2018 University of Puerto Rico Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

This accomplishment report covers the period from October 1, 2017 to September 30, 2018. During this fiscal year, the Puerto Rico Agricultural Extension Service (PRAES) used 153.64 FTE's, a decrease of 1.42 FTE's from the 155.06 reported for FY2017. The total FTE's for the Puerto Rico Agriculture Experiment Station (PRAEXS) increased by 16.5 this year. The total FTE's for FY2018 was 64.6. This Annual Report presents the undertakings by the research and extension work for a total of eleven (11) planned programs/initiatives, where seven are common for both units and four are exclusively for the extension service.
On September 6, 2017 Hurricane Irma hit the island of Puerto Rico, followed by Hurricane María on September 20th of the same year. Hurricane María caused devastating destruction. The island's electrical grid was largely wrecked, with repairs that took months to complete, creating an island wide power outage. Also, we experienced a shortage in drinking water, severe infrastructure damages and a collapse of all communication systems. Recovery efforts were somewhat slow in the first six months. Many citizens decided to move to the mainland and by late November 2017 and estimate of over 200,000 people had move to the State of Florida.
During 2018 the catastrophic effects of hurricane Maria were felt, particularly by the agriculture sector. The most affected crops were plantains and coffee. In recent years, due to the economic recession, there was a comeback to farming, where agriculture production experienced a 3-5% increase before Hurricane María. Hurricane Maria completely changed the scenario in the opposite direction. Agriculture revenue suffered $780 million loss according to preliminary figures from the Department of Agriculture. Hurricane Irma caused around $45 millions in agriculture production loss.
Several collaborations or initiatives were established with federal, state, local government and non-profit organizations to assist farmers. PRAES identified the most affected agriculture commodities and assisted in the distribution of 9,000 pounds of seed, valued in over $1 million, in and initiative of the "Seed Relief Puerto Rico" of the Delaware Valley University and the University of California-Davis. Likewise, a group of entrepreneurs from several food chains in PR created the Juntos se Cultiva initiative (grupo Gerena) and Mercy Corps joined the PRAES to support local farmers. They donated $200,000 for equipment and materials to assist in the recovery of coffee, vegetables, beekeepers, fisherman and beef producers.
A report of the effects of hurricane Maria on dairy farmers was prepared and presented in Washington, Michigan and Italy to create awareness on resilience and preparedness during natural disasters. In collaboration with NRCS, a proposal was submitted and approved ($250,000) to develop an emergency Plan for farmers in the events of natural disasters. At present, PRAES personnel continue with farm visits to determine structural, biosecurity and feeding strategies that were effective during the 2017 natural disaster and that could be use in the event of another weather emergency. This information will be published using various dissemination methods to train our farmers and increase resilience for future similar events.
Reliable drinking water was a great concern after the hurricane. The San Ignacio de Loyola Church donated, 104 filters and buckets for rain water collection which could filter one million gallons of water; with proper maintenance, the equipment can last for 10 years. Extension personnel received training on its use and maintenance to train community leaders in isolated areas. The Family and Consumer Science personnel offered workshops on home canning and long-term storage of dry food. We continue

collaboration with USDA-NRCS, Food and Nutrition Service and Rural Development for the Community Gardens Project. A 4-H group in Cataño, concerned with the mosquito problem after the hurricane conducted house-to-house visit to inform about eliminating the places where mosquitos hatch. They were known as the "Mosquitologists".
As a direct effect of the hurricanes Irma and María most of the experiments in the field were destroyed. For the first six months after the hurricanes the administration of the PRAEXS was focused on vegetative material cleanup in all six sub-stations and on infrastructure evaluation and re-construction. As a result, the Puerto Rico Authority of Solid Waste Management and the PRAEXS established a Memorandum of Agreement (MoU) to collect all vegetative material at the Gurabo sub-station. The Caribbean Climate Hub of the International Institute of Tropical Forestry (IITF) were collaborators in this initiative**.** Other collaborative initiatives developed after Hurricane María includes a partnership with Starbucks (as a subcontract with World Coffee Research) to provide clean seeds and seed lots to coffee producers. In addition, the Puerto Rico Coffee Task Force, a group composed of public and private agencies in Puerto Rico, was formed to meet the needs of coffee producers in Puerto Rico after the devastation left by Hurricane Maria.
The involvement of the PRAEXS in the recovery efforts after Hurricane María included the managing mudslides and clearing roads with heavy equipment, providing man-power to assist local communities, water analysis to determine the presence of bacteria and other water quality parameters, open fields for wood salvage efforts and helicopter landing. In addition the PRAEXS provided meeting rooms for state and federal agencies. The most important objective in the road to recovery after the Hurricane was to provide farmers with clean seeds and/or propagation material. Of the few banana and plantain plants left standing after the hurricane, farmers were able to obtain clean seeds free of pathogens and diseases. The PRAEXS researchers were able to collect propagation materials of our staple foods (sweet potato, yam, coco yam etc.) to provide farmers so they could start their plantations once again.

Global Food Security - Plant Production Systems, Genetic Resources and Breeding Program
The production of plantain and banana are important socioeconomic engines of agriculture in Puerto Rico. After Hurricane Maria both crops were severely affected, as well as, the people who depend on them. According to State Agriculture Department data, plantation production was 90% lost. Educational interventions through the IPM project in PR provided training on integrated management production and IPM for the restoration of banana and plantain plantations after Hurricane Maria. Three hundred fifty-one (351) farmers adopted 2 or more recommended practices to restore their plantations, specially improving the soil, beginning with healthy seed from tissue culture and maintaining good cultural practices throughout crop cultivation.
After hurricane Maria, crop production in the municipality of Ciales were severely affected. This municipality has an unemployment rate of 60% and their population lives under the poverty index. The F&F Hydroponic Corporation had a production of 20,000 lettuces weekly and employs 12 heads of family. Subsequently, their livelihood was threatened. The Extension Agent provided support to employees and farmers thru educational field visits and lessons in integrated crop management, emphasizing marketing, risk management and efficient production. Thirteen (13) agricultural employees committed to their source of income, together with the members of the F & F Hydroponics Corporation, participated in the recovery efforts to resume crop production. The agricultural employees in partnership with their employer managed to overcome hurricane Maria and continue developing the business. After market analysis and a risk management evaluation, they were able to produce 50,000 plants weekly of a lettuce variety (boston salannova).
Mr. Jose Carasquillo, a physical education teacher, visited the Extension office looking for information on agriculture production. He decided to give up his work and dedicate his life to agriculture with the idea of improving the economic situation of his family. He received training in the use of Trellises System for vegetables, by the Agricultural Extension Service (how to establish an agricultural business, agencies that work with farmers, development of business plans, inventories, employer obligations, good agricultural practices, selection of seeds, pest and disease management and soil fertility). He is currently taking a bee

course to incorporate bees on his farm and improve pollination. He also benefited from the Seed Relief program. Mr. Carrasquillo increased his family income by renting a 30 acres farm of which 27 are in production. He entered the PR Department of Agriculture Family Market Program. The income generated has allowed him to renounce his teaching position and totally be dedicated to agriculture. He has five vegetable ranches where he produces peppers, eggplants, cherry pepper, squash and coriander. He is also producing other crops like taro, bananas, cassava, pineapple and papaya.
The Plant Production Systems addressed important constraints faced by our agricultural sector. Crops in Puerto Rico are tropical; thus, improved varieties have to be developed locally. PRAEXS improved varieties of tropical pumpkin of sweet chili peppers, and released a black-colored bean named 'Hermosa.' The above activities were accompanied with the evaluation of available varieties of vegetables, starchy crops and fruits; among them, lettuce, banana, papaya, avocado, pomegranate and breadfruit. As a result of Hurricane María, there was a shortage of propagation material and seeds for many of the locally-grown crop. PRAEXS distributed --to farmers, to gardeners, to scientists and to the public-- planting material for starchy crops (taro, cassava and sweet potato), for cover crops and for vegetables. Some of this planting material is from varieties adapted to be grown under organic systems of production. On-farm research was performed to validate new technology, such is the case for the production of arracacha. Potential new crops were evaluated for organic and conventional system of production. Evaluations included Asian vegetables, pomegranate, garcinia and cover crops. A data base characterizing the coffee industry in Puerto Rico was assembled. Research continued on the use of unmanned aerial vehicles (Drones) for the evaluation of hurricane damage, forage yield, crop health, stress indicators in coffee and in citrus and for the management of cover crops to reduce soil deterioration.
As a mean to reach stakeholders, commodity meetings were held for starchy crops, coffee, fruit crops and vegetables/basic grains. From these discussions research priorities were identified. Results from research on improvement of management techniques for crops were summarized in technological packages such as that prepared for pepper and for beans. Field days and workshops were organized to demonstrate new varieties of lettuce, sweet chili peppers and starchy crops. Graduate research resulted in five M.S. thesis in Agricultural Sciences. Research results were published in refereed journals and in proceedings. Other research results were presented in scientific meetings.

Integrated Management of New and Emerging Pest and Diseases
In recent years an increase in public interest in cultivating vegetable gardens has been observed in order to have healthy food available in their own homes Also, the public is becoming aware of the negative effects of pesticides in their health. People are also trying to increase production using sustainable practices. Extension agents are using the Vegetable gardening IPM lessons and the Vegetable Gardening Festival to offer training in Identification and application of biological control and natural pesticides for pest and disease control. Also, information about identification and integrated management of vegetable and herbs was posted in the Extension Diagnostic Clinic Facebook page that reached 12,966 persons.
Control measures depend on proper identification of pests and diseases. The Mayaguez Extension Plant Diagnostic Clinic diagnosed 86 plant samples, diagnosing pests and diseases and provided a report with management recommendations. After Hurricane Maria visits were conducted to farmers in 7 municipalities to assess what pest and diseases were prevalent. Training on identification and integrated management; how to take samples to submit to the clinic was offered. The PR Pest Diagnostic Facilities project (PRPDF) delivered a questionnaire to assess IPM knowledge and practices implemented by growers. Eight (8) publications were developed to help farmers: How to Take Samples for Nematode Diagnosis, Management of Sooty Mold in Coffee, Identification and Management of Downy Mildew of Arugula, Management of Damping-off and Root Rot in Coffee Nurseries, Processing and Producing Healthy Sweet Potato Seed and Management of Yam Dry Rot in Seed Before Planting. About 47 Farmers learned how to identify pests and diseases after receiving an oral presentation and practical training and educational materials.
At the PRAEXS the IPM program focused on the generation of information on IPM strategies to maximize crop production and minimize pesticide use. Efforts span from the basic to the applied research and trainings activities relating to crop systems of importance for Puerto Rico. Research activities to report

include the completion of a study on eight mandarin genotypes grafted onto three selected rootstocks for tolerance to Huanglongbing (HLB). Also, tolerance of orange genotypes Rico 7-56, Pietri 3-34 and Rico 5-50 to CandidatusLiberibacter asiaticus assessed with qPCR (TaqMan). These genotypes were sent to the Rubidoux Citrus Quarantine Facilities for therapy and shoot-tip-micrografting. Progress was made in biocontrol approaches of important pests. The studies in the coffee berry borer (CBB) indicated that the Wolbachiasupergroup A is found in very low proportions in the CBB adult microbiome and contribute to reproductive success of CBB. Therefore, manipulation of its population could be useful for CBB biocontrol. Brevipalpusmites were surveyed in ornamental residential plants. Sixteen plant species were found to host the mites that were not previously reported as hosts. Findings in a bioassay informed the efficacy of Steinernema carpocapsaecombined with low-toxicity insecticides at low and high dosages produced higher mortality in larvae of Spodoptera frugiperdacompared with the insecticides applied alone. A study on control of plant-parasitic nematodes on plantain (Musa acuminata X M. balbisiana, AAB) was concluded.Two workshops on high throughput analysis and DNA purification were conducted at the Center for Invasive Species and Quarantine (CISQ) in Puerto Rico. Extension programs continued to transfer knowledge to growers to optimize productivity while ensuring the use of appropriate management practices for environmental sustainability. A workshop on Yam disease management provided information to growers about best management practices for Yam production. The program supported undergraduate and graduate research projects to complement research and extension efforts. A survey in the adoption of IPM practices in four different Municipalities of the island revealed that farmers in Mayaguez, San Juan, Ponce and Arecibo respectively have adopted recommended IPM practices.

Animal Production System

In Puerto Rico, animal production represents a significant component of the agricultural income. A week after the hurricane, Extension Personnel joined efforts with farmers to collect data regarding communication status and road accessibility, degree of damage (especially for insurance issues) and provide requested assistance. Several communication strategies, such as radio interviews, letters and farm visits were employed to provide information regarding biosecurity (management of dead animals and disease prevention), identify and communicate with governmental agencies to report farmers that needed re-opening of their communication routes, appropriate management of water for animal consumption, strategies for efficient energy usage after a natural disaster (especially used for milking dairy cows), construction of temporary shade structures, among others.

Calf mortality in Puerto Rican Dairy Farms ranges from 15-20%, affecting animal welfare and productivity. The main reason for this is improper passive immunity transference, hygiene, feeding and space. Most dairy farmers do not understand the importance of these practices and their repercussion on the productive potential of their heifers. A special project was created where 3 Dairy Extension Agents were trained to provide intensive farm visits to measure different calf health parameters and provide recommendations to a group of farmers. Total serum protein, colostrum IgG, calf height, weight and urine gravity (hydration status). The data collected in each dairy farm was compared with the benchmarks for dairy heifers and recommendations were offered accordingly. Also, 10 dairy farmers were trained in proper calf care practices and data from 52 calves were collected. Two dairy farmers invested in new calf pens, increasing calf cage room from 10 to 20 square feet/calf. One dairy farmer bought a milk pasteurizer and incorporated into their calf feeding system pasteurized milk. Another dairy farmer increased the frequency of calf pen cleaning and now feed their calves 2 times per day instead of 1 time per day. After six months a visit was conducted to collect data from their current calves to compare their health parameters and post management improvements. This information will be used to persuade more farmers on the benefits of implementing good calf care practices in their dairy farms.

During the last decades, many local dairy farmers switched from a grass-based feeding to grain feeding system. Due to the cost-effectiveness of this practice, several farmers abandoned the practice of grazing and its associated pasture management (fertilizing and weed control). Some sold land originally designated for grazing or chopping. When the price of grains increased, many dairy farmers found themselves in a precarious situation. Many farmers struggle to maintain their production based in grazing due to pasture degradation. The majority of those that sold their land, either had to purchase more land or

close their farms. Dairy Extension Personnel in collaboration with voluntary dairy farmers evaluated several improved forage varieties for grazing or chopping. With the preliminary results from field experiences, Mombaza grass (Panicum maximum Jacq.) was recommended to farmers due to its high yields (20 tons/acre/yr), drought tolerance and relative high protein content (8-22%). Several field days at two dairy farms were offered to demonstrate Mombasa's properties. In addition, several trainings were conducted on the identification and their control, soil sampling and profile interpretation, and management of Mombaza (establishment, maintenance, grazing and chopping). With collaboration of the AEE, a Brillion seed planter was lending to participating dairy farmers. A total of 65 acres were cleared of weeds and brought back in production of Mombaza grass in Camuy and Arecibo. This reduced the animal load per acre and reduced 15% dependence on grain for animal feeding. In addition, one dairy farmer was able to produce enough forage to feed his cows (49 animals) and have surplus Mombaza to sell as haylage, producing an extra income of $10,800/yr. Extension Dairy agents are using these experiences to convince more farmers to implement recommended good pasture management practices as a means to reduce grain dependence and increase production efficiency and sustainability.
Cattle production in tropical areas are constantly exposed to ectoparasites such as ticks and flies. Ticks are well known for being vectors of important diseases in cattle such as Anaplasma and Babesia. Recent research however, has demonstrated that flies can also carry these diseases. Extension research evaluated automatic and non-chemical technologies for the control of flies in a private and experimental dairy farm. This equipment (Fly aspiration system; CowVac) significantly reduced the number of flies by up to 50% in dairy heifers. In addition, an in-house PCR test was developed to help dairy farmers obtain fast results about infected animals. The data collected in this research was presented to farmers and other researchers and 2 dairy farms have been screened for these diseases; results and recommendations were offered to the farmers in less than three days.
The local beef industry poses several challenges. These include meat underproduction (13% of the local demand), poor quality of forages, and meat imports. In addition, the lack of industry organization diminishes the efficiency of the farmers in obtaining help. Some information regarding imported meats such as the quality of the animal care is not known. The Extension Beef Group developed a Beef Quality Assurance Training as a means to increase meat quality uniformity, by standardizing the product generated by our farmers. Also, assist farmers on how to get organized to increase their chances to compete against imported meat products and reach special meat niches, such as grass-fed beef. Five field days were organized including 14 collaborators from University of Puerto Rico, Texas A&M, Veterinaries and Students. A total of 862 farmers participated in these training that included Animal Registry, forage management and feeding, Animal Health, Biosecurity and Transportation, Meat cuts and quality, Reproductive management and general management. From these farmers, 180 completed the certification (participated in all the modules) and currently the Beef Extension Agents are planning to provide follow up visit to farmers.
Heat stress in tropical dairy production is one of the biggest challenges our farmers are experiencing. Extension Researchers had studied several genetic approaches to overcome this situation which includes the characterization of the Puerto Rican Slick Holstein Cow. Several publications have been published that include the study of their vaginal temperature under different environments and management. One of the biggest challenges found in these studies were the availability of thermometers to collect vaginal temperature over time. Currently, we use a HOBO thermometer coupled into a rubber anchoring system. This thermometer requires to be attached to a computer to synch and after data collection, it has to be removed and re-attached to a computer to collect the data. One of our Extension Dairy Researchers is currently working in collaboration with students of the College of Engineering to develop an improved thermometer for bovine vaginal temperature collection(Patent Case # A1002) to overcome some of the drawbacks of current technologies.
Enhanced milk, beef and lamb production has been the main focus of the of the Animal Systems research program at the PRAEXS. Milk production is still the major industry related to animal production in Puerto Rico. The research efforts PRAEXS have demonstrated the thermo-regulatory capacity of slick-hair phenotype Holstein cows raised under heat stress. The enhanced thermo-adaptability of slick-hair phenotype raised in environmental conditions with temperature-humidity index values higher than the

domestic animal comfort zone have been evidenced by lower vaginal and rectal temperature and different microanatomy of the skin as compared to normal hair animals. The thermo-adaptability of the slick-hair cows have resulted in animals with better feed efficiency, higher milk yield, and enhanced reproductive performance than Non-slick cows. Genetic expression and genes associated with the thermo-regulatory capacity of slick-hair phenotype cows also have been identified. The phenotyping and molecular characterization studies also have been performed in double muscling Senepol cattle. Results indicate differences in carcass characteristics and meat quality between heterozygous and homozygous animals. The continuous evaluation of management practices in Senepol cattle also have resulted in improved animal performance and highly acceptable quality of the meat. Experiments related to the novel sheep and goat industry have shown greater thermo-adaptability of small ruminant to environmental conditions associated heat stress as compared to bovines. Research efforts have resulted in the improvement of nutritional management practices and nutrient utilization in lambs, and a protocol of artificial insemination for ewes. Research results of the Animal Systems program have been presented at regional, national, and international meetings and 4 peer review articles have been published.

Climate change, Natural Resources and Environment

After the 2017 hurricanes experience, people are getting conscious about preparedness and recuperation. One hundred and eighty-six (186) persons participated in several training sessions offered on disaster management and plan preparation; 49% of those participants (91) prepared a contingency plan and obtained farm insurance.

People are also concerned regarding the changes in weather patterns and storm force. Five hundred fourteen (514) persons participated in 28 training meetings offered on climate change. From those who participated, 60%, or 307, adopted recommended practices in their farms, such as efficient water use practices, solid waste management, animal feeding, carbon sequestration and others.

A service agreement between the University of Vermont and the University of Puerto Rico Extension Service to document Puerto Rican's farmer's perception of climate change, extreme events, farmer preparation and the potential future behaviors related to climate adaptation. A questionnaire was developed and validated with Puerto Rican farmers. This agreement ended August 31, 2018. Four hundred and twelve (412) farmers completed the questionnaire. The results of this research will be published during 2019.

The primary goal of the Climate Change Natural Resources and Environment (CCNRE) research program continues to be to develop, perform and support scientific research regarding the impact of agricultural practices on the environment and natural resources of Puerto Rico. CCNRE's research grants continue to address key PRAEXS mission goals by supporting both the Department of Agriculture and the Natural Resources Department.

Research priorities identified by program stakeholders, and partially addressed in our projects, are: pollution prevention and mitigation practices for soil; watershed protection and management based on conservation practices; development of sustainable agricultural production practices to protect and enhance natural ecosystems; and prevention and control of invasive species through management approaches for biodiversity conservation and restoration.

Activities included an assessment of environmental management on soil organic matter, carbon storage on soil landscapes, ecosystem services to improve Puerto Rico water quality and greenhouse gas emissions and solutions to point and non-point sources of contamination in watersheds. Watershed protection and management, conservation and efficient use of water and management account for 43.5% of current research efforts. Activities also include a study of the insect fauna biodiversity to determine optimal integration of metadata to protect natural enemies' guilds of harmful insect pests, increasing native trees biodiversity in novel forest type and integrated management of poultry manure and birds to compost processing. Continued research on these topics will provide reliable scientific data to quantify the contribution of agriculture relative to other pollution sources and to measure the short and long-term impact of agricultural management systems on the environment. CCNRE's research is vital to meeting sustainable natural resources management and protection in the face of diminishing land and water resources and a progressive climate change

Global Food Security and Hunger
Assistance was provided to promote the organization of farmers and communities to attend to agriculture resources protection, food security, incentive opportunities, marketing risk and others. PRAES coordinated meetings between farmers and state and federal agencies. Eighty-two (82) public policy issues were attended. One hundred eighty-two (182) farmers participated in value added training. Sixty percent (60%) or 109 farmers adopted value added practice and 122 new products were created. Twenty-two (22) new products were developed. This present more food variety in the markets.
Using Home Gardening Curricular Guide, we offered 79 vegetables, fruits and starchy crops courses. Also, county agents and specialists organized field experiences, participated in radio and TV programs and used the youtube page "Huerto casero PR". Two thousand three hundred and twenty-three (2,323) persons completed a home garden course, of them, 1,815 established a home garden.

Adult and Childhood Obesity
Data reported in the Youth Risk Behavior Surveillance System (2017) showed that 24.2% of Puerto Rican adolescents (grades 9-12) were overweight or obese, 14.3% did not eat fruits, and 16.4% did not eat vegetables during the 7-days before the survey. Moreover, 30% did not participate in 60 minutes or less of physical activity in at least one day of the week. Three major approaches focused on the prevention of childhood obesity across the Island; "Project Moving to a Healthy Eating", "4-H Route for a Healthy Life" and general short courses in nutrition. A total of 2,890 kids participated in these initiatives through their 4-H clubs. As a result, 32% reported eating healthier foods, 25% increased their fruit consumption, 13% increased their vegetable consumption and 15% increased the consumption of whole grain cereals. In addition, 25% decreased the intake of sugary beverages and 33% increased their water intake. Besides, 34% of the participants reported increasing their physical activity levels.
Obesity has been associated with the major causes of death in the US and PR, including cancer, heart disease and diabetes. Extension is the principal institution in Puerto Rico that offers nutrition education in a informal settings focused on the prevention of obesity. A total of 1,449 adults participated in the nutrition short courses. Forty-six percent (46%) of the participants reported eating healthier foods, 30% increased their fruit consumption, 21% increased their vegetable consumption and 13% increased their consumption of whole grain cereals. In addition, 19% added healthier recipes on their daily menus and 32% of participants reported increasing their physical activity levels.

Family Well-Being
According to the Puerto Rico Family Department (2016), there is an increase in child neglect and abuse. An educational campaign was developed on the national prevention on child mistreatment and national family month at state level. A total of one thousand six hundred ninety-nine (1,699) parents benefitted. One thousand one hundred twenty-nine (1,129) parents reported improving their family relationships with their children and spending more time together. Besides, 1,489 persons completed courses in aging aspects where 824 or 55% of this audience gained knowledge.
Chronic diseases such as: breast cancer, diabetes, cardiovascular diseases and Alzehimer's are the leading causes of disability in Puerto Rico. To attend this problem educational materials and educational campaign was held at state level. Forty-nine (49) short courses were offered to families and individuals. As a result, 3,106 persons participated in the educational campaign and 511 completed the courses.

Food Safety, Science and Technology
According to Young, and Waddell (2016), some of the barriers for consumers to adopt safe food handling practices include: the belief that there is a higher risk of getting a foodborne illness when food is prepared and handled by others, they believe that the food system offers safe food, and they do not have control over foodborne illnesses, among others. The PRAES Consumer and Family Science Educators (CFSE) offered 64 courses in which 1,407 persons completed the course that included topics like hand washing, cooking at safe temperatures, avoiding cross contamination, and cleaning and sanitizing and others. Eighty-one (81%) adopted one safe handling practice, 58% cleaned and sanitized food surfaces, 72%

washed their hands properly and frequently, 61% separated ready-to-eat food from food that need to be cooked, 32% held food at safe temperatures.
According to CDC (2016), 61% of Foodborne illness outbreaks occur in food establishments. When Food Managers are certified they enhance their food safety knowledge (Brown et al., 2014). Eight (8) PRAES Family and Consumer Sciences Educators trained in Food Safety offered 102 Food Safety Courses to Food Managers throughout the island. Two thousand seven hundred and nine (2,709) Food Managers Completed the Food Safety Course of which 2,707 approved the test.
In 2000 Puerto Rico Health Department adopted the Food Code, which requires that all person in charge of a food establishment must demonstrate knowledge in proper food safety procedures. Those 102 Food Safety Courses emphasized the different safe handling practices and the importance of adopting and complying with the requirements of the Food Code. Sixty seven percent (67%) adopted at least 3 safe handling practices, 67% of food managers (FM) prepared a control plan for food temperatures, 69% of the FM washed their hands, 66% used separate cutting boards for ready-to-eat and raw meat, and others, 62% used a food thermometer to measure cooking temperatures, 67% used a utensil or disposable gloves when handling ready-to-eat food,68% washed equipment and utensils using hot water and then sanitized, 67% at least one of the methods offered by the Food Code, 67% held hot food at 135 °F, 65 % prepared in the cleaning vomits operational procedure.
Puerto Rico, as in many other places, is going through a major financial crisis, which may or may not be solved in the near future. We expect changes in the amount of money assigned to our government's budget. This will have a domino effect on agencies and instrumentalities, as well as public policies and regulations. Adding to the economic crisis, Hurricane Maria hit PR in 2017, affecting our agriculture and small business. Many food businesses have shut down and many people have moved from the island. On occasions, the support needed from the Municipal governments may vary if their interests are different from the ones established by our program; especially when part of the program is based on a different paradigm. It could take time for individuals, including our personnel, to change their attitudes and adopt a new model.
The signing of the Food Safety and Modernization Act of 2011, FSMA for its acronym in English, forced the food industry to change its approach from reactive to preventive. This change also impacted the food industry in PR. For this reason, since 2015, training began aimed at complying with the PCQI regulation. In addition to the approach on the PSR compliance date, several workshops have been offered for the PSR. However, the demand has not matched the offer, thus affecting the frequency that these workshops are offered. It is important to raise awareness in the farmers of our island, that even when they may be exempt from compliance with the regulation, the production of safe food is everyone's responsibility. Finally, Hurricane Maria severely affected the agriculture in PR. The economic situation and the impact of María, has forced Puerto Ricans to look for new options to generate income. All this, coupled with an active entrepreneurial movement allowed the development of small businesses which required of service and technical support. This is why several current projects are aimed at the creation of value-added agricultural products. In addition, more than 10 industries have been attended in relation to the creation of the table or content of updated nutritional information so that the products can be commercialized.

Strengthening Youth Life Skills, Leadership and their Community
Hurricane Maria came to aggravate the situation of child poverty on the island, accelerated the migration of families with children. This situation affects the opportunities for children and youth and aggravated that they may have well-being. Before the hurricane, 58% of our children and young people were living in poverty. Studies has shown how natural disasters cause post-traumatic stress disorder and other mental health conditions that may persist through the years.
As recommended in our 4-H Merit Review process, we began our work with an internship to know youth leaders, health promoters and teen teacher's feelings after hurricanes and new challenges they are confronting as citizens. Youth and adults work and learn together about health advocacy, emergency preparedness, diseases prevention among others to strengthen their knowledge and skills to help others and empower themselves to have healthy transition to the next stage of live. Youth participated in 135 community projects where more than 2,995 youth received knowledge and skills to manage their

emotions. Also, educational resources were provided to empower kids and youth for a better self-esteem. One hundred (100) youth leaders were trained to participate actively in community projects using the slogan "Oye mi voz, soy 4-H", inspired youth leaders to stand as reliable ambassador of 4-H program. Before their preparation they went to schools and communities to teach about disease prevention, community prevention practices to eliminated diseases contagious focus (ex. mosquito reproduction) and the importance of vaccination. We coordinated with Health Department, EFNEP and Voices Foundation a route to make accessible health services to 4-H families and communities. Also, they taught and helped in other critical issues in the communities like reforestation, helping others, food security. Eight thousand six hundred and fifty (8,650) kids and youth including 4-H participants were benefited from 4-H non-competitive and service activities around the archipelago and 11,942 participated in activities to teach basic life skills and leadership.
Health Promoters project and other 4-H initiatives like Route for a Healthy Living benefited 2,285 participants who demonstrated an improvement in healthy lifestyles and 4,330 took responsibility in their actions. Luis Caraballo, a second-year health promoter, shared with 4-Hers participating in the 4-H State Conference "when I began as Health Promoter I never imagined I can experience a weight reduction applied to myself what I teach to others. I lost 20 pounds and I feel great". With the skills developed, project participants with the collaboration of the Extension health specialist, five (5) health promoters received a scholarship from UPR Medical Science to participate in the Summer Internship to know the academicals program and the professional health schools on campus. This was the first time 4-H members participated in this internship. One of these participants, Mariangelie Torres mentioned that "In 4-H the opportunities are unlimited!" She was accepted UPR Natural Sciences to study nutrition.

Community Resources for Sustainable Development, Agriculture Economics, Marketing and Added Value
After hurricane María massive destruction and desolation was spread island wide, with many municipalities remaining without communication for long time. Many PRAES local offices served as relief, operation and communication centers with local and federal government agencies. PRAES personnel in collaboration with community leaders and organizations, were able to put in practice emergency and disaster training provided by the CRD program through the years, and in other cases improvised survival strategies to deal with a never-before-dealt level of island wide destruction and desolation.
Through the community projects UPRM-PRAES trained communities in the use of (and distributed over 2,000) bucket water filters and purifiers, and use of bucket-baking soda cloth washers, reducing the risk of a leptospirosis pandemic. The organization of common kitchens, thrift shops and health centers in community centers did help distribute potable water, ready to eat food, clothing, solar lamps and detergents. Vulnerable populations in the communities (such as the elderly, cancer and dialysis patients) were identified for assistance. Mental support activities were coordinated with health professionals to provide support to families who lost their homes or experienced post traumatic syndrome. Public health programs for the control of disease vectors such as mosquitos and rats were put in place, together with public areas cleaning and recycling initiatives to properly dispose of organic matter and plastic gathered in the relief being imported.
While relief efforts provided food and other necessary goods in the short run, PRAES help create local businesses, community gardens and small local agricultural production that benefitted both emerging producers and local consumers. "Crash courses" in entrepreneurship, garden and small plots production were conducted by PRAES personnel. Community associations were organized to establish small thrift shops that would provide clothing, hot meals and other goods to community members for free (paid by donations) or at very reasonable prices.
In Las Piedras a women agro-entrepreneur group was established to produce for the local family markets; Orocovis - five (5) Seniors of the local high school established a garden that provides fresh food to the local Head Start Center; Carolina, Trujillo Alto and Loiza - farmers' markets were established to sell products from small farmers and community gardens; Ciales - a Community Cooperative was established and obtained funds to manage their rural aqueduct and established their own photovoltaic power grid that will provide services to 25 families; San Sebastián and Morovis - thrift shops were established to distribute

aid in a sustainable manner; and in Florida and Comerío - cooperatives were created to provide employment opportunities to community members.

Sustainable Energy
Mr. Jose Negron is a young farmer. With his family produces lettuce in hydroponic system. His farm is located in the Toro Negro Ward which is an isolated community distant from urban areas. It was severely affected by hurricane Maria and was informed that they could be without power until may. He contacted the local Extension office and received information on alternative energy systems. After reviewing and analyzing several options, the suggested the system for renewable energy for hydroponics was solar. A solar energy system was designed for their needs for hydroponics lettuce production. In short period of time, they were able to power the system, avoiding losing $15,000 income with a monthly power bill of $200 savings.
Due to the lack of energy after hurricane Maria, the Ciales Extension personnel offered a workshop on how to install a solar system in an emergency situation. They presented the system components, costs, blue prints and installation demonstration, as well as alternative systems to energized a house in case of natural disaster. One hundred and twenty-eight (128) persons participated. Two families installed a solar system to energize their houses. One of them, use it as demonstration for the community.
While very little research has been done in the Sustainable energy, faculty involve in other programmatic areas, such as Animal systems, are showing interest in starting a research program involving sustainable energy.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	154.9	{No Data Entered}	52.2	{No Data Entered}
Actual	153.6	0.0	64.6	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

The Extension Merit Review process continues to be conducted through four committees representing each of the four major program areas: Agriculture, Marketing and Natural Resources; Family and Consumer Sciences; 4-H and Youth Development; and Community Resource Development. Each committee is composed of at least five members: Internal University members (the program leader, two specialists--one from the Planning and Evaluation Office and one from the major subject area), a researcher from the Agricultural Experiment Station and other faculty members, and external non-University members (representatives of the major government agencies or organizations that work with similar audiences). External Members in the different committees include representatives from government agencies at the regional or state level, such as: Department of the Family, Department of Education,

Department of Agriculture, the Mayor's Office, the Governor's Office for Youth Issues, Rural Development Corporation, the Farmers' Association, Farm Service Agency, Consumer Department, Head Start, Police Department, as well as representatives from non-governmental organizations, the religious sector and the private sector, among others. Each committee meets at least twice during the fiscal year to evaluate the proposed plan of work. External committee members evaluate the quality and relevance of the activities and programs to the State goals and offer recommendations in order to continue emphasizing critical areas in our programs. A written report is prepared at the end of each fiscal year by the program leader, in accordance with the committee members. The report is presented to the committee and describes how the committee's recommendations will be addressed and incorporated in the Plan of Work.
No significant changes were made for the PRAEXS merit review process. Part of the Hatch funds were allocated for competitive project grants. The competitive funded proposals were selected on the basis of the year's revised priorities published in our annual call for proposals. The annual call for proposals was prepared and distributed by the recently integrated Research and Extension Office. This new office combines the research activities for both, Agriculture Experiment Station and Cooperative Extension Service. This new approach will force a close collaboration between agencies concentrating our combined efforts in one common good. Another part of the budget was allocated for specific signature projects of the PRAEXS. These signature projects encourage emerging or incipient agricultural research areas that need to be developed in Puerto Rico. At the same time, it will be promoting the management of tropical agroecosystems under changing climatic conditions. All the proposals (competitive and signature projects) were submitted to the Assistant Dean for Research with the endorsement of Department Heads.

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 non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Other (Target invitation to collaborating municipal government agencies)

Brief explanation.

At the municipal level, the Local Extension Advisory Committees main task is to gather input information from our local stakeholders. The committees are composed of at least two participants from each of the program areas (Agriculture, Marketing and Natural Resources; Family and Consumer Sciences; 4-H and Youth Development and the Community Resource Development) and a minimum of two representatives from local agencies that work with similar Extension audiences. To encourage their participation, potential members received an invitation letter explaining the importance of the process and their participation to contribute improving Extension educational programs and general well-being of the people. Follow-up and promotion of the meeting is done as people participate in Extension educational activities.
The Agriculture Experiment Station has yearly commodity group meetings with our stakeholders. At these meetings farmers, extension agent, students and the general public identify the most pressing needs that should be addressed by our research program. On a yearly call for proposals under the Hatch program, these priorities are stated to our researchers. In addition, most planned programs include work groups between researchers and extension specialists. The College of Agricultural Sciences integrated academic departments continue to organize workshops, seminars and field days where research results are shared with interested parties. Participation to these workshops are encourage through internal university communications, emails sent to stakeholders, press releases and personal invitations by organizers.

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
- Open Listening Sessions
- Needs Assessments
- Use Surveys
- Other ((consultations with local extension agents and commodity leaders))

Brief explanation.

The members of these committees were selected by the Extension personnel at the local office from their target audience, past program participants, participants on educational activities and based on their experience regarding local people participation in the Extension programs. They are invited by letter and follow-up visits to participate in the committee. Also, some government agencies with whom there is a collaboration, recommend people to participate in our non-formal educational programs. These people often continued participating and/or become leaders and are interested in being more involved in the community.
Research stakeholders are identified through commodity leaders, extension personnel and through local advisory committees established by the College of Agricultural Science administrators. These meetings are also announced on the PRAEXS webpage.

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 the general public (open meeting advertised to all)
- Other (Focus group, electronic communications)

Brief explanation.

The process to collect the stakeholder input took place through meetings where sometimes, focal groups technic is used to determine priorities. The committee met twice during the year to discuss local issues or problems that could be addressed by Extension. Each local committee identified priority issues in each of the four program areas. The input collection is not limited to the meetings, since in some instances a focal group or a survey has been used to confirm and/or prioritize the needs/issues.
Input from research stakeholders is collected at the meetings organize by the commodity and programmatic area leaders. Stakeholders are asked about the most critical issues affecting their commodities and local areas and research priorities. Each commodity and program area leader summarizes these results. In addition, stakeholders contact researchers and program leaders through the internet. Preferences and concerns voiced though digital media are also included in the reports presented to the administration.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

Most of the input received from our Extension stakeholders relates to the needs and situations affecting individuals, communities and our society in general. Most of the issues identified from previous years, continues to be of concern for most people. For 2018, the most predominant aspect was the recuperation after the devastating effects of hurricane Maria followed by the precarious economic situation of the Island. Due to this situation, a large migration of people to the United States was reported.

In recent years there has been a greater interest in vegetable gardening due to the fact that people wanted to do something regarding food security, both at the household level as well as at the community and at school garden level, besides the opportunity it offers for some additional income. Obesity is another issue that persist as of great concern identified by our stakeholders. Stakeholders coincide that contributing factors are mainly bad food choices and lack of physical activity. People are also concerned about extreme weather events and their effect in local food production. This year 2018 was an example with Hurricanes Irma and Maria, which severely affected the agricultural production. Our stakeholders coincide on the importance of food security at our state level which is ranked as priority. They have also mentioned the importance of promoting sustainable agricultural practices, protecting our agricultural lands and natural resources, water and soil conservation, developing efficient marketing strategies as well as issues related to agricultural financing. Within the financial aspect, we need to continue promoting record keeping, which often farmers don't paid attention to. Other issues affecting children, youth and families, that our stakeholders are concerned are domestic violence affecting women, children and the elderly. This continues to strengthen the importance of our state level Family Well-being Planned Program which emphasized parenting skill and social and personal values through our different educational curriculum directed at adults, youth and the elderly. Stakeholders also recognized the contribution of Extension targeting these and other issues affecting our youth, through our 4-H clubs organized in schools and communities. Our community and agencies collaborators continue identifying unemployment and the lack of economic opportunities as our most pressing challenge to community prosperity.

The majority of the issues identified by the Stakeholders from previous years, still continues to be of concern. But in 2018, the most predominant aspect was the recovery after the path of two strong hurricanes, which distorted the life of everyone in Puerto Rico. In addition to these natural disasters, the precarious economic situation of the Island exemplified by the lack of job opportunities and the significant migration of people to the United States which increased after the hurricanes. The primary lesson learned is that we need to strengthen the collaboration with agencies that work in emergency rescue and natural disaster management in order to be more efficient in our educational role. Volunteers, that participated in Extension programs recognized this and are devoting resources to prepare volunteers to assist in the organization of relief effort in the time of need (shelter, food, water, etc.).

Stakeholders coincide that contributing factors for the obesity problem are mainly bad food choices and lack of physical activity besides the aggressive fast food advertising. The situation persists and

is widespread through the population since these are long term issues. Therefore, Extension needs to broaden its effort with the Health Department, Food and Nutrition Services and other related agencies to target this problem.
Extreme weather events and how to cope with this effect is a great concern. Extension has traditionally worked with community leaders to provide educational assistance on this subject matter. People recognized this effort and are preparing emergency plans both at family and community level. We need to also include farmers, to adopt recommended practices to reduce farm losses. Since our agricultural production is very diversified and mostly conducted in small family owned farms, where the average farmer's age is over 55 years old and most of the land is located in step slops. These are a very vulnerable population to extreme weather events, which also required assistance on renewable energy options for their survival at both; individual as well as farming
The stakeholders for the PRAEXS have recognize the importance of not only seed quantity but quality. In addition, conservation of our natural resources and the protection of our biodiversity have been subjects of importance for our stakeholders. After Hurricane María most of the vegetation was lost including flowers for bee pollination. Many of our stakeholders ask for help on how to establish beehives and the best plants for honey production. A research project was recently approved that will be addressing these issues.The input received in PRAEXS meetings from all stakeholders is summarized, evaluated and presented in a meeting of commodity leaders, program coordinators and research administrators. Here is where the final decisions are taken. The list of priorities assembled through this process guides the year call for proposals or new Hatch and special projects. It is also considered by researchers when applying for external funds when there are issues in need to be emphasized.

Brief Explanation of what you learned from your Stakeholders

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will be addressing these issues.

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. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	7734757	0	4874943	0
Actual Matching	3867387	0	2298972	0
Actual All Other	0	0	0	0
Total Actual Expended	11602144	0	7173915	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security - Plant Production Systems, Genetic Resources and Breeding Program

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		6%	
202	Plant Genetic Resources	5%		32%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		20%	
204	Plant Product Quality and Utility (Preharvest)	20%		6%	
205	Plant Management Systems	20%		30%	
403	Waste Disposal, Recycling, and Reuse	10%		6%	
405	Drainage and Irrigation Systems and Facilities	10%		0%	
601	Economics of Agricultural Production and Farm Management	15%		0%	
602	Business Management, Finance, and Taxation	10%		0%	
604	Marketing and Distribution Practices	10%		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	19.9	0.0	10.5	0.0
Actual Paid	21.5	0.0	22.8	0.0
Actual Volunteer	0.0	0.0	3.4	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**
1080875	0	1622935	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
540438	0	767375	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

At PRAES
Develop and release improved cultivars of crops of economic importance.
Introduce and evaluate the performance of starchy crops and fruit crops.
Create electronic publication describing germplasm collections.
Distribute germplasm to scientists and the public.
Conduct research and publish technological packages describing best management practices for crops of economic importance
Increase on arm research to validate new technology
Publish research results in bulletins and local newspapers for farmers, and in referred journals for scientists.
Present research results at scientific meetings.
Collect information from stakeholders on critical issues of importance to this program to to help establish future research priorities.
Upgrade research facilities for the establishment of a micropropation program.
Conduct technical production training meetings.
Organize capacity building workshops
Demonstration methods
Conduct meetings, farmers guidance visits. Collaborate with state, local and federal government agencies.
Use mass media to disseminate information.
Prepare technical plans (IPM, irrigation systems, cultivation practices)
Prepare curricula and other educational materials

At PRAEXS
Publish research results in refereed journals and in proceedings and present results at scientific meetings, to colleagues, farmers, and students.
Developed and released improved cultivars of crops of economic importance adapted to tropical environments.
Evaluation of introduced vegetables, starchy crops and fruit crops varieties and germplasm.
Distribute propagation material and seeds, to farmers, gardeners, scientists and the public.
Conducted research and published technological packages describing best management for pepper and for beans.
Increased on farm research to validate new technology, such as that used for the production of arracacha.
Established research priorities for critical issues of importance to this program by meeting directly with

stakeholders.
Organized workshops for the production of new varieties of lettuce and sweet chili peppers.
Demonstrate methods thought field days for vegetables, starchy vegetables and organic farming systems.
Collaborate with state, local and federal government agencies.
Use of mass media to disseminate information such as the availability of organic seeds and propagation material for crops grown locally.
Completion graduate research for five M.S. Thesis in Agricultural Sciences.
Research on the use of unmanned aerial vehicles (Drones)for the evaluation of hurricane damage, forage yield, crop health and stress indicators in coffee and in citrus, and in the management of cover crops to reduce soil deterioration.
Evaluated the potential for new crops for organic and conventional, and controlled greenhouse conditions systems used in Puerto Rico
A data base characterizing the coffee industry in Puerto Rico was assembled.
Studies were conducted on the control Huanglongbing Diseasein citrus; these included evaluation for tolerant varieties and control for vectors of the disease.

2. Brief description of the target audience

For PRAES

- Citrus and Vegetable growers
- Banana and Plantain growers
- Banana Growers Association
- Coffee growers
- Vegetable growers
- Fruit growers
- Ornamental growers
- Puerto Rico Department of Natural and Resources
- International Institute for Tropical Forestry. USDA-FS
- Puerto Rico Department of Agriculture
- Ornamental, Landscaping, Plant Nursery Industry Growers

For PRAEXS

- Fruit and citrus and vegetable growers.
- Banana, plantain and starchy vegetable growers.
- Coffee growers.
- Vegetable growers.
- Forage growers.
- Ornamental, Landscaping, Plant Nursery Industry Growers.
- Organic and Agroecological farmers.
- Puerto Rico Department of Agriculture.
- Puerto Rico Department of Natural Resources.
- USDA's Natural Resources Conservation Service.
- Home gardeners.
- Policy makers and governmental planners.
- Universities graduate and undergraduate students.
- General public.

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	9475	126440	0	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	1	12	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of producers trained in integrated coffee management.

Year	Actual
2018	1280

Output #2

Output Measure

- Number of producers trained in integrated banana and plantain management

Year	Actual

2018	685

Output #3

Output Measure

- Number of producers trained in integrated starchy crops management.

Year	Actual
2018	175

Output #4

Output Measure

- Number of producers trained in integrated vegetable management.

Year	Actual
2018	688

Output #5

Output Measure

- Number of producers trained in integrated tropical fruits management.

Year	Actual
2018	107

Output #6

Output Measure

- Number of producers trained in integrated citrus management.

Year	Actual
2018	57

Output #7

Output Measure

- Number of persons trained in vegetable gardening.

Year	Actual
2018	25

Output #8

Output Measure

- Number of collaborations established to improve outreach.

Year	Actual
2018	27

Output #9

Output Measure

- Number of educational activities offered (e.g. meetings, demonstrations, field days, press releases, workshops).

Year	Actual
2018	8

Output #10

Output Measure

- Number of participants in field days.

Year	Actual
2018	100

Output #11

Output Measure

- Number of participants in on-farm demonstrations.

Year	Actual
2018	80

Output #12

Output Measure

- Number of students attending field days to seed production fields, germplasm collections and other experimental fields.

Year	Actual
2018	0

Output #13

Output Measure

- Number of non-refereed publications.

Year	Actual
2018	3

Output #14

Output Measure

- Number of presentations in scientific meetings.

Year	Actual
2018	19

Output #15

Output Measure

- Number of research and/or extension proposals submitted addressing Global Food security and hunger.

Year	Actual
2018	2

Output #16

Output Measure

- Number of MS Thesis related to Global Food Security and Hunger.

Year	Actual
2018	5

Output #17

Output Measure

- Number of new/improved varieties developed and released.

Year	Actual
2018	1

Output #18

Output Measure

- Number of activities to inform stakeholders about established projects and their benefits

Year	Actual
2018	6

Output #19

Output Measure

- Number of producers trained in integrated basic grain management.

Year	Actual
2018	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers that adopted two or more recommended practices for integrated coffee management.
2	Number of producers that increased production and quality of coffee.
3	Number of producers that adopted two or more recommended practices for integrated plantain and banana management.
4	Number of producers that increased production in plantain.
5	Number of producers that adopted two or more recommended practices for vegetable management.
6	Number of producers that increased production of vegetable crops.
7	Number of producers that adopted two or more recommended practices for citrus management.
8	Number of producers that increased production of citrus.
9	Number of producers that increased knowledge after completing a non-formal education course in vegetable gardening.
10	Number of persons that established a vegetable garden after completing a non-formal education course in vegetable gardening.
11	Number of publications distributed on Best Management Practices.
12	Sales (in dollars) of improved cultivars seeds at the substations.
13	Number of locally produced starchy crops with increased output according to the Department of Agriculture Statistics and/or Extension Specialist/Commodity leader reports.
14	Number of vegetable crops with increased output according to Dept. of Agriculture statistics and/or Extension Specialist/Commodity leader reports.
15	Amount of certified organic seeds produced and distributed from organic plots at the substations.
16	Number of producers that increased production of basic grains.
17	Number of locally produced fruits with increased output according to Extension Specialist/Commodity Leader reports

18	Land area in coffee and forage crops or under storm damage as characterized by drone applications

Outcome #1

1. Outcome Measures

Number of farmers that adopted two or more recommended practices for integrated coffee management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	211

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Number of producers that increased production and quality of coffee.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	72

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Number of producers that adopted two or more recommended practices for integrated plantain and banana management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	351

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The cultivation of plantain and banana is one of the main socioeconomic engines of agriculture in Puerto Rico. After Hurricane Maria both crops were severely affected and also the people who depend on them. According to The State Department of Agriculture, plantations were lost by 90%.

What has been done
Intervention through the IPM projects were carried out in different areas of the plantain and banana zone, providing training in integrated management production and IPM for the restoration of banana and plantain plantations after Hurricane Maria.

Results
Three hundred fifty one (351) farmers adopted 2 or more recommended practices to restore their plantations, specially improving the soil, beginning with healthy seed from tissue culture and maintaining good cultural practices throughout the cultivation of the crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Number of producers that increased production in plantain.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	223

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

Number of producers that adopted two or more recommended practices for vegetable management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	356

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
After the passage of hurricane Maria the crops of the municipality of Ciales were severely affected. Ciales according to the 2009-2013 survey has an unemployment rate of 60% and their population lives under the poverty index. The F&F Hydroponic Corporation had a production of 20,000 weekly lettuces agricultural activity that offered employment to 12 heads of family, that after the passage of Hurricane Maria were threatened with losing their jobs.

What has been done
Extension Agents provided support to employees and farmers thru educational field visits and lessons in integrated crop management, emphasizing marketing, risk management and efficient production. Thirteen (13) agricultural employees committed to their source of employment and livelihood, together with the members of the F & F Hydroponics corporation, participated in the recovery efforts to resume crop production.

Results
The agricultural employees (13) managed to overcome hurricane Maria and are prepared to continue developing their business.After market analysis, evaluation of risk management and development of resilience, they produced 50,000 plants of a variety of salads (boston salannova) weekly. The economic and social impact benefits improved the quality of life of the families directly and indirectly involved and in the agricultural business. In addition to guaranteeing jobs

for sustenance, the initiative also helped increase food security in Puerto Rico.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #6

1. Outcome Measures

Number of producers that increased production of vegetable crops.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	377

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mr. Jose Carasquillo, a physical education teacher arrives at the Extension office with the intention of wanting to give up his work as a teacher and dedicate himself to agriculture with the idea of improving his family economic situation.

What has been done
Mr. Carrasquillo was trained by the Agricultural Extension Service in the use of Trellises System for growing vegetables, how to establish his first Agricultural Business, agencies that work with farmers, development of Business Plans, Inventories, employer obligations, good agricultural practices, selection of seeds, pest and disease management and soil fertility. He is currently taking a bee course to incorporate bees on his farm and improve the pollination of his crops. Soil samples from his farm were sent for analysis and a soil report with recommendations was made. He benefited from the Seed Relief program.

Results
Mr. Jose Carrasquillo increased his family income by renting a 30 acres farm of which 27 are in production. He entered the Family Market Program of the Department of Agriculture of Puerto Rico and the income generated allowed him to renounced his teaching position and dedicate himself to farming. He has five vegetable ranches where he produces peppers, eggplants, cherry pepper, squash and coriander. In addition, he is also producing other crops like taro, bananas,

cassava, pineapple and papaya. He is currently dedicated to full-time agriculture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Number of producers that adopted two or more recommended practices for citrus management.

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)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #8

1. Outcome Measures

Number of producers that increased production of citrus.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #9

1. Outcome Measures

Number of producers that increased knowledge after completing a non-formal education course in vegetable gardening.

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Number of persons that established a vegetable garden after completing a non-formal education course in vegetable gardening.

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Number of publications distributed on Best Management Practices.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	565

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers in Puerto Rico need to sustainably attain adequate yields and reduce production costs in order to compete in an open market economy.

What has been done
Distribution of technological packages was reduced because of the lack of electricity, water and difficulties for transportation as aftermath for the hurricanes occurred in September 2017. However, printed copies of technological practices for different crops are distributed to farmers, extension agents, and specialists, local and Federal Government officials, educators, private sector professionals in agriculture and the general public. Drafts of technological packages for cucumbers, melons (honeydew and cantaloupe), citrus, taro, arracacha and tannier are in an advance stage of completion. A technological package for the production of pepper (Bell and Cubanelle) was completed.

Results
The PRAEXS distributed paper copies of technological packages, Journal of Agriculture of the UPR (1,305 copies of issues) and other bulletins and publications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems

Outcome #12

1. Outcome Measures

Sales (in dollars) of improved cultivars seeds at the substations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	50983

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lack of seeds and propagation materials of improved varieties from locally grown crops continue to be among the major constraints for local farmers. This situation has been repetitively pointed out by extension agents. PRAEXS provides vital support for the continued production of traditional crops because seed is not available from the private sector.

What has been done
PRAEXS produces seed and propagation materials of improved varieties for crops of local interest that are distributed to farmers at a minimal cost. Among these crops are: green-shelled bean, pigeon peas, tropical corn, sweet corn, banana, plantain, true yam, taro, tannier, sweet cherry pepper, tropical pumpkin, coffee and tropical-type sweet potato. Contributions to these efforts came also from institutional resources.

Results
Acreage planted with high quality seed and propagation material increased. This is especially true after hurricanes that occurred in September 2017 when the majority of commercial crops were devastated by high speed winds and rain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #13

1. Outcome Measures

Number of locally produced starchy crops with increased output according to the Department of Agriculture Statistics and/or Extension Specialist/Commodity leader reports.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Historical data reflects that the root and tuber group of the starchy crop decreased in production over the last 60 years. In recent decades, however, there has been increased production of both banana and plantain. Locally, banana and plantain are the most important starchy crops.

What has been done
PRAEXS has an active research program for banana and plantain production. This program includes detailed research for field management systems, pest control and recently in varietal evaluation. Research results together with outreach initiatives, and efforts of the Local Department of Agriculture, have resulted in increased production and quality for both crops.

Results
Data from the ?Coorporacion de Seguros Agricolas?, a subsidiary of the Puerto Rico?s Department of Agriculture, shows that current area planted for banana and plantain is about half of that in production before the hurricanes Irma and Maria that occurred in September 2017. As compared to the last quarter of 2017, increase in acreage for plantain was 9.5% and was 2% for banana. Extension specialist indicated acreage and production for all starchy crops are expected to increase as farmers recover from the aftermath of hurricanes occurred in September 2017.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #14

1. Outcome Measures

Number of vegetable crops with increased output according to Dept. of Agriculture statistics and/or Extension Specialist/Commodity leader reports.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vegetable crop production is among the most important agricultural business. Production is primarily directed to local markets. However, some crops such as tomato and watermelon have markets outside of Puerto Rico.

What has been done
PRAEXS has an active research program for vegetable crops. This program includes detailed variety evaluation, management systems and pest control. Some of these crops are produced under controlled conditions such as in hydroponics and in greenhouses. Research results together with outreach initiatives, and efforts of the local Department of Agriculture have resulted in increased acreage certain vegetable crops.

Results
Information provided by the Extension Specialist indicated that after Hurricanes occurred in September 2017 local vegetable crop production decreased sharply. It was also informed however, that during 2018 acreage for some vegetable increased as is the case for cucumber, 15%; tomatoes, 17 %; eggplant, 19%; tropical pumpkin, 19%; lettuce, 14%; cabbage, 30%, and watermelon, 21%. These increases in acreage should be associated with increased output for the crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #15

1. Outcome Measures

Amount of certified organic seeds produced and distributed from organic plots at the substations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	565

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Organic and agroecological farmers need a reliable supply of seed and propagation material for crops and varieties of crops of local interest.

What has been done
Organic and agro-ecological planting for seed productions were reestablished at the Lajas substation. Crops included; tropical pumpkin, tropical-type sweet potato, green-shelled bean, sweet corn, lettuce, sweet cherry pepper, cowpea and eggplant. Efforts for these planting includes a substantial contribution of Capacity funds as well as State funds.

Results
Production of organic seed and propagation material decreased as associated to the aftermath of hurricanes occurred in September 2017. However, a total of 565 seed packages from tropical crops vegetable and grains were distributed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #16

1. Outcome Measures

Number of producers that increased production of basic grains.

Not Reporting on this Outcome Measure

Outcome #17

1. Outcome Measures

Number of locally produced fruits with increased output according to Extension Specialist/Commodity Leader reports

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Tropical fruit crop production is directed to both local markets and for export. Certain fruit crops such as breadfruit, papaya and pineapple have increased acreage and outputs in recent decades.

What has been done
PRAEXS has an active research program for tropical fruit crops. This program includes detailed variety evaluation, management systems and pest control. Research results together with outreach initiatives, and efforts of the Local Department of Agriculture have resulted in increased acreage certain fruit crops grown locally.

Results
Information provided by the Extension Specialist indicated that after Hurricanes occurred in September 2017 local fruit production decreased sharply. However, recently acreage for some fruits increased as is the case for breadfruit, 15%; papaya 45%, pineapple 10%, and passion fruit 10%. These increases should be associated with increased output for the crops. Extension specialist indicated acreage for other fruit crops haven?t increased primarily because lack of adequate of seed and propagation materials.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #18

1. Outcome Measures

Land area in coffee and forage crops or under storm damage as characterized by drone applications

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

One year after catastrophic storm Maria wiped out about 80 percent of the crop value, Puerto Rico's agricultural economy is in slow recovery, jeopardizing the viability of agricultural industries and people who have lived from agriculture. The effect of this hurricane on agriculture promoted very fragile conditions for crops. There was a resurgence of new pests and diseases, due to the effect of winds and the change in the population of birds and other biological organisms that in the past were controlling them. As a result, we have conditions on the Island that promote new pest and disease outbreaks affecting agricultural production.In addition, the University of Puerto Rico; thus, the College of Agricultural Sciences, has been facing major budget reductions related to the decrease of previously available Commonwealth subsidies. These subsidies represented a major part of the University of Puerto Rico's financial resources. As a direct consequence both PRAES and PRAES are experiencing reductions in personnel and in financial resources needed to complete the activities related to the planned programs. Detailed budget allocations to our institution have been certified by the Financial Oversight and Management Board for Puerto Rico.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In development of BMP and IPM in poinsettias a survey was administered to poinsettia growers. Seventeen (17) growers were interviewed in Aibonito, Barranquitas and Comerio municipalities. Thirty five percent (35%) of the growers do not know IPM, all of them said that they control weeds inside and outside their greenhouses, and that they identify pests by experience, 12% do not remove diseased parts of plants, do not use preventive

applications and do not follow label instructions.Sixty five percent (65%) have a register of pesticide use and they reported the use of 32 different products for poinsettia management. This data confirms the importance of educating growers in IPM to reduce pesticide use.

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Animal Systems

☑ 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	10%		0%	
132	Weather and Climate	5%		0%	
133	Pollution Prevention and Mitigation	5%		0%	
202	Plant Genetic Resources	5%		0%	
205	Plant Management Systems	8%		0%	
301	Reproductive Performance of Animals	8%		5%	
302	Nutrient Utilization in Animals	8%		20%	
303	Genetic Improvement of Animals	8%		30%	
306	Environmental Stress in Animals	8%		15%	
307	Animal Management Systems	0%		25%	
308	Improved Animal Products (Before Harvest)	5%		0%	
311	Animal Diseases	5%		0%	
313	Internal Parasites in Animals	5%		0%	
315	Animal Welfare/Well-Being and Protection	5%		0%	
401	Structures, Facilities, and General Purpose Farm Supplies	5%		0%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		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	11.4	0.0	4.0	0.0
Actual Paid	15.0	0.0	9.6	0.0

Actual Volunteer	0.0	0.0	0.5	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**
758677	0	1773090	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
379338	0	861041	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Conduct seminars, meetings, trainings, extension agent certifications, and workshops.
2. Organize field days for producers
3. Local and international visits (with similar environments and agricultural systems) to exchanged farm management experiences and research findings.
4. Develop educational material consisting of model plans and educational material (publications, newsletters, videos, CDs).
5. Develop proposals to seek external resources as a means to conduct applied research to address the current needs in livestock production. Offer Counseling and orientation to farmers.
6. Work in collaboration with communication media.
7. Establish collaborations with government agencies (e.g. Environmental Quality Board; State Departments of Health, Department of Agriculture, Dairy Industry Regulatory Office, Environmental and Natural Resources and Education; Puerto Rico Aqueducts and Sewage Authority; USEPA; NRCS; and others).
8. Improve collaboration with our partners at the University of Puerto Rico and other educational institutions.
9. Certify more demonstrative farms on different ag commodities around the island.
10. Identify funding sources to develop proposals to conduct applied research to address the current and future needs in livestock production.

2. Brief description of the target audience

Farmers, agricultural entrepreneurs, animal rights organizations, schools, PRAES professionals, government personnel, community leaders, students from the College of Agricultural Sciences and related academic fields, and professionals from the private sector.

Beef dairy and small ruminant producers, agricultural entrepreneurs, extension agents, Agronomists and other personnel from the Department of Agriculture and private sector, community leaders, and/or animal rights organizations.

3. How was eXtension used?

www.eXtension.org has been used as a source of information by Extension Specialist and Agents to complement training presentations, material offered to Extension Agents and Farmers, as well as professional development material.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4324	121073	584	0

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

Remote Access Data Logger Thermometer for Monitoring Rectal Temperature in Bovines

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	2	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 1. Number of farmers trained in recommended bio-security practices as a means to mitigate diseases and increase animal production.

Year	Actual
2018	601

Output #2

Output Measure

- 2.Number of farmers trained in practices in animal welfare and protection.

Year	Actual
2018	1023

Output #3

Output Measure

- 3. Number of farmers trained in recommended practices in recordkeeping.

Year	Actual
2018	610

Output #4

Output Measure

- 4. Number of farmers trained in efficient practices against internal and external parasites.

Year	Actual
2018	139

Output #5

Output Measure

- 5. Number of farmers trained in the means of mitigating the effects of climate change on livestock production.

Year	Actual
2018	586

Output #6

Output Measure

- 6. Number of farmers trained in the implementation of alternative crops/forages as a means to improve nutrient utilization.

Year	Actual
2018	216

Output #7

Output Measure

- 7. Number of farmers trained in recommended economic practices associated with business efficiency.

Year	Actual
2018	303

Output #8

Output Measure

- 8. Number of meetings held with stakeholders to discuss the situation of each livestock industry and corresponding research priorities.

Year	Actual
2018	1

Output #9

Output Measure

- 9. Number of popular (non-refereed) publications to report research results and other pertinent information for the benefit of producers and other interested parties.

Year	Actual
2018	14

Output #10

Output Measure

- 10. Number of publications in refereed scientific journals.

Year	Actual
2018	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers that adopted a bio-security program.
2	Number of farmers that adopted practices in animal welfare and protection.
3	Number of farmers that adopted recommended recordkeeping procedures.
4	Number of farmers that adopted practices for the control of internal and external parasites on their farms.
5	Number of farmers that adopted one or more practices for heat stress control.
6	Number of farmers that improved the nutrient utilization practices in their herds.
7	Number of farmers and agricultural entrepreneurs that used tools to make effective economic decisions to improve their business.
8	Number of producers participating in field days or training sessions who adopted or expressed intentions to adopt recommended management practices on their farms.
9	Number of rabbits, pigs, and dairy and beef cattle of genetically improved breeding stocks, from the University of Puerto Rico herd, sold to local producers to improve the genetic quality of their herds.
10	Number of popular (non-refereed) articles published to report research results and other pertinent information for the benefit of producers and other interested parties.
11	Description and management of breeding stock of purebred Senepol and crossbreds of Senegal with other beef breeds from the University of Puerto Rico herd
12	Number of farmers that adopted slick-hair Holstein cows into their dairy herds

Outcome #1

1. Outcome Measures

Number of farmers that adopted a bio-security program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	48

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Number of farmers that adopted practices in animal welfare and protection.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	191

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Calf mortality in Puerto Rican Dairy Farms ranges from 15-20%, affecting animal welfare and productivity. The main reason for this are improper passive immunity transference, hygiene, feeding and appropriate space. Most dairy farmers do not understand the importance of these practices and the repercussions they pose on productive potential of their heifers.

What has been done
A special project was created and 3 Dairy Extension Agents were registered and trained to provide intensive farm visits, measure different calf health parameters and provide recommendations to a group of farmers. Total serum protein, colostrum IgG, calf height, weight and urine gravity (hydration status). The data collected in each dairy farm was compared with the benchmarks for dairy heifers and recommendations were offered accordingly.

Results
A total of 10 dairy farmers were trained in proper calf care practices and the data from 52 calf were collected. Two dairy farmers invested in new calf pens, increasing calf cage space from 10 to 20 square feet/calf.One dairy farmer bought a milk pasteurizer and incorporated it into their calf feeding systems pasteurized milk. Another dairy farmer increased the frequency of calf pen cleaning and now feed their calves 2 times per day instead of 1 time per day. A period of six months will be waited to visit and collect data from their current calves to compare their health parameters post management improvements. We intend to use this information to convince more farmers about the benefits of implementing good calf care practices in their dairy farms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
311	Animal Diseases

Outcome #3

1. Outcome Measures

Number of farmers that adopted recommended recordkeeping procedures.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	52

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Number of farmers that adopted practices for the control of internal and external parasites on their farms.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	93

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
311	Animal Diseases
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #5

1. Outcome Measures

Number of farmers that adopted one or more practices for heat stress control.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	39

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
315	Animal Welfare/Well-Being and Protection
401	Structures, Facilities, and General Purpose Farm Supplies

Outcome #6

1. Outcome Measures

Number of farmers that improved the nutrient utilization practices in their herds.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

During the last decades, many local dairy farmers switched from grass-based feeding to grain feeding systems. Due to the costs-effectiveness of this practice, several farmers abandoned the practice of grazing and its associated pasture management (fertilizing and weed control). Some even sold land originally designated for grazing or chopping. When the price of grains increased, many dairy farmers found themselves in precarious situation. Many struggle to maintain their production based in grazing due to pasture degradation. The majority of those that sold their land, either had to purchase more land or close their farms.

What has been done

Dairy Extension Personnel in collaboration with voluntary dairy farmers evaluated several improved forage varieties for grazing or chopping . With the preliminary results from Field Experiences, Mombaza grass (Panicum maximum Jacq.) was recommended to farmers due to its high yields (20 tons/acre/yr), drought tolerance and relative high protein cotent (8-22%). Several Field days at two dairy farms were done to demonstrate Mombasa's properties. In addition, several trainings were offered about identification of weeds and their control, soil sampling and profile interpretation, and management of Mombanza (establishment, maintenance, grazing and chopping). With collaboration of AES, a Brillion Seed Planter was lend to participating dairy farmers.

Results

A total of 65 acres were cleared of weeds and brought back in production of Mombanza grass in the counties of Camuy and Arecibo. This reduced the animal load per acre and reduced 15% dependence on grain for animal feeding. In addition, one dairy farmer was able to produce enough forage to feed his cows (49 animals) and have surplus Mombaza to sell as haylage, producing an extra income of $10,800/yr. Extension Dairy agents are using these experiences to convince more farmers to implement recommended good pasture management practices as means to reduce grain dependence and increase production efficiency and sustainability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
202	Plant Genetic Resources
205	Plant Management Systems
302	Nutrient Utilization in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Number of farmers and agricultural entrepreneurs that used tools to make effective economic decisions to improve their business.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #8

1. Outcome Measures

Number of producers participating in field days or training sessions who adopted or expressed intentions to adopt recommended management practices on their farms.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
308	Improved Animal Products (Before Harvest)
601	Economics of Agricultural Production and Farm Management

Outcome #9

1. Outcome Measures

Number of rabbits, pigs, and dairy and beef cattle of genetically improved breeding stocks, from the University of Puerto Rico herd, sold to local producers to improve the genetic quality of their herds.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

Outcome #10

1. Outcome Measures

Number of popular (non-refereed) articles published to report research results and other pertinent information for the benefit of producers and other interested parties.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals

307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

Outcome #11

1. Outcome Measures

Description and management of breeding stock of purebred Senepol and crossbreds of Senegal with other beef breeds from the University of Puerto Rico herd

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The beef industry of Puerto Rico has traditionally been at a disadvantage in competition with imported meat, which is partly due to low genetic performance genetic of the native cattle and poor management practices of the herd. Genetic improvement and other factors associated with its performance are essential needed to enhance the competitively of locally produce beef and increase its sales value to benefit the producer.

What has been done
Senepol cattle are a Bos taurus type naturally polled, of a docile natural, produce good-quality beef and are well-adapted to tropical environments. The Institutional Senepol herd is now one of the outstanding sources of breeding stock in the World.

Results
The willingness of beef producers in Puerto Rico to use purebred or crossbred Senepol animals in their herds has been a positive factor all along. Every year breeding stock of the UPRM herd is auctioned off to beef producers located in the 8 agricultural regions of the island where beef cattle are raised. When fed under grazing conditions with supplementation and good management practices Senepol cattle are yielding beef of highly acceptability quality. Phenotyping and molecular characterization of bovine double muscling also have been performed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

307 Animal Management Systems

Outcome #12

1. Outcome Measures

Number of farmers that adopted slick-hair Holstein cows into their dairy herds

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The dairy cattle represent the largest portion of the animal production income of Puerto Rico. However, its sustainability is threatened by elevated cost of production and low milk yield. Improving profitability at dairy farms level will need selection of animals adapted to heat stress, enhancement of its reproduction performance, maximize nutrient utilization by animals, and evaluating of novel forage sources.

What has been done
A better selection of dairy cattle, which tolerate warmer climates and produce more efficiently, is the focus of the main research area at the UPRM Animal systems. The physiological parameters associated the thermoregulatory capacity, and the genetic expression and microanatomy of the skin of slick-hair Holstein cows raise under heat stress have been evaluate with great success. Research on feed efficiency, growth and reproductive characteristics and phenotype and molecular characterization of skin of slick-hair Holstein cows also have been performed. A conference on slick-hair phenotype Holstein cows in tropical climates, and demonstrative field days on the use of novel forage on slick-hair phenotype Holstein were conducted.

Results
Slick-hair phenotype appears to be an adaptation of cattle to environmental climates as evidenced by lower physiological parameters values associate with heat stress as compared to normal hair animals.
Slick-hair phenotype Holstein cows have been adopted in Puerto Rico dairy farms.
Average feed efficiency, milk yield and reproductive performance also was improved when slick-hair cows were incorporated in dairy herds. Non-typical forages (e.i. Pennisetum purpureum x Pennisetum glaucum, Soybean, Crotalatia, and Canavaria) also have been incorporated as fiber sources in dairy farms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

In September 2017, Puerto Rico experienced the worst natural disaster on record: Hurricane Maria. This dramatically changed all aspects of animal production on the island.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Affiliation with Dairy Herd Improvement Association to collect variables of interest from Dairy Farmers. Continuous evaluation of the quality and accuracy of the data collected in our online report system (SISE). In addition, together with personnel of the Experimental Station we are trying to increase efforts to improve the record keeping of other animal production systems.

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Integrated Management of New and Emerging Pests and Diseases

☑ 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
211	Insects, Mites, and Other Arthropods Affecting Plants	50%		30%	
212	Pathogens and Nematodes Affecting Plants	10%		40%	
215	Biological Control of Pests Affecting Plants	0%		10%	
216	Integrated Pest Management Systems	40%		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	4.4	0.0	3.2	0.0
Actual Paid	3.7	0.0	8.4	0.0
Actual Volunteer	0.0	0.0	0.7	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**
184761	0	1001051	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
92380	0	528306	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop Partner-mediated Pest Management Strategic Plans for the crops in Puerto Rico.
- Foster the use of cutting-edge technology to implement IPM.
- Enchance our capacity to conduct fast pest and disease diagnosis.
- Disseminate research results through publications, seminars, field days, conferences, and any other method deemed appropriate to reach our target audiences: Extension agents, government partners, students, producers, consumers and environmental groups.
- Technical production training meetings.
- Capacity building workshops
- Demonstration methods
- Meetings, visits and guidance to farmers.
- Collaborations with state, local and federal government agencies.
- Use mass media to desseminate information.
- Preparation of technical plans (IPM. irrgation systems, cultivation practices)
- Prepare curriculum and other educational materials.

2. Brief description of the target audience

- Citrus and Vegetable growers
- Banana and Plantain growers.
- Ornamental growers
- Puerto Rico Department of Natural Resources.
- U.S. Fish & Wildlife Service--Caribbean Regional Office.
- International Institute for Tropical Forestry. USDA-FS
- Puerto Rico Department of Agriculture
- Ornamental, Landscaping, Plant Nursery Industry Growers of Cucurbits South of USA and Puerto Rico
- IPM specialists
- Researchers in the vegetable industry
- Forest and land managers
- Undergraduate and graduate students from the Crops and Environmental Sciences
- Federal and state agricultural agencies (PRDA, USDA/APHIS. USDA/ARS, USDA/NRCS).
- American Phyto-pathological Society (APS), Agronomy Society of America, Horticultural Society, Puerto Rican Agricultural Sciences, Entomological Society of America
- Consumers and homeowners

3. How was eXtension used?

www.eXtension.org has been used by Extension Specialists and Agents as a source of Information to complement trainings, field days and other activities with their clientele and as a tool for professional development.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	130	200	0	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	8	9	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of abstracts and oral presentations in professional scientific meetings resulting from program activities.

Year	Actual
2018	18

Output #2

Output Measure

- Number of joint Research-Extension activities that include pest diagnostics and identification.

Year	Actual
2018	6

Output #3

Output Measure

- Number of field days, farm visits, symposia, workshops, topic conferences, and open houses that emphasized in IPM practices that impact food security.

Year	Actual
2018	6

Output #4

Output Measure

- Number of people who participated in IPM non-formal education courses.

Year	Actual
2018	880

Output #5

Output Measure

- Number of Extension Specialists that provide training manuals, field days, talks, newspaper articles, conferences, and design web site resources in integrated pest management aiming at food security.

Year	Actual
2018	6

Output #6

Output Measure

- Number of Faculty and Extension Specialists that provide information and recommendations on best management practices for pest and disease control.

Year	Actual
2018	6

Output #7

Output Measure

- Number of stakeholders with increased knowledge on emerging pests and aware of reduced risk pesticides.

Year	Actual
2018	97

Output #8

Output Measure

- Number of articles published in newspapers.

Year	Actual
2018	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers that adopted one or more recommended practices for integrated management of Citrus Greening.
2	Number of persons that increased knowledge about IPM in the vegetable garden after completing a non-formal education course.
3	Number of persons that implemented integrated management recommendations after receiving a pest or disease diagnose for their crops.
4	Number of emerging pests identified as a result of research activity.
5	Number of producers that increased knowledge after participating in a joint Research-Extension activity (field day, on-farm demonstration or oral presentations) on new and emerging pests and diseases.
6	Number of farmers that acquired knowledge in integrated management of vegetable diseases in shade houses.
7	Number of farmers that adopted one or more recommended practices for Black Sigatoka Management.
8	Number of farmers that acquired knowledge in integrated management of Citrus Greening.

Outcome #1

1. Outcome Measures

Number of farmers that adopted one or more recommended practices for integrated management of Citrus Greening.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	19

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of persons that increased knowledge about IPM in the vegetable garden after completing a non-formal education course.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	245

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In recent years, puertoricans are cultivating vegetable gardens in their homes to produce healthy food. Also. they are aware of the negative effects of pesticides in their health. They are also trying to produce in a sustainable way.

What has been done
Extension agents are using the Vegetable gardening IPM lessons and the Vegetable Gardening Festival to offer training in identification and application of biological control and natural pesticides for pest and disease control. About 300 persons were reached directly in presentations and practical trainings. Information about identification and integrated management of vegetable and herbs posted in the Facebook page of Extension Diagnostic Clinic reached 12,966 people.

Results
Two hundred and forty five (245) persons increased their knowledge in IPM aft6er completing a non-formal course in IPM in vegetable garden. People are aware about the use of IPM to control pests and diseases in their vegetable gardens, including, natural and biological pesticide application, use sanitation measures, promoting the presence of biological control organisms by growing herbs and other companion plants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Number of persons that implemented integrated management recommendations after receiving a pest or disease diagnose for their crops.

2. Associated Institution Types

- 1862 Extension

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)
Control Measures depend on proper identification of pests and diseases. Therefore, diagnosis is one of the most important aspects. Without proper identification control measures can be a waste of time and money and can lead to further plant losses. Proper disease diagnosis is therefore vital to implement the management practices for the specific pest or disease.

What has been done
The extension Plant Diagnostic Clinic in Mayaguez diagnosed 86 plant samples, diagnosing pests and diseases and provided a report with management recommendations. The PR Pest Diagnostic Facilities project (PRPDF) educational outreach consisted of visits to farmers in 7 municipalities after Hurricane Maria to assess what pests and deseases were prevalent and trained them in identification, integrated management and how to take samples to submit to the clionic. The PRPDF delivered a questionare to access IPM knowledge and practices implemented by growers. Six (6) publications were develop to help farmers:How to take samples for nematode diagnosis, Management of sooty mold in coffee, Identification and management of downy mildew of arugula, Management of damping of and root rot in coffee nurseries, Processing and producing healthy sweet potato seed and Management of Yam Dry Rot in seed before planting.

Results
About 47 Farmers learned how to identify pests and diseases after receiving hands-on training and educational materials. After that, they reduced pest and disease damage by implementing recommended management practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Number of emerging pests identified as a result of research activity.

2. Associated Institution Types

- 1862 Extension
- 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 Puerto Rico numerous plant diseases and insects impact crop quality and yield. Seed-borne diseases and poor seed quality are common problems in seed materials and affect vegetable production. Increased frequency of extreme weather events has resulted in increased importance of abiotic diseases. Effective management of diseases and pests depends on an accurate identification.

What has been done
The Plant Diagnostic Clinic in Juana Diaz, conducted timely detection and identification of new diseases affecting corn, soybeans, tepary bean, tomatoes and pineapples and prevented the dissemination of emergent pathogens into new areas.

Results
The accurate identification of five new diseases resulted from isolations on artificial media, serological and molecular identification. Pathogenicity tests confirmed the causal agent of the diseases. Polymerase chain reaction (PCR) analyses with primers from the ITS region, B-tubulin, and the elongation factor were conducted. New sequence data was deposited in GenBank/NCBI of the causal organisms of the new diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

216 Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Number of producers that increased knowledge after participating in a joint Research-Extension activity (field day, on-farm demonstration or oral presentations) on new and emerging pests and diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	60

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producers need knowledge of new and emergent pest and diseases in vegetables and other important crops in the island.

What has been done
Two field days were held at the Juana Diaz and Isabela Experiment Stations with the attendance of approximately 60, Extension Agents and producers. Attendants received information on pests and diseases on vegetables and local crops of importance. Participants also learned about pest and disease control by observing field plots examples of the best practices. The Disease Clinics displayed information about their services and growers brought their own samples for pest and disease identification.

Results
A survey in the adoption of IPM practices in four different Municipalities of the island revealed that 65, 43, 27 and 11 percent farmers in Mayaguez, San Juan, Ponce and Arecibo respectively know pest and diseases affecting their crops and have adopted recommended IPM practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Number of farmers that acquired knowledge in integrated management of vegetable diseases in shade houses.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Number of farmers that adopted one or more recommended practices for Black Sigatoka Management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Number of farmers that acquired knowledge in integrated management of Citrus Greening.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	154

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The citrus industry was affected by hurricanes Irma and Maria. However, citrus remains important in the island with 7,000 acres of citrus planted in 2017. The prevention of Citrus greening in commercial nurseries is a priority.

What has been done
The AES fruit specialist and County agents offered 9 trainings in Citrus Greening Management and citrus pets and diseases control. Visited 43 farms to guide citrus growers in management of citrus greening and Asian Citrus Psyllid control. A demonstration plot was established in a citrus orchard, where citrus growers will observe a management program for HLB. In this plot the demonstration of unmanned aerial vehicle (UAV) with multispectral camera to monitor citrus greening dispersal was utilized.

Results
Citrus growers (43) have begun to adopt a Citrus Greening management programs in their orchards. A total of 65 farmers acquired knowledge in use of UAV (drone) with multispectral cameras to monitor the Citrus Greening.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The PRPDF delivered a questionnaire to assess IPM knowledge anmd practices implemented by growers. Of the farmers visited and trained, Fifty-five percent (55%) know what IPM is, 82% know their pest problems, 50% know how to take samples and submit them to the clinic for diagnosis. In IPM practices used by farmers on their farms, 45% cleans tools used in the farm, 64% rotates crops, 73% inspects seed before planting, 82% reused and incorporates harvast residues and 100% selects the seed, eliminates weeds and diseased plants or their parts and monitors their crops for pests and diseases.

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change, Natural Resources and Environment

☑ 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
101	Appraisal of Soil Resources	0%		3%	
102	Soil, Plant, Water, Nutrient Relationships	0%		6%	
103	Management of Saline and Sodic Soils and Salinity	0%		2%	
104	Protect Soil from Harmful Effects of Natural Elements	30%		4%	
111	Conservation and Efficient Use of Water	25%		17%	
112	Watershed Protection and Management	25%		9%	
121	Management of Range Resources	0%		3%	
122	Management and Control of Forest and Range Fires	0%		1%	
123	Management and Sustainability of Forest Resources	0%		5%	
124	Urban Forestry	0%		7%	
125	Agroforestry	5%		0%	
136	Conservation of Biological Diversity	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		14%	
212	Diseases and Nematodes Affecting Plants	0%		3%	
215	Biological Control of Pests Affecting Plants	0%		1%	
216	Integrated Pest Management Systems	0%		4%	
403	Waste Disposal, Recycling, and Reuse	15%		16%	
	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	10.7	0.0	4.0	0.0

Actual Paid	9.6	0.0	11.5	0.0
Actual Volunteer	0.0	0.0	0.4	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**
481787	0	299622	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
240894	0	118155	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The devastating effects of hurricane Maria (September 2017) were mostly felt during 2018. This experience made people more aware and conscious about preparedness and recuperation. Some of the activities for PRAES in the Climate change, natural resources and environment programmatic area were:
1. One of the most evident Hurricane effects are mud slides which severely affected farm road access. Therefore, we continued our educational effort on soil erosion control in collaboration with the USDA-Natural Resource Conservation Service (NRCS).
2. Training continues to be offered on watershed protection, water harvesting and storage. The concern this year was regarding water availability and quality for both human consumption and for farm animals.
3. Also, collaboration continues with the Caribbean Climate Hub developing activities and collecting data from farmers on ways used for their recovery.
4. The effort on brush/ forest fires prevention was diminished due to change in priorities. Besides the risk of forest fires was decreased due to the amount of rain fall and overall humidity increase.
5. Assistance was provided to farmers on farming natural disaster recovery effort, several articles and brochures were prepared and recommended practices such as fruit orchard tree pruning, coffee plantation renewal, and others.
For the PRAEXS
1. Quantify the contribution of agriculture in relation to pollution source, and to measure the short-and-long term impact of agricultural operations on the environment.
2. Develop pollution prevention and mitigation (practice, measure, thresholds) for protection of watershed and soil resources.
3. Develop soil improvement and maintenance practices.
4. Develop and promote sustainable agricultural practices as a key component to foster agricultural-led economic growth in the island.
5. Determine the factors that influence the sustainable agricultural production practices adoption in Puerto Rico.
6. Determine the pathways of entry, ecological impact, and management of non-native species on biodiversity.
7. Develop management approaches for conserving and restoring biodiversity.
8. Publish research advancements in journals, bulletins, newspaper articles, and popular magazines.

2. Brief description of the target audience

Farmers, producers, communities, government professionals, Extension personnel, community leaders, youth, leaders, volunteers, students (undergrad and graduates), Puerto Rico Department of Agriculture personnel, USDA agencies personnel, UPR Faculty members.

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	1484	985	0	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	12	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people who received capacity development (workshops, seminars, conferences) on water quality, watershed protection, and conservation.

Year	Actual

2018	81

Output #2

Output Measure

- Number of participants in non-formal educational courses on climate change.
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of people who received capacity development in agroforestry, soil erosion, and storm water runoff control.

Year	Actual
2018	126

Output #4

Output Measure

- Number of people who received capacity development on soil erosion and water environmental regulations.

Year	Actual
2018	73

Output #5

Output Measure

- Number of people who received capacity development on prevention of brush or forest fire.
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of people who received capacity development on natural disasters and emergency management to reduce loses and maintain their farming operation.

Year	Actual
2018	186

Output #7

Output Measure

- Number of stakeholders receiving research information on best management practices for agricultural and natural ecosystems.

Year	Actual
2018	20

Output #8

Output Measure

- Number of oral or poster presentations at professional scientific meetings resulting from program activities.

Year	Actual
2018	16

Output #9

Output Measure

- Number of research proposals submitted.

Year	Actual
2018	5

Output #10

Output Measure

- Number of educational activities in collaboration with the Extension Service personnel to disseminate information to farmers and the general public about research results.

Year	Actual
2018	12

Output #11

Output Measure

- Number of graduate and undergraduate students involved in research projects.

Year	Actual
2018	6

Output #12

Output Measure

- Number of people who received capacity development on farm waste management and gas emission in farms.

Year	Actual
2018	94

Output #13

Output Measure

- Number of producers/persons that participated in joint Research-Extension activities (field days, on-farm demonstrations or oral presentations).
  Not reporting on this Output for this Annual Report

Output #14

Output Measure

- Number of people who participated in climate change in courses where the curricular guide was used.

Year	Actual
2018	514

Output #15

Output Measure

- Number of people who participated in a non-formal education course on water collection, storage and re-use for agricultural purposes.

Year	Actual
2018	113

Output #16

Output Measure

- Number of non-refereed publications resulting from program activities
  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 people who adopted recommended practices for the adaptation or mitigation of climate change on their farms (water use efficiency, waste management, livestock feeding practices, carbon sequestration, others).
2	Number of people who established watershed protection practices.
3	Number of people who adopted practices to improve water collection, storage, and reuse efficiency.
4	Number of people who adopted agroforestry practices, soil erosion or water runoff control practices.
5	Number of people who comply with environmental soil erosion and water requirements.
6	Number of people who adopted one or more practices to prevent brush or forest fires.
7	Number of people who prepared a contingency plan for natural disasters or got farm insurance.
8	Number of trainings, research demonstrations, tours, surveys and meetings with stakeholders to discuss research results, critical issues and priorities.
9	Number of students (graduate and undergraduates) receiving training and work experience in this research program.
10	Number of people who increased knowledge in soil management practices, soil health and carbon sequestration.
11	Number of people who increased knowledge on practices to improve soil quality through an integrated soil management system.
12	Number of non-native insects and weed species that pose a significant economic, ecologic and aesthetic impact in Puerto Rico, identified through an island-wide pest status assessment.
13	Number of people reporting willingness to adopt best management practices to improve conservation and efficient use of water.
14	Number of people reporting gained knowledge through podcasts and web videos
15	Number of target audience that report an increased knowledge through trainings, research demonstrations, tours, surveys and meetings
16	The number of people receiving training in Agro-ecology and adopting agro-ecological practices

Outcome #1

1. Outcome Measures

Number of people who adopted recommended practices for the adaptation or mitigation of climate change on their farms (water use efficiency, waste management, livestock feeding practices, carbon sequestration, others).

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	307

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
People are concerned regarding the changes that are being observed in weather patterns and storm force such as hurricanes. Every year the number and strength of severe climate events are increasing around the word. In our case,Puerto Rico is located in the hurricane path.

What has been done
Five hundred and fourteen (514) people participated in 28 training meetings offered on climate change.

Results
From those who participated in the training sessions on climate change, 60% or 307 adopted one or more recommended practices in their farms, such as efficient water use practices, solid waste management, animal feeding, carbon sequestration (soil health) and others.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water

112	Watershed Protection and Management
125	Agroforestry
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Number of people who established watershed protection practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	37

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry

Outcome #3

1. Outcome Measures

Number of people who adopted practices to improve water collection, storage, and reuse efficiency.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	161

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
403	Waste Disposal, Recycling, and Reuse

Outcome #4

1. Outcome Measures

Number of people who adopted agroforestry practices, soil erosion or water runoff control practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	78

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry

Outcome #5

1. Outcome Measures

Number of people who comply with environmental soil erosion and water requirements.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
403	Waste Disposal, Recycling, and Reuse

Outcome #6

1. Outcome Measures

Number of people who adopted one or more practices to prevent brush or forest fires.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of people who prepared a contingency plan for natural disasters or got farm insurance.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	91

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Most people are worried about the effects a natural disaster might have on their farm production and income.

What has been done
Information was developed to offer capacity training on natural disaster and emergency plans to reduce losses and maintain the farm operation.

Results
One hundred and eighty-six (186) persons participated in several training sessions offered on disaster management and plan preparation; 49% of those participants (91) prepared a contingency plan and obtained farm insurance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry
403	Waste Disposal, Recycling, and Reuse

Outcome #8

1. Outcome Measures

Number of trainings, research demonstrations, tours, surveys and meetings with stakeholders to discuss research results, critical issues and priorities.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To increase outreach efforts throughout diverse educational activities across disciplines and group of interest.

What has been done
Outreach efforts incremented throughout different activities across disciplines and groups or interest. Major initiatives include workshops, seminars, field days, meetings, training and research demonstrations. A novel project emphasizing soil and water resources to strengthen awareness, improve knowledge, and engage young adults in the decision-making process with the goal of improving environmental stewardship targeted secondary education and post-secondary students and their mentors. A series of workshops that included topics such as watershed and stream resources, dairy farm activities, the role of communities in an environmental decision-making process, land and aquatics data collection, wastewater treatment plants, coastal resources, water quality parameters, and soil profile observation.

Results
The capacity building of the audience increased, public awareness and interest about the research program have grown as shown by the number of participants, stakeholders? input and number of consultations reported.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
124	Urban Forestry
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
216	Integrated Pest Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #9

1. Outcome Measures

Number of students (graduate and undergraduates) receiving training and work experience in this research program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To support the training of outstanding students at the undergraduate and Master?s levels, to fill national identified expertise areas in the Agricultural and Natural Resources Sciences. This initiative responds to the need to ensure the development of the intellectual capital of the Natural Resources and Agricultural Sciences workforce in areas relevant to College of Agricultural Sciences and USDA identified by both federal and local agricultural agencies.

What has been done
Funding from research grants has been allocated to support students? training, provide work experience, and completion of a master?s degree in identified priority needs research areas within the Agricultural and Natural Resources Sciences. Students have been recruited to increase the number, quality, and diversity in the Natural Resources and Agricultural Sciences to build up science competitiveness throughout actual research activities and experiences. During the last year, undergraduate and graduate student have received training and work experience in this research program provided field and laboratory research experience for more than at dozens of undergraduate students. Students participating in Biodiversity research projects were involved in field and laboratory activities, including sampling, identification, and curation of specimens.

Results
There are numerous benefits for undergraduate and graduate students who get involved in research. Research experience allows university students to understand published works better, learn to balance collaborative and individual work, determine an area of interest, and jump-start their careers as researchers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

123	Management and Sustainability of Forest Resources
124	Urban Forestry
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
403	Waste Disposal, Recycling, and Reuse

Outcome #10

1. Outcome Measures

Number of people who increased knowledge in soil management practices, soil health and carbon sequestration.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
403	Waste Disposal, Recycling, and Reuse

Outcome #11

1. Outcome Measures

Number of people who increased knowledge on practices to improve soil quality through an integrated soil management system.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	60

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soil quality has become an issue of major concern for farmers and extension agents but little or no information is available in Puerto Rico.

What has been done
Several workshops have been developed in collaboration with NCRS to educate the public about soil quality and health.

Results
Increase in the number of people educated in the topic of soil health. Increase in the number of proposals submitted under the subject of soil quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
104	Protect Soil from Harmful Effects of Natural Elements
403	Waste Disposal, Recycling, and Reuse

Outcome #12

1. Outcome Measures

Number of non-native insects and weed species that pose a significant economic, ecologic and aesthetic impact in Puerto Rico, identified through an island-wide pest status assessment.

Not Reporting on this Outcome Measure

Outcome #13

1. Outcome Measures

Number of people reporting willingness to adopt best management practices to improve conservation and efficient use of water.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need of better tools and management practices to improve and promote the adoption of conservation and efficient use of water practices.

What has been done
Researchers at the PRAEXS are studying micro-irrigation designs and practices that can be scaled to a site-specific characteristic and end-user capabilities in the Caribbean basin. In addition, they aim to develop technology transfer products to promote adoption of micro-irrigation practices.

Results
Farmers are adopting micro-irrigation management practices to produce root crops in the semiarid regions of southern Puerto Rico. A milestone development up to date is the development of the H2OCrop, a mobile application for managing irrigation in the island.

4. Associated Knowledge Areas

KA Code	Knowledge Area

111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

Outcome #14

1. Outcome Measures

Number of people reporting gained knowledge through podcasts and web videos

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need to improve outreach for research awareness, and audience engagement.

What has been done
Our researchers used multiple online tools such as websites, podcasts, and blogs to reach different audiences. Content and new websites development have increased during the last year. Research groups such as the Agro-Ecological created their own webpage agroecologico.eea.uprm.edu for target audiences interested in knowledge improvement of environmentally friendly agricultural practices. Meanwhile, "desdelaeea" podcast, Reclying and manure and sustainable agriculture websites such as http://agriculturapr.blogspot.com/ continue

Results
Monitoring accounts and participating in discussions (e.g., answering questions in social media) was a key component for sustaining participation from followers and encouraging growth and engagement of their online community. Collectively, online outreach reached the milestone of over 100,000 hits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity

104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
124	Urban Forestry
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
403	Waste Disposal, Recycling, and Reuse

Outcome #15

1. Outcome Measures

Number of target audience that report an increased knowledge through trainings, research demonstrations, tours, surveys and meetings

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)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
216	Integrated Pest Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #16

1. Outcome Measures

The number of people receiving training in Agro-ecology and adopting agro-ecological practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	125

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An increasing numbers of students, farmers and agricultural enthusiasts are asking for information on organic and agroecological crop production

What has been done
Over 100, undergraduate and graduate students received training in agroforestry, silvicultural management and, agricultural research techniques by novel occupational workshops. All students comprised minorities that included people of Hispanic/Latin American cultural and racial

heritage, and women.

Results
Research results reached a diversity of audiences through personal communications, field days, seminars, and publications. An Agro-Ecological course was created for the general public interested in improving their knowledge in agricultural practices to enhance soil quality. Researchers also reached target audiences using a webpage agroecological .eea.uprm.edu.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy

Brief Explanation

This report recognizes the impact hurricanes Irma and María had on this research programmatic area. In the aftermath of the hurricanes, most of the Island spent the about five months without basic services such as drinking water, power or any sort of communication. In addition, Puerto Rico has been experiencing an economic recession for over 10-years.At present, the island is still in a recovery mode due to the lack of financial resources, the institutional financial situation and the delay in relief funds assignments. Another hurdle is the loss of experimental plots, samples, equipment, and personnel.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

From an applied perspective, the multiple data collection activities to compile input from the program participants and stakeholders, such as surveys, workshops and seminars, website questionnaires, document review, and analysis, were not always successful. The most efficient were workshops, seminars, and website, particularly web-videos and podcasts. With these tools the audience was expanded exponentially. The advantage of outreach tools is that they reveal the needs and interests of a broader audience. The

satisfaction with these tools is evident in the number of hits and positive comments on the websites. Moreover, this method is a more efficient outreach tool than the other ones.
Student mentoring is a vital cornerstone of the CCNRE research program. There are numerous benefits for undergraduate and graduate students who get involve in research. During the last year, graduate students who received training and work experience in this research program provided field and laboratory research experience for more than at dozens of other undergraduate students.
As stated by scholars, research experience allows university students to understand published works better, learn to balance collaborative and individual work, determine an area of interest, and jump-start their careers as researchers. Exposure to an area of research is invaluable and undoubtedly also helps students explore career fields. Institutions of higher education have a duty of attracting the most curious minds and provide the means for their first test of the research waters.

Key Items of Evaluation

Historically the core of this research program is defined in the following knowledge areas; Conservation and Efficient Use of Water, Watershed Protection and Management, Soil Plant, Water and Nutrient Relationships and Conservation of Biological Diversity. Last year alone these KA represented the 60% of the program research efforts through 19 research projects. Several avenues of research are pursued more intensely including new ways to manage the agricultural production practices to avoid watershed pollution, soil erosion and the impact of non-native and invasive species. These successful projects are characterized by the interdisciplinary team which involves scientists from a range of disciplines, carefully designed research projects with long-term goals in which the next step is always interlocking to the previous and future research efforts.
This report recommends strengthening the process and the priorities for research funded by state and federal agencies to address these critical priorities of research. Research should be focused on identifying feasible options for soil health improvement, watershed protection and management and conservation of biodiversity and providing sustainable approaches that are adaptable and affordable over the long term. Projects focused on long-term research should be highly encouraged as well the partnership with research programs and institutions with existing research networks. CCNRE's research is vital to meeting sustainable natural resources management and protection in the face of diminishing land and water resources and a progressive climate change.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety, Science and Technology

☑ 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
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	0%		70%	
701	Nutrient Composition of Food	0%		20%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	100%		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	4.4	0.0	1.8	0.0
Actual Paid	10.5	0.0	3.8	0.0
Actual Volunteer	0.0	0.0	0.1	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**
529614	0	67254	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
264807	0	7242	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Offered Safe Food Handling Curriculum to consumers. This curriculum includes Food safety for pregnant women, food safety around the year, and food safety during emergencies.
• Exhibits, information centers, radio shows, among others.
• Offered Food Safety Course to Food Establishment managers PRAES and personnel of other agencies.
• Trainings: Emphasis on the institutions that serve At Risk Population accordingly to the Food Code regulations.
• Training in HACCP, GAP and GMP
• Research in new product development using by-product from food industry and agricultural commodities.

2. Brief description of the target audience

• Extension professionals and other professionals.
• Parents that plan/buy/prepare food for the family.
• Consumers considered as a At Risk Population.
• Persons in Charge of Retail Food Establishments
• Scientists, plant breeders and growers working with cucurbita crops
• Consumers, farmers and food industry of Puerto Rico.

3. How was eXtension used?

N/A

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	12416	18428	2883	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 consumers completing one Food Safety educational curriculum for consumers.

Year	Actual
2018	1430

Output #2

Output Measure

- Number persons in charge of food establishments completing Food Safety Course.

Year	Actual
2018	2709

Output #3

Output Measure

- Number of persons completing courses, workshops, and seminars offered by the program.

Year	Actual
2018	0

Output #4

Output Measure

- Number of active research projects in the program.

Year	Actual
2018	3

Output #5

Output Measure

- Number of non-refereed publications based on research results.

Year	Actual

2018 5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of consumers that adopted one or more food handling practices.
2	Number of participants that approved the certification exam.
3	Number of participants that adopted three or more of eight selected food-handling practices recommended by the Food Code.
4	Number of products developed or improved as a result of research on active projects
5	Number of participants approving exam taken after completing courses, workshops, and/or seminars offered by the program. (Courses: Good Manufacturing Practices, Hazard Analysis and Critical Control Points, Good Agricultural Practices)
6	Number of farmers and agro-industries directly impacted by risk analyses conducted as part of research projects

Outcome #1

1. Outcome Measures

Number of consumers that adopted one or more food handling practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1161

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fourty eight (48) million people become ill, 128,000 are hospitalized, and there are 3,000 deaths due to foodborne illnesses. Nine percent(9%) of the outbreaks occur at home (CDC, 2016). According to Young, and Waddell (2016) some of the barriers for consumers to adopt safe food handling practices include: the belief that there is a higher risk of getting a foodborne illness when food is prepared and handled by others, they believe that the food system offers safe food, and they do not have control over foodborne illnesses, among others.

What has been done
The Consumer and family Science Educators (CFSE) of the PRAES offered 64 courses through which 1407 completed the course that included topics like hand washing , cooking at safe temperatures, avoiding cross contamination, cleaning and sanitizing, among others.

Results
Of the persons that participated in our courses eighty one percent (81%) adopted at least one safe handling practice, 58% cleaned and sanitized food surfaces, 72% washed their hands properly and frequently, 61% separated ready-to-eat food from food that needed to be cooked, 32% held food at safe temperatures.

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 that approved the certification exam.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2707

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One in every six Americans become sick due to foodborne illnesses. According to CDC (2016) 61% of Foodborne illness outbreaks occur in food establishments. When Food Managers are certified they enhance their food safety knowledge and therefore the number of outbreak cases. (Brown et al., 2014).

What has been done
Eight(8) PRAES Family and Consumer Sciences Educators that are trained in Food Safety offered 102 Food Safety Course to Food Managers throughout the island.

Results
Two thousand seven hundred and nine (2,709) Food Managers Completed the Food Safety Course of which two thousand seven hundred and seven approved the test.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of participants that adopted three or more of eight selected food-handling practices recommended by the Food Code.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1822

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico Health Department adopted the Food Code in the year 2000, which requires that all Person in Charge of a Food Establishment must demonstrate knowledge in proper food safety procedures.

What has been done
Eight (8) PRAES Family and Consumer Sciences Educators that are trained in Food Safety offered 102 Food Safety Courses to Food Managers through out the island. Through the courses we emphasized the different safe handling practices and the importance of adopting and complying with the requirements of the Food Code.

Results
Sixty seven percent (67%) adopted at least 3 safe handling practices, 67% of food managers (FM) prepared a control plan for food temperatures, 69% of the FM washed their hands, 66% used separate cutting boards for ready-to-eat and raw meat, and others, 62% used a food thermometer to measure cooking temperatures, 67% used a utensil or disposable gloves when handling ready-to-eat food,68% washed equipment and utensils using hot water and then sanitized them, 67% used at least one of the methods offered by the Food Code, 67% maintained cooked food at 135 °F and 65% prepared the cleaning vomits operational procedure.

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

Number of products developed or improved as a result of research on active projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The food industry is a complex and diverse business that supplies the food consumed by the masses. This industry includes: agriculture, food manufacturing and food processing. Puerto Rican farmers need to meet new trends in food consumption. In agriculture, it?s important to evaluate and release new germoplasm for food production. Food processing is an important part of our food industry. White cheese is very popular in Puerto Rico and adding value to a sub-product of this industry may allow the cheese producers to improve their profitability.

What has been done
Self-fed seed was produced from five tropical pumpkins (Cucurbita moschata) lines that have been identified in replicated trials as being good candidates for the production of baby squash. These lines produce fruit with an attractive yellow skin color and have different shapes that vary from oblong to round to flatten.
A yogurt formulation using acid whey was developed and a sensory analysis was conducted.

Results
Germoplasm data indicates that the production of baby squash (immature squash harvested two to three days after the first flowering) can be extended for about 14 weeks if harvesting is continuous). The peak period of baby squash production occurs from 5 to 9 weeks after its first flowering. Baby squash stored at 10oC presented a shelf life of 14 days, while the storage at 5C shortened the shelf life to 7 days.
Liquid acid whey was useful in manufacturing yogurt; however, it needs to be supplemented with either dry milk or dry whey powder to obtain a product with acceptable organoleptic quality. The yogurt fermentation took longer, and the color tended to look darker and with a yellowish tint

when compared to one fermented with milk.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

Outcome #5

1. Outcome Measures

Number of participants approving exam taken after completing courses, workshops, and/or seminars offered by the program. (Courses: Good Manufacturing Practices, Hazard Analysis and Critical Control Points, Good Agricultural Practices)

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of farmers and agro-industries directly impacted by risk analyses conducted as part of research projects

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

In 2017 we were devastated by Hurricane Maria. It was difficult inviting people to courses when mostly everyone was without electrical power and some without water supply. The majority of our personnel visited shelters to talk about food safety during emergencies, and hand washing. This natural disaster worsened our economical crisis. Many families decided to move to the US mainland. Puerto Rico, as in many other places, is going through a major financial crisis, which may or may not be solved in the near future. We expect changes in the amount of money assigned to our government's budget. This will have a domino effect on agencies and instrumentalities, as well as public policies and regulations. Adding to the economic crisis, Hurricane Maria hit PR in 2017, affecting our agriculture and small business. Many food businesses have shut down and many people have moved from the island.
On occasions, the support needed from the Municipal governments may vary if their interests are different from the ones established by our program; especially when part of the program is based on a different paradigm. It could take time for individuals, including

our personnel, to change their attitudes and adopt a new model.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

N/A

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Community Resources for Sustainable Development, Agricultural Economics, Marketing and Added Value

☑ 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
602	Business Management, Finance, and Taxation	20%		0%	
604	Marketing and Distribution Practices	0%		17%	
607	Consumer Economics	0%		33%	
608	Community Resource Planning and Development	40%		17%	
610	Domestic Policy Analysis	0%		33%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	30%		0%	
805	Community Institutions, Health, and Social Services	10%		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	28.9	0.0	1.0	0.0
Actual Paid	25.8	0.0	5.9	0.0
Actual Volunteer	0.0	0.0	0.2	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**
1297352	0	110991	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
648675	0	16853	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

PRAES CRD program was steered toward survival and recovery efforts following the hit of hurricane María on September 19, 2017, right before the beginning of fiscal year 2018. Community oriented initiatives focused in "on the spot disaster and emergency management", community self-reliance, community organization to facilitate both domestic and federal government aid distribution, and our local offices served as interagency communication and networking centers. Community economic development initiatives focused in establishing community based gardens and agricultural ventures that would provide needed goods in times of scarcity.
While research activities were also temporarily compromised by the hurricanes onslaught, investigators were able to either modify research designs to complete proposed activities with resources available, or make adjustments in their project's timetables to meet their objectives. Research activities performed include:

- The investigation of new market niches for our products through several consumer surveys. Consumer preferences for farinaceous crops, vegetables, and breadfruit were explored in these surveys.
- A literature review and opinion survey of PRAEXS researchers on the topic of program restructuring alternatives open to agricultural research institutions facing competing land-use policy issues.
- Personal interviews of customers at retail stores and consumer clubs in 13 municipalities across the island to estimate the demand for regular, differentiated coffees, and their substitutes. A database was created with consumers' demographics, preferences, perceptions and willingness to pay for differentiated coffees.
- The completion and submission of two graduate theses on the effects of selected federal food programs on employment in PR and on the performance of students in standardized tests. Econometric modeling, with data obtained from food federal programs, was also done to explore the impact of these programs on Puerto Rico's food industry.
- The analysis of results from a Delphi survey of local experts to identify the most pressing issues in food system work in PR. Results were compared to outcomes obtained in the southern US region.
- The design of a questionnaire and administration of a survey to estimate consumer willingness to pay for differentiated coffee and milk products in PR. Preliminary results were analyzed.
- The dissemination of studies' results through oral and poster presentations at professional conferences, podcasts, newspaper articles, meetings with stakeholders, websites, and short video recordings.
- The publication of research results at peer-reviewed journals.

2. Brief description of the target audience

Vulnerable population, community leaders and community organizations, as well as small farmers and producers' cooperatives and associations; research and extension faculty, land grant administrators, government officials and policy makers, consumers, food industry participants, coffee industry components (growers, roasters, coffee shop owners, etc.), and community participants

3. How was eXtension used?

eXtension was consulted in the literature review conducted for a research and education project on local food systems; also for web seminar recordings on local food system topics.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	17637	35424	1292	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	2	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of presentations in scientific meetings
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of non-refereed publications (posters, newspaper articles, etc)

Year	Actual
2018	3

Output #3

Output Measure

- Number of new technology generated (models, software, processes)
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of persons trained in community-based business (at least four workshops)

Year	Actual
2018	61

Output #5

Output Measure

- Number of leaders trained in community organization and empowerment (at least four workshops).

Year	Actual
2018	426

Output #6

Output Measure

- Number of leaders trained in emergency and disaster situations (at least four workshops).

Year	Actual
2018	668

Output #7

Output Measure

- Number of students participating in extension and research activities

Year	Actual
2018	10

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge about new information/tools (medium term measure) aimed at improving: consumption decisions, production management, marketing decisions, institutional arrangements and organizational capacities, public policy decisions, natural resources and environmental management.
2	Number of adopters of new or improved practices/tools in consumption decisions, production management, marketing decisions, institutional arrangements and organizational capacities, public policy decisions, natural resources and the environmental management.
3	Total number of participants in new market-niches improved as a result of program research.
4	Number of persons applying the recommended practices in the process of developing a community-based business.
5	Number of community-based businesses established.
6	Number of community projects established to benefit the community.
7	Number of leaders participating actively in the design and implementation of community projects.
8	Number of communities that developed an emergency and safety plan.
9	Number of families that developed an emergency and safety plan.
10	Number of new employments created.

Outcome #1

1. Outcome Measures

Number of stakeholders gaining knowledge about new information/tools (medium term measure) aimed at improving: consumption decisions, production management, marketing decisions, institutional arrangements and organizational capacities, public policy decisions, natural resources and environmental management.

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)
Issue (Who cares and Why): (6 to 8 Lines Max): One of the long term critical issues facing Puerto Rico is the low labor market participation rate of its population and the lack of adequate mechanisms to motivate those unemployed to actively seek jobs. Continued assessments of current welfare policies outcomes are needed to better tailor their assumptions and benefits to the island's context, and to help transform them into effective poverty palliatives.

What has been done
A study was conducted to assess the effect of Nutrition Assistance Program (NAP) disbursements to Puerto Rican households on the island's employment rate. A web page including the project's information and results was created. An educational video on the history of the NAP program was also produced and published at the page: https://usdafoodprogramsonpreconomy.wordpress.com/A thesis was submitted and a paper with

Results
Using estimated spatial regression models it was concluded that NAP family benefits have a significantly negative effect on the employment rate. The study further suggests that these benefits may act as a disincentive for participants to seek a job. As explained by Valdes (2018) in her thesis "NAP policies restrict too tightly the income that people may have while still receiving benefits, disincentivizing vulnerable populations from working rather than motivating them to make the transition to work". Results on the unintended negative consequences of the NAP are attributed to structural flaws in the program's design that must be corrected to improve the impact of this social welfare policy in Puerto Rico. Further research using qualitative methods on the motives, values and reasoning behind people's labor decisions, and of the informal sector dynamics, are needed to improve job creation initiatives in the island.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
607	Consumer Economics
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Number of adopters of new or improved practices/tools in consumption decisions, production management, marketing decisions, institutional arrangements and organizational capacities, public policy decisions, natural resources and the environmental management.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The UPR College of Agricultural Sciences (CAS), facing diminishing federal and state budget allocations and changing internal and external contexts, has to make important policy decisions concerning its research and education programs, physical facilities, and internal land-use plans. More research-based input on alternatives open and stakeholder views on these topics are needed to take informed policy decisions that continue to meet the research and practical needs of land grant constituents.

What has been done
A literature review essay on the historical evolution of selected land grant institutions and changing trends in public agricultural research financing and program restructuring. (2) An online survey of CAS researchers to assess their opinions on new programs and uses for the agricultural experiment station lands. (3) Presentations of results to CAS administrators and at professional meetings.

Results
The literature review showed that to better use its resources, public research centers elsewhere

have adopted the following strategies: (1) sale of research results, (2) sale of agricultural and livestock products produced on their farms, (3) sale of non-agricultural goods and services (such as workshops, pest and disease diagnostics, etc), (4) sale of assets or research programs, (5) gifts and donations, (6) rental of land and facilities, and (7) creation, under their aegis, of specialized facilities such as food innovation centers or technology incubation farms. Salient results from the researchers survey showed that 85% of participants supported an expansion of the seed production program of crops most demanded by farmers; 72% was in support of establishing a farm incubation program at the substations but 26% was undecided; 61% was opposed to the selling of AES land assets. Recommendations regarding the expansion of the seed production program have been already adopted by the CAS administration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
610	Domestic Policy Analysis

Outcome #3

1. Outcome Measures

Total number of participants in new market-niches improved as a result of program research.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	122

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

604	Marketing and Distribution Practices
607	Consumer Economics
610	Domestic Policy Analysis

Outcome #4

1. Outcome Measures

Number of persons applying the recommended practices in the process of developing a community-based business.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	38

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Number of community-based businesses established.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

Outcome #6

1. Outcome Measures

Number of community projects established to benefit the community.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	31

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
After hurricane María massive destruction and desolation was spread island wide, with many counties remaining uncommunicated for weeks. Lack of electricity and communication networks (roads, bridges, phone service) represented a challenge to rescue and aid efforts. Lack of drinking water in this densely populated Island, represented a mayor threat for the spread of serious diseases and the possibility of a pandemic.

What has been done
Many PRAES local offices served as relief, operation and communication centers with local and federal government agencies.PRAES personnel in collaboration with community leaders and organizations, were able to put in practice emergency and disaster training provided by the CRD program through the years, and in other cases improvised survival strategies to deal with a never-before-dealt level of island wide destruction and desolation.

Results
Through the community projects UPRM-PRAES trained communities in the use of (and distributed over 2,000) bucket water filters and purifiers, and use of bucket-baking soda cloth washers, reducing the risk of a leptospirosis pandemic. The organization of common kitchens, thrift shops and health centers in community centers did help distribute drinking water, ready to eat food, clothing, solar lamps and detergents. Vulnerable populations in the communities (such as the elderly, cancer and dialysis patients) were identified for assistance. Mental support activities were coordinated with health professionals to provide support to families who lost their homes or experienced post traumatic syndrome. Public health programs for the control of disease vectors such as mosquitos and rats were put in place, together with public areas cleaning and recycling initiatives to properly dispose of organic matter and plastic gathered in the relief being imported.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
805	Community Institutions, Health, and Social Services

Outcome #7

1. Outcome Measures

Number of leaders participating actively in the design and implementation of community projects.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	395

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #8

1. Outcome Measures

Number of communities that developed an emergency and safety plan.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
805	Community Institutions, Health, and Social Services

Outcome #9

1. Outcome Measures

Number of families that developed an emergency and safety plan.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	202

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
805	Community Institutions, Health, and Social Services

Outcome #10

1. Outcome Measures

Number of new employments created.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
After Hurricane María, many communities were left uncommunicated. While relief efforts provided food and other necessary goods in the short run, PRAES helped create local businesses, community gardens and small local agricultural production that benefitted both emerging producers and local consumers.

What has been done
Non-formal and -crash courses- in entrepreneurship, garden and small plots production were conducted by PRAES personnel. Community associations were organized to establish small thrift shops that would provide clothing, hot meals and other goods to community members for free (paid by donators) or at very reasonable prices.

Results
In Las Piedras a women agro-entrepreneur group was established to produce for the local family markets; In Orocovis 5 Seniors of the local high school established a garden that provides fresh food to the local Head Start Center; In Carolina, Trujillo Alto and Loiza farmers markets were established to sell products from small farmers and community gardens; In Ciales a Community Cooperative was established and obtained funds to manage their rural aqueduct and establish their own photovoltaic power grid that will provide services to 25 families; In San Sebastián and Morovis, thrift shops were established to distribute aid in a sustainable manner; and in Florida and Comerío, cooperatives were created to provide employment opportunities to community members.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Hurricane María devastation of Puerto Rico was overwhelming, knocking out electric and water service, and leaving rural areas uncommunicated for months. Survival and distress relief efforts lasted month, and electric service was restored to a 90% by the end of February. This emergency did not deter the bankruptcy process initiated by the U.S. Congress appointed Fiscal Oversight Board, which has imposed drastic cuts in public spending and government services. Mass migration is steady at 85,000 plus a year, which increased after the hurricane.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No program evaluation was carried in 2018.

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustainable Energy

☑ 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
401	Structures, Facilities, and General Purpose Farm Supplies	15%		0%	
402	Engineering Systems and Equipment	10%		0%	
403	Waste Disposal, Recycling, and Reuse	60%		0%	
405	Drainage and Irrigation Systems and Facilities	15%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.1	0.0	0.3	0.0
Actual Paid	3.0	0.0	0.0	0.0
Actual Volunteer	0.0	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**
129363	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
64691	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

-Included in workshops and meetings, aspects of sustainable energy with emphasis on structures, waste management, irrigation equipment and energy conservation.
- Establish collaborations with government agencies (Puerto Rico Power Authority, Environmental Quality Board, Departments of Agriculture,Natural Resources and Enviroment, Puerto Rico Aqueducts and Sewage authority, USEPA, USDA, NRCS, and others) and with our partners in the University of Puerto Rico and other educational institutions.
-Design and make plans that include and promote energy sustainability and efficiency in structures, waste management systems and irrigation systems (new facilities or improving existing facilities.

2. Brief description of the target audience

Extension professionals, government professional personnel, professional from the private sector.

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	431	1489	14	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 clients that participated in workshops and meetings offered which include aspects of energy sustainability and efficiency.

Year	Actual
2018	232

Output #2

Output Measure

- Number of government agencies and partners in the University of Puerto Rico and other educational institutions that collaborate in projects that promote energy sustainability and efficiency.

Year	Actual
2018	10

Output #3

Output Measure

- Number of active research projects in the program.

Year	Actual
2018	1

Output #4

Output Measure

- Number of new proposals submitted targeting the program's priorities.

Year	Actual
2018	0

Output #5

Output Measure

- Number of popular (non-refereed) publications based on research results.

Year	Actual
2018	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clients adopting designs and plans that include and promote energy sustainability and efficiency in structures, waste management systems and irrigation systems (new facilities or improvements to existing facilities).
2	Number of projects/initiatives/clients adopting designs, plans or energy alternatives developed as a result of partnerships between government agencies, the University of Puerto Rico, and other educational institutions that collaborate and promote energy sustainability and efficiency.
3	Number of popular (non-refereed) articles published based on research results.

Outcome #1

1. Outcome Measures

Number of clients adopting designs and plans that include and promote energy sustainability and efficiency in structures, waste management systems and irrigation systems (new facilities or improvements to existing facilities).

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	86

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mr. Jose Negron is a young farmer. With his family produces lettuce in hydroponic system. His farm is located in the Toro Negro Ward which is an isolated community distant from urban areas. It was severely affected by hurricane Maria and was informed that they could be without power until may.

What has been done
He contacted the local Extension office and received information on alternative energy systems. After reviewing and analyzing several options, the suggested system for hydroponics renewable energy was solar.

Results
A solar energy system was designed for their needs for hydroponics lettuce production. After visiting several commercial solar equipment, they bought the necessary equipment. In short period of time, they were able to power the system, avoiding losing $15,000 income and a monthly power bill of $200 savings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Number of projects/initiatives/clients adopting designs, plans or energy alternatives developed as a result of partnerships between government agencies, the University of Puerto Rico, and other educational institutions that collaborate and promote energy sustainability and efficiency.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	35

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

Outcome #3

1. Outcome Measures

Number of popular (non-refereed) articles published based on research results.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Other (Availability of economic incentives)

Brief Explanation

Island affected by Hurricane Maria, left all infrastructure severely damaged, with no power (100%), no communications (95% failed). It was the 3rd deadliest hurricane in US history, and the 2nd largest power blackout in the world. Local offices had to work with emergencies at their counties were it was possible. Most of the work was related to food and water supply to community. Many cities and rural areas were without power for up to 10 months.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

N/A

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Adult and Childhood Obesity

☑ 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	60%		0%	
704	Nutrition and Hunger in the Population	10%		0%	
724	Healthy Lifestyle	30%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	8.8	0.0	0.0	0.0
Actual Paid	7.5	0.0	0.0	0.0
Actual Volunteer	0.0	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**
378080	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
189040	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Developed joint action at community level to promote and implement physical activity programs and nutrition education for adults, parents, caregivers and kids.
2. Taught participants about portion size control, adequate meal patterns, supermarket tours, meal planning, shopping lists to ensure healthy food choices within a budget
3. Demonstrated easy, healthy food recipes to encourage the consumption of fruit, vegetables and whole grain foods
4. Encouraged the importance of gardening to increase physical activity and the consumption of fruit, vegetables and healthy foods
5. Demonstrated the importance of reducing refined sugars and saturated fats to prevent obesity and the development of chronic diseases

2. Brief description of the target audience

Children/youth and their families, caregivers, and adults.

3. How was eXtension used?

N/A

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7237	2912	8230	2239

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 children and youth that completed non-formal nutrition and physical activity education courses.

Year	Actual
2018	2890

Output #2

Output Measure

- Number of families/caregivers that completed non-formal nutrition and physical activity education courses.

Year	Actual
2018	1449

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of children and youth that reported eating more healthy foods.
2	Number of families/caregivers that reported eating more of healthy foods.
3	Number of children and youth that reported eating less of foods/food components which are commonly eaten in excess.
4	Number of families/caregivers that reported eating less of foods/food components which are commonly eaten in excess.
5	Number of children and youth that reported increasing their physical activity.
6	Number of children and youth that reported engaging in 60 minutes or more of physical activity.
7	Number of families/caregivers who gained knowledge about the importance of gardening to promote physical activity and improve nutrition.
8	Number of children and youth that reported adopting healthy eating patterns

Outcome #1

1. Outcome Measures

Number of children and youth that reported eating more healthy foods.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	926

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Studies showed that being overweight or obese between ages 14 and 19 is associated with increased adult mortality from a wide variety of systemic diseases. Data reported in the Youth Risk Behavior Surveillance System (2017) showed that 24.2% of Puerto Rican adolescents (grades 9-12) were overweight or obese, 14.3% did not eat fruit, and 16.4% did not eat vegetables during the 7 days before the survey. Moreover, 30% did not participate in less then 60 minutes of physical activity on at less then 1 day of the week. These behaviors might prone to obesity at early ages.

What has been done
Nutrition education is addressed as a critical issue in Puerto Rico-Extension. Three major approaches focus on the prevention of childhood obesity across the Island. These include Project Moving to Healthy Eating, Project Route 4-H for a Healthy Life and a general short course in nutrition. A total of 2890 kids participated in these initiatives through their 4-H clubs. Through these interventions kids participated in experiential learning activities including My Plate, nutrition labeling and healthy snacks.

Results
After the nutritional interventions, 32% reported eating more healthy foods, 25% of participants increased their fruit consumption, 13% increased their vegetable consumption and 15% increased the consumption of whole grain cereals. In addition, 25% decreased the intake of sugar y beverages and 33% increased water intake. Participants also learned about the importance of physical activity and after the intervention 34% of participants reported increasing their physical activity levels. These results show positive changes in dietary behaviors and that nutrition education is a key component in any educational effort to prevent childhood obesity.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of families/caregivers that reported eating more of healthy foods.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	662

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity has been associated with the major causes of death in the US and PR, including cancer, heart disease and diabetes. This places obesity as a critical issue that needs to be addressed for the health and well-being of the Puerto Rican population. Data reported on the Behavioral Risk Factor Surveillance System (2017) showed that the prevalence of obesity for adults (18 years and older) in Puerto Rico was 32.9%. According to this survey, 44% of Puerto Rican adults consume fruits and 54% consume vegetables one or more times per day.

What has been done
Nutrition education is a key factor to promote the acquisition of knowledge and behavior changes that leads to healthier lifestyles for the prevention of obesity. Extension is the principal institution in Puerto Rico that offers nutrition education in non-formal settings focused on the prevention of obesity. A total of 1449 adults participated in the nutrition short courses that included topics on My Plate, healthy recipes and the promotion of physical activity.

Results
After the nutrition course, 46% of participants reported eating more of healthy foods, 30% increased their fruit consumption, 21% increased their vegetable consumption and 13% increased the consumption of whole grain cereals. In addition, 19% added healthier recipes on their daily menus and 32% of participants reported increasing their physical activity levels. Nutrition education has helped participants improved their dietary behaviors. Follow-up activities should continue to increase the number of positive changes.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of children and youth that reported eating less of foods/food components which are commonly eaten in excess.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	674

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Number of families/caregivers that reported eating less of foods/food components which are commonly eaten in excess.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	391

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of children and youth that reported increasing their physical activity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	972

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Number of children and youth that reported engaging in 60 minutes or more of physical activity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	314

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Number of families/caregivers who gained knowledge about the importance of gardening to promote physical activity and improve nutrition.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1011

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population

Outcome #8

1. Outcome Measures

Number of children and youth that reported adopting healthy eating patterns

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	648

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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

Brief Explanation

On September 19-20, Puerto Rico was hit by category 5 Hurricane María, therefore beginning Fiscal Year 2018, the educational priorities were dramatically refocused to ensure the safety of individuals, families and communities affected by the devastation. The Island was left without potable water, electricity and communication for more than six months. Extension personnel helped families address their needs in other areas. Most

schools did not started operating or operated partially until about six months or more, therefore many 4-H Clubs could not meet as usual. Most educational activities, relevant to food and nutrition were focused in the development of home gardens and food safety in times of emergency and disaster. The hurricane did aggravate the already debilitated economy of the Island. Therefore, affecting program goals and objectives.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The project Moving to Healthy Eating (NIFA-AFRI grant #2016-69001-24960) is one of the initiatives in PR-Extension to promote healthy eating habits to prevent childhood obesity. The project was conducted in ten municipalities across the five regions of PR-Extension. One of the main objectives of this project was to develop culturally-sensitive and age-appropriate nutrition education materials for 12 to 14 years old 4-H members, with the purpose of promoting healthy dietary and physical activity behaviors. A total of 331 4-H members from ten 4-H clubs participated in the project. The young 4-H members participated in a short nutrition course with experiential learning activities. The educational topics included: Importance of healthy eating; barriers to healthy eating; preparing a healthy plate based on guidelines from MyPlate.gov; strategies for increasing fruits and vegetables; strategies for increasing whole wheat grains and cereals; for consuming healthy snacks and for increasing physical activity. The purpose of the evaluation was to measure changes in behavior through the adoption of recommended practices after using the new educational materials. Through a pre and post-test design, the 4-H participants answered a questionnaire before the beginning of the first lesson of the educational intervention. Participants answered a post questionnaire at the end of the last lesson (post I) and again after one month of completing the intervention (post II). Participants answered how often they performed the recommended dietary practices and the frequency of physical activity (5=every day, 4=almost every day, 3=sometimes, 2=almost never, 1=never). Results showed that after one month of completing the intervention compared to the baseline data, the young participants significantly increased (P0.05) the frequency of consumption (mean frequency) of vegetables (2.57 vs 2.69), fruits (3.58 vs 3.71), 100% fruit juices (2.79 vs 3.46), whole grain rice (2.39 vs 2.57) and cereals (2.61 vs 2.78) and decreased their consumption of sweet desserts (3.34 vs 3.21). The USDA promote that a healthy plate should be half of fruits and vegetables. Before the nutrition program, 17% of the participants reported that their plate did not included fruits and vegetables. After the program, this decreased to 11%. However, 8.3% reported that half of their plate included fruits and vegetables but this rather decreased at the end of the intervention (6.7%). Regarding physical activity among the participants, days of the week dedicated to physical activity increased, as mean at baseline was 4.75 vs 4.81 one month after completing the intervention, however results were not statistically significant. Overall, these results show that nutrition education is a key component in any educational effort to prevent childhood obesity.

Key Items of Evaluation

Childhood obesity; dietary intake in Latino youth.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Family Well-being

☑ 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
607	Consumer Economics	10%		0%	
724	Healthy Lifestyle	40%		0%	
801	Individual and Family Resource Management	10%		0%	
802	Human Development and Family Well-Being	40%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	20.2	0.0	0.0	0.0
Actual Paid	21.6	0.0	0.0	0.0
Actual Volunteer	0.0	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**
1089433	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
544717	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Participation in radio programs, educational campaigns, exhibitions in malls and public places with informative brochures, educational materials, promotional flyers, conduct workshops, courses, trainings, curriculum and educational materials development.
Also, establishments of collaborations with government agencies and institutions.

2. Brief description of the target audience

Extension Agents, FCS Educators, PRAES Specialists , professionals from other agencies, community volunteers, elderly people, at risk population, children, youth , farmers and general public.

3. How was eXtension used?

N/A

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4401	6229	586	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 persons that completed courses in parenting and related areas.

Year	Actual
2018	1381

Output #2

Output Measure

- Number of persons that completed courses in aging aspects.

Year	Actual
2018	1489

Output #3

Output Measure

- Number of persons that completed courses in consumer education and family resource management

Year	Actual
2018	276

Output #4

Output Measure

- Number of persons that completed courses in health related issues.

Year	Actual
2018	908

Output #5

Output Measure

- Number of educational campaigns in family and health related issues.

Year	Actual
2018	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of persons that gained knowledge in aging aspects.
2	Number of reported changes of family development behaviors.
3	Number of reported changes in financial capability and/or consumer behavior
4	Number of reported changes of health behaviors.

Outcome #1

1. Outcome Measures

Number of persons that gained knowledge in aging aspects.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	824

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #2

1. Outcome Measures

Number of reported changes of family development behaviors.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1699

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the Puerto Rico Family Department (2016), there are an increase of child neglect and maltreatment.Sixteen thousand (16,000) children were reported.

What has been done
As result of that situation, the Family Life Specialist developed an educational campaign in the national prevention maltreatment month and National Family Month at state level. In which at risk families were trained and oriented in parenting and family relations topics.

Results
One thousand six hundred ninety nine (1,699) parents were benefit.One thousand one hundred twenty nine (1,129) parents reported improving their family relationships with their children and spending more time together.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #3

1. Outcome Measures

Number of reported changes in financial capability and/or consumer behavior

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	252

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #4

1. Outcome Measures

Number of reported changes of health behaviors.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3106

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Chronic diseases such as: breast cancer, diabetes, cardiovascular diseases, and Alzheimers are the leading causes of disability in Puerto Rico.

What has been done
To attend this issues, the PRAES Health specialist developed educational campaigns and educational materials at state level.
Also, the FCS Educators disseminate the information through these campaigns to the population at risk level and offered 49 short courses to families and individuals.

Results
As result of that, 3,106 people were benefited through educational campaigns and 511 completed the courses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The aforementioned external factors might have affected the outcomes reported are related to decrease the participation in our programs.
The increase of migration and the economy situation in Puerto Rico had affected the life and priority of families and individuals.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

During FY 2018, evaluation studies are conducted periodically. We used a questionnaire in each short course that was completed by each participants.
The participants can demonstrate Knowledge and skills learned in the short courses. Also, they can express satisfaction and motivation among the topics offered through the curriculum.
Some of the participants were motivated to continue and to invite other families to participate in these courses.

Key Items of Evaluation

N/A

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Strengthening Youth Life Skills, Leadership and their Community

☑ 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%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	35.7	0.0	0.0	0.0
Actual Paid	29.9	0.0	0.0	0.0
Actual Volunteer	0.0	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**
1504264	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
752132	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conferences and workshops
Training in life skills, leadership, and community services
Curriculum development in life skills, leadership and community service

Camps and outdoor activities
Participate in mass communication to promote 4-H as a positive organization for youth.
Projects in radio, press, TV and social media to provide communication skills.
Projects where youth, adults and volunteers can develop skills that will enable them to make a positive contribution to society and strengthens youth/adult partnerships
Contests activities/events
Field trips / Community health fairs / Exhibitions activities/events
Research project
Youth Health Promoters projects
Training for teen-teachers
Teen-teacher's education program in schools and community
Gardening training
Subject Matter Campaigns using multimedia
4-H Health Advocacy Summit
4-H State Conference
Youth Emergency preparedness workshops
Environmental Photojournalist initiative

2. Brief description of the target audience

Youth and 4-H members, Extension professionals (specialists, agricultural agents and family and consumer science professionals), professional government personnel, volunteers, and community residents.

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	5457	0	41105	16202

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 children/ youth who participated in life skills and subject matter educational programs designed to teach basic life skills and leadership

Year	Actual
2018	11492

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	As a result of experiences in a 4H program or project, the number of participants who take responsibilities for their actions.
2	As a result of experiences in a 4-H program or project, number of participants who are confident to speak in front of groups.
3	As a result of experiences in a 4H program or project, the number of participants who can work well with others youth.
4	As a result of experiences in a 4H program or project, the number of participants who helped with a project that made a difference through community service.
5	As a result of experiences in a 4-H program or project, number of participants who can work successfully with adults
6	As a result of experiences in a 4H program or project, number of participants that used health information to make decisions.
7	As a result of experiences in a 4H program or project, number of participants that used technology to help express their ideas about health issues.

Outcome #1

1. Outcome Measures

As a result of experiences in a 4H program or project, the number of participants who take responsibilities for their actions.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4330

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

As a result of experiences in a 4-H program or project, number of participants who are confident to speak in front of groups.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2935

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

As a result of experiences in a 4H program or project, the number of participants who can work well with others youth.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1995

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

As a result of experiences in a 4H program or project, the number of participants who helped with a project that made a difference through community service.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	890

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impact of Hurricane Maria aggravated the situation of child poverty on the island and accelerated the migration of families with children. This situation affects the opportunities for children and youth and their well-being. As evidenced by the statistics before the hurricane, 58% of our children and young people were living in poverty. Studies have shown that living in poverty may result in chronic stress for children, which has an adverse effect on learning, memory and is associated with health problems, among others. A number of studies have shown how natural disasters cause post-traumatic stress disorders that may persist for years.

What has been done
As recommended in our 4-H Merit Review process we began our work with an internship to know youth leaders, health promoters and teen teachers. Feelings after hurricanes and the new challenges they are confronting as citizens and students. Our plan of work to manage this critical issue included: community activities with special attention to communities affected during the hurricane, support for youth leaders and expand 4-H enrichment activities in order to help kids and youth move forward after hurricanes events. Through these activities youth and adults worked and learned together about health advocacy, emergency preparedness, diseases prevention, among other topics to strengthen their knowledge and skills to help others and

empower themselves.

Results

Youth participated in 135 community projects where more than 2,995 youth gained knowledge and skills to manage their emotions and developed a better self-esteem. One hundred (100) youth leaders were trained to participate actively in community projects using the slogan "Oye mi voz, soy 4-H", inspiring youth leaders to stand as reliable ambassadors of the 4-H program. These youth leaders visited schools and communities to teach about disease prevention practices to eliminate diseases contagious focus (ex. mosquito reproduction) and the importance of vaccination. Also they taught and helped in other critical issues in the communities like reforestation and food security. The 4-H program staff coordinated with the PR Health Department, EFNEP and Voices Foundation a route to make accessible health services to 4-H families and communities. A total of 890 youth helped with a project that made a difference through community service.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

As a result of experiences in a 4-H program or project, number of participants who can work successfully with adults

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1042

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

As a result of experiences in a 4H program or project, number of participants that used health information to make decisions.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2882

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Youth Well-Being Index from the Youth Development Institute, is a radiography of the state and conditions of the boys/girls between 0 to 21 years old living in PR. Consistently they have graded D in the island due to high infant poverty levels and low academic achievements, among others. According to the national "Healthy People 2020" initiative, teens who can handle the changes and associated risk factors of the adolescence period become successful, happy and healthy adults. Adolescence is a critical time for the development of lifestyles practices, attitudes and beliefs related to health and well-being.

What has been done
Through our 4-H Youth Health Promoters project we continued offering activities and experiences for youth to gain life skills and leadership. We implemented strategies to create awareness among youth about important health topics and expose 4-H to health projects where they can make careers selection in this professional area. The 4-H health specialist created the educational material 15 healthy habits to empower youth health, which was used as a platform to create spaces for youth and adults dialogues to develop community action plans. We received the collaboration of the PR Health Department and the Auxiliary Secretary for Health Promotion sponsored with new equipment and health educational materials and offered support training for youth health promoters.

Results

The Health Promoters project and other 4-H initiatives like Route for Healthy Living benefitted 2,285 participants and 859 reported improvement in healthy lifestyles. Luis Caraballo a second year health promoter shared with 4-H participating in the 4-H State Conference -when I began as Health Promoter I never imagine I can experience a weight reduction applying to myself what I teach to others, I lost 20 pounds and I feel great. Five (5) 4-H health promoters received a scholarship from UPR Medical Science Campus to participate in the Summer Internship to get to know the academic program and the professional health schools on campus. This is the first time that 4-H members participated in this internship. This experience was described by the 4-H, Mariangelie Torres -In 4-H the opportunities are unlimited! Through this opportunity, we were able to explore different health professions on campus. It was a rewarding experience, with great benefits and a lot of learning. Thanks to 4-H for being an integral part of our life. Mariangeli was accepted in Natural Sciences in UPR-Río Piedras campus, to study food and nutrition.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

As a result of experiences in a 4H program or project, number of participants that used technology to help express their ideas about health issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	231

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

After two major hurricanes the island continues in a recovering process. We completed the majority of activities planned although our clubs suffered a decrease in 4-H participation and big turnover in membership enrollment. The island is still experiencing an unstable economy that affects 4-H families' budget and university and collaborative agencies resources. Changes in the public school system also impacted our plan of work. More than 200 schools around the island were closed. New government regulations in the island resulted in increasing the expenses to organize camps' experiences also recreational and educational facilities are closed or partially closed due to the recovery process.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Because of the effects of Hurricane Maria an expanded evaluation process was not possible during FY 2018, however a questionnaire was administered to a small sample of 4-H that participated in the Annual State Conference. Thirty-eight of the conference participants answered an open ended question about what has been the most important aspect they have learned as a 4-H member. The most frequent answers were the acquisition of new knowledge and sharing with other young people. They specifically mentioned gaining knowledge about healthy lifestyles and the environment. Several of the young people mentioned that the experiences they have gained through 4-H make them feel empowered. The following quote represents this opinion: "I have learned to use my voice, learned how to reach my goals knowing that my voice can make a difference and how the small voices can have accomplished big things, one by one." Other skills mentioned by the young people that they have gained through 4-H include leaderships skills, helping others and teamwork. For many of these youngsters, 4-H provides them a place where they can meet and share with new and different people. Two quotes that represent these views are: "4-H is like a family"; "I also learned that 4-H in addition to be an organization is a kind of lifestyle and you will always take with you wonderful memories and friendships that will last a lifetime." For these youngster 4-H represents not only an organization that offers knowledge in technical skills but furthermore a place where they can develop social and emotional skills that will lead to a positive youth development.

Key Items of Evaluation

4-H Common measures tools. PYD model

V(A). Planned Program (Summary)

Program # 11

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
131	Alternative Uses of Land	15%		0%	
205	Plant Management Systems	20%		0%	
307	Animal Management Systems	20%		0%	
501	New and Improved Food Processing Technologies	5%		0%	
603	Market Economics	15%		0%	
610	Domestic Policy Analysis	5%		0%	
704	Nutrition and Hunger in the Population	20%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.7	0.0	0.0	0.0
Actual Paid	6.0	0.0	0.0	0.0
Actual Volunteer	0.0	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**
300551	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
150275	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Global Food Security and Hunger Initiative was worked using PRAES Food Security Curricular Guides and PRAES Home Garden Curricular Guide. With these, we offer food security courses, training, participate on radio and TV programs and attend press interview. During this year we also use a power point about the vulnerability of PR food supply chain, Hurricaine Maria and adaptation strategies. We coordinate work with state and federal agencies.

2. Brief description of the target audience

Farmers, government professionals, county agents, agro-entrepreneurs, home owners, housewives, children, youth, 4H members, volunteers and private professional

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	204043	497077	5284	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 agricultural enterprises feasibility studies.

Year	Actual
2018	24

Output #2

Output Measure

- Number of youth participating in food system educational program.

Year	Actual
2018	5284

Output #3

Output Measure

- Number of adults participating in food system knowledge and skill enhancement programs.

Year	Actual
2018	188735

Output #4

Output Measure

- Number of first detectors trained in early detection and rapid response of plant pests, animal pests and diseases.
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of communities trained in agricultural disaster preparedness.

Year	Actual
2018	87

Output #6

Output Measure

- Number of food security extension publications and presentations.

Year	Actual
2018	163

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of public policy issues related with national food security that were reviewed or proposed.
2	Number of farmers that adopted one or more recommended post-harvest practices.
3	Number of fallow "cuerdas"(acres) sowed or prepared for animal production or other agricultural production.
4	Number of home gardens established.
5	Number of acres in conservation tillage or other BMP.
6	Number of new or improved value-added products that can be sold by producers (and other members of the food supply chain).
7	Number of marketing agreements established between local farmers and distributors or other components of the food supply chain.
8	Number of communities that have written agriculture and food considerations into disaster preparedness plans or procedures.
9	Number of networks prepared to mitigate biological and abiotic disruptions
10	Number of youth that improved knowledge of food systems.
11	Number of adults that improved knowledge of food systems.
12	Number of food councils and institutes created to promote practical food systems policies.
13	Number of research and extension advisory councils and boards.
14	Number of communities that retained farm lands due to educational interventions.
15	Number of consumers that adopted the food basket as a guide for food security at the household level.

Outcome #1

1. Outcome Measures

Number of public policy issues related with national food security that were reviewed or proposed.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The farmers and community organizations are vital to present citizen position about public policy issues.

What has been done
Assistance was provided to promote the organization of farmers and communities to attend situations related to the protection of agricultural resources, food security, incentive opportunities, marketing risk and others. PRAES coordinated meetings between farmers and state and federal agencies like PR Department of Agriculture and USDA.

Results
Thirty two (32) public policy issues were attended.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
610	Domestic Policy Analysis
704	Nutrition and Hunger in the Population

Outcome #2

1. Outcome Measures

Number of farmers that adopted one or more recommended post-harvest practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	109

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
We import more than 80% of local food consumption and Puerto Rico is located on the hurricane pass zone. We need to reduce risk and increase local production to upsurge our food security. One available alternative is by implementing the post harvested practices.

What has been done
Materials and information was gathered and several training sessions were offered where 182 farmers participated in value added trainings. PRAES worked with University of Puerto Rico Food Institute and high Quality Beef cattle initiative to offer trainings to our clientele.We trained 182 farmers on value added.

Results
Sixty percent (60%) or one hundred and nine (109) farmers adopted value added practices and 22 new products were created. This present more food diversity in the market.This result was limited by the availability of local products after Hurricane Maria.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

Outcome #3

1. Outcome Measures

Number of fallow "cuerdas"(acres) sowed or prepared for animal production or other agricultural production.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1895

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico has a high dependency on food imports.After Hurricane Maria, we import more than 90% of local food consumption.

What has been done
PRAES county agents and specialist offered food security and agricultural production trainings, coordinated field trips and developed other educational activities to promote new sow and animal enterprise establishment and expansion. Our farm was devastated after Hurricane Maria and the farmers were focused on their enterprise recovery.

Results
Three thousand fifty five (3,055) fallow acres sowed or prepared for agricultural production

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
501	New and Improved Food Processing Technologies

Outcome #4

1. Outcome Measures

Number of home gardens established.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1773

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Puerto Rico Land Use Plan,identified 619,181 acres of agricultural land to produce food for 3.2 million of people. We import more than 80% of our food consumption.We need to use land efficiently to increase our food security.

What has been done
Using the Home Garden Curricular Guide we offered 79 vegetables, fruits and starchy crops garden courses. Also, PRAES county agents and specialist organized field experiences, participated in radio and TV program and used a Youtube page -huerto casero PR-.

Results
Two thousand three hundred and twenty three (2,323) persons completed a home gardening course, from which 1,815 established a home garden (76%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
704	Nutrition and Hunger in the Population

Outcome #5

1. Outcome Measures

Number of acres in conservation tillage or other BMP.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of new or improved value-added products that can be sold by producers (and other members of the food supply chain).

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	22

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many agricultural products have a short shelf life and in many occasions, farmers have over production. The farmers will have more income if they adopt value added practices.

What has been done
PRAES county agents and agricultural specialists offered educational activities on agricultural value added products.

Results
Twenty two (22) new products with value added were developed.

4. Associated Knowledge Areas

KA Code	Knowledge Area

501 New and Improved Food Processing Technologies

Outcome #7

1. Outcome Measures

Number of marketing agreements established between local farmers and distributors or other components of the food supply chain.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Another Food Security dimension is the accessibility. Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Fresh products provide adequate nutrients for a healthy diet. The local farmers can provide more accessibility to fresh products considering different marketing alternatives.

What has been done
PRAES county agents and specialist coordinated meetings with food supply chain members to provided farmers on marketing strategies.

Results
Sixteen (16) new marketing agreements were established.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics

Outcome #8

1. Outcome Measures

Number of communities that have written agriculture and food considerations into disaster preparedness plans or procedures.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico is located in a climate change highly vulnerable zone which means that our fragile food security requires to be considered in any disaster recovery plan. Hurricane Maria caused serious infrastructure and agricultural damage to our island. Loss in agriculture infrastructure was estimated on $2 billion and in agricultural production was $200 million.

What has been done
PRAES county agents and specialist trained 76 communities on agriculture and food considerations in disaster recovery plan.

Results
Eighty Seven (87) communities were oriented in a Disaster Recovery Plan including food security adaptation strategies. Fifteen (15) communities adopted a Disaster Recovery Plan.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

Outcome #9

1. Outcome Measures

Number of networks prepared to mitigate biological and abiotic disruptions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
205	Plant Management Systems
307	Animal Management Systems
610	Domestic Policy Analysis

Outcome #10

1. Outcome Measures

Number of youth that improved knowledge of food systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4309

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Like adults, the young people are unaware about the PR food system, its risk and vulnerability.

What has been done
PRAES personnel offered educational activities about food system and food security using the Food Security Curricular Guide. Also,we coordinated field trips to the farms and visited the agricultural markets. Work with Ruta Saludable Initiative and Agro Science Camp where young people were exposed to the local food system.

Results
Four thousand three hundred and nine (4,309) children, youth and 4H participants acquired knowledge about food system, supply chain, food security on healthy fresh foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics

Outcome #11

1. Outcome Measures

Number of adults that improved knowledge of food systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	168554

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico has a highly vulnerable food system. We need to increase knowledge about food security to help develop a local food system.

What has been done
PRAES personnel offered 93 Food Security courses, participated on Radio Programs and offered conferences were 188,735 adults participated in these educational activities to gain knowledge and improve their skills on food systems. From those, 168,554 reported increase on their knowledge about food systems and 4,177 adopted PR recommendation on food baskets.

Results
One thousand six hundred sixty eight five hundred fifty four (168,554) adults increase their knowledge about PR Food System (89%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
704	Nutrition and Hunger in the Population

Outcome #12

1. **Outcome Measures**

Number of food councils and institutes created to promote practical food systems policies.

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

Number of research and extension advisory councils and boards.

Not Reporting on this Outcome Measure

Outcome #14

1. **Outcome Measures**

Number of communities that retained farm lands due to educational interventions.

2. **Associated Institution Types**

- 1862 Extension

3a. **Outcome Type:**

Change in Action Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2018	0

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
205	Plant Management Systems
307	Animal Management Systems

Outcome #15

1. Outcome Measures

Number of consumers that adopted the food basket as a guide for food security at the household level.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4177

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
When we talk about food security, we talk about food availability, food access, utilization and food supply chain stability.Consumption food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being well all physiological needs are met. The PR Recommend Food Basket 2012 presents and excellent guide for healthy food.

What has been done
PRAES personnel used the Recommend Food Basket information to assist there clientele to identify, acquired and prepare healthy food.

Results
Four thousand one hundred and seventy seven consumers adopted recommend Food Basket to identify, acquire and prepare healthy food.

4. Associated Knowledge Areas

KA Code	Knowledge Area

704 Nutrition and Hunger in the Population

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Puerto Rico was impacted by Hurricane Maria and caused serious damage to infrastructure, crops and animal enterprise. Now the Island passes through a critical economic fiscal situation. The actual environmental regulations limit our local production.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NA

Key Items of Evaluation

NA

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	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 whit 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.