, health and wellness, green infrastructure, alternative energy, and the proud history of the Chocolate City" (O'Hara 2018).

The report concludes by identifying low hanging fruit of compelling story lines within each of the five pillar areas that lend themselves for implementation using the collected indicators to track progress toward the vision portrait in the story.

The report, "Five Pillars of Economic Development: A Study of a Sustainable Future for Wards 7 and 8 in Washington, D.C.," is in progress and expected to be published spring 2020. Also, the report will serve as the basis for submitting at least three papers for publication.

1.4.2 Community Outreach and Education (Cooperative Extension)

1.4.2.1 Sustainable Energy and Green Infrastructure

Human activities can negatively impact hydrological and chemical cycles, pollute air and water, degrade soil, reduce biodiversity, and affect energy use. Improving the energy efficiency of building is particularly important in the District of Columbia since the majority of emissions stem from building and not from mobile sources. To improve the management of buildings for increased energy efficiency, UDC continued to offer a 56-hour Green Building Operator's Certification to District building operators that led to an energy shift of in selected District operated facilities. 37 District Residents and DC government employees participated in the training. As a result of the documented improvements in building management, District taxpayers realized annual economic savings on energy use of over \$500,000.

Similarly, the percentage increase in water reuse and conservation due to green infrastructure practices continues to reduce pressure on water use and water runoff management. As water reuse increases, the use of water released to the greywater system decreases. Regrettably, there are few qualified technicians in the District of Columbia who are trained to maintain green infrastructure installations that contribute to the reuse of water. UDC offered 60 underemployed or unemployed District residents with a high school diploma or equivalent 106 hours in green infrastructure construction, inspection, and maintenance. 28 residents qualified for and passed the National Green Infrastructure Certification Exam. Participants who successfully complete the National Green Infrastructure Certificate are placed into part or full-time employment opportunities in the green infrastructure industry. This initiative ultimately affects the quality of life of program participants and DC residents at large economically, socially, and environmentally.

1.5 Water Safety and Water Management

1.5.1 Relevant Research

Following is a summary of our research activities for the development of a stormwater runoff collection and treatment system.

1.5.1.1 Development of a Novel Stormwater Runoff Collection and Treatment System for Urban Agriculture and Food Security

With the fast increase of urban population, vast quantities of energy and water are being consumed whilst harmful quantities of wastewater and stormwater runoff are generated through the creation of massive impervious areas. In addition, rising oil prices, unreliable rainfall and natural disasters have all contributed to a rise in global food prices. Food security is becoming an increasingly important issue, especially urban residents here in US. There is an urgent need of developing effective and economical feasible solution for the best management practices to minimize storm water runoff, reduce soil erosion, maintain groundwater recharge, and minimize surface water and groundwater contamination from combined sewer overflows[1].

In the last decade, researchers from universities and nongovernmental organizations, as well as industry consultants, have proposed new techniques and methodologies to remedy wastewater which include using micro/nanostructured membrane/filtration, nanoparticle catalytic, and chemical reaction, etc. [1-12]. However, these methods often times are inapplicable for urban agriculture farm or household, because the cost of the system and requirement of post processing are usually time-consuming and expensive [4, 5, 12]. This project will address this issue by the design and development of a novel stormwater collection and treatment system which can harvest and store stormwater from densely populated urban areas and

use it to produce food at relatively low costs. This will reduce food miles (carbon emissions) and virtual water consumption and serves to highlight the need for more sustainable land-use planning.

The broader goal is to assist in exploring an efficient and cost effective way to improve regional and global food security, create local capacity and improve social, economic and environmental condition of people and organizations in the District of Columbia through integrating research, teaching and community service in this project . This project will be accomplished through two tasks:

- 1) Storm water Treatment Material preparations; and
- 2) Storm water collection and treatment system design and development.

The efficiency of the system will be evaluated at the EPA Certified Environmental Quality Testing Lab at the UDC Van Ness Campus. To broaden the impact of the project, the results will be disseminated through the following approaches: 1) Live demonstration of the stormwater collection and treatment system at the Firebird Farm of UDC; 2) Hands-on workshop and training sessions; 3) Presentation and tour program at University open house and Engineering Discovery Day at UDC to local high school students and visitors; and 4) Conference poster/presentation and journal publications. The research is very much useful for the District of Columbia because it can help solve the urban stormwater runoff issue and reduce the cost of stormwater management cost to meet the increasing volume of stromwater runoff and pollution, especially in metropolitan area.

The following progress has been made during the reporting period:

Objective 1: To design and manufacture the metallic oxide nanoparticles infused mesoporous material.
Completed:

1. **Major activities completed:** The previous developed new synthesis method has been further improved and used to prepare more hybrid material for testing.
2. **Data collected:** Using the further improved method, we have synthesized over 3 times more samples during the same reporting period. These batches of the hybrid materials of different sizes of TiO₂ nanoparticles have been tested at UDC Environmental Quality Testing Laboratory using the state-of-the-art Inductively Couple Plasma-Mass Spectrometer (ICP-MS).
3. **Discussion of the results:** the data collected has shown that this new method can provide an improved efficiency and reduced cost. More importantly, an over 95% adsorption efficiency for trace metals for the hybrid MCM-48 with TiO₂ materials, and a significantly improved maximum adsorption capacity compared to pure MCM-48 has been observed experimentally. This finding has been presented at two national conferences and received wide interests. Currently, a manuscript submitted to a peer-reviewed journal is under review.

Objective 2: To characterize the microstructure and evaluate the pollutant removal performance of the synthesized material.

Completed:

1. **Major activities completed:** the capability and efficient of this hybrid material has been tested at UDC Environmental Quality Testing Laboratory using the state-of-the-art Inductively Couple Plasma-Mass Spectrometer (ICP-MS) following EPA standard procedures for heavy metals removal. The hybrid material was characterized using a Tescan XEIA Plasma Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) with Energy Dispersive X-Ray Spectrometry. To further quantify its porous structure, nitrogen adsorption experiments were carried out for all the hybrid mesoporous samples (MCM-48 infused with TiO₂) at 77 K on a MicromeriticsTM ASAP 2020 Porosimeter.
2. **Data collected:** The newly prepared hybrid materials of different concentrations of nanoparticles have been repeatably tested and verified for heavy metal removal test following EPA standard procedure. The results have shown that this hybrid material is very effective in absorbing the heavy metals tested here

(Pb, As, Cu, and Cd) with an efficiency above 95%. The size of the nanoparticle infused onto the mesoporous structure has a significant impact on the absorption efficiency. The material has also shown good filtration for organic dyes.

3. **Discussion of the results:** current results have shown that this hybrid material can be used to remove heavy metals from contaminated water effectively. The next step is to explore the method to further optimize the structure of the material to further improve its efficiency and test its capability in removing pesticides and paratheatrical contaminants.

Objective 3: To design a stormwater collection and treatment system with synthesized material.

Completed:

1. **Major activities completed:** an improved design of the stormwater collection and treatment system has been developed and a prototype has been built and tested.

2. **Data collected:** an improved design of the stormwater collection and treatment system has been developed, which can be used to harvest and store stormwater from densely populated urban areas and use it to produce food at relatively low costs. This system consists of an expandable storage tank that has a minimum volume and occupied space of 15 cubic feet and can expand to a theoretical maximum volume of 40 cubic feet. The filtration system consists of a mechanical filtration with a filter size of 250 microns and a chemical filtration system with the mesoporous nanostructured material, MCM 48, to filter heavy metals and other pollutants.

3. **Discussion of the results:** current results have shown that this system can be easily attached to the down spout of a typical DC house. The installation took less than 20 minutes and did not include difficult alteration. The system fit into the confined space, and did not collect unwanted bugs or rodents.

Objective 4: To evaluate its performance, and optimize the design to reduce the cost and time-consumed of per-liter clean water processed.

Completed:

1. **Major activities completed:** the original stormwater collection and treatment system has been redesigned and optimized for a balance between space and efficiency.

2. **Data collected:** we have performed some preliminary testing and we are still working on to collect more data

3. **Discussion of the results:** we are still in the process of collecting more data

This system was demonstrated at 2018 Engineering Innovation Day, Discovery Innovation Day, and Career Night at UDC, in which local middle and high school students and teachers visit the lab and observed the demonstration of the mesoporous material and the stormwater system. It has also been shown to various visitors to the PI's lab including the University Administrators, PI's collaborators, external users and students who are interested in renewable energy and water treatment. The system has also been presented at the 6th National Capital Region Water Resources Symposium April 6, 2018 at the University of the District of Columbia, at 2018 UCOWR and NIWR annual conference held in Pittsburg, PA between June 26-28, 2018, and at American Water Resources Association) 2018 summer conference in Fort Worth, Texas between 9 to 11 July 2018. The audience includes professionals in water treatment and management, stakeholders, students and faculty members across the nation.

The results obtained have been disseminated to the targeted audience (i.e. DC residents and high school students) through two major activities during this report period:

1. Over 80 local high school students, UDC students and faculty have toured the PI's laboratory at 2018 Engineering Innovation Day, Discovery Innovation Day, and Career Night at UDC, in which the hybrid material with nanoparticles and the proposed stormwater collection and treatment system were demonstrated.

2. The system has also been presented at the 6th National Capital Region Water Resources Symposium April 6, 2018 at the University of the District of Columbia, at 2018 UCOWR and NIWR annual

conference held in Pittsburg, PA between June 26-28, 2018, and at American Water Resources Association) 2018 summer conference in Fort Worth, Texas between 9 to 11 July 2018. The audience include professionals in water treatment and management, stakeholders, students and faculty members across the nation. The estimated total number of people have attended the presentations are over 50, and the readers of the published work are even more and are not counted here.

So far, we are able to accomplish all planned objectives, and we will continue to perfect this novel method by further testing and optimization of the stormwater collection and treatment system. We are also interested in exploring its capacity in removing new containments including pharmaceutical containments, will continue to look for places that can allow us to evaluate its performance. The results will be further disseminated to the targeted audience through various outreach activities, including publication, demonstration and workshop.

Participants for this study included three undergraduate students (Chemistry/Mechanical Engineering) and one graduate student in Water Resources Management.

During current grant period, we have focused on: 1) Training opportunities to UDC students, 2) Outreach to local high school students and visitors, UDC students and faculty, and general audience who are interested in environmental protection; and 3) Technical information to researchers in similar field or interested in stormwater collection and treatment.

Journal Publications:

Vu, T., Deksissa, T., & Xu, J. (2017). Development and characterization of a hybrid mesoporous material infused with metallic oxide nanoparticles for water treatment. *Nanomaterials and Nanotechnology*. <https://doi.org/10.1177/1847980417727428>

1.6 Food Safety

1.6.1 Relevant Research

This section summarizes research activities pertaining to soil analysis for trace elements and pesticide residue in fruit and vegetables.

1.6.1.1 Pesticide Residue on Fruit and Vegetables from Farmers Markets and Community Gardens in Washington DC

Adequate daily intakes of fruits and vegetables (FV) is recommended as part of healthy eating practices, however daily consumption of FV with elevated pesticide residues poses risk to human health. Organically produced foods are very small part of the total food sales in US, only 4%, and 96% of our food supplied by the traditional farming that may use pesticides such as herbicides, insecticides or fungicides. Pesticides are applied to improve the quality and quantity of FV. Pesticide residue in FV is among many biological and chemical food contaminants that are of concern when addressing food safety in the ever-increasing demand for food security locally as well as globally. According to World's Food organization, food contaminated with harmful biological and chemical substances is responsible for 200 diseases, ranging from diarrhea to cancers. According to USEPA, the pesticide residue exceeding EPA tolerance levels in food in the U.S. between 1994 and 2014 is low, but indicates an increasing trend. The trend shows that there is a need for continued monitoring for pesticide residue in the fresh produces. The objectives of this study include:

- (1) to identify most commonly used pesticide in the District and its surrounding,
- (2) to assess fast screening method for pesticide residue analysis on fruit and vegetables,
- (3) provide training to DC gardeners on pest management practices, and

(4) writing a final technical report.

The main objectives of this research project were mainly three-fold: 1) to assess the level of pesticide residue on fruit and vegetables (FV) purchased from main supermarket and local farmers markets; (2) to determine the difference between organic and non-organic FV purchased from the main supermarkets; and (3) to establish a pesticide residue testing program at UDC. During this study, we tested and implemented pesticide testing methods at UDC's Environmental Quality Testing Laboratory using Gas Chromatograph Mass Spectrophotometer. UDC now can test pesticide residue in the environmental samples such as fruits, vegetables, water and soil. Based on the USDA's pesticide data program (USDA, 2015), we selected five types of fruit and vegetables that were known to have detectable pesticide residues, including tomato, potato, strawberry, nectarine, apple and lettuce. We collected 79 samples of fruit and vegetables from five main supermarkets (48 samples) located in five DC Wards (1,2,3,5,6 and 8) and eight local farmers markets (31 samples) from all eight wards of the District of Columbia. The samples were analyzed for 138 types of pesticide residues, including 39 fungicides, 52 herbicides, 38 insecticides, 4 pesticide metabolites, 1 plant growth, and 1 repellent. Samples from the main supermarket included 15 samples from organic farming and 33 samples from traditional farming. Samples from the farmers market included all 31 samples from the local farmers markets. All samples were extracted using QuEChERS and analyzed using Gas Chromatography Mass Spectrophotometry (GC-MS).

The results showed that all samples from the main supermarket had at least one detectable pesticide residue; 50% of the collected samples exceeded the EPA tolerance limit in four or more pesticide residues; and 65% samples exceeded the EPA tolerance limit in one or more pesticides. The most frequently detected pesticides include tetrahydrophthalimide and thiabendazole. All samples from the farmers market had four or more detectable pesticide residues that exceeded the EPA tolerance limit. This is an interesting finding and needs further studies as locally produced fresh produce are expected to have no or lower pesticide residues. The market basket samples from the farmers market showed more percentage of samples that exceeded the EPA tolerance limits than the samples from the main supermarket. The most frequently detected pesticide in apples, nectarines and potatoes was Chlorfenapyr. This compound is an insecticide which exceeded the EPA tolerance limit in our study, as well as in the USDA pesticide monitoring program reported in 2014 through 2017. The results showed that at least one tested pesticide was detected in both organic and non-organic fruits and vegetables purchased from the main supermarkets. The detected level of pesticide residue exceeded the EPA tolerance limit in lettuce, potatoes, and tomatoes.

This study indicates that there was a detectable amount of pesticide residue on both organic and conventional fruits and vegetables. Based on samples collected from main supermarkets, 57% of tested samples were well below the EPA tolerance level while 43% were above the EPA level. There was no significant difference between organic and non-organic except in apple. Further studies are needed to quantify more pesticide compounds in greater food commodity samples. It should also be noted that purchasing organic fruit and vegetables may not ensure non detectable pesticide residues due to the fact that the sample may get contaminated with pesticides at any stage between farm and plate. To reduce human exposure to higher levels of pesticide residue through fruit and vegetable intake, looking into the effect of household food preparation on the levels of pesticide residue is crucial. During this reporting period, we launched further research to assess the effect of washing, peeling and other household food preparation techniques on the levels of pesticide residue on fruit and vegetables.

The opportunity for training and professional development provided by this research project is actually significant. Three full time environmental scientists were trained in the state-of-the-art analytical methods pertaining to testing pesticide residue and semi-volatile organic compounds in fruits, vegetables, and environmental samples, including soil and water. In addition, four MS thesis students majoring in nutrition and dietetics were trained in sample preparation and sample analysis in fruit and vegetables using advanced analytical technologies including HPLC, GC-MS, and ICP-MS. Five master thesis (MS) and two

graduate capstone projects were supported during this project:

- Almushayti, Albatul (Graduated in May, 2017). Assessing the Most Common Pesticides Residues in Fruits and Vegetables from the Main Supermarket in DC Using GS/MS. MS Thesis , University of the District of Columbia, Washington DC.
- Gandura Almalaki (Graduated in May, 2017). Analysis of Water Soluble Vitamins in Ethnic Crops, MS in Nutrition and Dietetics.
- Ahdab Jabi (Graduated in May, 2017). Analysis of Fat Soluble Vitamins in Ethnic Crops, MS in Nutrition and Dietetics.
- Liah Alamlaki (Graduated in May, 2017). Analysis of Anticancer Compounds in Ethnic Crops, MS in Nutrition and Dietetics.
- Lamya Aljamie (Graduated in December, 2017). Antiatherogenic Compound Analysis in Four Cultivars of PHOENIX DACTYLIFERA L. Date Fruits and Seeds Using HPLC/DAD: A Comparative Study, MS thesis in Nutrition and Dietetics.
- Sania Rose (Graduated in May, 2018). Pesticide Analysis in Fruit and Vegetables purchased from local farmer's market in DC. Graduate Capstone Project, Major in Water Resources Management..
- Maryam Sabur (Graduates in May, 2019). Pesticide and semi-volatile organic compounds in DC water ways, Graduate Capstone Project, Majoring PSM in Water Resources Management.

The results were disseminated through a poster presentation, MS Thesis Presentations, and Powerpoint presentations at local workshops in the DC community.

As the continuation of this research project, we will test the effect of different household food processing techniques on pesticide residues in fruit and vegetables, continue our laboratory study, and develop more publications.

The target audience of this project includes DC residents, UDC students majoring in food science or nutrition, DC Department of Energy and Environment, Environmental Protection Authority, urban agriculture researchers, and sustainable DC affiliates.

The main products include development and implementation of laboratory analytical techniques for pesticide residue analysis in fruits, vegetables, water, wastewaters, and sediments. Two important methods for pesticide residue analysis were implemented: 1) EPA 525.3 or pesticide residue analysis in drinking water using GC-MS; EPA 625 for pesticide analysis in wastewater water using GC-MS; and EPA 8270 for pesticide analysis in soil or sediments using GC-MS. Based on these methods, UDC has applied for the national laboratory accreditation or NELAP for pesticide testing in environmental samples.

Publications during this project include:

- Almushayti, Albatul (2017). Assessing the Most Common Pesticides Residues in Fruits and Vegetables from the Main Supermarket in DC Using GS/MS. MS Thesis , University of the District of Columbia, Washington DC., 75 pages.
 - Gandura Almalaki (Graduated in May, 2017). Analysis of Water Soluble Vitamins in Ethnic Crops, MS in Nutrition and Dietetics, 60 pages.
 - Ahdab Jabi (Graduated in May, 2017). Analysis of Fat Soluble Vitamins in Ethnic Crops, MS in Nutrition and Dietetics, 52 pages.
 - Liah Alamlaki (Graduated in May, 2017). Analysis of Anticancer Compounds in Ethnic Crops, MS in Nutrition and Dietetics, 65 pages.
 - Lamya Aljamie (Graduated in December, 2017). Antiatherogenic Compound Analysis in Four Cultivars of Phoenix Dactylifera L. Date Fruits and Seeds Using HPLC/DAD: A Comparative Study, MS thesis in Nutrition and Dietetics, 64 pages.
 - Sania Rose (Graduated in May, 2018). Pesticide Analysis in Fruit and Vegetables purchased from local farmer's market in DC. Graduate Capstone Project, Major in Water Resources Management, 51 pages.
- Integrated Pest Management (IPM) training was not implemented even if it was part of the original

objectives of this project; we modified the project objectives because a new project specialist was hired to conduct the IPM training at UDC supported by DC Department of Environment and Energy. To avoid duplication efforts, the project focused on monitoring pesticide residues in fruits and vegetables as well as environmental samples, including potable and non-potable waters and soil. We also added further study in testing the effect of household food preparation on the level of pesticide residues on fruit and vegetables.

1.6.2 Community Outreach and Education (Cooperative Extension)

1.6.2.1 Sustainable Water Roundtable.

This project has provided training and professional development opportunities for the Principal Investigators, faculty, graduate and undergraduate students. Working on this project, the PI's had the opportunity to apply state-of-the-art laboratory techniques, including sample preparation for total and extractable trace metal analysis in soil, bio-solids and plant tissues using the latest lab equipment, Nexion 300 D ICP-MS and EPA 2008. Faculty and students were trained in these advanced techniques. The project advanced professional experience of three research faculty, 15 graduate students, and 27 undergraduates for the last three years. Furthermore, 6 MS thesis were conducted and completed based on the research capacity partly developed through this project.

The results of the project have been disseminated via conference proceedings, local and national oral and poster presentations and direct contact with the DC residents that have received free soil testing services as part of the project activities. DC urban gardeners have received interpretation of their soil testing result and recommendations for further action to improve their soil quality. Through the life of the project, we disseminated soil testing result and recommendation for more than 600 soil test results.

During this reporting period, three graduate assistants and two lab senior personnel or co-principal investigators have participated on this research project. Students assisted in sample collection, sample preparation and sample analysis. The lab personnel assisted in the sample preparation for lab analysis. The target audience of this project included DC residents who are currently gardening or planning to garden, home gardeners and community gardeners, DC Department of Environment, Environmental Protection Authority, urban agriculture researcher, and sustainable DC affiliates. During this project, we analyzed soil samples for more than 600 garden plots or gardens. The majority of the gardens tested for trace metals and minerals were home gardens (78%).

The main outputs or outcome of this research project includes national accreditation of UDC's Environmental Quality Testing Laboratory, and publications of conference presentations. As the result of this research support UDC is now accredited in soil and water testing for trace metals and major elements through the National Environmental Laboratory Accreditation Program (NELAP). The lab now established a minimum fee based soil and water testing service for the DC residents. Furthermore, a new website was created for the lab service: www.udc.edu/EQTL.

Publications or presentations made through the life of the project included:

- Tilhoo, Kailash, Mani Shehni Karam Zade, Sebhat Tefera, and Tolessa Deksissa (2018). Assessment of Trace Metal in the District of Columbia Food Hub's Soil, 2018 Emerging Researchers National (ERN) Conference in STEM. PowerPoint Presentation, Accepted.
- Rose, Sania, Trinh Vu, Yacov Assa, Sebhat Tefera, and Tolessa Deksissa (2016). Analysis of Arsenic, Copper, and Lead Contamination in Urban Gardens in the District of Columbia. The 2016 Emerging Researchers National (ERN) Conference in STEM, Washington, DC, February 25-27, 2016. PowerPoint Presentation.
- Rose, Sania, Trinh Vu, Yacov Assa, Sebhat Tefera, and Tolessa Deksissa (2016). Analysis of Arsenic, Copper, and Lead Contamination in Urban Gardens in the District of Columbia. The 73rd Joint

Meeting BKX and NIS for 2016 will take place in Hampton, Virginia, April 6 - 9, 2016. PowerPoint Presentation

- Deksissa, Tolessa, Sebhat Tefera, and Yacov Assa (2016). Urban Soil Quality Assessment as Green Urban Stormwater Management Strategy. NCR-AWRA 4th Annual Water Symposium, Washington, DC, April 8, 2016. PowerPoint Presentation
- Deksissa, Tolessa (2016). Unbiased Soil and Water Quality Monitoring: Academic and City Collaborations, Director, Water Resources Research Institute, Sustaining Water Resources in the Mid Atlantic, Dec. 6, 2016. PowerPoint Presentation.

This is the final report, but we are planning to write the guidelines on the best practices to reduce food contamination through growing food crop on contaminated soil.

1.6.2.2 Certified Professional Food Manager Program (CPFMP) and ServSafe Food Safety Course

Each year, roughly one out of six Americans get sick; 128,000 are hospitalized, and 3,000 die from foodborne illness," (Academy for Nutrition and Dietetics, 2016). Foodborne illness is a major problem throughout the country, and even here in Washington, DC. "More than 200 diseases are spread through food" (World Health Organization, 2016). With 5,500+ food establishments in the District of Columbia alone, the need for intelligent, passionate, and dedicated Certified Professional Food Managers is urgent.

There are only 22 sanitarians, two administrative staff, two supervisors, one program manager, and one food technologist employed by the District of Columbia. Thus, the Certified Professional Food Manager course is necessary to continue to train qualified individuals to help monitor and ensure our food's safety.

The Certified Professional Food Manager Course is taught by Paul Brown Jr. It is a vital program in the District of Columbia that helps residents get the certification and confidence needed to gain employment in commercial food operations. It also helps to safeguard that the food that is being served to the public and residents of the District of Columbia, is safe and free from physical, chemical and biological contamination. The course is a three day, 16 hour course which delves into basic food safety and sanitation, and how to make sure employees, facilities, and food products are food-safe compliant. It runs from 9:00 am - 4:00 pm each day, and culminates with students taking a nationally recognized exam from Prometric. There is a pretest given at the beginning of the course that assesses the student knowledge provide to intervention and a posttest following the intervention to assess the student knowledge after the intervention. These pre and posttests are used as practice in preparation for the National Exam. The National Exam is an 85 question test, in which student must achieve a score of 70% or better to become a Certified Professional Food Managers. Students are also required to complete practice exercises in the textbook to help prepare for the National Exam.

The course is taught regularly throughout the year at the University of the District of Columbia and we also work with partners throughout the city as well. The areas of focus in the city have been wards 5, 7, and 8. The vast majority of students tend to be African American and women. The course helps students get food manager certification by taking and passing a National Exam, which is good for five years. We also help them by giving the students some practice tests to get ready for the National Exam. We give them a pretest before we start teaching to see what they know before any lessons are taught and a posttest to see what they've learned from the lessons taught and from studying independently at home. Finally, we focus on our CPFMP course on teaching basic food safety and its principles. We use the book, NSF HealthGuard Professional Food Manager Certification Training Version 6.0, as a guide to delve into the important aspects of food safety, foodborne illness, the food facility, pest management, and the principles of food safety.

This certification is helpful to anyone who would like to take the course, but is vital to those seeking

employment in food service. It aids those working in commercial kitchens, restaurants, fast food, daycares and schools or those who are looking to go into business for themselves. This usually happens through the increasingly popular mobile food facilities (food trucks), bed and breakfasts', and catering businesses. This certificate is a requirement to work in commercial food settings or where food is being served to the public. It allows for upward mobility for those already employed in lower level food service.

Individuals have come from a host of different agencies throughout the city and surrounding area. We have partnered with and taught students, individuals and entrepreneurs who were employed, unemployed and under employed from places such as, Mana Food Center, Nexus Holistics, French Embassy, Washington English Center, Homes for Hope Community Inc., Grant Associates Inc., Bread for the City, Linden Manor, Elsie Whitlow Stokes, The Goodwill, New Course Restaurant and Catering, Zenful Bites, Levy Food Service, The Calpro Group and Levy Foods among other groups.

During FY18, Paul Brown Jr taught the CPFM course seven times in two different locations - University of the District of Columbia (4200 Connecticut Ave NW Washington DC 20008) and the Washington English Center (2200 California Street NW Washington DC 20008). There were 285 students who registered to take the course during the fiscal year, 201 of whom were female and 69 were male, and 15 reported as "other." The overwhelming majority of students were African American (141), there were also 42 who reported as Caucasian, 36 who reported as Asian. There were 66 who did not report their race. Ages of the students ranged from as young as 18, all the way to 73. 57 of the students were aged 18-29. 69 fell between the ages of 30-39, 57 from 40-49, 42 students were between the ages of 50-59, 18 of the students were between the ages of 60-100 and 42 students did not report their age. There were 70 students who got at least a 70% on the National Exam, from Prometric, which is the passing grade for certification.

While the course is open to anyone who needs it, it is vital requirement for those looking to work with or around food being served to the public. "It is important for people to understand how their behavior and activities contribute to the safety of food and how they can decrease the risk of foodborne illness." (HealthyPeople.gov, 2020 Topics & Objectives, 2017) The students came from a number of different professional backgrounds, some were unemployed, some were students, and some were gainfully employed or were entrepreneurs.

The Certified Professional Food Manager course for FY18 saw some really good exam scores. Students, overall, did very well. 87% of the students who took the class, passed their exam and became Certified Professional Food Managers. There is a Pre Test given in the course that assesses what the students know coming in before being taught anything, then there is a Post Test that assesses what the students learned in the two class days. They are used as practice in preparation for the National Exam.

In the seven classes in FY18, students made an average score of 66 on the Pre Test, which is the same from FY17. They averaged a score of 93 on the Post Test in FY18, again, up a bit from the 90 in FY17. The National Exam score for FY18 is 78, up a bit, from the 75 in FY17. There is definitely room for improvement; the emphasis will be on independent learning and studying away from the classroom. My hope is that students will understand the importance of why safe food handling is so important when dealing with the public.

In addition to the CPFM course, Paul Brown, Jr. also taught the certificate on-line course ServSafe course six times in four different locations, City Blossoms (516 Kennedy Street NW Washington DC, 20011), Bethel Christian Fellowship Church (2200 Martin Luther King Jr Ave SE Washington DC, 20020), Hopkins Housing Complex, (1430 L Street SE Washington DC, 20003), and Community College Preparatory Academy (2405 Martin Luther King Jr Ave SE Washington DC, 20020). There were 70 students who registered to take the course during the fiscal year. Fifty-nine of the 70 students reported their race as Black, 2 as Caucasian, and 3 as Asian, 5 students reported as other and one student did not report. Nine

of the students were male, 54 of the students were female and 7 reported other. One-hundred percent of the 70 students pass the online examination and received a certificate.

The course was open to anyone who wanted a basic food safety information on how to keep foods and the public safe from the threat of food-borne illness. "It is important for people to understand how their behavior and activities contribute to the safety of food and how they can decrease the risk of foodborne illness." (HealthyPeople.gov, 2020 Topics & Objectives, 2017).

The course, while not recognized by the DC Department of Health for certification purposes, can help students unfamiliar to or who need a refresh, in food safety. The ServSafe Food Handler course allows students to essentially practice or gauge their knowledge of food safety without the fear of failing a national exam. Students could then move on to the Certified Professional Food Manager Course with vital knowledge of basic food safety if they so choose to.

1.7 Urban Families, Youth, and Communities

1.7.1 Relevant Research

No research activities have been conducted in the area of 4H and Youth Development.

1.7.2 Community Outreach and Education (Cooperative Extension)

During this reporting period, the UDC CAUSES 4-H program has been in the process of implementing organizational changes that will further improve the quality of our programs and the efficiency and effectiveness of our program delivery. The new organizational model builds on our strengths as an urban land-grant program that is located in a community that is rich in skills, knowledge, and civic mindedness. As we transition to our new organizational model, which will more effectively use the rich resources of the District of Columbia to the benefit of our 4H Clubs and the students and club leaders we serve, our programs and their delivery format have also been under review to ensure continuous improvement. We have two new employees joining our 4-H team for a total of 4 staff person. Mustafaa Madyun our new Assistant Director for the Center for 4-H & youth Development joined the 4-H team in September of 2017 and has focused on providing training for community youth serving volunteers, 4-H staff and 4-H program volunteers while supervising the 4-H staff. He also worked with the National Consumers League around supporting the LifeSmarts Competition. He has helped to develop plan of action for the 2019 4-H program year.

Olivia Harp our new Program Associate for Leadership Development and Training, began in March of 2018 and she is acclimating to the 4-H program very quickly. Her primary focus has been training volunteers that work in the District of Columbia at other youth serving organizations with a focus of UDC 4-H becoming the place to go for training youth and volunteers that serve our youth. She maintains a volunteer spread sheets of resource volunteers that can come into clubs to share their expertise to support our volunteer leaders. These volunteers may or may not start clubs. A separate spread sheet that she maintains reflects volunteers interested in starting and managing 4-H clubs. She has rewritten our volunteer manual and provided a mirid of training programs for volunteers to include grant training and Advanced Youth development training reaching more than 560 participants in total to include providing Leadership training to 197 youth in the Department of Energy and the Environment from six sites across the during the summer months. 348 adults were provided Advanced Leadership training and 13 adults were provided 4-H Volunteer Leaders training to work specifically with youth in 4-H clubs.

Diego Lahaye, our Program Assistant for Resource Development now also contributes to a list of volunteers that are interested in becoming 4-H volunteer leaders. Mr. LaHaye also manages our 4-H soccer program that includes more than 11,000 direct youth contacts and our Nutrition and Dietetics program which engaged 5 UDC college students in providing nutrition education 4-H Club Activities to youth at Murch Elementary school in four classrooms totaling 1,200 youth contacts. Mr. LaHaye helps with

the Urban Agriculture program managing activities of volunteers and youth. the youth were selected during the last fiscal year but have made the most impact this year. He continues to be the primary contact for volunteers interested in help with starting their clubs.

Our Program director worked with volunteers that managed seven gardens in Washington, DC during the programming year. Worked with volunteers to arrange a Food Justice Summit for 2019, developed 11 new strong partnership that have resulted in additional programming for fiscal year 2019.

We ended the year reaching more than 12,067 youth indirect contacts and 3,000 in direct contacts. Consistent with our organizational transition, we faced a reduction in clubs but a boost in numbers of youth in 4-H programs.

We managed new 4-H clubs, three specialized 4-H programs and a robust volunteer education program: (1) the 4-H Nutrition Education program (food safety, security and nutrition), (2) the LifeSmarts Program (sustainable energy, water quality and climate change, childhood obesity), and (3) the 4-H Soccer Program (Childhood Obesity). We hosted 2 summer camping programs and our Military Partnerships Program also continued to engage youth in our primary NIFA goals and STEM Education activities in new and different formats, and we were able to serve youth during this reporting period.

1.7.2.1 4H Nutrition Program

For the past four years, we have worked with UDC CAUSES Nutrition and Dietetics professor Dr. Michelle Harris in engaging college students in Land grant majors in providing Nutrition Education 4-H clubs in local school settings. Nutrition and Dietetics students work with 4-H staff to provide a minimum of six weeks for programming in the public school setting six weeks to present programming to children related to nutritious eating, exercise, food security, and food safety. The college students were given a stipend of \$30.00 a week as needed for demonstrations and program materials. Murch Elementary School participated, with 100 youth participants in the programming. 80% of our college students went past the six-week class mandate because they became attached to the youth and appreciated the feedback from the teachers and children. College students were advised at the beginning of the semester that this program would account for 30% of their classroom grade. There is a request to expand the program from teachers and youth.

1.7.2.2 4H Soccer Program

Addressing childhood obesity must take many forms to succeed. Our UDC 4-H CAUSES Soccer program engages youth in three age categories in learning about healthy eating and exercise, and uses the Health program engaged more 1,000 youth. The youth participated in three soccer tournaments, a nine-week fitness program, leadership training, nutrition training for athletes all culminating in a soccer tournament championship. At the end of the summer an overnight camping experience for 60 of the youth who participated in the soccer program was provided at the Riverview camping facility in Maryland.

During this program year three leaders in the soccer program, including our Program Assistant, Diego Lahaye and volunteers Victor Molina and Jose Sorta attended the National Soccer Foundation training in Philadelphia, Pennsylvania to learn best practices, create new networks and share information about our DC 4-H program. A coaches' conference was held to provide skills development, that included Nutrition education and demonstrations. A plan was put in place to offer referee training to youth in 2019. A study of the impact of the crime rate was conducted during this program year. There has been a steady decline in youth related violence in the neighborhood where the soccer program is being implemented.

1.7.2.3 4H Military Kids

Because of our reduction in staff and new working structure our 4H Military Partnerships Program activities decreased by we hosted a spring break day program with 4-H volunteers providing STEM Education programs. Youth visited the Firebird Farm which is their favorite UDC food hub and swam in the UDC

pool. They came to the university for four days and were treated to experiential programs that addressed Nutrition, Water Quality, Food Justice, Food Systems and Leadership. During the Christmas months they also made healthy soups, participated in Yoga and relaxation programs that address keeping a healthy mind and body. They created gifts for their parents using recycled materials with a discussion about sustainable living.

The UDC 4-H Program has enjoyed a productive program year in 2018 with a total reach of 12,067 4-H participants served among four 4-H team members. New volunteers have been trained, new partnerships have been developed with the community organizations needing training for their volunteers, new 4-H school gardens have been established, our nutrition education program continues to grow reaching more youth and providing more opportunities for college students in land-grant programs to experience the true functions of a land grant university, our soccer program has increased dramatically receiving positive feedback from parents, youth and coaches in the community. We are moving forward to continue to reach the youth and volunteers interested in youth development for the 2019 program year.

Data regarding program outputs and outcomes submitted in this report does not include any information about the SNAP Ed and EFNEP programming offered through the UDC CAUSES Center for Nutrition, Diet and Health.

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Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	24.0	0.0	22.0	0.0
Actual	24.9	0.0	19.2	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- External Non-University Panel
- Expert Peer Review

2. Brief Explanation

We have established a Merit Review Process for research/extension in Land Grant Programs that continues to work well at ensuring that research proposals are judged fairly and on their merit. For Hatch and Mini-grants offered through the Station, the process includes: the Development of a RFP; Solicitation of RFP; Receipt of Proposals; Review of Proposal Packets for Completion of Requirements; Peer Review;

Director's Review; Completion of Required Forms for submission to USDA; Electronic Submission to USDA for expert panel review; USDA Approval; and Issuance of Award. The Peer Review panel includes representatives from various departments/schools across the University. Research projects are often joint ventures, conducted by faculty as well as qualified research and extension staff.

The Peer Review Committee assesses our program's proposed research/extension projects and activities based on the following criteria:

- Knowledge base of the research
- Adequacy of procedures and experiment to meet the objectives
- Feasibility of accomplishing the objectives
- Scientific merit of the proposed research
- Familiarity with work of others related to the proposal
- Outcomes and Impacts
- Appropriate budget for proposed research
- Budget Justification

All research/extension projects are monitored by the Director and Associate Director to ensure that objectives and timelines are being met. An annual progress report is required and is reviewed by the Station Director prior to electronic submission to USDA. All projects must include student learning experiences.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Other (distribution lists; website)

Brief explanation.

CAUSES regularly seeks stakeholder input through its partnerships with non-profit organizations, DC agencies, and residents through neighborhood organizations and the ANCs, a network of neighborhood representatives that are active in every Ward of the District of Columbia. In addition, we collect program feedback from participants, community partners, and faith-based organizations. Particularly important is our work with individuals and organizations in the most underserved Wards of the District, Wards 5, 7 and 8. These are largely low income communities, characterized by extensive food deserts, high unemployment, high school dropout rates and other significant challenges. We have reached out to seniors, youth, single mothers, ministers, community advocates, working class and middle class residents. Three of our Urban Food Hubs are also located in Wards 5, 7 and 8. Additionally, stakeholder input is sought at both research and extension activities such as the Farmers' Market, workshops, seminars, and demonstrations throughout the eight Wards of the District of Columbia. We let our stakeholders know that their input is essential to

the research conducted and extension services provided to benefit them, their families, and communities within the District of Columbia. We encourage their input via stakeholder surveys, interviews, and one on one dialogue, and two major stakeholder events held annually.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Use Surveys
- Other (workshops, seminars, Quality of Life Day Event)

Brief explanation.

Our objective is to meet with residents and organizations across the eight Wards of the District. Currently, our focus is on the underserved population of the city, residing in Wards 5, 7 and 8. A large segment of this population is low income residents with many households lead by a single parent or, in some cases, a grandparent(s). Research and Extension, separately as well as jointly, host a number of activities during the year including workshops, seminars, demonstrations, training sessions, and an annual Farmer's Market on the University's main campus. In addition, the CAUSES Landgrant center directors, along with the Dean and Associate Dean of Landgrant programs, have met with DC agencies and non-profit organizations to solicit information about priority needs for the District of Columbia. An important tool in structuring these informational meetings is the so-called Sustainable DC Plan, developed by former DC mayor Vincent Gray. The plan outlines the ambitious goals of making Washington DC the greenest, healthiest and most livable city in the United States by 2030. Moreover, the Sustainable DC Plan sets sustainable development targets that provide a roadmap for CAUSES to focus its activities in support of the Sustainable DC goals. The Directors of the five CAUSES Centers have now begun to convene networking meetings several times per year that bring together organizations and DC agencies in their respective areas of responsibility -- Urban Agriculture; Sustainable Development; Nutrition Diet and Health; Youth Development; and Housing and Community Planning.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Our objective is to meet with residents and organizations across the eight Wards of the District. Currently, our focus is on the underserved population of the city, residing in Wards 5, 7 and 8. A large segment of this population is low income residents with many households lead by a single parent or, in some cases, a grandparent(s). Research and Extension, separately as well as jointly,

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3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- To Set Priorities

Brief explanation.

The assessment work of CAUSES is supported by a full-time assessment specialist, who is assisted by a full-time associate. This staff works closely with the five landgrant center directors and the five academic program directors in CAUSES to ensure that input received from stakeholders is reviewed, assessed and processed to improve on our applied research and community outreach activities. The result of this assessment and analysis work indicates that we are addressing many of the issues and concerns identified by our stakeholders. However, there are areas that offer opportunities for expansion and improvement of our work. Our ability to realize these opportunities depends largely on budget and personnel allocations, yet operational improvements will also be necessary to fully realize the potential of expanded and new research and community outreach opportunities. Especially critical are operational areas in human resources and procurement. The President of the University of the District of Columbia has made operational and processing one of his priorities and has established a new organizational structure that includes a Chief Operating Officer with responsibility for IT, procurement, and facilities. As the University's landgrant college, CAUSES and its leadership is keenly aware of the responsibility to build capacity that improves the social, economic and environmental conditions of the District and its diverse stakeholders through relevant research and community education programs. In its monthly management meetings, the CAUSES center directors, academic program directors and operations staff are carefully reviewing and updating our Plan of Work to expand our effectiveness and reach.

Brief Explanation of what you learned from your Stakeholders

Stakeholders concerns have remained relatively consistent. In line with the Sustainable DC Plan and its targets, concerns of the broad range of DC stakeholders include improving health and especially preventive measures that improve health conditions before treatment becomes necessary; improved access to locally grown, high quality food; water quality including the goal to make the rivers within the District fishable and swimmable; improved infrastructure; more access to parks and outdoor recreation; better sustainability literacy. In addition, we have observed a growing interest in Urban Agriculture. In 2015 we launched an Urban Agriculture Certificate program and enrollment has continued to increase. Issues and topics of concern include the following:

- Safety of Foods: Growth, storage, and preparation of foods
- Economic Development: Jobs, training, sustainable neighborhoods
- Obesity: Healthy children and adults; Prevention of Chronic Illnesses; Healthy Eating; Activities for Children
- Urban Gardening: Growing their own food; exposure to different types of food, including ethnic crops and organic foods
- Healthy Food Choices: Eating better for better health and longevity
- Healthy Lifestyles: youth activities related to physical fitness and proper nutritio
- Sustainable energy: continued availability of resources for themselves, their children and generations to come
- Urban Agriculture
- Aquaponics and Hydroponics

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totalled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	763028	0	455385	0
Actual Matching	754028	0	455375	0
Actual All Other	672395	0	600938	0
Total Actual Expended	2189451	0	1511698	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	175523	0	166960	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Climate Change
2	Global Food Security and Hunger
3	Health, Nutrition and Childhood Obesity Prevention
4	Urban Families, Youth, and Communities
5	Alternative Energy and Capacity Building
6	Water Safety and Water Management
7	Food Safety

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		40%	
111	Conservation and Efficient Use of Water	20%		20%	
124	Urban Forestry	20%		20%	
204	Plant Product Quality and Utility (Preharvest)	0%		20%	
903	Communication, Education, and Information Delivery	40%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	4.2	0.0	4.0	0.0
Actual Volunteer	409.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
114249	0	76573	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
114249	0	76573	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
99565	0	157039	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conducted research activities associated with research project on reducing impacts of solar radiation on a crop producing green roof and modifying roof microclimates through an adjacent crop producing green facade.
2. Trained student researchers on datalogging equipment and software, and how these tools can be used to collected data relevant to their design work.
3. Lead/coordinated efforts of 30 volunteers to assist with some of the tasks associated with research project to include: planting, harvesting, installing planters, and removing existing extensive roof growing medium.
4. Conducted community stakeholder meetings, workshops, demonstrations and technical assistance on the effect of environmental degradation as it relates to the quality of life for District residents; and
5. Conducted a community-based health survey with residents of Ward 6 in which questions about climate change were included.

2. Brief description of the target audience

- 1) District of Columbia residents
- 2) DC Public School Teachers
- 3) Youth, Grades K-12
- 4) Urban gardeners
- 5) Storm and waste water operators
- 6) Landscapers
- 7) Nursery Owners

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2189	64790	214	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of articles published
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of fact sheets published
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of newsletter published
Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of workshops, demonstrations and technical assistance implemented.

Year	Actual
2018	3

Output #5

Output Measure

- Number of research projects completed
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of soil, air and water samples test results

Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of informational materials distributed
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of conference presentations

Year	Actual
2018	1

Output #9

Output Measure

- Number of certificate of completion issued
Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percent of program participants that will become more environmentally aware due to new knowledge from informational materials provided and workshop presentations
2	Percent of program participants that will implement new environmental skills to improve natural resources and the environment
3	Percent of soil, air, and water samples meeting EPA standards after implementation of research project.

Outcome #1

1. Outcome Measures

Percent of program participants that will become more environmentally aware due to new knowledge from informational materials provided and workshop presentations

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dr. Elgloria Harrison and Mr. William Hare are representatives for the University of the District of Columbia for the Northeast Climate Change Hub. The Hub's objectives follow:

1. To mutually develop and deliver science-based region-specific information and technologies to agricultural and natural resource managers that enables climate-smart decision-making and provides assistance to implement those decisions;
2. To engage networks of outreach professionals, researchers, stakeholders and educators in capacity building to address climate-related issues; and
3. To transform and innovate the delivery and sharing of science-based climate adaptation and mitigation information from discovery, to translation, to practice.

What has been done

Two community stakeholder meetings were held on Climate Change and Asthma and Climate Change and Air Pollution in Ward 6 of the District; a Climate Change Workshop was conducted at H.D. Woodson High School, Washington, DC; a community based health survey was conducted with residents of Ward 6, Census track 64, in which questions about climate change were included; Dr. Harrison served as a panel speaker on the topic of Climate change and Health at a conference sponsored by Citizen Climate Lobby (CCL) to discuss the impact of climate change on health; a Climate Change and Carbon Reduction academic course (ENSC 460) was taught each fall and spring semester to undergraduate students in the Urban Sustainability program; Climate Master Program focus group training was provided by Dr. Allison Chatrchyan, in anticipation of our participation in the Climate Master Program here in the District of Columbia; Two focus groups were facilitated on Climate Change as a part of a large research collaboration within the NE

Climate Hub: These focus groups were to determine the need for a Climate Master Volunteer Group similar to the Master Garden Program: 1) Group 1 with citizens from Ward 6, Washington DC and 2) Group 2 with select members of our Master Gardeners Program.

Results

As a result of combined activities (guest lecture, workshops, community stakeholder meetings, and educational in-services) on climate change, we reached a total of 300 people over the course of this reporting period. 300 people are now more aware of Climate Change issues affecting their city, country, and the world. We established a partnership with the Washington, DC community in the Buzzard Point neighborhood, to which we are assisting this community in issues related to climate change and natural resources. This is an ongoing project and as a result of our community work, we were asked to assist in conducting a community based health survey to determine if there are links between climate change and health as well as the impacts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Percent of program participants that will implement new environmental skills to improve natural resources and the environment

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percent of soil, air, and water samples meeting EPA standards after implementation of research project.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Not enough data was collected this research year to yield results worth disseminating. It is anticipated that the data from the upcoming growing season will be adequate for analysis and dissemination of results.

During this reporting period, for the NE Climate Change Hub project, we focused on residents in the Buzzard Point neighborhood of Ward 6 and also conducted an educational session in Ward 7 with High school students. We expect to expand climate change education to more wards throughout Washington, DC.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Global Food Security and Hunger

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	50%		40%	
205	Plant Management Systems	30%		30%	
216	Integrated Pest Management Systems	20%		30%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	4.0	0.0
Actual Paid	3.0	0.0	3.2	0.0
Actual Volunteer	305.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
76096	0	53811	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
76096	0	53811	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	129221	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1) Conducted research activities in Agroforestry and Polyculture; Urban Food Hubs; Green Roofs; Farmers Markets; Urban Food Production, Cultural Techniques; Educational Collaborative and Aquaponics.

2) Facilitated workshops, training sessions, demonstrations, field activities, and farm tours at for program participants to teach and update knowledge of sustainable agricultural techniques at each the Food Hub to establish, maintain, protect, and market both food crops and flower gardens;

3) Developed and distributed informational fact sheets, brochures, and newsletters related to production and protection of urban gardens;

4) Participated in local, National, and international conferences and meetings on sustainable agriculture and urban gardening;

5) Provided pesticide safety education and certification for monitoring insect and disease infestations and recommendations for control while preventing environmental degradation;

6) Maintained Urban Ag and Master Gardening certifications; trained food producers and gardeners will participate in making nutrient dense food crops accessible and affordable in food desert areas of the District while beautifying the city through volunteer hours; and

7) Conducted Green Roof Tours for stakeholders, students, faculty, and staff

2. Brief description of the target audience

- 1) District of Columbia residents
- 2) DC Public School Teachers
- 3) Youth - Grades 3-8
- 4) Urban community gardeners
- 5) Urban food producers and farmers markets
- 6) Landscapers
- 7) Nursery owners

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	737	63170	89	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	2	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of articles published
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of fact sheets published

Year	Actual
2018	7

Output #3

Output Measure

- Number of Newsletters published

Year	Actual
2018	2

Output #4

Output Measure

- Number of workshops, demonstrations and technical assistance implemented.

Year	Actual
2018	67

Output #5

Output Measure

- Number of research projects completed
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of soil, plant and water samples test results

Year	Actual
2018	87

Output #7

Output Measure

- Number of informational materials distributed

Year	Actual
2018	2859

Output #8

Output Measure

- Number of conference presentations
Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of certificate of completion issued

Year	Actual
2018	65

Output #10

Output Measure

- Number of pounds of produce distributed to DC communities in food desert areas to assist homeless and low income populations with food and nutrition security

Year	Actual
2018	12577

Output #11

Output Measure

- Number of activities utilizing the Green Roof for research and educational training purposes.

Year	Actual
2018	6

Output #12

Output Measure

- Number of students exposed to permaculture production systems through a farmer-to farmer educational collaborative

Year	Actual
2018	8

Output #13

Output Measure

- Number of volunteers supporting urban agricultural initiatives in support of our research and service to the community.

Year	Actual
2018	1240

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percent of program participants that will adopt urban gardening techniques learned from informational materials provided and workshop presentations
2	Percent increase in urban gardens using some compost material as a soil amendment
3	Percent of soil, plant and water sample results within acceptable crop production range
4	Percent increase in the growth of a variety of ethnic crops in home, school, and community gardens in the District of Columbia.
5	Percent of new food producers that will adopt the bio-intensive method of urban agriculture production
6	Percent increase in distribution of pounds of food donated to food desert areas in DC for low income or homeless individuals/families.
7	Percentage of residents and students with a change in knowledge through exposure to Green Roof research and education training space
8	Percentage of students with a change in knowledge and perspective of permaculture production systems for ethnic crops through international connections and informational exchanges.
9	Assessment of Urban Production for tropical crops
10	Percentage of students certified in community compost training showing interest to continue their work in the community.

Outcome #1

1. Outcome Measures

Percent of program participants that will adopt urban gardening techniques learned from informational materials provided and workshop presentations

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

From consuming produce that is tastier and higher in nutritional value to decreasing CO2 emissions by harvesting as locally as your backyard, District residents are all "a buzz" about the many benefits of local food production. Urban agriculture has caught on, and unlike large-scale intensive agriculture operations, urban agriculture utilizes comparatively smaller spaces while focusing on diversified, edible crops. Many residents already subsidize what they buy at the grocery store through community garden plots and by growing in their backyards, yet are in need of technical assistance with issues ranging from cultivar selection and planting dates to fertilizing, soil contamination, and integrated pest management. Alternately, other District residents don't have access to grocery stores, let alone yard space or a nearby community garden in which they can grow their own food.

What has been done

Forty-Seven (47) participants were trained as Master Gardeners, receiving 45-50 hours of basic horticulture training. Program trainees agreed to work in their communities to teach District of Columbia residents how to cultivate garden spaces and manage landscapes sustainably using research-based information. This environmental horticulture approach reduces fertilizer and pesticide use resulting in improved soil and water quality.

Results

In FY 18, 79 (which includes 47 trainees) Master Gardeners and trainees provided 9,000 hours of horticultural expertise to the District of Columbia. The value of volunteer time is \$38.77 per hour according to www.independentsector.org with a total value of \$348,930.00 in savings to the District of Columbia. Forty-seven (47) Master Gardener trainees completed 50 hours of basic horticulture training, a final exam and 50 hours of volunteer hours. Various Master Gardener

projects throughout all eight wards of the District of Columbia have been established which includes the UDC food hubs, schools, parks, beautification projects, landscape design, youth gardens, local and national botanical gardens, and partnerships with non-profit organizations. Master Gardeners volunteered 600 hours to the success of the Ward 3 Food Hub (green roof/greenhouse). The value of their volunteer time is \$23,262.00 in savings to the University. Their duties included propagation of vegetables and companion plants, planting, maintenance, and harvesting. Produce was harvested and donated to the following: food banks, including the UDC Student Food Pantry, UDC Center for Nutrition, Diet, and Health, East Capital Street Farmers Market, and volunteers. 1/3 of Master Gardeners continue their education in horticulture related field and obtain employment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Percent increase in urban gardens using some compost material as a soil amendment

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percent of soil, plant and water sample results within acceptable crop production range

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Percent increase in the growth of a variety of ethnic crops in home, school, and community gardens in the District of Columbia.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Percent of new food producers that will adopt the bio-intensive method of urban agriculture production

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Percent increase in distribution of pounds of food donated to food desert areas in DC for low income or homeless individuals/families.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

More than 11% of Washington D.C., USA is considered a food desert. That is approximately 6.5 square miles of food deserts overall and they are concentrated in African American Wards of the city, predominately east of the Anacostia River. Urban dweller migration to cities became a topic of intense discussion when it was noted that the number of urban dwellers outpaced the number of rural dwellers for the first time in modern history. This shift in population continues to pose significant challenges for food production as the number of food producers are declining compared to the number of food consumers.

What has been done

Crop productivity was increased at the UDC Farm of specialty crops. These specialty crops were donated to food based non profit organizations and our student food pantry to increase food and nutritional security in Washington D.C.

Results

Our increase capacity (10%) to grow more crops allowed us to produce 12,577 lbs of food crops which were distributed to address food and nutritional security in the District of Columbia.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Percentage of residents and students with a change in knowledge through exposure to Green Roof research and education training space

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The urban population of the world has grown rapidly, from 746 million in 1950 to 7.2 billion in 2014. Within the United States, the Northeastern region is the most urbanized. Even within this heavily urbanized region, Washington, DC is notable because it has a population density greater than any state in the country and continues to grow by 1,000 residents per month. Supporting this population growth in a sustainable way is a primary challenge for Washington, DC, in part, because land for agriculture becomes increasingly removed from the city center, reducing access to locally grown food. Further complicating sustainable development and food production within the metropolitan Washington, DC area are the changing climatic conditions which increase severe weather events such as heat waves and deluges and alter normal temperature and precipitation cycles.

What has been done

In 2018 we grew six varieties each of strawberries and tomatoes at three different green roof sites, one control site, and in hydroponic and aquaponics systems to assess productivity in urban, high heat environments. In addition to yield, samples were collected for nutritional analysis by collaborators at the Beltsville Human Nutrition Research Center (USDA-ARS) to determine differences among varieties and production systems. We trained six UDC undergraduate students in tomato and strawberry production, data collection, and educational outreach plus an additional 163 direct adult contacts were reached because they volunteered on production and data collection. We presented the project at one open house at UDC’s research farm, through four tours of UDC’s green roof, and through UDC’s Master Gardener class. The total number of people reached was 250.

Results

As a result of the research conducted, six undergraduate students have gained both knowledge and experience in tomato and strawberry production, data collection, and educational outreach. 163 volunteers have increased their knowledge of tomato and strawberry production and data collection due to their participation in the research. Stakeholders participated in Green Roof Tours which provided pertinent information regarding the production of tomatoes and strawberries utilizing a green roof as a growth option. A total of 250 people have enhanced knowledge which may now be applied to assist with their individual/family urban food production needs as well as the needs of their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Percentage of students with a change in knowledge and perspective of permaculture production systems for ethnic crops through international connections and informational exchanges.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

More than 11% of Washington D.C., USA is considered a food desert. In 1980 Washington, D.C. officially twinned with Dakar, Senegal. Providing adequate and nutritious food in these cities have been challenging in urban areas where both sales and production are scarce and in rural areas where droughts, floods and anthropogenic pressures impact agricultural production. International farmer exchanges can increase the viability of permaculture ethnic crop production. Poverty is the most salient pressure and thus a challenge in the equation for achieving food security in these communities. This research project seeks to establish a farm educational training program that increases crop yield, knowledge and market demand for African and Caribbean ethnic crops. The goal of this project is to create and sustain permaculture systems that increase the yields of ethnic crops by establishing international connections and informational exchanges.

What has been done

The University of the District of Columbia, College of Agriculture, Urban Sustainability and Environmental Sciences (UDC CAUSES), launched its first study abroad program bringing eight UDC students and two CAUSES faculty to an exploration of ecological approaches to sustainable development in Senegal, West Africa. The trip connected UDC students with students from Cheikh Anta Diop (UCAD), the premier public University in Dakar, and the city of Dakar, DC's sister city. The trip explored opportunities and challenges of implementing sustainable development in international communities, as well as exploring indigenous ecological knowledge. Students participated in assessing permaculture plots. While conducting the plot assessments, they interviewed farmers about their yields, techniques, challenges, and distribution. Farmers explained their soils had high salinity, which can be a result of large amounts of coastal development. Introducing trees into growing culture and introducing more crop diversity can mitigate much of this problem. Women farmers discussed challenges such as plant disease, pest management and using natural remedies and repellants like neem. Conversations were had about soil health, salinity and how the introduction of low-tech strategies for soil amendment can be extremely helpful. UNESCO Dakar briefed the UDC and UCAD group on work that was being done across the country using methods of statistical aggregation of data. UNESCO is working with government agencies to meet Millennium Challenge Goals by meeting the needs of individuals and communities that help them live and thrive in place. For educational purposes, this allowed students to see the value of data and its usefulness in comparison across larger and broader spectrums. The work that UNESCO is doing is very important but it also sparked interest and a line of questioning that focused on the local perspective and how disconnected levels of government management were to the realities on the ground. Students experienced first hand challenges of multi-national level operations and meeting multi-stakeholder goals. And, that funding mechanisms must be sustainable because the interplay between US domestic politics play critical roles in international aid. Individual or face-to-face interviews were our choice of extension method because it has proven to be effective when used in both developed and developing countries. We met the farmers at home or on their farms and discussed issues of mutual interest, sharing with the farmer both information and advice. The farmers were able to benefit from our exchanges in conversation and built confidence between our groups, critical for our long-term sustainability with the project.

Results

As a result of the international connection and information exchange, eight UDC students have increased knowledge of permaculture production systems in Dakar, Senegal, Africa. In a final debrief, all UDC students expressed how much they had learned and gained, as well as connections they were making with their classes. Some gained clarity on the true challenges in the application of sustainability policy or international aid. Others said they developed greater perspective on the tensions of nonprofit operation and sustainability programming communities. For some, the possibilities of a new professional path, international development, had opened due to the trip and our connections with professionals in those fields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #9

1. Outcome Measures

Assessment of Urban Production for tropical crops

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our research aims to mitigate the negative impact of climate change (NIFA goal) and regional population growth on food production by improving food security (NIFA goal) within a quarter mile of 75% of DC residents (Sustainable DC Initiative). Specifically, we used two tropical crops, roselle (*Hibiscus sabdariffa*) and sweet potato (*Ipomoea batatas*), to answer the following questions: 1) which cultivars are the highest performers in urban agricultural production; and 2) and what are the nutrient profiles of the highest performing cultivars of each crop? This information will benefit farmers and gardeners who are looking to improve production in urban areas. Ultimately, this information will also help consumers, who will have access to crops with higher nutrients.

What has been done

Seven varieties of sweet potato greens and five genotypes of roselle were grown on a green roof in downtown Washington, DC and in field rows at UDC's Firebird Farm (Beltsville, MD) in 2017. In 2018 the sweet potato and roselle trials were repeated. However, a second field row of sweet potatoes was added to the project to determine whether leaf harvests affects tuber production (leaves were not harvested in this second row, whereas they were in the first). Also, two additional genotypes of roselle were added to the trials and one additional production systems was added (high tunnel production). Our primary focus was on yield and nutrient content of leaves (for sweet potato and roselle) and calyces (for roselle), which are edible, but tubers of sweet potatoes were also weighed and sent for nutrient analysis in year 2. Leaves were harvested multiple times each year, separated by whether they were marketable or unmarketable quality, and then weighed to determine yield. Calyces from roselle were collected once per year. Insect pests were also identified and quantified. The nutrient content of leaves, calyces, and tubers are currently undergoing nutrient analysis by collaborators at the Beltsville Human Nutrition Research Center (USDA-ARS).

Results

Results show that the varieties of sweet potato did not produce different amounts of marketable leaves within a location. Tuber production did not differ among varieties, but was severely reduced by harvesting leaves.

Results show that genotypes of roselle produced different amounts of marketable leaves within all locations. Only two genotypes reliably produced edible calyces, a commercial Thai red genotype and a genotype that produces green calyces (hereafter, "green genotype"). The green genotype has been the focus of a mass selection breeding program in the DC area and shows the most adaptability to a range of growing systems and environmental conditions. This genotype had the fewest Japanese beetles in the field, which is the main pest of this crop in the mid-Atlantic.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #10

1. Outcome Measures

Percentage of students certified in community compost training showing interest to continue their work in the community.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	29

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As part of the fourth component of UDC food hub concept - "waste and water recovery", CAUSES has strong initiatives to move toward zero waste by reusing its food hub wastewater, garden as well as food waste. Each UDC food hub site now has an aquaponics system and a community compost system, which allow fish wastewater and garden wastes to be reused in the hub. The UDC Community Compost project was incorporated as a strategy to manage the food hub's organic waste as well as the community members food waste by giving them the opportunity to turn them to valuable compost. In this way, we will dramatically minimize our garden and food waste as well as reduce the use of chemical fertilize at our food hub sites. UDC CAUSES is determined to move toward zero waste in all its food hub sites.

What has been done

During FY 2018, the UDC CAUSES team (Center for Sustainable Development and Resilience (CSDR)) built a three-bin compost system to all UDC Food Hub sites including Firebird Research Farm. The construction of the bins was turned to a hands-on training for those in the community who showed interest to join our compost classes. The project also includes a community compost class to train the community about how to turn garden and food waste to valuable compost. The program started with informing and engaging the community to understand their needs and interest. Then, a comprehensive compost training manual was developed. Communities were informed 2 month before each class schedule. The UDC community compost certificate program was provided during six weeks in summer (once a week, 3 hours hands-on experience training class). Three UDC food hubs (Van Ness, P.R. Harris and B. Backus) received the training. Each class started with 1.5 hours theory and 1.5 hours hands-on training working with food waste.

Results

In Van Ness Food Hub site (Ward 3), we had 7 students, which 6 of them completed the program and certified. In P. R. Harris Food Hub Site (Ward 8), we had 12 students and 10 of them were certified. In B. Backus Food Hub Site (Ward 5) we had 15 students and 13 of them completed the program and were certified. In all three sites, certified students showed interest to continue their work on the compost project. In B. Backus site, the community established a compost COOP and working hard to develop their compost project. They would like to reach to a point that they could sell their compost.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our increased capacity (10%) to grow more crops allowed us to produce 12, 577 lbs of food crops which were distributed to address food and nutritional security in the Washington D.C area.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Health, Nutrition and Childhood Obesity Prevention

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	0%		40%	
723	Hazards to Human Health and Safety	0%		20%	
724	Healthy Lifestyle	100%		20%	
903	Communication, Education, and Information Delivery	0%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	1.9	0.0	1.2	0.0
Actual Volunteer	325.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
79569	0	50492	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
79569	0	50482	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
124638	0	200	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Changing the Health Trajectory for Older Adults through Effective Diet and Activity Modifications:

- 1) Examined nutritional barriers that prevent the consumption of fruits, vegetables, and whole grains.
- 2) Trained students in the development of a survey instrument, validation procedures, and uniform administration of survey instruments.
- 3) Conducted survey, reaching 96 participants.
- 4) Provided nutrition education to survey participants
- 5) PI and four research assistants published an article in the September 2018 edition of the American Journal of Undergraduate Research (AJUR), a peer reviewed journal designed to facilitate publication of undergraduate research.
- 6) Developed an informational brochure entitled "Final Report Nutritional State of Affairs."

Parental Practices Supporting Positive Eating Behaviors during Independent Eating Occasions

- 1) Project team developed and tested an individual interview data collection protocol, which was implemented across all states and the District of Columbia. Interviews were conducted with children and parents after the child took photos of all food and beverages consumed over a 24-hour period.
- 2) Results of the parent and child interviews were used to develop a series of survey items to address frequency of use of the practices identified from interviews and their associations with child intake.
- 3) Cognitive interviews were conducted with 10 parent/early adolescent dyads to assess comprehension and clarity of the items. Revisions were made to both surveys based on feedback from parents and children.
- 4) A manuscript entitled "Perceived parent practices to influence independent eating occasions among early adolescents: a qualitative study of low-income parents and children" was submitted to the Journal of Nutrition and Behavior and currently under review.

The Bodywise Program

The Bodywise Program continues to provide services to over 500 older adults in the District of Columbia, which means it supersedes the goal of 425 seniors served during the fiscal year. The Bodywise program offers classes in water aerobics, movement and chair exercise, low-impact aerobics and yoga across the District. A huge success for this fiscal year was collaborating with UDC Wellness Center to give all Bodywise participants free memberships to the Wellness Center on campus. The Bodywise Program continues to impact the lives of the senior population by promoting health, wellness, and fitness in the District of Columbia.

2. Brief description of the target audience

- 1) Adult men and women over the age of 65 who live in Metropolitan Washington, DC
- 2) DC Public School teachers
- 3) Students, grades Pre-K through 9
- 4) Children 2 -5 years of age
- 5) Pre-School/Headstart and Daycare teacher volunteers
- 6) Non-commercial agency staff members

- 7) Non-profits
- 8) Residential Homes
- 9) Overweight individuals and non overweight individuals from the same environment
- 10) Obese individuals and non obese individuals from the same environment
- 11) Low income seniors living in multi-family housing
- 12) Researchers/Biologists
- 13) Low-income adults who are responsible for planning and preparing the family's food with emphasis on households with young children
- 14) Low income youth
- 15) Non-commerical agency staff members
- 16) On-going participating food handlers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4465	2095	125	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Youth and adults will receive direct basic nutrition and food safety education

Year	Actual
2018	31799

Output #2

Output Measure

- Youth and adults will receive direct education on health issues and direct education and demonstration on physical activity

Year	Actual
2018	7233

Output #3

Output Measure

- Development of a manuscript for the publication of data on the mechanisms of action of g-T3 on MCF-7 breast cancer cells.
Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Employ microarray experiments and a range of cellular and molecular biological techniques to determine the molecular basis of the action of y-T3.
Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of articles published
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of fact sheets published
Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Number of newsletters published

Year	Actual
2018	2

Output #8

Output Measure

- Number of workshops implemented

Year	Actual
2018	14

Output #9

Output Measure

- Number of research projects completed
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of informational materials distributed

Year	Actual
2018	503

Output #11

Output Measure

- Number of certificate of completion issued
Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Number of conference presentations
Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of parent participants who make better food choices (fruits/vegetables).
2	Percentage of participants who improved eating habits.
3	Development of broad applications for the inhibition of breast cancer cell proliferation and possibly cell transformation
4	Number of participants who improved their dietary intake, including an increase in fruits and vegetables
5	Percentage of participants, who through information and interactive approaches, have adopted better eating habits thereby increasing their daily intake of fresh fruit and vegetables.
6	Participants indicating that they would use healthy fruit and vegetable recipes in an effort to improve their health.
7	Community Stakeholder engagement in physical fitness activity
8	Percentage of older adult participants who have gained knowledge and are better positioned to identify healthy eating choices.

Outcome #1

1. Outcome Measures

Percentage of parent participants who make better food choices (fruits/vegetables).

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7233

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the American College of Sports Medicine (ACSM), the District of Columbia was the third fittest city in the United States in 2018, down from the number one spot in 2016. The ACSM Fitness Index is a ranking of America's 100 largest cities. Cities with the highest scores are considered to have strong community fitness, a concept analogous to individuals having strong personal fitness. These cities also present with more strengths and resources that support healthy living and fewer challenges that hinder it. The District of Columbia Department of Parks and Recreation (DPR) provides numerous fitness classes. However, the classes are not geared to seniors with limited mobility. Additionally, seniors are interested in exercising during daylight hours and within their communities. Mayor Muriel E. Bowser has initiated many efforts to support a FitDC including Advisory Committee on Community use of Public Space, Commission on Out of School Time grants and Youth Outcomes, DC State Athletics Commission, Healthy Youth and School Commission, The Mayor's Council on Physical Fitness, health and Nutrition.

What has been done

The Bodywise sites included Wilson Aquatic Center (Ward 3), Takoma Aquatic Center (Ward 4), University of the District of Columbia (Ward 3), Allen House (Ward 7), SOME Senior Center @ Kuehner House (Ward 8), Phillip T. Johnson Senior Center (Ward 7), Overlook @ Oxon Hill (Ward 8), The View (Ward 5), and Arthur Capper (Ward 6).

The Bodywise Program has grown with 69 new members and several renewed memberships in all 8 wards. Bodywise has hosted in 9 different sites with an average of 71 fitness and health promotion classes monthly.

Results

The average of the unduplicated participation monthly was 231. The total Bodywise contacts were 6,152. Staff generated an additional 1081contacts for a total of 7,233 contacts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Percentage of participants who improved eating habits.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Development of broad applications for the inhibition of breast cancer cell proliferation and possibly cell transformation

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of participants who improved their dietary intake, including an increase in fruits and vegetables

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Percentage of participants, who through information and interactive approaches, have adopted better eating habits thereby increasing their daily intake of fresh fruit and vegetables.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	31799

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the U.S. Census Bureau, in 2014, the District of Columbia had 139,422 adults 55 and older and in 2017, there were approximately 149,269 adults 55 and over residing in the District. There was an increase of over 9,847 older adults in three years residing in the District. As a result of steady growth in the aging population nationally and locally, additional services and programs are necessary to address the growing needs among this population. Because individuals are living longer, additional resources are needed. Aging services and programs are resources that assist older adults to successfully age in place and stay connected in their communities. A program such as the Senior Companion Program is critical because it provides companionship to seniors who live alone. Without this program, seniors become isolated and neglected which in turns affect their overall health outcomes. Poor health outcomes place heavy financial burden on the healthcare system. The Senior Companion Volunteers can encourage their clients to seek preventative care such as attending regular physician and medical appointments and getting involved in programs that promotes health, wellness and fitness.

What has been done

The Senior Companion Program funded by the Corporation for National and Community Service continues to recruit, retain, and train thousands of senior volunteers 55 years and older living in the District of Columbia to serve other District citizens (approximately 3,800 annually) in their places of residence or at group facilities such as: senior housing buildings, senior centers and hospitals. The Respite Aide program provides health and wellness services in the Asian community is funded by the District of Columbia Office on Aging. These dedicated volunteers assist many frail elderly persons with health and wellness activities. Translation services are provided at all in-service trainings for the VIDA participants.

Results

The volunteers assisted with NBC 4 Health & Fitness Expo, Chevy Chase Community & Health Resource Fair, Department of Park and Recreation and DC Office on Aging Senior Fest, Mayor's Annual Senior Holiday Celebration, National Institute on Aging Fit4 Function, Go4Life Program, MLK Day of Service, Mayor Muriel Bowser's 7th Annual Senior Symposium, Ward 8 Older American Spring Celebration, and Fort Stanton Community Center. The volunteers contributed 9,560 volunteer hours in Ward 1; 6,692 in Ward 2, 4,780 in Ward 3, 4,780 in Ward 4, 12,428 in Ward 5, 7,648 in Ward 6, 17,208 in Ward 7, 5,736 in Ward 8 for a total of 68,832 volunteer hours generating 17,208 direct contacts. The 14-stipend senior Respite Aide volunteers contributed 1040 volunteer hours and generated 3,640 direct contacts to Asians and Pacific Islanders seniors who have not mastered the English language.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Participants indicating that they would use healthy fruit and vegetable recipes in an effort to improve their health.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	152

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Residents in food desert areas, such as Ward 8 of the District of Columbia, often have limited access to fresh produce and have higher incidence of nutrition related diseases.

What has been done

Workshop were provided at the Farmers Markets, providing tasty and healthy fruit and/or vegetable recipes that are easy to prepare. These recipes were distributed to participants in addition to nutrition education on the health benefits of recipe ingredients.

Results

93% of the participants indicated that they would prepare fruits and vegetables, according to the recipe given.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Community Stakeholder engagement in physical fitness activity

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7233

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the American College of Sports Medicine (ACSM), the District of Columbia was the third fittest city in the United States in 2018, down from the number one spot in 2016. The ACSM Fitness Index is a ranking of America's 100 largest cities. Cities with the highest scores are considered to have strong community fitness, a concept analogous to individuals having strong personal fitness. These cities also present with more strengths and resources that support healthy living and fewer challenges that hinder it. The District of Columbia Department of Parks and Recreation (DPR) provides numerous fitness classes. However, the classes are not geared to seniors with limited mobility. Additionally, seniors are interested in exercising during daylight hours and within their communities. Mayor Muriel E. Bowser has initiated many efforts to support a FitDC including Advisory Committee on Community use of Public Space, Commission on Out of School Time grants and Youth Outcomes, DC State Athletics Commission, Healthy Youth and School Commission, The Mayor's Council on Physical Fitness, health and Nutrition.

What has been done

The Bodywise sites included Wilson Aquatic Center (Ward 3), Takoma Aquatic Center (Ward 4), University of the District of Columbia (Ward 3), Allen House (Ward 7), SOME Senior Center @ Kuehner House (Ward 8), Phillip T. Johnson Senior Center (Ward 7), Overlook @ Oxon Hill (Ward 8), The View (Ward 5), and Arthur Capper (Ward 6).

The Bodywise Program has grown with 69 new members and several renewed memberships in all 8 wards. Bodywise has hosted in 9 different sites with an average of 71 fitness and health promotion classes monthly.

Results

The average of the unduplicated participation monthly was 231. The total Bodywise contacts were 6,152. Staff generated an additional 1081 contacts for a total of 7,233 contacts.

Participation in fitness activities for more than 7,000 community stakeholders in the District of Columbia will help residents with managing a healthier lifestyle. The benefits of exercise are varied to include: weight loss, assisting in stabilizing and lowering blood pressure and cholesterol levels, and assisting with maintaining good mental health/moods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Percentage of older adult participants who have gained knowledge and are better positioned to identify healthy eating choices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adults at midlife and older age comprise the fastest growing population segment in the U.S. Baby boomers, who make-up much of this population shift, have higher rates of obesity, chronic disease and disabilities than previous generations. Older adults are at higher risk of developing arthritis, sarcopenia, diabetes, hypertension, hypercholesterolemia, age-related muscular degeneration, and cardiovascular disease (CVD) than younger adults. These conditions that are associated with disabilities, compromise physical capacity and loss of independence but are preventable by diet or/and physical activity, providing the basis for the proposed work of this transdisciplinary team.

Adults make daily choices without being aware of how that seemingly, inconsequential decisions may impact their health. Numerous biological, environmental and behavioral risk factors influence an individual's daily health choices. To better understand the factors influencing age-related diseases and health-promotion in midlife and older adults, this multistate research project will examine: (1) environmental factors influencing the adoption of health-promoting lifestyle changes and (2) evaluation of lifestyle interventions that lead to measurable outcomes. The projects under each of these study areas, either directly or indirectly, address overweight/obesity and chronic disease reduction in midlife and older adults. The major goals of this project are to:

1. identify biomarkers of successful aging and the impact of diet/physical activity on these biomarkers throughout the life cycle;
2. examine the community environment, including its traditions, culture, and beliefs, and how it can be used to promote healthy eating and successful aging; and
3. examine the effectiveness of novel interventions in influencing/promoting the attainment of a healthy weight via increased fruits, vegetables, and grains intake and physical activity for successful aging.

What has been done

While three goals were identified under this multi-state research project, the research at the University of the District of Columbia focused on goal (2) examining the community environment, including its tradition, culture, attitudes, beliefs, and how it can be used to promote health eating and successful aging. More specifically, the researchers examined nutritional barriers that prevented the consumption of fruits, vegetables, and whole grains.

Results

During this reporting period, the results of this research showed that older Americans who lived in Wards, 5, 7, 8 in Washington, DC lacked knowledge of the importance of eating more fruits and vegetables. Many members of these communities identified unhealthy foods (processed foods high in sugars and salt) to be healthy and less able to identify foods that are considered healthy. The research assistants reached 96 older adults and provided nutritional education once the older adult completed the survey.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Family and Social Support)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

After administering a five question survey to 152 attendees of the Farmers' Market located in Ward 8, a food desert, in Washington, D.C. , 142 (93%) of the attendees responded yes to "After tasting this recipe, do you plan to make it at home?"

Seniors have reported feeling better, able to walk longer distances and weight loss. Seniors reported that Bodywise is an important service to the senior community. Bodywise is an important aspect of our fitness program.

During this reporting period, the results of this research showed that older Americans who lived in Wards, 5, 7, 8 in Washington, DC lacked knowledge of the importance of eating more fruits and vegetables. Many members of these communities identified unhealthy foods (processed foods high in sugars and salt) to be healthy and less able to identify foods that are considered healthy.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Urban Families, Youth, and Communities

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
806	Youth Development	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	2.0	0.0
Actual Paid	5.7	0.0	2.0	0.0
Actual Volunteer	511.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
155047	0	70871	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
155047	0	70871	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
124424	0	200	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- 1) Leadership Development Meetings
- 2) Woodworking Projects

- 3) Language Program - Spanish
- 4) Gardening Projects
- 5) Computer Labs
- 6) Water Quality and GIS Technology
- 7) Curriculum Development
- 8) Fact Sheets
- 9) Newsletters
- 10) High School Financial Planning Program
- 11) Videotape series
- 12) Community Business entry-level training

2. Brief description of the target audience

- 1) Youth
- 2) Adults
- 3) Seniors
- 4) Military Personnel
- 5) DC residents
- 6) College students
- 7) Ex-offenders
- 8) Low to moderate income residents
- 10) Low income families with youth in high risk communities
- 11) Small, new start, home based businesses

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4456	2095	11830	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	5	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants in parenting workshops.
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Conduct 15 sessions per year for junior and senior high schools in the District of Columbia on financial planning.
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Percent increase in the number of 4-H clubs throughout the city.

Year	Actual
2018	40

Output #4

Output Measure

- Youth will receive training in the areas of STEM education, and sewing, health and fitness, and camping.

Year	Actual
2018	11507

Output #5

Output Measure

- Youth will receive leadership development training through conferences and special programs.

Year	Actual
2018	197

Output #6

Output Measure

- Youth that are members of a military family will receive 4-H programming as members of the 4-

H program and as a separate group of military participants through the 4-H military partners program.

Year	Actual
2018	95

Output #7

Output Measure

- Number of youth participating in 4-H club activities that have a parent/s that is/are incarcerated.
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of articles published

Year	Actual
2018	5

Output #9

Output Measure

- Number of fact sheets published

Year	Actual
2018	5

Output #10

Output Measure

- Number of newsletters published
Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Number of workshops implemented

Year	Actual
2018	551

Output #12

Output Measure

- Number of research projects completed
Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of informational materials distributed

Year	Actual
2018	1795

Output #14

Output Measure

- Number of conference presentations

Year	Actual
2018	75

Output #15

Output Measure

- Number of certificate of completion
Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of children who have increased their knowledge of the essential elements of team work through participation in 4-H club activities.
2	Number of children who demonstrate responsibility as a result of participation in 4-H Program activities. participation.
3	Number of parenting workshop participants who have used their knowledge of support services available to apply for assistance in an effort to meet some of their parenting needs.
4	Number of Youth demonstrating an immediate and long-term commitment to civic engagement.

Outcome #1

1. Outcome Measures

Number of children who have increased their knowledge of the essential elements of team work through participation in 4-H club activities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	11704

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Parents in the Columbia Heights neighborhood reported concerns that youth were cutting school, behaving in a disrespectful manner and they were concerned about drugs or gang involvement if they did not find an intervention.

What has been done

UDC 4-H staff member Diego Lahaye began a partnership with the Columbia Heights Educational campus for three years to address this concern. The program has expanded to reach youth in 5 Wards from 13 different schools. The Center for 4-H and Youth Development provides volunteer and Advanced Youth Development training to adults and structural support to all program participants. Youth from schools across the District participate in this program free of charge to members. The program contributes to three of the University's goals, as set forth by the U.S. Department of Agriculture's National Institute of Food and Agriculture: combating childhood obesity, improving food safety, and improving food security. Teams are organized by gender and age, offering a high-quality soccer experience for both recreational and competitive players.

Our UDC 4-H Soccer program includes healthy eating workshops presented by the Center for Nutrition, Diet and Health for coaches and youth. Youth in the program are physically active daily as they practice and master the skills involved in becoming effective athletes. They often practice as a team late into the night during the summer. They play games during the week and on the weekends. They attend a summer camp overnight program where they are instructed in cooking healthy meals by Chef Herb Holden, from the Center for Nutrition, Diet and Health. Coaches attend training annually and during this reporting period two volunteers accompanied Diego Lahaye to the National Soccer Foundation training in Philadelphia, Pennsylvania. The conference provided an opportunity for participants to network, learn skill development techniques, and share our program with others from around the country.

More than 400 parents attend these games regularly.

Results

The coaches, volunteers, parents and 4-H staff have supported the youth in this 4-H program at every level. A UDC student has worked with Mr. Lahaye to track a reduction in teen violence in the neighborhood. There has been a steady decline in crime among teens since the beginning of the program in the neighborhood. Attendance has improved at school because more youth are involved in this community connected program. 100% of the youth report learning something they did not know about soccer and leadership. Annually, the groups select a player that shows the greatest level of leadership. 99.9% return to play in the soccer program another year. 80% of program participants have greater knowledge of better eating habits. Coaches report learning about and working with youth more effectively, and understanding nutritional needs of athletes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Number of children who demonstrate responsibility as a result of participation in 4-H Program activities. participation.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	235

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Youth in the District of Columbia need to have information on growing their own food in an urban setting, understanding organic and non organic garden and how to grow food in soil and soilless environments. Many schools in the city now have youth that are very interested in growing their own gardens and they are requesting our support to train the youth.

What has been done

During the last reporting period, 16 4-H volunteer leaders were trained. Six of which expressed an interest in working with youth to learn about gardening or environmental programs. Six new 4-H gardens were planted and children were provided information about how to plant and maintain their gardens. They visited the UDC Firebird Farm in Beltsville, MD for additional training about urban gardens, organic versus non-organic planting, aquaponics and hydroponics systems, the importance of green houses, ethnic gardens and a host of other topics.

Results

Three schools created a product from their planted gardens and sold them at the Rooting DC annual event and their school farmer's market.

100% of the children involved in planting projects reported feeling that their contribution to the school or community is a source of pride. 40% of the youth surveyed report eating better as a result of the experience they had in planting a school garden. 80% of the gardens have been maintained.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Number of parenting workshop participants who have used their knowledge of support services available to apply for assistance in an effort to meet some of their parenting needs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	234

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Youth serving organization need to have well trained staff in the area of youth development. Staff that use a universal language to discuss how services are delivered and how youth are managed around the city can impact positively the outcomes we provide for youth. This continuity of services is greatly needed.

What has been done

The Center for 4H & Youth Development at CAUSES provides the Advancing Youth Development (AYD) Curriculum for Youth Workers. This national training program and professional development curriculum is well established in the District of Columbia.

This training was delivered in addition to conventional 4-H Volunteer Leaders Training. The AYD curriculum was designed for the trainers of direct-service youth workers, especially those serving youth from high-risk situations. AYD introduces youth workers to the youth development approach and its implications for youth work. The course provides an overview of the Youth Development framework, which is a way to think about young people that focuses on their capacities, strengths, and developmental needs. AYD is consistent with the primary focus of 4-H which is to facilitate leadership within young people.

The curriculum comprises seven sessions, which build on one another and require a minimum of 12 hours total to complete, as described below.

Introduction to Youth Development:

Youth workers reflect on their own experience as youth, recognize the importance of youth work in the lives of young people, and learn some of the core concepts and language of youth development.

Developmental Youth Outcomes:

Youth workers define the goals they have for young people and young people have for themselves and learn strategies to help them get there by using the youth development approach.

Cultural Assumptions:

Youth workers identify the barriers that adults bring to their work with youth and identify alternative caring behaviors.

Core Competencies of Youth Workers:

Youth workers examine the key attributes, skills, and knowledge of an exemplary youth worker.

Opportunities and Supports:

Youth workers learn how best practice requires the engagement of youth in a wide array of opportunities, supports, and services.

Youth Participation:

Youth workers discuss the practices and policies of meaningful youth participation and ways to promote them in their programs.

Practice, Review, and Celebration:

Youth workers deepen their learning about youth development through practice and review.

In addition to the Advancing Youth Development Course for youth workers, the Center for 4-H & Youth Development have piloted at training for youth: AYD for Youth: Navigating Adult Relationships.

This training is another facet of the work of the Center for 4H & Youth Development. Additionally, the training helps build the capacity and sustainability of our community-based organizations and agencies as it deepens the workforce in the field of youth development. We have reached 234 adults during the program year with this training.

Results

Participants in the program report gaining an important reminder about best practices in reaching youth in their care. Participants in the training have advertised the program to other youth serving organizations resulting in new referrals for training.

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of Youth demonstrating an immediate and long-term commitment to civic engagement.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	419

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

College students in land grant majors need a greater connection to understanding the land grant system. Children in area schools need to improve eating habits, understand the need for regular exercise and understand the connection between illnesses and the food we consume.

What has been done

Dr. Michelle Harris partners with the Center for 4-H to allow a presentation about our nutrition education program. Nutrition and Dietetics students complete 4-H training and provide a minimum of six weeks of nutrition education training in the classroom setting. Mr. Diego Lahaye a 4-H Program Assistant coordinates the primary functions of the program. the 4-H Director provides a class session about the land grant system with emphasis on the Center for 4-H & Youth Development.

Results

80% of our Nutrition and Dietetics students report having a better understanding of the land grant system.

72% of Children in the program report having greater knowledge about healthy food choices.

The program has expanded by 50% in the number of youth served.

The school continues to request more programming.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Program Changes)

Brief Explanation

This program year we were using a new model for implementing our 4-H programs. In the new model two of the staff focused on training volunteers that work at other agencies. Only one team member worked on implementing and starting new 4-H clubs. We reduced the number of clubs we started and we will be using more resource volunteers to start new clubs in program year 2019. We had two managers for one staff person most of the program year. Mr. Diego Lahaye, a nine year veteran of the 4-H team continued to start and maintain 4-H clubs. Ms. Olivia Hart joined the team in March of 2018 and began to provide training for volunteers in the community with the Assistant 4-H Director.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The evaluations for the programs we implemented last year were very positive.

Adults taking the Advance Leadership Training have requested additional training and word is getting around that UDC 4-H is the place to come for staff training. Adults attending the training are impressed with the offerings and the surveys are very favorable.

Our UDC 4-H Soccer program has grown to include more than 10,000 youth contacts and we have more youth registered this program year. 90% of all of the surveys we administer come back extremely favorable. 90% of youth not graduating that are involved in the Soccer program return the next program year. Parents fill the stadium for every game.

We are ending our partnership with the National Consumer's league to begin a new youth competition that includes topics more specific to Urban Agriculture, and Food Systems.

Our UDC 4-H Nutrition Program continues to grow and offer opportunities to new college students and 4-H youth in our local schools. Our program evaluations from the program remain very positive.

We look forward to adding more new 4-H clubs this program year with new volunteers that are well trained and able to support our youth.

Key Items of Evaluation

For our volunteer training the adults already work with youth somewhere else in the city, so we wanted to know; What they expected from the training, what they felt they received that could help their work, how they will use what they learned in their work with youth they are serving, and what they would like to learn more about in the future.

For our gardening program we wanted to know, if the youth could identify which plants grow better in which season, how would they recognize water thirsty plants, how can they identify healthy soil before testing the soil, if they could name green fertilizers, what are the differences in organic vs non organic plants, as well as soil and soilless planting systems.

For our soccer program we wanted to see a reduction in crime in the community among youth. Would the program participants recommend the program to other youth, How did youth rate the improvement of their physical /fitness for the beginning of the program to the end of the season, what was their favorite part of the program and their least favorite part of the soccer program, how would they rate the leagues organization, what other comments would the youth want to add to their evaluation.

For our nutrition education program we needed to know if the children were improving their eating habits and fitness practices as a result of cooking demonstrations and their interactive activities with the college students. We wanted to know if they fully understood how to read food labels, look for hidden sugars and understand how they impact food choices for the family. We wanted to know that the college students fully understood the functions of the land grant programs in the community and that they are an important part of our service to the community. Dr. Harris had core a set of outcomes she expected for the class.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Alternative Energy and Capacity Building

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	50%		0%	
133	Pollution Prevention and Mitigation	25%		0%	
607	Consumer Economics	0%		34%	
608	Community Resource Planning and Development	0%		33%	
903	Communication, Education, and Information Delivery	25%		33%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	4.1	0.0	3.8	0.0
Actual Volunteer	409.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
144249	0	76573	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
144249	0	76573	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
99565	0	157039	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

To improve the management of buildings for increased energy efficiency, UDC continued to offer a 56-hour Green Building Operator's Certification to District building operators that led to an energy shift of in selected District operated facilities.

UDC offered 60 underemployed or unemployed District residents with a high school diploma or equivalent 106 hours in green infrastructure construction, inspection, and maintenance. 28 residents qualified for and passed the National Green Infrastructure Certification Exam.

2. Brief description of the target audience

DC Department of the Environment
 DC Department of Transportation
 DC Department of Public Works
 Researchers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2189	64790	214	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops completed

Year	Actual
2018	4

Output #2

Output Measure

- Number of fact sheets published
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of articles published
Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of informational material distributed

Year	Actual
2018	150

Output #5

Output Measure

- Number of conference presentations

Year	Actual
2018	12

Output #6

Output Measure

- Number of certificate of completion issued

Year	Actual
2018	67

Output #7

Output Measure

- Number of research projects completed

Year	Actual
2018	2

Output #8

Output Measure

- Number of newsletters published

Year	Actual
2018	12

Output #9

Output Measure

- Number of Training Courses leading to certification

Year	Actual
2018	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percent increase in renewable energy production use due to green infrastructure
2	Percent increase in water reuse and conservation due to green infrastructure
3	Percent increase in energy conservation due to green infrastructures

Outcome #1

1. Outcome Measures

Percent increase in renewable energy production use due to green infrastructure

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Human activities can negatively impact hydrological and chemical cycles, pollute air and water, degrade soil, reduce biodiversity, and affect energy use. Improving the energy efficiency of building is particularly important in the District of Columbia since the majority of emissions stem from building and not from mobile sources.

What has been done

To improve the management of buildings for increased energy efficiency, UDC continued to offer a 56-hour Green Building Operator's Certification to District building operators that led to an energy shift of in selected District operated facilities. 26 District Residents and DC government employees participated in the training.

Results

26 District Residents and DC government employees participated in the training. As a result of the documented improvements in building management, District taxpayers realized annual economic savings on energy use of over \$500,000.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Percent increase in water reuse and conservation due to green infrastructure

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The percentage increase in water reuse and conservation due to green infrastructure practices continues to reduce pressure on water use and water runoff management. As water reuse increases, the use of water released to the greywater system decreases. Regrettably, there are few qualified technicians in the District of Columbia who are trained to maintain green infrastructure installations that contribute to the reuse of water.

What has been done

UDC offered 60 underemployed or unemployed District residents with a high school diploma or equivalent 88 hours in green infrastructure construction, inspection, and maintenance. 32 residents qualified for and passed the National Green Infrastructure Certification Exam.

Results

Participants who successfully completed the National Green Infrastructure Certificate were placed into part or full-time employment opportunities in the green infrastructure industry. This initiative ultimately affects the quality of life of program participants and DC residents at large economically, socially, and environmentally.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Percent increase in energy conservation due to green infrastructures

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	26

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Human activities can negatively impact hydrological and chemical cycles, pollute air and water, degrade soil, reduce biodiversity, and affect energy use. Improving the energy efficiency of building is particularly important in the District of Columbia since the majority of emissions stem from building and not from mobile sources.

What has been done

To improve the management of buildings for increased energy efficiency, UDC continued to offer a 56-hour Green Building Operator's Certification to District building operators that led to an energy shift of in selected District operated facilities.

Results

26 District Residents and DC government employees participated in the training. As a result of the documented improvements in building management, District taxpayers realized annual economic savings on energy use of over \$500,000.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Respondents recorded an 88% change in knowledge in response to the training provided.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Water Safety and Water Management

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	4.1	0.0	3.8	0.0
Actual Volunteer	409.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
114249	0	76573	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
114249	0	76573	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
99565	0	157039	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Objective 1: To design and manufacture the metallic oxide nanoparticles infused mesoporous material.
Completed:

1. **Major activities completed:** The previous developed new synthesis method has been further improved and used to prepare more hybrid material for testing.
2. **Data collected:** Using the further improved method, we have synthesized over 3 times more samples during the same reporting period. These batches of the hybrid materials of different sizes of TiO₂ nanoparticles have been tested at UDC Environmental Quality Testing Laboratory using the state-of-the-art Inductively Couple Plasma-Mass Spectrometer (ICP-MS).

Objective 2: To characterize the microstructure and evaluate the pollutant removal performance of the synthesized material.

Completed:

1. **Major activities completed:** the capability and efficient of this hybrid material has been tested at UDC Environmental Quality Testing Laboratory using the state-of-the-art Inductively Couple Plasma-Mass Spectrometer (ICP-MS) following EPA standard procedures for heavy metals removal. The hybrid material was characterized using a Tescan XEIA Plasma Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) with Energy Dispersive X-Ray Spectrometry. To further quantify its porous structure, nitrogen adsorption experiments were carried out for all the hybrid mesoporous samples (MCM-48 infused with TiO₂) at 77 K on a Micromeritics™ ASAP 2020 Porosimeter.
2. **Data collected:** The newly prepared hybrid materials of different concentrations of nanoparticles have been repeatably tested and verified for heavy metal removal test following EPA standard procedure. The results have shown that this hybrid material is very effective in absorbing the heavy metals tested here (Pb, As, Cu, and Cd) with an efficiency above 95%. The size of the nanoparticle infused onto the mesoporous structure has a significant impact on the absorption efficiency. The material has also shown good filtration for organic dyes.

Objective 3: To design a stormwater collection and treatment system with synthesized material.

Completed:

1. **Major activities completed:** an improved design of the stormwater collection and treatment system has been developed and a prototype has been built and tested.
2. **Data collected:** an improved design of the stormwater collection and treatment system has been developed, which can be used to harvest and store stormwater from densely populated urban areas and use it to produce food at relatively low costs. This system consists of an expandable storage tank that has a minimum volume and occupied space of 15 cubic feet and can expand to a theoretical maximum volume of 40 cubic feet. The filtration system consists of a mechanical filtration with a filter size of 250 microns and a chemical filtration system with the mesoporous nanostructured material, MCM 48, to filter heavy metals and other pollutants.

Objective 4: To evaluate its performance, and optimize the design to reduce the cost and time-consumed of per-liter clean water processed.

Completed:

1. **Major activities completed:** the original stormwater collection and treatment system has been redesigned and optimized for a balance between space and efficiency.
2. **Data collected:** we have performed some preliminary testing and we are still working on to collect more data

2. Brief description of the target audience

- UDC Students

- UDC Faculty
- General Audiences (residents and professionals in the field of Natural Resources Management and Policy)

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2189	64790	214	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- System/Design Modification

Year	Actual
2018	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Design and manufacture the metallic oxide nanoparticles infused mesoporous material.

Outcome #1

1. Outcome Measures

Design and manufacture the metallic oxide nanoparticles infused mesoporous material.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the last decade, researchers from universities and nongovernmental organizations, as well as industry consultants, have proposed new techniques and methodologies to remedy wastewater which include using micro/nanostructured membrane/filtration, nanoparticle catalytic, and chemical reaction, etc. However, these methods often times are inapplicable for urban agriculture farm or household, because the cost of the system and requirement of post processing are usually time-consuming and expensive. This project will address this issue by the design and development of a novel stormwater collection and treatment system which can harvest and store stormwater from densely populated urban areas and use it to produce food at relatively low costs. This will reduce food miles (carbon emissions) and virtual water consumption and serves to highlight the need for more sustainable land-use planning.

The broader goal is to assist in exploring an efficient and cost effective way to improve regional and global food security, create local capacity and improve social, economic and environmental condition of people and organizations in the District of Columbia through integrating research, teaching and community service in this project. This project will be accomplished through two tasks: 1) Storm water Treatment Material preparations; and 2) Storm water collection and treatment system design and development.

The previous developed new synthesis method has been further improved and used to prepare more hybrid material for testing.

What has been done

The previous developed new synthesis method has been further improved and used to prepare more hybrid material for testing. Using the further improved method, we have synthesized over 3

times more samples during the same reporting period. These batches of the hybrid materials of different sizes of TiO₂ nanoparticles have been tested at UDC Environmental Quality Testing Laboratory using the state-of-the-art Inductively Couple Plasma-Mass Spectrometer (ICP-MS).

Results

The data collected has shown that this new method can provide an improved efficiency and reduced cost. More importantly, an over 95% adsorption efficiency for trace metals for the hybrid MCM-48 with TiO₂ materials, and a significantly improved maximum adsorption capacity compared to pure MCM-48 has been observed experimentally. This finding has been presented at two national conferences and received wide interests. Currently, a manuscript submitted to a peer-reviewed journal is under review.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water

V(H). Planned Program (External Factors)

External factors which affected outcomes

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

So far, we have been able to accomplish all planned objectives, and we will continue to perfect this novel method by further testing and optimization of the stormwater collection and treatment system. We are also interested in exploring its capacity in removing new containments including pharmaceutical containments and will continue to look for places that can allow us to evaluate its performance. The results will be further disseminated to the targeted audience through various outreach activities, including publication, demonstration and workshop.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		50%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	100%		25%	
903	Communication, Education, and Information Delivery	0%		25%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	4.0	0.0
Actual Paid	1.9	0.0	1.2	0.0
Actual Volunteer	325.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
79569	0	50492	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
70569	0	50492	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
124638	0	200	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Certified Professional Food Manager (CPFM) Course is designed to get those who work in food service or those who serve food to the public; certified to do so. It is a three-day, 16-hour course that teaches students how to keep food safe during prep, cooking, and service. Upon completion of the course and individual sits for the national exam and upon passing allows the individual to handle food for the public. It also stresses the importance of hygiene, correct procedures, facility cleanliness and maintenance, and pest management to reduce the number of food hazards and food borne illness. The ServSafe Food Handler course is a one-day online course. Participants learn the basics of food safety for home use and receive a Certificate of Completion. However, it does not lead to certification and individuals are not qualified to handle food in a food serving facility for the public.

The CPFM course was taught seven times in two different locations. University of the District of Columbia (4200 Connecticut Ave NW Washington DC 20008) and the Washington English Center (2200 California Street NW Washington DC 20008).

The ServSafe course was taught six times in four different locations including City Blossoms (516 Kennedy Street NW Washington DC, 20011), Bethel Christian Fellowship Church (2200 Martin Luther King Jr Ave SE Washington DC, 20020), Hopkins Housing Complex, (1430 L Street SE Washington DC, 20003), and Community College Preparatory Academy (2405 Martin Luther King Jr Ave SE Washington DC, 20020).

Other activities included pretest, post test, national examination, DC Code examination, data collection, data analysis and reporting results.

Research activities for Pesticide residue on Fruit and Vegetables from Farmers Markets and Community Gardens in Washington, DC:

Tested and implemented pesticide testing methods at UDC's Environmental Quality Testing Laboratory using Gas Chromatograph Mass Spectrophotometer; three environmental scientists were trained in state-of-the-art analytical methods pertaining to testing pesticide residue and semi-volatile organic compounds in fruit and vegetables using advanced analytical technologies; four MS thesis students majoring in nutrition and dietetics were trained in sample preparation and sample analysis in fruit and vegetables using advanced analytical technologies.

During this study, we launched further research to assess the effect of washing, peeling and other household food preparation techniques on the levels of pesticide residue on fruit and vegetables.

2. Brief description of the target audience

There were 285 individuals who registered to take the CPFM course during the fiscal year, 201 of whom were female and 69 were male, and 15 reported as "other." Most of participants were African American (141), there were also 42 who reported as Caucasian, 36 who reported as Asian. There were 66 who did not report their race. Ages ranged from as young as 18, all the way to 73. 57 of the students were aged 18-29. 69 fell between the ages of 30-39, 57 from 40-49, 42 participants were between the ages of 50-59, 18 of the participants were between the ages of 60-100 and 42 students did not report their age.

There were 70 participants who registered to take the ServSafe online course during the fiscal year. Fifty-nine of the 70 participants reported their race as Black, 2 as Caucasian, and 3 as Asian. One student reported their race as "two or more," while four students reported as "other." There was one student who did not report their race. Nine of the participants were male and 54 of the participants were female. Seven of the participants marked "other" in response to gender.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4465	2095	125	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Classroom instruction/workshops on Food Handler Certification Regulations to include DC Code Examination or Serve Safe National Examination, and Practice Examinations

Year	Actual
2018	13

Output #2

Output Measure

- Number of articles published
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of fact sheets published

Year	Actual
2018	21

Output #4

Output Measure

- Number of newsletters published

Year	Actual
2018	2

Output #5

Output Measure

- Number of workshops implemented

Year	Actual
2018	13

Output #6

Output Measure

- Number of research projects completed

Year	Actual
2018	0

Output #7

Output Measure

- Number of informational materials distributed

Year	Actual
2018	2100

Output #8

Output Measure

- Number of conference presentations

Year	Actual
2018	0

Output #9

Output Measure

- Number of certificate of completion

Year	Actual
2018	355

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage decrease in the risk of factors of foodborne illness.
2	Number of participants gaining awareness, knowledge and skills in Food Handling techniques.
3	Number of participants scoring a required minimum of 70% on post test and national examination.
4	Pesticide testing for residue in fruit and vegetables from samples taken from Farmers Markets and main supermarkets in the District of Columbia

Outcome #1

1. Outcome Measures

Percentage decrease in the risk of factors of foodborne illness.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	355

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Center for Disease Control and Prevention estimates that 48 million people get infected with a foodborne illness each year. 128,000 of those need hospitalization and 3,000 of those die each year to foodborne illness. Burden of Foodborne Illness: Findings (2015) Retrieved from <https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>.

What has been done

A comparison of the past two years shows improvements in scores:

FY 16: Pretest - 60; Posttest - 89; National Exam - 85
FY 17: Pretest - 66; Posttest - 90; National Exam - 75
FY 18: Pretest - 66; Posttest - 93; National Exam - 78

Results

Eighty-seven percent(87%) of students who took the CPFM course, passed their national exam and became Certified Professional Food Managers. One- hundred percent (100%) of the ServSafe participants passed the online ServSafe course. However, participants were allowed to repeat the course twice to achieve a pass score.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of participants gaining awareness, knowledge and skills in Food Handling techniques.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of participants scoring a required minimum of 70% on post test and national examination.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	355

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The CDC estimates that 48 million people get infected with a foodborne illness each year. 128,000 of those need hospitalization and 3,000 of those die each year to foodborne illness. Burden of Foodborne Illness: Findings (2015) Retrieved from <https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>.

What has been done

The 13% participants who did not pass the CPFM course were invited to retake the course.

Results

87% of 285 participants who took the CPFM course passed the national examination and 100% of the ServSafe participants passed the online course and received a Certificate of Completion.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Pesticide testing for residue in fruit and vegetables from samples taken from Farmers Markets and main supermarkets in the District of Columbia

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	79

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adequate daily intakes of fruits and vegetables (FV) is recommended as part of healthy eating practices, however daily consumption of FV with elevated pesticide residues poses risk to human health. Organically produced foods are very small part of the total food sales in US, only 4%, and 96% of our food supplied by the traditional farming that may use pesticides such as herbicides, insecticides or fungicides. Pesticides are applied to improve the quality and quantity of FV. Pesticide residue in FV is among many biological and chemical food contaminants that are of concern when addressing food safety in the ever-increasing demand for food security locally as well as globally. According to World's Food organization, food contaminated with harmful biological and chemical substances is responsible for 200 diseases, ranging from diarrhea to cancers. According to USEPA, the pesticide residue exceeding EPA tolerance levels in food in the U.S. between 1994 and 2014 is low, but indicates an increasing trend. The trend shows that there is a need for continued monitoring for pesticide residue in the fresh produces.

What has been done

The main objectives of this research project were three-fold: 1) to assess the level of pesticide residue on fruit and vegetables (FV) purchased from main supermarket and local farmers markets; (2) to determine the difference between organic and non-organic FV purchased from the main supermarkets; and (3) to establish a pesticide residue testing program at UDC. During this study, we tested and implemented pesticide testing methods at UDC's Environmental Quality Testing Laboratory using Gas Chromatograph Mass Spectrophotometer. UDC now can test pesticide residue in the environmental samples such as fruits, vegetables, water and soil. Based on the USDA's pesticide data program (USDA, 2015), we selected five types of fruit and vegetables that were known to have detectable pesticide residues, including tomato, potato, strawberry, nectarine, apple and lettuce. We collected 79 samples of fruit and vegetables from five main supermarkets (48 samples) located in five DC Wards (1,2,3,5,6 and 8) and eight local farmers markets (31 samples) from all eight wards of the District of Columbia. The samples were

analyzed for 138 types of pesticide residues, including 39 fungicides, 52 herbicides, 38 insecticides, 4 pesticide metabolites, 1 plant growth, and 1 repellent. Samples from the main supermarket included 15 samples from organic farming and 33 samples from traditional farming. Samples from the farmers market included all 31 samples from the local farmers markets. All samples were extracted using QuEChERS and analyzed using Gas Chromatography Mass Spectrophotometry (GC-MS).

Results

The results showed that all samples from the main supermarket had at least one detectable pesticide residue; 50% of the collected samples exceeded the EPA tolerance limit in four or more pesticide residues; and 65% samples exceeded the EPA tolerance limit in one or more pesticides. The most frequently detected pesticides include tetrahydrophthalimide and thiabendazole. All samples from the farmers market had four or more detectable pesticide residues that exceeded the EPA tolerance limit. This is an interesting finding and needs further studies as locally produced fresh produce are expected to have no or lower pesticide residues. The market basket samples from the farmers market showed more percentage of samples that exceeded the EPA tolerance limits than the samples from the main supermarket. The most frequently detected pesticide in apples, nectarines and potatoes was Chlorfenapyr. This compound is an insecticide which exceeded the EPA tolerance limit in our study, as well as in the USDA pesticide monitoring program reported in 2014 through 2017. The results showed that at least one tested pesticide was detected in both organic and non-organic fruits and vegetables purchased from the main supermarkets. The detected level of pesticide residue exceeded the EPA tolerance limit in lettuce, potatoes, and tomatoes.

This study indicates that there was a detectable amount of pesticide residue on both organic and conventional fruits and vegetables. Based on samples collected from main supermarkets, 57% of tested samples were well below the EPA tolerance level while 43% were above the EPA level. There was no significant difference between organic and non-organic except in apple. Further studies are needed to quantify more pesticide compounds in greater food commodity samples. It should also be noted that purchasing organic fruit and vegetables may not ensure non detectable pesticide residues due to the fact that the sample may get contaminated with pesticides at any stage between farm and plate. To reduce human exposure to higher levels of pesticide residue through fruit and vegetable intake, looking into the effect of household food preparation on the levels of pesticide residue is crucial. During this reporting period, we launched further research to assess the effect of washing, peeling and other household food preparation techniques on the levels of pesticide residue on fruit and vegetables.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Eighty-seven percent(87%) of students who took the CPFM course, passed their national exam and became Certified Professional Food Managers. One- hundred percent (100%) of the ServSafe participants passed the online ServSafe course. However, participants were allowed to repeat the course twice to achieve a pass score.

All samples from the farmers market had four or more detectable pesticide residues that exceeded the EPA tolerance limit. This is an interesting finding and needs further studies as locally produced fresh produce are expected to have no or lower pesticide residues.

Further studies are needed to quantify more pesticide compounds in greater food commodity samples. It should also be noted that purchasing organic fruit and vegetables may not ensure non detectable pesticide residues due to the fact that the sample may get contaminated with pesticides at any stage between farm and plate. To reduce human exposure to higher levels of pesticide residue through fruit and vegetable intake, looking into the effect of household food preparation on the levels of pesticide residue is crucial. During this reporting period, we launched further research to assess the effect of washing, peeling and other household food preparation techniques on the levels of pesticide residue on fruit and vegetables.

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
600	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes with climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.