

## Opportunities with USDA

### Poster Abstracts

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#### 1. Possible Role of Invasive Mongoose in Sustaining Cattle Fever Tick Populations in Puerto Rico

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Since cattle diseases can affect farming operations, and compromise food safety, it is crucial to monitor and manage them. . *Bovine babesiosis* is a tick-borne disease caused by the pathogen *Babesia* (*B. bovis*, *B. bigemina*, and *B. divergens*) transmitted primarily by *Rhipicephalus (Boophilus) microplus* (Southern Cattle Tick) . *Babesia* causes severe morbidity and mortality in cattle; hindering cattle development, cattle sustainability and economic growth of areas that depend on cattle ranching. Puerto Rico currently suffers from a babesiosis outbreak where current management practices have been ineffective. Present efforts are being focused to manage the tick vector. This island has no native land mammals but an ubiquitous introduced small carnivore (Small Indian Mongoose, *Herpestes javanicus*) might be sustaining tick populations. Preliminary data was collected to provide insight on a possible host-ectoparasite relationship between the mongoose and the ticks. Mongoose were trapped and fitted with radio telemetry collars to ascertain locality of mongoose in regards to cattle pastures. Mongoose were recaptured and thoroughly checked for ticks to determine their role as a potential host.

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#### 2. Big Data Analytics for Designing Zero Carbon Production-Distribution Networks

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This project aims to design a net-zero carbon manufacturing-distribution system via onsite renewables generation. In particular, local wind turbines and solar photovoltaic systems are interconnected with the main grid through the net metering scheme. A net-zero carbon emission target is attained as long as the sum of renewables throughput and the consumption is balanced across a year. A data pool consisting of 10-year weather information from ten cities in the world are collected to verify and validate the proposed onsite renewable generation system. Monte Carlo simulation and big data analytics are employed to estimate the hourly and monthly energy throughput taking into account the power intermittency. Excel solver and Matlab program search for the optimum production schedule and the best sizing of renewable generators. The results show that virtually any manufacturing facility around the world can be powered with onsite wind and solar energy at an affordable cost provided the wind speed is above 5 m/s or the PV installation cost is reduced by 50 percent.

**Keywords:** Sustainable manufacturing, carbon savings, big data intelligence, simulation, distributed energy resource.

### **3. Powering High-Tech Manufacturing Facilities using Renewable Electricity**

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In this research, simulation and optimization models are applied for designing distributed and renewable energy systems, the paradigm for producing electricity through solar photovoltaics and wind turbines. Distributed generation (DG) can be integrated into high technology manufacturing facility, particularly in semiconductor wafer fabs, seeking to reduce electricity bills and carbon footprints. The simulation and optimization model presented represents the DG power generation, taking into consideration weather uncertainty, the day of the year, and the hour of the day, and also simulates the hourly load of the wafer fab. The simulation model then determines if it has to either compute the cost of hauling energy from the utility grid, due to the deficiency of power from the DG system, or compute revenue for selling renewable energy to the utility company, due to surplus power from DG systems. Finally the simulation model computes and outputs the total cost and the loss-of-load probability of the DG system. To facilitate the input of parameters into the simulation model, we developed a user interface using Microsoft Excel, R statistical software, and RExcel. The purpose of RExcel is to transfer the input parameters from Excel to R, run the simulation code, and return the output data to Excel. A case study will be presented to demonstrate the effects of carbon credits, capital investment, and the utility rate on the net present value and payback period of the DG system.

### **4. Towards Net-Zero Carbon Manufacturing Operation: An Analytics Design**

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The manufacturing industry is undergoing a radical paradigm change, gearing towards green and sustainable operations. It is anticipated that by 2030 the majority of world-wide large industry facilities will be powered by 20-40% renewable energy. However, quantitative studies on energy reliability and return-on-investment are still rare in literature. This project aims to answer the follow question: How to design a cost-effective, onsite renewable energy system to realize net-zero carbon industrial facility? A key criterion to assess the manufacturing sustainability is called green energy coefficient (GEC). It measures the percentage of renewable energy used in a production system. We design and operate a carbon neutral distributed generation system by attaining 100% GEC goal via onsite wind turbine (WT) and solar photovoltaic (PV) power.

### **5. Design and Use of BGREEN “Farm in a Box” to Produce Vegetables in South Central Texas**

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BGREEN Farm in a Box is an enclosed energy efficient, small scale garden that is friendly to the environment and sustainable vegetable production. It was used in this project to produce okra, corn, tomatoes and bell peppers. Picking vegetables that people consume in a home-culinary setting was important for this project along with the hope that low income families would be able to harvest enough vegetables to provide a supplemental income, and self-satisfaction to contribute to financially burdened communities. Vegetables produced through this research project were selected on factors that were

applicable to both productivity and sustainability. Treatments consisted of a control, mycorrhizae supplementation, and micro irrigation usage. Evaluation of the project was based on the following variables: cost of the construction materials for “Farm in a Box”; cost of seed and disposable supplies; quantity of vegetables produced; quality of vegetables produced; and growth yield comparison of vegetables.

## **6. The Effects of Herbicides on *Arundodonax L.* and the Effects of Insecticides on *Amblyomma Americanum*, *Dermacentor Albipictus*, *Stomoxys Calcitrans*, *Haematobia Irritans*: A Summer Internship Experience**

**Elizabeth Gomez\***<sup>1</sup>, Margarita Barco<sup>1</sup>, Douglas Morrish<sup>1</sup>  
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During an internship in the summer with the Agriculture Research Services, a study and different bioassays were conducted. In the study two experiments were performed on the Giant Reed (*Arundo donax L.*) which is a perennial with a bamboo like stem and corn like leaves. It is an invasive, constricts vegetation, and its concentration is growing at an uncontrollable speed. The objective of this study was to determine which of the two herbicides, Burnout II and Worry Free, would have a greater affect in the extermination of the Giant Reed. One experiment consisted of the shoots of the Giant Reed in a tube containing a mixture of water and either herbicide solution. In the other experiment the shoots were placed in cups filled with soil and a mixture of water and either herbicide solution. Both experiments were observed for the growth of shoots, buds, and roots of each herbicide that was tested at different concentrations. The purpose of the bioassays was to assist in the collection of data to determine if Lone Star Ticks (*Amblyomma americanum*), Winter Ticks (*Dermacentor albipictus*), Stable Flies (*Stomoxys calcitrans*), and Horn Flies (*Haematobia irritans*) would repel from different insecticides. The insecticides used in the bioassays included Azasol, Neemix, and Orange Guard. Conducting the study and performing different bioassays has given the opportunity to gain experience in a laboratory setting, new knowledge of botany and entomology, and learning the importance of different aspects of agriculture in today’s world.

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## **7. Effects of Humidity and Temperature on Screwworms in Panama: A Summer Internship Experience**

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Humidity and temperature are two factors that correlate significantly in screwworm growth and development. Screwworms are sensitive to the condition and environment within the host. Research was conducted in Pacora, Panama and included the detection of humidity and temperature, data collection and assimilation of the data using Microsoft Excel. On a daily basis screw worm diet was prepared, placed and put onto eight racks consisting of 22 trays. The researcher placed a specific sensor (Hobo or Log Tag) onto the racks so it could detect humidity and temperature every 15 minutes. Once the sensor was placed onto the racks they were moved by production workers to a room held at 39 degrees Celsius for 29 hours. Next, the racks were moved to a room with a reduced temperature for another 24 hours. The racks

were then held for 72 hours at an 18 degrees Celsius temperature. Each day the researcher would collect sensors, download data onto a computer, and place them in folders corresponding to the numbers on sensors ranging from 1-88. The researcher took the data collected, separated the different room numbers, took specific range of numbers, and created new excel sheets for each room. The data was not analyzed but, it provided clarity to the Screwworm Eradication Program through the Agricultural Research Service. As a student at Texas State University, I am confident this internship has helped me sharpen my skills to becoming a proficient Animal Scientist.

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## **8. Floating Garden Beds**

Marcella I. Juarez, Marissa A. Cervantes, Charles B. Hoitt, Sarah P. Martinez, and C. R. Richardson  
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The floating garden beds that we will be building as a part of the USDA BGREEN project will be a modern take on the 'chinampas' that were utilized by ancient Aztecs as a method of agriculture. These chinampas were man made 'islands' built on top of fresh water lakes. These islands were built using layers of vegetation, dirt, and mud, which would later decompose and fertilize the soil with the moisture provided by the lake. This method eliminated the need for fertilization application and irrigation systems and the roots grew directly into the water. These floating gardens allowed utilization of otherwise unused water surface for food production and supported a very intense and productive form of cultivation. We will attempt to recreate these chinampas into a more modern, affordable, and accessible way using floating garden beds and look at plant growth, health, and yield when compared to traditional raise bed gardening. We will be looking to see if this modern take on an ancient growing method could allow farmers to utilize land covered by bodies of water, to allow farmers to grow plants that they would otherwise be unable to grow due to pests, and see if these floating garden beds are a competitive method of growing today.

## **9. Inoculation: Medical Break Through or Agricultural Break Through?**

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Inoculation is a commonly used method of prevention of disease in the medical field all around the world. Inoculation can also be termed as a vaccination or an injection of a virus into a subject, usually a human, when dealing with infectious diseases such as the flu or even small pox. Researchers have been studying inoculation for hundreds of years now, but is there another use for inoculation other than for medicinal purposes? This work-in-progress will focus on the use of inoculation to infect tomato plants with the Rhizobium nodules of a mesquite tree. Research suggests that nodules have a symbiotic relationship with the mesquite tree and can be found in the roots. Through the process of nitrogen fixation the mesquite tree is able to absorb nitrogen from the atmosphere and redistribute it back into the soil. By creating a virus from the mesquite roots, we can inject the tomato plant causing an infection of nodule microbes. Tomato plants are not able to produce their own nitrogen; once the infection is complete the tomatoes will be able to absorb nitrogen from the atmosphere and spread it throughout the soil acting as its own fertilizer. This study provides information and discussion about local Texas soil as well as using inoculation to benefit the production of common crops that can be grown by families in their own backyard.

## **10. The Next Generation of Water Sustainability**

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Water sustainability is very important and the next generation of methods offers opportunities to improve sustainability. What will be accomplished using this next generation concept:

- Being able to pump water in areas where electricity and gasoline are not an option
- Being able to buy equipment parts at local hardware stores
- Self-assembly
- Improved sustainable water availability

## **11. Small Scale Demonstration and Benefits of Producing Vegetables in BGREEN Boxes**

Manuel E. Juarez, Marissa A. Cervantes, Charles B. Hoitt, Sarah P. Martinez, and C. R. Richardson  
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At our research site for the USDA project BGREEN, we will be planting, cultivating and harvesting the three sisters, the three main agricultural crops of the Native Americas: corn, beans, and squash. The Native Americans before us discovered that these three crops greatly benefit and help each other thrive. The stalk of corn, or maize, provides a natural “pole” structure for the beans to climb on as they grow. The beans, as legumes, provide nitrogen to the soil that the corn and squash utilize. Lastly, the leaves of the squash plant spread across the ground and act as a “living mulch” blocking sunlight, which prevents the establishment of weeds, creates a microclimate and aids in the retention of moisture in the soil. In addition, the vines of the squash plant are equipped with prickly “hairs”, which help to discourage pests. Aside from these three crops benefiting each other in the ground/garden, they also complement each other nutritionally and prove for a balanced diet. At our research site, we will be planting the crops from seed in three different raised garden bed boxes. All of these boxes have compost and native soil in them. However, one box has been treated with mycorrhiza, another box has manure added to it and the last box is the control for our experiment. The corn and squash will be planted first, and when the corn reaches about 5 inches in height, the beans will then be planted as well. We are looking forward to studying the growth and benefits of these three important crops.

## **12. Soil Sifting Your Garden**

Daniel J. Firova, Marcus F. Guerra, Charles B. Hoitt, and C. R. Richardson  
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In using simple construction methods to make a detachable cylindrical rotating cage sitting on a light weight table, large particles of unwanted material may be removed from the soil. Unwanted material could include rocks, large clay particles, parasitic larvae and debris. In addition to removing these unwanted materials, this device also creates wide rows created with deep soil that have an increased pore space.

### **13. Sustainable Farming Practices and Innovative Production Systems in Costa Rica**

**Jessica Espinoza\***<sup>1</sup>, David Vela<sup>1</sup>, Douglas Morrish<sup>1</sup>  
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Texas State graduate students observed sustainable food systems on a two week excursion through Costa Rica, where sustainable production farming practices are common. Students explored the collaborative efforts of production, processing, distribution, and consumption, while also accounting for the protection and enhancement of environmental, economic, and social health. Students also observed farming techniques of staple crops, such as, mangoes, rice, cocoa, banana, and coffee. Students were also able to observe and learn about the small scale fishing operations and the livestock industry from small scale producers and discover natural resource management efforts taken. The goals of the trip were to understand basic farming practices in rural Latin American communities, gain an appreciation for the difficulty of raising agricultural crops without the use of herbicides, pesticides, and fertilizers, understand the sociological and cultural values of native farmers, as well as, gain an appreciation for sustainable farming practices found throughout Costa Rica. Students traveled through three geographical climates: mountainous highlands, rain forest/ tropical, and valley terrain. Throughout the terrains they were able to observe unique and innovative alternatives allowing for more productive soil, safer water, and reduced levels of pollution. The trip also incorporated exposure to the leadership development efforts in Costa Rica. This component highlighted social and environmental consciousness and ethical behaviors. Biodynamic farms, compost operations, and the impacts of organic farming were also explored.

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### **14. The Texas Stock Tank and Its Uses for BGREEN Benefit for People, Livestock and Wildlife**

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The Texas stock tank was originally designed to aid the ranchers in watering their livestock that was on their land and later fenced in by barbed wire. On the open plains and prairies, the stock tank could keep stock from wandering off the ranchers' property and the also proved useful in times of reduced flow in streams and rivers by acting as water storage areas. Or, in cases where running water was diverted, naturally or purposefully, these stock tanks could survive for a period of time giving ranchers valuable time to sort out any problems that the lack of water produced. The first tanks were just dammed up gullies or naturally occurring low lying run-off areas that could be walled by an easily constructed berm/mound made of local rocks and dirt. Later stock-tanks were excavated in low lying water run off areas and with the advent of the windmill and pumps the tanks could be built above the ground and used to water different water troughs at lower levels by using gravity alone. Now they can be used as an inexpensive source of water for farming and animals. These tanks later became a haven for fish (stocked or naturally appearing). And, with the advent of these fish, the stock tank became an environment within itself. Many different varieties of life exist in these ponds. Along with the fish there are a many forms of aquatic vegetation, different insect larva, frog eggs and tadpoles, and turtles. These ponds also became a much needed water source for many different species of wildlife that exist in close proximity of the location of the tank, deer, possum, fox, birds, etc. These tanks also play a large role in migrating fowl. These animals use them on their migration as a food source, a water source and a temporary habitat where they can rest.

## **15. The Value of BGREEN Farm in a Box: To Produce and Promote Sustainability in a Hispanic Home**

Daisy S. Garcia, Marcus F. Guerra, Marissa A. Cervantes, Charles B. Hoitt, and C. R. Richardson  
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Farm in a Box is a project in which students from Texas State plant, grow, and harvest various vegetables which are then donated to the local food bank. We want to find the best way to produce food on a small scale, from seed to harvest. This information can help promote sustainability and be used as a template to show families how they can produce some vegetables in their backyards, and in the process not only save money on groceries, spend time outdoors, but also have the satisfaction knowing they were able to produce their own food. Our project will benefit those who cannot afford to buy more healthy foods throughout the year because of various reasons including financial hardship. We will be able to share the knowledge needed to produce food year round, and help more families in need.