

## **UAB Grand Challenge Concept Paper**

**Name of the UAB Grand Challenge:** Vertical Gardens to Address Urban Food Deserts

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**Description of the Problem to be Addressed, including its importance to the State of Alabama and how it is generalizable to other states, the U.S., and the world:**

The Centers for Disease Control and Prevention (CDC) MMWR 2013 states persons age of 2 years old and older should increase intake of fruits and vegetables, as increasing nutrient-rich foods may decrease chronic disease risk (heart disease, stroke, diabetes, etc.). A relationship exists between access to healthier foods and overall healthier diets, and lower-income, minority communities typically have less access to fresh fruits and vegetables and increased negative health outcomes [U.S. Department of Health and Human Services, 2013]. Based on the non-thesis report of University of Alabama at Birmingham graduate student (Ashlyn Manzella) using the 2010 census data, approximately 70 percent of Birmingham, Alabama, ZIP codes are located in low-income, low-access areas (food deserts/food insecure). Over 289,000 Birmingham residents are impacted by these conditions, and the area's racial breakdown is 65% African-American, 30% white, and 5% other. Encouraging healthier eating habits and providing those with limited access to fresh fruits and vegetables, such as community gardens and farm stands, is an important way to reduce risks of chronic diseases due to poor diets in these low-access areas.

Additionally, potable water has become an expensive commodity in Jefferson County, Alabama, and other areas in the United States of America due to poor infrastructure and requirements to sequester heavy metals and other toxic chemicals from wastewaters, as these toxins comprise a major public health threat. Many water treatment facilities and infrastructure, water lines, and sewer lines are in dire need of updates or replacement, but the costs for these improvements are extremely high. In Jefferson County, Alabama, the cost for sewerage is double the cost of potable water resulting from several years of mismanagement of funds and infrastructure. Further, the cost to treat contaminated water is on the rise as pollutants are continually being discharged into potable water supply waterways. As the role of the Environmental Protection Agency (EPA) is diminished, the increase of pollutants can be expected to rise and the cost for treatment will likewise rise.

Due to the public health risks associated with heavy metals and toxic chemicals in wastewater and the lack of availability of fresh fruits and vegetables in urban and rural areas, especially economically challenged populations, a solution to combat these issues exists. One way to reduce food insecurity is to create urban and community gardens. However, urban and community gardens require significant space and potable water to provide enough food to impact healthy food access for an entire community. Vertical gardens offer a solution for providing fruits and vegetables while reducing the need for land space and potentially water resources. Vertical gardens increase the productivity yield while minimizing the areal square footage for growing gardens while providing ample food if designed correctly.

Vertical gardening/farming is a method of producing crops (fruits and vegetables) vertically (into the air). This means that the gardens occupy significantly less space than traditional gardens

and farms. Vertical farming is credited to Dickson Despommier, a professor of ecology at Columbia University, who came up with the idea of taking urban rooftop gardens a step further, creating vertical gardening “towers” in buildings that would allow all of a building’s floors (not just the rooftop) to be used to produce crops.

This grand challenge project seeks to define guidelines for producing high-nutrient valued plants using sustainable urban and vertical farming techniques in urban areas such as the greater metropolitan Birmingham area. It is suspected that if local water sources, such as roof runoff and pond/lake water, can be used without the addition of fertilizers and pre-treatment chemicals, fruits and vegetables can be grown sustainably. This research seeks to reduce soil, water, and energy requirements for growing healthy foods for consumption while increasing the viability of these techniques in meeting nutritional needs.

Vertical gardening techniques to be examined in this project include tower gardens (a hydroponic/aeroponic gardening system employing no soil), raised bed gardens, pallet gardens, and pyramid gardens. For each gardening system, the study will address irrigation requirements, germination times, maturation times, plant yields, and biomass production, as well and the cost-effectiveness of such an approach.

Advantages cited for the use of vertical gardening techniques include: year-round crop production, can be made weather-proof, use significantly less water irrigation, less food spoilage, cleaner air, reduced clutter, take up significantly less space, provide increased accessibility to fruits and vegetables, provides the ability to grow more plants, can obtain higher crop yields, reduces the impact of an urban environment, and offers enhanced visual appeal and aesthetics.

Potential limitations include: limited growing space; planters dry out quickly; can be expensive, potentially can be messy; watering and drainage can be a problem; and requires basic education on design and use.

### **Desired Outcomes and the Conceptualization of the Plan of Work to Achieve Them:**

This project will put UAB at the forefront of vertical gardening techniques, offering low-cost alternatives to obtaining healthy foods in food insecure areas, particularly in an urban setting. This approach can be used and implemented at other urban sister cities, such as Memphis, TN and Atlanta, GA. It is expected by providing fresh produce and healthy food preparation advice to those in all socioeconomic statuses, Birmingham will reduce its incidences of cardiovascular disease and other health issues related to a diet devoid of nutrients.

This Grand Challenge project will further tie in with the Food/Water/Energy Nexus research issues. The **water, energy and food (WEF) nexus** means that the three sectors — **water** security, **energy** security and **food** security — are inextricably linked and that actions in one area more often than not have impacts in one or both of the others. The water-food-energy nexus is central to sustainable development. Demand for all three is increasing, driven by a rising global population, rapid urbanization, changing diets and economic growth. Agriculture is the largest consumer of the world’s freshwater resources, and more than one-quarter of the energy used globally is expended on food production and supply. The inextricable linkages between these critical domains require a suitably integrated approach to ensuring water and food security, and sustainable agriculture and energy production worldwide.

## **List of Potential Team Members (individuals and organizations) from inside and outside**

### **UAB:**

#### Individuals:

Dr. Michelle Fanucchi, Environmental Health Sciences, School of Public Health  
Dr. Fouad H. Fouad; Director, Sustainable Smart Cities Research Center (SSCRC)  
Dr. Mona Fouad; Senior Associate Dean, Preventive Medicine  
Dr. David Hagan; UAB Occupational Health and Safety  
Dr. Lyle Hytes; School of Health Professions  
Dr. Karolina Mukhtar; Department of Biology  
Dr. Tonya Perry; Director, Center for Urban Education  
Dr. Julie Price; Director/UAB Office of Sustainability  
Dr. Hessam Taherian, Department of Mechanical Engineering  
Dr. Stephen A. Watts; Department of Biology  
Mr. Rip Weaver, Executive Director, Aldridge Gardens  
Mr. Matthew Winslett, Director of Utilities Management at UAB  
Ms. Ashlyn Manzella, Doctoral Student, Department of Civil, Construction & Environmental Engineering

#### Internal Organizations:

UAB Blazer Kitchen  
UAB Center for Urban Education  
UAB Department of Biology  
UAB School of Engineering  
UAB Occupation Health & Safety (OHS)  
UAB Office of Sustainability  
UAB School of Health Professions  
UAB School of Public Health  
UAN Honors College

#### External Organizations:

Aldridge Gardens (Rip Weaver; Executive Director); Hoover, AL  
City of Birmingham and other municipalities i.e. Parks  
Birmingham Housing Authority  
Catholic Diocese of Birmingham and other religious organizations  
Jefferson County Department of Health (JCDH)  
Jefferson County Coalition for Health Equity (Monica Baskin, UAB Preventative Health)  
Shape Birmingham  
Health Action Partnership  
Innovate Bham  
Gulf States Health Policy Council  
Regional Planning Commission of Greater Birmingham (Mikhail Alert)  
Schweitzer Fellowship Boggs  
United Way's Bold Goals Coalition  
Southern Research Institute (Bill Greiko)  
Community Food Bank  
U.S. Department of Agriculture  
U.S. Department of Energy (DOE)  
U.S. Geological Survey (USGS)