2016 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 accomplishments report covers the period from October 1, 2015 to September 30, 2016. During this fiscal year, the Puerto Rico Agricultural Extension Service (PRAES) used 158.67 FTEs, a decrease of 6.2 FTEs from the 164.87 reported for FY 2015. The Puerto Rico Agricultural Experiment Station (PRAEXS) dedicated 51.5 paid FTE/SY and 17 volunteer FTE/SY to the development of its programs. The research accomplishments highlighted in this report reflect the significant amount of volunteer effort by our faculty. The seven initial programs summarized below are combined research and extension efforts while the last four are solely under the extension service.

1. Global Food Security - Plant Production Systems, Genetic Resources and Breeding Program
Plantain and banana producers in PR face problems associated with damage by the Banana Weevil, Cosmopolites sordidus, nematodes and Banana Rust Thrip (BRIT). Coffee, an important crop, has been affected by coffee rust and the coffee berry borer in recent years. Training in better management practices and more efficient production systems has been offered. Out of 341 producers who participated, 45% (154) adopted two or more recommended practices in integrated coffee management. Banana farmers have reduced herbicide use by 80% using cover crops and reduced irrigation frequency. A total of 1,707 producers were trained in integrated vegetable management, and 53% adopted two or more practices; 141 courses in vegetable gardening were offered.

On the research side, we have continued germplasm evaluations of new hybrids and traditional varieties of grains, vegetables, fruits, coffee and starchy crops. Four new bean varieties with enhanced disease resistance were released and other bean lines better adapted to soils with low fertility were identified. Tests of five new varieties of sweet potato adapted to the needs of farmers in Puerto Rico were concluded, and planting materials were distributed to interested farmers and gardeners. Progress was also made in studies of the mechanism of resistance to potyviruses in tropical pumpkin, while a study concerning consumer preferences and willingness to pay for new sweet chili pepper varieties was concluded and an MS thesis completed. To increase the availability of the improved germplasm resulting from PRAEXS research, agreements have been signed with the PR Department of Agriculture to produce at our substations seeds, vegetative planting materials, seedlings and grafted fruit trees for distribution and sale to growers. Results from our projects were shared with the scientific community and the public through participation in conferences, publications, web pages, podcasts, seminars and field days.

2. Animal Systems
Rabbit meat production has declined in Puerto Rico over the last few years. Maunabo Extension Service in collaboration with the Department of Agriculture offered training in rabbit care and management, and health benefits of its consumption. In addition, a 4-H parade to show different rabbit breeds was held. An initiative to develop the rabbit meat entrepreneur, the first Rabbit Festival in the La Fermina Community was established with the collaboration of the Agribusiness Women Association. A new rabbit farm was recently started with 400 mothers and 39 studs; currently, there are 3,900 animals. The farmer also opened a new rabbit abattoir to process up to 2,000 rabbits/day.

The beef industry is also growing and generating interest in Puerto Rico. During 2016, several educational activities were conducted for the improvement of beef cattle production and the beef industry. Beef farmers and ranchers expanded their knowledge through these educational and hands on activities. Out of 1,200 farmers who participated in these activities, an estimated 40% adopted recommended management practices improving the overall outcome of their animal production.

Research in our Animal Systems program continued supporting the local dairy industry and beef cattle production by managing the dairy herd at the Lajas PRAEXS and the research component at the Montaña Beef Cattle Research and Training facility. Beef cattle producers in Puerto Rico need to improve the genetic composition of their herds to produce high quality meat and increase their share of consumer markets. The achievements of the Montaña farm are contributing to this goal. For example, a Senepol bull from the Montaña herd was listed as leader in weight at weaning in the records kept by the Senepol Cattle Breeders Association and published in its 2016 Sire Summary. To lead in one characteristic, an animal must be among the superior 10% of active registered animals in that characteristic, proof of the success of our genetic selection program. In dairy, studies continue to evaluate the suitability for forage production of tropical locally-adapted corn varieties, as well as evaluations of Maralfalfa grass silage for quality in lactating cows. Due to the positive results of research conducted on Holstein cows of the slick-hair genotype regarding their adaptive capacity to thermal stress and productive performance, a new project was started to add further information on the merits of this genotype.

3. Integrated Pest Management of New and Emerging Pests and Diseases
Significant progress was achieved in research and extension activities in 2016. With the support of the Citrus Clean Plant Network, testing for systemic pathogens of Citrus spp. plants in commercial nurseries was performed in collaboration with the PR Dept. of Agriculture (PRDA). Approximately 20,000 citrus-tested plants produced by the PRAEXS and PRDA were made available to citrus producers and the public after testing for Candidatus Liberibacter asiaticus, Citrus Tristeza Virus and Xylella fastidiosa. In addition, a collection of 20 Citrus sinensis commercial varieties and 33 accessions of Citrus spp. are growing in screen-protected structures to maintain germplasm for future use. Extension agents trained 240 producers in citrus integrated disease, pest management and nutritional programs. Fifty-five of these growers adopted two or more management practices including the consistent use of a fertilization program and the alternate use of insecticides to control the psyllid vector. Horticultural crop research focused on evaluating watermelon, peppers and cabbage production under screen-shade structures in growers' fields and at the Juana Diaz PRAEXS. Results demonstrated that field-grown vegetables have a greater incidence of pests when compared to those under screen-shade structures. These findings were disseminated to growers and Extension specialists on field days and in horticultural meetings. Integrated research and outreach activities increased producers' knowledge of effective management of plant parasitic nematodes affecting Musa sp. and Arracacha xanthoriza. In Musa sp., results increased the cost-benefit ratio of nematode control. Black Sigatoka, the most damaging and costly disease, continued to be the target of the PRAES due to the instability of climatic conditions and the constant requirements of management options. Growers participated in meetings and talks organized during 2016 by researchers and Extension specialists conveying information about symptoms and early diagnosis of Black Sigatoka; for example, 554 banana growers were trained in integrated management of the crop. About 75% of the growers adopted two or more management practices to improve their crop. Information was also provided about the genetic composition and race structure of the pathogen Fusarium oxysporum f.sp. cubense (Panama disease) in banana to raise awareness of this pathogen on the island. The management of the coffee berry borer was addressed with field visits and seminars offered to coffee producers. Plant Diagnostic Clinics processed more than 1,000 diseased plants and provided recommendations for disease and pest management. Extension agents were trained in IPM in the vegetable garden, hydroponics and root and tuber crops. In vegetable gardening, IPM training emphasized the use of biorational pesticides and benefits of crop association and herbs to promote pest management. In hydroponic IPM, the most important parts of the trainings given by Extension agents were monitoring, exclusion, hygiene and cultural control options. The educational program in root crops was successful as demonstrated by the fact that 55 growers increased

production.

4. Climate Change, Natural Resources and Environment
Given the island topography and an annual average precipitation of 53.01 inches (NOAA 2007), soil erosion is of great concern. Soils have been depleted and most of the organic matter is gone. This year, a curricular guide on soil health was developed, and training was offered to Extension personnel. Soils are a crucial filter and buffer to contaminants, protecting water resources. Soil also acts as a pool of biodiversity and as a sink for atmospheric carbon dioxide. An ongoing effort towards non-formal education on this subject continues. For example, a project with the USDA Forest Service was implemented to promote best management practices (BMPs). Farmers and property owners requested information on how to establish these practices on their farms, properties, in their communities as well as beach access. Often we experience periods of drought. Therefore, training continues to be offered on water harvesting and storage. From a total of 447 participants, 257 (57%) reported adopting recommended practices for water storage and reuse efficiency. Collaboration with the Caribbean Climate Hub continues in the development of educational materials and activities for farmers. Education in collaboration with the Fire Department continue on forest fire prevention, which resulted in a significant reduction in forest fires this year, but for 2017 the Fire Department foresees an increase in the number of forest fires particularly, in the south and southeastern part of the Island.

In research, experiments involving different management practices and subsurface irrigation in the growth of taro in the southern region of PR have continued. Results to date show that the dry conditions prevailing in the south do not favor the development of the Taro Leaf Blight that limits production in other regions of the island. The adoption of advances in irrigation technology and scheduling, and changing the region and system of production, have been the key to maintaining taro seed production programs while improving water use efficiency and conservation. Research to improve soil quality through soil conservative management practices has also continued. Experiments conducted at the Corozal PRAEXS substation showed that application of compost, cover crops and effective microorganisms had profound effects on the amount and quality of soil organic matter (SOM), pH, soil enzymatic activities and humic acids concentration. At this stage results have been shared mostly with the scientific community but a Web page will soon be activated to better disseminate information on soil management practices that improve the quality of degraded soils.

In addition, work on the identification and survey of non-native insect and weeds species from agricultural and wildlife lands on the Puerto Rican archipelago was concluded. Among other findings, results showed that five non-native weed species, and 75 non-indigenous insect species were reported of concern. Twenty-six of the invasive insect species were introduced during the last decade. Moreover, during FY 2016 this research program provided field and laboratory work experience to 12 graduate students (8 with Hatch funds) and 16 undergraduates. While training experiences varied among projects, students participating in Biodiversity research were trained in field and laboratory activities, including sampling, identification and curation of specimens. All students were active in laboratory data analysis and curatorial activities at the Museum of Entomology and Tropical Biodiversity insect collection. Finally, research results have been successfully disseminated through journals, bulletins, newspaper articles, and through website videos, podcasts and blogs.

5. Food Safety, Science and Technology
Foodborne illness is an important public health issue. According to Cairnduff et al., (2016), consumers do not know how important food safety practices are when trying to prevent foodborne illnesses. Many think that all food safety responsibilities fall on manufacturers. A total of 1,507 consumers completed a Food Safety course that included at least three lessons; 75% adopted at least one safe food handling practice. Twenty-five moms-to-be completed the protect-your-baby curriculum and 100% adopted at least one safe food handling practice; 44% cleaned and sterilized baby bottles; 88% handled maternal milk safely; 88% handled infant food safely.

Food safety training could offer long-term benefits to the food industry (Adesokan, H. K., et al., 2015). PRAES Home Economists, trained and certified, offered 134 courses throughout the year. The course consists of 12 lessons. A total of 3,636 food managers completed the Food Safety Course and 3,619 (99%) passed the test with 70% or higher.

According to CDC (2014), 60% of outbreaks occur in restaurants. PRAES prepared a food safety course that complies with Food Code 2013 knowledge areas. A total of 3,636 food managers were trained, of which 3,619 passed the course's test. Among the participants, 1,401 (38%) worked for at-risk populations in programs such as Head Start, School lunch and in homes for the elderly; 2,235 worked in other types of food establishments that served the general population like fast food eateries, sit-in restaurants, street vendors, and others.

The PRAEXS research program in food safety and food science is nurtured by the work of the faculty and students of the Food Science and Technology program of the College of Agricultural Sciences. Last year work continued in the areas of risk assessment and risk management of local agricultural systems by analyzing the quality of water used for lettuce production in hydroponic systems, and by submitting recommendations that should be adopted to comply with the new Fresh Produce Rule. Significant progress was also achieved in the development of new food products from traditional crops with the creation of a product from pumpkin flowers and with the design and evaluation of a process to reduce the calcium oxalate present in the tanier corm. A multifunctional flour made from the tanier corm is being tested for the confection of different products. Yogurt elaboration using acid whey as a major ingredient was also achieved, as part of research underway to develop products with a high concentration of nutrients and low in fat. In addition, our program's faculty continues to provide training in HACCP, GAP and GMP while mentoring 12 students, some of whom will soon defend theses developed as part of our research projects.

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

Puerto Rico is experiencing one of the most severe economic crises in its history. This situation fosters the opportunity for self-employment and community-based economic activities. Through individual and community group training in business creation and entrepreneurship skills development, twenty-one new businesses (that report income) were created and 30 new jobs were generated. The curricular guide "Community's Entrepreneurial Tool Box" was used. Puerto Rico is also susceptible to weather extremes due to its location. Using the curricular guide "Climate Change and Natural Disaster Preparation", 458 community leaders were trained. Thirteen communities and 71 families developed emergency and safety plans in communities prone to floods, tidal waves, ground displacement and forest fires.

Research efforts financed by our capacity funds were focused on the study of new and current potential markets for agricultural products; in education of land-use policy issues, and in documenting the impact of selected U.S. programs on the Puerto Rico food industry. Analyses of the surveys conducted in a 2014 study of the Family Farmers Market (FFM) were concluded, and a report was presented to government officials and participants in the study. This report was instrumental in the final permanent approval by the USDA of the SNAP- supported FFM in Puerto Rico. A total of 124 farmers were participating in these markets in 2016. Data gathering was also begun for a study of the effect of SNAP in the number of farms and employment level in the island. Finally, taking the case of a land swap controversy involving one of PRAEXS experimental farms, an analysis was made of the lessons learned that could be useful for the implementation of educational campaigns around public policy issues. Results from these studies have been presented in conferences, academic journals, newspaper articles and podcasts.

7. Sustainable Energy

Regarding renewable energy, our Agricultural Extension agents offered various workshops and

established 20 new collaborations with other universities or government agencies on the island. As a result, our agents reported 724 direct contacts and 664 indirect contacts and indicated that 555 of them showed an increase in knowledge in the area. We planned for 155 people to adopt designs or improvements to existing facilities promoting energy sustainability. From 155 clients who participated in workshops and meetings about energy sustainability and efficiency, 46% (70) adopted or are planning to adopt recommended practices. Twenty-five projects or initiatives were developed or are still being developed by those partnerships and collaborations. On the research side, a new project was started related to energy generation and nutrient recovery from agricultural waste and optimization of biodigester design. However, this project is not funded with Hatch resources. Collaborating faculty remains interested in submitting new proposals if local or capacity funding opportunities are opened.

8. Adult and Childhood Obesity
A nutrition education curriculum was designed to promote healthy eating and physical activity for school-aged children and teens. The involvement of 4-H children and youth in Nutrition Knowledge, healthy eating adoption and physical activity competitions contributed to positive changes toward healthy eating practices in this group. Training of teens to teach the youngest on healthy recipe preparations, sugar content in common drinks among other practices, helped to change behaviors in teens, children and caregivers. Children and youth who participated in nutrition education courses showed a 61% increase in healthy food selection.

9. Family Well-being
In 2016, 7,749 women were victims of domestic violence by their partners (Office of Women's Advocacy, 2016). Twelve special projects were developed to address family development issues; 225 women benefited and reported improvement in self-esteem, anger management and parenting. Another concern is long-term chronic disease. Extension educators offered non-formal education courses on the promotion of healthy lifestyles to 844 participants. Out of these participants, 428 (51%) individuals reported engaging in more physical activities and 277 (33%) reported being able to control their blood sugar and cholesterol levels.

10. Strengthening Youth Life Skills, Leadership and their Community
4-H leaders participated in Healthy lifestyle initiatives offering 352 presentations in schools and communities, benefiting 3,009 children and youth. Teen teachers and the 4-H staff organized 34 healthy living community activities including World Physical Activity Day. A total of 115 youths participated in the 4-H State Conference (PR) where they reinforced their communication skills; 12 youth leaders prepared a 4-H pledge video to present in different activities. The video was presented in the 2016 National 4-H Extension Agents Meeting and 2016 National 4-H Congress. Melvin Soto, selected for the 4-H Congress youth leadership team, said, "It was amazing to see our work at the national level." Mariangelie Torres, a 4-H health promoter, stated, "4-H helped me feel confident in public speaking and gave me the strength to be a 4-H spokesperson." Three other PR 4-H congress delegates noted that they felt self-confident as presenters at the National 4-H Congress, even though their first language is Spanish.

A total of 2,208 4Hers developed skills and participated in projects that made a difference in their communities. A permanent place in El Yunque National Rainforest (Casa del Arbol 4-H/ 4-H House of the Tree) aims to educate and contribute to forest protection. Three 4-H youth leaders presented their work at El Yunque to USDA Secretary Thomas Vilsack. Volunteer Nilda García was nominated for the Salute to Excellence Award for her outstanding work.

11. Global Food Security and Hunger
Most of our food is imported and our economic crisis make it vital to promote home and community gardening as a strategy for local production as well as a better nutrition. This year, 36 community gardens were established in 23 municipalities as a result of an agreement with the USDA Federal Strike Force (Food and Nutrition Service, Rural Community Development, NRCS, FSA, RD and the State Department

of Agriculture). Also, the Extension Service has been working with local farmers to increase production, offering training in post-harvest practices and food technology. One hundred and thirty two (132) producers adopted one or more post-harvest recommended practices, which resulted in a 5% increase in starchy crops production for the family markets. Twenty (20) farmers were able to add value to their products, which provided a 10% increase in their revenue.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	159.6	{No Data Entered}	54.7	{No Data Entered}
Actual	158.7	0.0	51.5	0.0

II. Merit Review Process

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

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

2. Brief Explanation

The Merit Review process is conducted in the PRAES through four committees which represent our four major program areas: Agriculture, Marketing and Natural Resources; Family and Consumer Science; 4-H and Youth Development and Community Resource Development. Each committee is composed of External University and External Non-University Personnel. They met twice during the year. In the first meeting, Extension staff presented the Preliminary Plan of Work for the upcoming year and members of the committee were asked to present their recommendations related to the POW. The program area leaders, together with other Extension staff, defined the educational strategies to address the recommendations offered by the committee members. These were then incorporated in the final POW as needed. During the second committee meeting an oral and written report were presented by the program area leader which identify how the committee recommendations were addressed and the Annual Report of Accomplishment was presented to the committee.

In the case of the PRAEXS, there has been only one change in the merit review process, which was already incorporated into last year's POW update. Although we continue to allocate part of our Hatch-funded research to competitive grants selected on the basis of an annual call for proposals with the year's revised priorities, some funds were earmarked last year as two-year seed grants for recently recruited faculty wishing to advance our research agenda. The scientific peer review evaluation of these proposals followed the same guidelines used for the merit review of other Hatch grants.

A call for proposals that included the year's revised research priorities was prepared and distributed by the PRAEXS Research Office. Proposals were submitted to the Assistant Dean for Research with the preliminary endorsement of the respective Department Head. The Assistant Dean for Research sent the proposal to a local peer reviewer or an external reviewer for their written comments on the scientific merit of the proposed research and compliance with the PRAEXS strategic plan. Proposals and reviewers' input were discussed and evaluated by the CAS Associate and Assistant Deans for Research, and a final

decision was taken by the administration. Project directors of the selected proposals were given the opportunity to incorporate reviewers' suggestions and adjust as appropriate. Once the proposals were approved by NIFA, the new or revised projects were included in the PRAEXS research program.

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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals

Brief explanation.

At the municipal level, the Local Extension Advisory Committees main task is to collect input 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.

In the case of the PRAEXS, two types of meetings are held to identify critical issues that should be addressed by our programs. First, annual meetings with researchers, extension faculty, farmers and other members of the public interested in the work performed in the different programs or commodity groups continue to be held. In these meetings, the progress of active research projects is discussed, preliminary results are shared, and further input is sought from participants to update research needs and priorities. The meeting is usually celebrated at the Research Center or substation closest to the principal area of production, and coordinated with the Agricultural Extension Service commodity specialist and agricultural agents of the region. Both the commodity leader and other Extension personnel identify and invite members of producers' associations, individual farmers, faculty and students, government officials and community organizations with interest in the commodity group's work and related research programs. These meetings are also announced in the PRAEXS web page, podcasts, and radio programs. Second, commodity group leaders, program coordinators and directors of the College of Agriculture Sciences integrated academic departments continue to organize thematic workshops, seminars and field days where research results are shared and the research and extension needs or public policy determinations are discussed. Participation in these thematic activities is encouraged through internal university communications, emails sent to already identified stakeholders, press releases, and personal invitations by the activity 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
- Open Listening Sessions
- 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 among their target audience, based on their experience and participation in the Extension programs, invited by letter and follow-up visits to join the committee.

Research stakeholders are identified through commodity leaders, extension personnel and local advisory committees established by CAS administrators. Since many meetings are also announced on the PRAEXS web page, interested public not targeted by these invitations also attend the meetings.

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. The committee met twice during the year to discuss critical issues locally, as well as to identify emerging issues that could be addressed by Extension. Each local committee identified priority issues in each of the four program areas. Also survey has been used by Extension personnel to collect information on issues or concerns. These are then analized and prioritized as part of the meeting.

Input from research stakeholders was collected at the meetings conducted by commodity and program leaders, and in activities with non-traditional groups such as organic farmers. At the end of the meeting stakeholders were asked to fill out a written evaluation that included questions about the most critical issues affecting their commodities, localities or production systems and about our research priorities. This information was summarized in a report made by the commodity and program leaders. Increasingly, stakeholders contact researchers and program leaders through the Internet media. Stakeholders, initially identified by electronic contact, are included in subsequent commodity or research activity invitations. Preferences and concerns voiced through digital means 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.

Input collected from stakeholders at the Local Advisory Committees was reported to the state level. This data was evaluated by state program leaders in order to identify emerging issues that ought to be included in the state plan of work or redirect programs when needed. Issues identified by farmers and other agricultural representatives that required or suggested a research agenda, are referred to the Agricultural Experiment Station. At the local level, municipalities set priorities for the local plan of work according to their stakeholder's input.

Input from stakeholders has been used in determining the research priorities of each planned program and commodity group, and this information, in turn, has guided the request for proposals issued by the PRAEXS Research Office during the year. The inputs received during past years from traditional and non-traditional stakeholders and government officials were also critical to starting organic experimental farms in our substations and for establishing a Certified Quarantine Facility to better meet the threats presented by invasive species. Last year, we were finally able to digitize and make available electronically our Journal of Agriculture, as requested by our stakeholders.

Brief Explanation of what you learned from your Stakeholders

On the research side:
Each commodity sector has its set of concerns, some amenable to researchable solutions, others needing more active policy intervention to stabilize the conditions of the sector. While our stakeholders still hold previously identified concerns (lack of certified quality seeds, control strategies for new pests and diseases, high input prices, etc.), their apprehension is growing regarding the prolonged and worsening economic crisis of the island and the impact that the massive emigration of recent years is having on the market and availability of labor. Producers are also more interested in finding new value-added and processing alternatives for their products that could potentially improve their competitive position with respect to imports. Interest in research that focuses on differentiating cultivars for fresh and for processing markets is also growing. There is also increased attention to niche markets that rely on quality certifications. In response, we have gradually changed the focus of our research and outreach program in the coffee and beef-producing commodities, for example, emphasizing market differentiation through quality certifications. In coffee, we have several projects addressing all aspects needed to facilitate the certification of our coffee in the "specialty coffee" markets, while in beef, our efforts are concentrated on facilitating producers' access to the "grass fed" certified market. Stakeholders have also provided recommendations on how to improve the ways in which we traditionally share information with them. In response, researchers are using other alternative methods, such as podcasts and web pages, extending results to a wider audience.

In Extension

Most of the input received from our stakeholders relates to the needs and situations affecting individuals, communities and our society in general. Most of the issues identified for FY 2016 are a continuation of those presented in FY 2015. As people continues to increase awareness about Food Security though our Planned Programs, there has been a greater interest in vegetable gardening, both at the household level and at the community and at school garden level.

Another issue identified by our stakeholders is obesity, particularly among children and youth. Stakeholders coincide that contributing factors are mainly bad food choices and lack of physical activity. Extension has been addressing these issues through two of the National Initiatives; Childhood Obesity and Food Security. The situation persists and is widespread through the population since these are long term issues. Therefore, we will continue to work on these issues in our Planned Programs for the upcoming years. People are also concerned about extreme weather events and their effect in local food production, mainly drought and excess precipitation. There has been a pronounced demand for water harvesting and storage for both home and farming.

Among Agricultural issues, our stakeholders coincide in the importance of food security at our state level. 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. All these are issues that Extension addresses through our Agricultural related Planned Programs but that needs to provide continue update and still are ranked as priorities. These are long term issues.

Issues affecting children, youth and families, in addition to obesity, stakeholders are mainly concerned with the domestic violence affecting our women, children and the elderly. This continues to strengthen the importance of our state level Family Well-being Planned Program which emphasize in 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 addressing 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. Training and mentorship in marketable skills and entrepreneurial mindset is seen as a short time relieve and longtime solution of the current economic crisis.

PRAES-CRD was able to draw interest and train a growing number of community members in business design and planning. Participants endeavored to put in practice the skills and knowledge acquired through the "Community Entrepreneurship Toolbox." Despite the widening economic crisis, some participants managed to initiate their small businesses and community enterprises. A growing number of them are initiating agribusinesses.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
6664256	0	4700875	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	7590977	0	4568950	0
Actual Matching	3795489	0	2350096	0
Actual All Other	0	0	1113	0
Total Actual Expended	11386466	0	6920159	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	926721	0	839433	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security - Plant Production Systems, Genetic Resources and Breeding Program
2	Animal Systems
3	Integrated Management of New and Emerging Pests and Diseases
4	Climate Change, Natural Resources and Environment
5	Food Safety, Science and Technology
6	Community Resources for Sustainable Development, Agricultural Economics, Marketing and
7	Sustainable Energy
8	Adult and Childhood Obesity
9	Family Well-being
10	Strengthening Youth Life Skills, Leadership and their Community
11	Global Food Security and Hunger

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%		8%	
202	Plant Genetic Resources	5%		40%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		16%	
204	Plant Product Quality and Utility (Preharvest)	20%		4%	
205	Plant Management Systems	20%		28%	
403	Waste Disposal, Recycling, and Reuse	10%		0%	
405	Drainage and Irrigation Systems and Facilities	10%		0%	
601	Economics of Agricultural Production and Farm Management	15%		4%	
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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	25.9	0.0	10.5	0.0
Actual Paid	20.6	0.0	10.6	0.0
Actual Volunteer	0.0	0.0	2.2	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**
983617	0	1391278	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
491808	0	839270	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

- Technical production training meetings.
- Capacity building workshops.
- Demonstration of methods.
- Meetings, visits, and guidances to farmers.
- Collaborations with the state, local and federal government agencies.
- Use of mass media to disseminate information.
- Preparation of technical plans (IPM, irrigation systems, cultivation practices)
- Prepare curricula and other educational materials.
- Release of four new bean varieties
- Continued with evaluation of germplasm of starchy vegetables, fruit crops, coffee, vegetables and basic grains
- Completion of seven M.S. Thesis
- Sales of $165,748 of seeds and grafted fruit trees at the substations
- Distribution of 8,478 paper copies of technological packages and Journal of Agriculture UPR
- 1.48 million views on internet blogs on plant systems
- Distribution of 2,921 pounds of organic seeds of 63 different vegetables, culinary herbs and cover crops (since 2010)
- Day long commodity meetings were held for the starchy vegetables, fruit crops, coffee, and vegetables/basic grains
- Research was started on the use of drones to evaluate crop health of coffee and citrus

2. Brief description of the target audience

Farmers, government professionals, county agents, agricultural entrepreneurs, pesticide applicators, homeowners, landscapers, and professionals 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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14749	208991	8316	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	7	29	36

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of producers trained in integrated coffee management.

Year	Actual
2016	341

Output #2

Output Measure

- Number of producers trained in integrated banana and plantain management

Year	Actual
2016	554

Output #3

Output Measure

- Number of producers trained in integrated starchy crops management.

Year	Actual
2016	184

Output #4

Output Measure

- Number of producers trained in integrated vegetable management.

Year	Actual
2016	1707

Output #5

Output Measure

- Number of producers trained in integrated tropical fruits management.

Year	Actual
2016	235

Output #6

Output Measure

- Number of producers trained in integrated citrus management.

Year	Actual
2016	240

Output #7

Output Measure

- Number of persons trained in vegetable gardening.

Year	Actual
2016	4093

Output #8

Output Measure

- Number of collaborations established to improve outreach.

Year	Actual
2016	180

Output #9

Output Measure

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

Year	Actual
2016	10

Output #10

Output Measure

- Number of participants in field days.

Year	Actual
2016	865

Output #11

Output Measure

- Number of participants in on-farm demonstrations.

Year	Actual
2016	215

Output #12

Output Measure

- Number of students attending field days to seed production fields, germplasm collections and other experimental fields.
  Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Number of non-refereed publications.
  Not reporting on this Output for this Annual Report

Output #14

Output Measure

- Number of presentations in scientific meetings.

Year	Actual
2016	30

Output #15

Output Measure

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

Year	Actual
2016	13

Output #16

Output Measure

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

Year	Actual
2016	7

Output #17

Output Measure

- Number of new/improved varieties developed and released.

Year	Actual
2016	4

Output #18

Output Measure

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

Year	Actual
2016	6

Output #19

Output Measure

- Number of producers trained in integrated basic grain management.
  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 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 stakeholders that adopted the proposed 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 acquired at substations with organic plots (taken as a proxy of growers knowledge of organic agricultural practices).
16	Number of producers that increased production of basic grains.
17	Number of stakeholders that received research-based information on the proposed Best Management Practices for different crops.

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
2016	154

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Coffee has been one of our main agriculture products and it has been mostly grown in a traditional way.

What has been done
With the development of better management practices and more efficient production systems, we have been able to assist growers to obtain higher yields and improve their quality.

Results
From 341 producers who participated in trainings, 45% (154) adopted two or more recommended practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

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
2016	66

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 #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
2016	418

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plantain and banana producers in Puerto Rico face problems associated to damage by the Banana weevil, Cosmopolites sordidus, nematodes and Banana Rust Thrip (BRT). The young larvae of the banana weevil bore into the pseudostem base, rhizome and roots. BRT damage affect the quality of the fruit and has become a major constraint to production in the last year. The presence of these pests required the intervention of Extension Agents and Specialists to deliver an educational program to producers on integrated management of this pest to improve production.

What has been done
Recommended IPM practices help farmers to control pests and increase production. Extension specialists and agents offered trainings, visits and orientations to farmers (which included the distribution of educational materials).

Results
Banana farmers are now aware of the importance of preventing and managing pests in banana after receiving trainings and educational information through the Extension Banana Specialist and Extension Agents, and are implementing IPM practices to manage pests efficiently.

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
2016	224

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 #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
2016	905

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

We import most of our vegetables and fruits. People are aware of this situation. Therefore, there

is a great demand on local vegetable production.

What has been done
A Curricular Guide was developed on home gardening. Training sessions were offered at different levels: homeowners as well as for commercial production to also educate on Integrated Vegetable Management.

Results
From the 1,707 producers trained in Integrated Vegetable Management, a 53%(905) adopted two or more recommended practices.

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
2016	469

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 #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
2016	132

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Citrus greening has severely affected the citrus production in Puerto Rico. There is a great concern regarding the sustainable production of this fruit.

What has been done
Educational materials have been developed and a variety of activities were offered (from visits, workshops, trainings, orientation sessions) to assist farmers.

Results
From 235 producers trained in Integrated Tropical Fruit Management, 56% (132) adopted two or more recommended practices for citrus management.

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
2016	74

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
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.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4030

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the worsening economic conditions and an increased interest in organic and sustainable living, many people in Puerto Rico are turning to vegetable gardening as a supplement to their family's diet.

What has been done
The Vegetable Gardening Curricular Guide is used by the Extension Agents to prepare educational activities and disseminate vegetable gardening information to homeowners and other public.

Results
740 families increased their food supply by producing vegetables in the garden.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	971

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Extension outreach objectives addressed critical needs in vegetable home gardens to respond faster and in a more accurate way to the needs of homeowners, Extension Agents, and the general public.

What has been done

141 courses were given in vegetable gardening, and 4,093 persons around the Island completed a short course.

Results
971 persons establisehd a vegetable garden after completing a course. From those, 606 vegetable gardens were established in homes. The estimated money saved by a family after consuming the products of their vegetable garden is approximately $3,760.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Number of stakeholders that adopted the proposed Best Management Practices.

Not Reporting on this Outcome Measure

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
2016	165748

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lack of seeds of improved germplasm continues to be one of the major constraints to production identified by extension agents and growers in our yearly commodity meetings with stakeholders.

What has been done

The PR Department of Agriculture contracted the PRAEXS to produce seeds, vegetative planting materials, seedlings and grafted fruit trees for distribution to growers at the Fortuna Substation. At the Corozal and Gurabo Substations, plantain, banana, and root & tuber crop planting materials were distributed. At the Isabela Substation, 75,000 pounds of tanier planting materials were distributed to growers.

Results
The land area planted with improved varieties has been increasing over the past few years. The Isabela Substation sold $69,364 worth of dry beans, corn, tropical squash, pigeon peas and coriander to farmers. At the Fortuna Substation, sales of grafted trees of avocado, mango, soursop and West Indian cherry, seedlings of passion fruit and grapes, as well as other fruit trees of guava, cashew, papaya and tamarind amounted to $35,082. At the Adjuntas Substation, sales of coffee and citrus seedlings, anthuriums and grasses for soil conservation amounted to $45,266. Corozal and Gurabo sales of improved cultivars seeds amounted to $16,036.

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
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production of root & tuber crops has decreased by more than 80% during the past 60 years, while consumption has decreased by a much lower percent.

What has been done
PRAEXS has an active research program in starchy crops. New varieties have been developed locally or introduced and evaluated. Improved management practices have also resulted in improved yields. Research results together with outreach by the extension specialist and agents have resulted in increased production. Vegetative material for the planting of 212 acres of tanier was produced at the Isabela Substation and distributed to farmers through PR Department of Agriculture personnel.

Results
PR Department of Agriculture statistics are not available for the 2015/16 year. Although the Commodity Leader for Starchy Crops reports that production has increased less than 1% over the previous year, reports by the specialist from the educational program in root crops production show that 55 growers increased production of their crops.

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
2016	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Diseases and insects are major constraints for tropical vegetable production. Crop management practices need to be constantly evaluated.

What has been done
Germplasm evaluation of new hybrids and traditional varieties has continued. Organic seed production of vegetable seeds was continued at the Lajas and Gurabo Substations of PRAEXS.

Shade houses have been established at the Fortuna and Lajas Substations to conduct research in an insect free environment.

Results
Production increased for tropical squash (16%), cooking pepper (15%), eggplant (6%), cucumber (16%), watermelon (22%) and cabbage (52%) between the 2013-14 and the 2014-15 seasons. Tomato and onion production declined, however, by 22% and 15%, respectively.

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 acquired at substations with organic plots (taken as a proxy of growers knowledge of organic agricultural practices).

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A demand exists for organically grown crops. Current local supply of organically grown crops is very limited. Organic seeds must be imported at high costs from suppliers in temperate zones. Organic seeds of crops that grow under tropical conditions are necessary to meet local demand.

What has been done
Areas within the Gurabo and Lajas Substation of the PRAEXS have been certified as organic. The PRAEXS has been distributing seeds with the ?USDA Organic? label since receiving the final organic certificate from the Quality Certification Services (Gainesville, Florida) in 2010.

Results
At the organic farm at the Lajas PRAEXS Substation 2,921 pounds of organic seeds of 63 different vegetables, culinary herbs and cover crops have been distributed with the ?USDA Organic? label since the project began in 2010. Organic seeds are advertised on the project

website at http://prorganico.info/organico_semillas.htm. Over 7,585 packages have been distributed. Seeds of the following crops have been produced: tropical pumpkin, eggplant, okra, upland rice, corn, cilantro, winged beans, cowpea, Mucuna, Crotalaria, basil, corn, pigeon peas, sorghum, jack and velvet beans, sun hemp, lettuce and others. In Gurabo, seed from cassava, sweetpotato, sweet chili pepper and cocoa was produced and distributed to community and school gardens.

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	57

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers in Puerto Rico, Central America and the rest of the Caribbean need bean and pigeon pea cultivars with increased disease and insect resistance, and tolerance to abiotic stresses, to improve the food security situation of vulnerable populations in the region.

What has been done
White bean germplasm lines were released that combine resistance to bean golden yellow mosaic virus (BGYMV), bean common mosaic necrosis virus (BCMNV) and rust. Bean lines better adapted to soils with low soil fertility were identified. In collaboration with the Dry Grain Pulse CRSP project, common tepary bean cultivars with enhanced disease resistance and tolerance to abiotic stresses have been developed and released. Resistance to the pigeon pea pod fly is being incorporated into two pigeon pea selections obtained from a cross between the Lazaro selection and ICP-11950.

Results
In Puerto Rico, the new varieties released permit more bean production during the hot and humid summer months. Demand for seed of recently released bean cultivars exceeds PRAEXS production-for-sale capacity, evidencing the great acceptance and adoption of these cultivars by farmers. In the case of pigeon peas, the use of cultivars with pigeon pea pod fly resistance can increase yield by 40% and reduce insecticide use by 50%. In Central America and the Caribbean, over 80,000 farmers plant improved bean cultivars developed by the Dry Grain Pulse CRSP Project in which collaboration from Puerto Rico?s bean breeding program has been significant.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

Outcome #17

1. Outcome Measures

Number of stakeholders that received research-based information on the proposed Best Management Practices for different crops.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers in PR need to sustainably increase yields and reduce production costs in order to compete in an open market economy.

What has been done
Printed copies of technological practices for different crops have been distributed to farmers, extension agents and specialists, PR and Federal Government officials, educators, private sector professionals in agriculture and the public. Drafts of technological packages for growing melons (honeydew and cantaloupe), plantain, citrus, corn and taniers are in an advanced stage of completion. BMP have been presented and discussed at field days and workshops by PRAEXS and the Extension Service.

Results

The PRAEXS distributed 8,478 paper copies of technological packages, Journals of Agriculture of the UPR and other bulletins and publications in 2016. Internet blogs by researchers received over 1.48 million views on the Internet. PRAEXS provides vital support for the continued production of traditional crops because seed is not available from the private sector. Most of the starchy vegetables are propagated by vegetative planting material.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Public Policy changes
- Competing Programmatic Challenges
- Other (Lack of updated statistics about the agricultural sector)

Brief Explanation

Citrus production continues to be affected significantly by the severity of the Citrus Greening Disease. Cost increases in the application of insecticides to manage the psyllid vector and the use of an intensive fertilization program limit growers economically. The Agricultural Extension Service and the Agricultural Experiment Station are working in collaboration with the Department of Agriculture by producing quality declared rootstock.
The lack of updated statistics on the agricultural sector in Puerto Rico limits the information available to document outcomes and the impact of our programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No evaluation was made.

Key Items of Evaluation

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
202	Plant Genetic Resources	5%		5%	
205	Plant Management Systems	10%		10%	
301	Reproductive Performance of Animals	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
303	Genetic Improvement of Animals	15%		15%	
306	Environmental Stress in Animals	15%		15%	
307	Animal Management Systems	10%		10%	
308	Improved Animal Products (Before Harvest)	5%		5%	
311	Animal Diseases	10%		10%	
315	Animal Welfare/Well-Being and Protection	10%		10%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	14.1	0.0	5.0	0.0
Actual Paid	11.9	0.0	3.6	0.0
Actual Volunteer	0.0	0.0	0.9	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**
567398	0	1323376	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
283699	0	489608	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. Continued to use traditional one-on-one extension contacts during farm visits and consultation with producers by telephone or electronic mail.
2. Conducted seminars, meetings, trainings, extension agent certifications, and workshops.
3. Conducted training sessions, workshops and field days to impart further education and demonstrate recommended management practices to livestock and commercial forage producers. Maintained communication with livestock producer organizations and solicited their input regarding problems they face that may benefit from research.
4. Performed local and international visits (to places with similar environments and agricultural systems) to exchange farm management practice experiences and research findings.
5. Produced educational material (publications, newsletters, CDs).
6. Developed proposals seeking external resources as a means of conducting applied research to address the current needs in livestock production.
7. Offered counseling and orientation.
8. In collaboration with communications media, participated in radio and television programs and produced newspaper articles on topics of agricultural interest.
9. Attended and presented research results at meetings of relevant scientific societies both locally and internationally.
10. Established collaborations with government agencies (e.g., Environmental Quality Board; State Departments of Health, Agriculture, Environmental and Natural Resources, and Education; Puerto Rico Aqueducts and Sewage Authority; USEPA; USDA; NRCS; and others) and established contact with the new leadership of the Department of Agriculture of Puerto Rico (installed in January, 2017) to work cooperatively in support of its initiatives.
11. Improved collaboration with our partners at the University of Puerto Rico and at other educational institutions.
12. Disseminated educational materials and research results in non-technical terms, and news of interest via the web page entitled "SEA del Oeste Informa", and by circulating printed publications, such as the serials "La Res Informativa" for the beef cattle industry and "Críe Ovejas" for small ruminant producers.
13. Encouraged the maximum participation of graduate and undergraduate students of the Animal Science Department of UPR at Mayagüez in research projects pertinent to the needs of the local livestock industries.

2. Brief description of the target audience

Livestock and commercial forage producers, agricultural entrepreneurs, Agricultural Extension Service

professionals, College of Agricultural faculty, university students, professionals in the private sector, government personnel, community leaders, and animal rights organizations.

3. How was eXtension used?

www.eXtension.org has been used as a source of information by Extension specialists and agents to complement training presentations, materials offered to Extension agents and farmers, as well as professional development material.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3263	645	52	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	11	12	23

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
2016	423

Output #2

Output Measure

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

Year	Actual
2016	648

Output #3

Output Measure

- 3. Number of farmers trained in recommended practices in recordkeeping, disease control and prevention, and feed utilization.

Year	Actual
2016	542

Output #4

Output Measure

- 4. Number of dairy-beef farmers trained in recommended practices that are efficient against internal parasites in Puerto Rico.

Year	Actual
2016	211

Output #5

Output Measure

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

Year	Actual
2016	250

Output #6

Output Measure

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

Year	Actual
2016	205

Output #7

Output Measure

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

Year	Actual
2016	232

Output #8

Output Measure

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

Year	Actual
2016	3

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
2016	7

Output #10

Output Measure

- 10. Number of publications in refereed scientific journals.

Year	Actual
2016	12

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 increased animal production after adopting the recommended recordkeeping, disease control and prevention, and feed utilization practices.
4	Number of farmers that adopted practices for the control of parasites on their farms.
5	Number of farmers that adopted one or more practices to control heat stress.
6	Number of persons that improved the nutrient utilization practices in animals.
7	Number of farmers and agricultural entrepreneurs that used economic tools to make effective economic decisions to improve their business.
8	Number of producers participating in field days or training sessions who adopted recommended management practices on their farms
9	Number of animals of genetically improved breeding stock, from the University of Puerto Rico herd, sold to local beef 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.

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
2016	105

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
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
2016	113

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #3

1. Outcome Measures

Number of farmers that increased animal production after adopting the recommended recordkeeping, disease control and prevention, and feed utilization practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	90

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A dairy farmer from Camuy, Puerto Rico, frequently had problems with milk quality. This resulted in various penalties including discarding of bulk tank milk. During this time, the farmer averaged >750,000 SCC/ml and >50,000 CFU/ml.

What has been done
The Dairy Industry Regulatory Office in conjunction with Extension Service put together effort to provide training. The extensionists of Camuy and Hatillo visited the dairy farm and evaluated all lactating cows with a CMT to detect subclinical mastitis. Milk from cows with mastitis was collected and sent for bacteriology analysis and treated accordingly. The mastitis specialist visited the dairy farm to assess the milking process. According to this, the extensionists provided training to the milkers.

Results
The discarding of milk was halted and SCC and bacterial counts were reduced to 178,000 cells/ml and 16,000 CFU, respectively. Although the total milk production was reduced due to removal of mastitic cows, the farmer was able to sell what he produced. In fact, due to the improvement in quality, he was allowed to rent some of his quota. He used this extra money to further improve milk quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	85

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
315	Animal Welfare/Well-Being and Protection

Outcome #5

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	50

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

Outcome #6

1. Outcome Measures

Number of persons that improved the nutrient utilization practices in animals.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	39

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The quantity and quality of forages is an important limitation to improved milk production in the tropics. Increased plantings of high quality forages are needed to achieve satisfactory feed efficiency and profitable animal production.

What has been done
Research and extension on highly nutritious forages. Research in PR has determined the high nutritive value and digestibility of the tropical legumes 'Henorico' perennial peanut (HPP) and perennial soybean (Neonotonia wightii), and of the grass 'Maralfalfa' (Pennisetum spp).
Seed material of Maralfalfa and soybean, and field demonstrations about their management, has been made available to producers.

Results
Local farmers have visited experimental plots of the Henorico variety of rhizome perennial peanut, the locally-bred Mayorbela variety of corn, and Maralfalfa grass (a Pennisetum) at Lajas and two varieties of forage soybeans at Isabela. Planting of these forages on some private farms has occurred.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals

303	Genetic Improvement of Animals
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Number of farmers and agricultural entrepreneurs that used economic 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
2016	36

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rabbit meat production in Puerto Rico has been declining during the last years.

What has been done
The Extension Service of Maunabo in collaboration with the Department of Agriculture offered training about the care and management of rabbits, health benefits of rabbit consumption and organized a 4H parade to show different rabbit breeds. As an initiative to economically develop the meat rabbit entrepreneur, the first Rabbit Festival was established in La Fermina Community in collaboration with the Agribusiness Women Association. These entities worked together with a farmer from ?Barrio Rios?, Maunabo, regarding the establishment and permitting of new agricultural enterprises.

Results
The farmer mentioned previously opened a new rabbit farm with 400 mothers and 39 studs. He currently has 3,900 total animals. Also, he recently opened a new rabbit abattoir to process up to 2,000 rabbits per day. He is currently working with Extension Service to obtain the corresponding permits.

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 recommended management practices on their farms

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The beef industry in Puerto Rico is slowly growing. A Value Added Producer Grant was approved by USDA late in 2015 to finance the formation of a Beef Producers Cooperative with the purpose to improve production and marketing of locally produced beef. Great interest exists among beef cattle farmers in farm management, genetics, reproduction, final beef quality, biosecurity and nutritional information in order to increase production efficiency. The improvement in farm management and animal handling is now required for many incentives or for participation in initiatives such as the Beef Farmers Cooperatives.

What has been done
Non-formal short courses in beef cattle production, field days on seed production of forage soybean and establishment of new varieties of grasses (Maralfalfa), trainings on sanitary and quality aspects of beef production, and technical meetings on the concept of grass-fed beef have been offered. The Puerto Rico Beef Quality Assurance Program has continued to offer seminars and certifications in various beef cattle management areas, with positive responds from the cattle farmers.

Results
Out of 1,200 farmers who participated in these activities an estimated 40% adopted the recommended management practices improving the overall outcome of their animal production. Although we do not have evaluation results from all of them, the results from a training offered to the "Beef Quality Assurance" program showed that 43% of 19 respondents were very interested in continuing in this program and taking more courses or workshops in topics such as breeding and nutrition, 19% in selection and development of breeds and 9% in pasture management and beef quality. One participant in a two-day short course in beef cattle production acquired 135 acres through the USDA Farm Service Agency and increased the head count in the farm from 70

to 95. Through a collaboration with the Extension Service, she also obtained the permits to operate and sell meat to two local supermarkets.

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 animals of genetically improved breeding stock, from the University of Puerto Rico herd, sold to local beef 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
2016	65

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beef cattle producers in Puerto Rico need to improve the genetic composition of their herds to increase their share of consumer markets that demand high quality meat.

What has been done
The Montaña Beef Cattle Research and Teaching Farm is dedicated to improving animal science education and to conducting research contributing to the development of Puerto Rico?s beef cattle industry. Besides hosting graduate and undergraduate research in beef cattle genetics, physiology, nutrition, growth and beef quality, the farm provides UPR-CAS purebred registered Senepol cattle of high genetic merit to sell to local cattle producers and to export to the U.S. and Caribbean islands.

Results

Last year beef cattle producers, with farms widely distributed over the island, purchased 27 male animals (calves and young bulls) from the following breeds: 21 pure Senepol, 2 pure Charolais and 4 crossbred Senepol x Charolais; and 38 female animals (calves, heifers, and cows) from the following breeds: 9 pure Senepol and 29 crossbred Senepol x Charolais. At present, the Montaña farm has 10 active pure Senepol sires. Eight of these sires are among the superior 20% for two or more of these traits among their offspring: weight at birth, at weaning and at one year of age. Moreover, a Senepol bull from the Montaña herd was listed as leader in weight at weaning in the records kept by the Senepol Cattle Breeders Association and published in its 2016 Sire Summary. To lead in one characteristic, an animal must be among the superior 10% of active registered animals in that characteristic, proof of the success of our genetic selection program.

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
2016	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

205	Plant Management Systems
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
315	Animal Welfare/Well-Being and Protection
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

Puerto Rico has undergone a significant drought during the months of May through October.

Increases in the price of milk enacted at the consumer level may continue to shrink the market for fresh milk in PR among a population whose purchasing power is on decreasing; price increases also discourage efforts towards greater efficiency in the operation of the island's dairy farms.

Uncontrolled imports of beef from the U.S. and several foreign countries whose production costs are lower than in PR continue to grow. The narrow profit margins at the farm level force many producers to cease operations resulting in a decline in the amount of meat locally produced.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We are currently working together with the Dairy Herd Improvement Association to train our Extension Agents working with Dairy Farmers about a creation of records using PC Dart. We expect to improve the quality and accuracy of the data collected in our online report system (SISE). Also, together with the personnel of the Experiment Station we are trying to increase efforts to improve the recordkeeping of other animal production systems.

Key Items of Evaluation

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%		18%	
212	Pathogens and Nematodes Affecting Plants	10%		24%	
215	Biological Control of Pests Affecting Plants	0%		22%	
216	Integrated Pest Management Systems	40%		36%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	2.5	0.0	3.1	0.0
Actual Paid	4.6	0.0	2.2	0.0
Actual Volunteer	0.0	0.0	1.1	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**
219591	0	1333050	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
109796	0	720386	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1113	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Implemented the production of healthy propagative citrus material with the support of the Citrus Clean Plant Network.
• Performed tests for systemic pathogens of Citrus spp. plants in commercial nurseries in collaboration with the PR Dept. of Agriculture (PRDA)
• Provided extension training in citrus integrated disease, pest management and nutritional programs
• Concluded with the development of disease management strategies for plant parasitic nematodes in plantain. Integrated research and outreach activities increased producers' knowledge of effective management strategies for plant parasitic nematodes.
• Presented seminars on preventing new diseases, including Banana Bunchy Top and Fusarium race 4. Information shared in these activities aimed at recognizing of symptoms and quarantine measures to prevent the establishment of new pathogens. Seminars on Bunchy Top and Fusarioum race 4 reached 200 growers, extension personnel and researchers.
• Evaluated watermelon, peppers and cabbage production under screen-shaded structures in growers' fields
• Processed more than 1,000 diseased plants in the Plant Diagnostic Clinics and provided recommendations for disease and pest management
• Trained extension agents in IPM in the vegetable garden, in hydroponics and in root and tuber crops
• Disseminated research results and extension information through peer reviewed publications, participation in conferences and seminars and through the organization of field days.

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-Forest Service
• 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 Crops and Environmental Sciences.
• Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS)
• Consumers and homeowners

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1760	2300	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	6	4	10

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
2016	25

Output #2

Output Measure

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

Year	Actual
2016	4

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
2016	11

Output #4

Output Measure

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

Year	Actual
2016	1662

Output #5

Output Measure

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

Year	Actual
2016	6

Output #6

Output Measure

- Number of individuals that visit the Web-based resources in Integrated Pest Management.

Year	Actual
2016	2270

Output #7

Output Measure

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

Year	Actual
2016	1118

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 Black Sigatoka Management.
2	Number of farmers that adopted one or more recommended practices for integrated management of Citrus Greening.
3	Number of persons that increased knowledge about IPM in the vegetable garden after completing a non-formal education course.
4	Number of persons that implemented integrated management recommendations after receiving a pest or disease diagnose for their crops.
5	Number of articles published in newspapers.
6	Number of emerging pests identified as a result of research activity.
7	Number of persons who adopted reduced risk pesticides and practices.
8	Number of farmers reporting decreased losses due to key and emerging pests.
9	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.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	418

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Black sigatoka continues to be a major concern for Puerto Rico, due to the instability in climatic conditions with an increase in precipitation in the last years.

What has been done
Meetings and presentations organized during 2016 by researchers and extension specialists that conveyed information about symptoms and early diagnosis.

Results
A total of 554 banana and plantain growers were trained in integrated management of the crops. About 75% of the growers adopted two or more management practices to improve their crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #2

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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	132

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Citrus greening is the most important disease of citrus in Puerto Rico. The damage of citrus greening in Puerto Rico was considerable in 2015 and 2016.

What has been done
With the support of the Citrus Clean Plant Network and the Puerto Rico Department of Agriculture, production of Citrus spp. rootstocks and budwood in screen-proof structures shows the program's success in developing healthy citrus plants. The scope of the program includes all the work required to support Citrus testing in growers' nurseries and orchards. Research efforts also include the evaluation of nutritional programs aimed at improving citrus management, to ameliorating the effect of Citrus Greening in orchards affected by the disease.

Results
Citrus growers recognized the importance of testing at citrus nurseries and that this practice will be effective in controlling the spread of citrus greening. Citrus growers showed interest in applying a nutritional program to their orchards.

4. Associated Knowledge Areas

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

Outcome #3

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
2016	668

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The adoption of IPM practices is limited in vegetable gardens in the island and there is a constant need to educate homeowners and small scale producers in the use of alternative management for pest and disease control.

What has been done
A curricular guide on vegetable gardening was prepared which includes management practices and was used in the Annual Vegetable Gardening Festival. Several educational activities were organized by the Extension Agents. These tools were effective in the dissemination of vegetable gardening information to homeowners and others.

Results
Vegetable gardeners are increasing their knowledge about IPM. The main outcome as a result of the educational activities has been an increase in their understanding of IPM practices in the vegetable garden. This will allow stakeholders to choose management practices to control pests and diseases in a safe way.

4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Plant Diagnostic Clinic receives daily visits from growers who become engaged in the process of disease detection and identification. A total of 613 samples were processed and recommendations provided. These are essential services for growers and the general public to acquire knowledge and ownership of the process of disease and pest detection.

What has been done
Farmers reported improved knowledge in managing viral and bacterial diseases in vegetables. New hosts for Tospovirus were identified that include weeds hosts and sweet chili pepper. Visits to growers? fields to address emerging diseases in vegetables and plantains were made. Disease identification using PCR (Polymerase Chain Reaction) has improved virus and bacteria identification and resulted in new disease reports. Assessment of the effectiveness of the Plant Diagnostic Clinic through a survey indicates that growers understand the importance of accurate disease identification for reducing crop losses.

Results
Farmers in the southern vegetable production area, as well as in other production areas in Puerto Rico are receiving recommendation for disease and pest management through visits to the Plant Diagnostic Clinic at the Juana Diaz Substation and from crop and IPM specialists. Contacts with farmers have demonstrated that they are receiving recommendations and reducing the application of unnecessary pesticides for disease and pest control.

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 articles published in newspapers.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New pests and diseases are responsible for crop losses in Puerto Rico. There is a constant need to inform the public about the potential threat of new insects and pathogens entering the island.

What has been done
Publication of a newspaper article about Tropical race 4 (TR4)in banana and plantain aimed to educate the public about the importance of preventing a disease that is not reported in Puerto Rico and cannot be controlled by fungicides. Two local radio programs were produced for vegetable and plantain growers.

Results
The newspaper article reached 15,000 readers and increased awareness about the importance of early detection and prevention of the spread of TR4 in plantains on the island. The radio program for vegetable production reached an audience of 100 households. The radio program ?Fuerza Agricola?, broadcast to agricultural stakeholders included information about TR4 and reached 1,500 listeners.

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 emerging pests identified as a result of research activity.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Solanaceous and cucurbit crops are the main vegetable crops in the southern Puerto Rico. Continuous cultivation perpetuates the pathogens and pests in the agricultural areas and has resulted in an increase in diseases and insects. Detecting new pests and diseases is important in preventing outbreaks that result in dissemination to other areas of the island, thus making growing crops unprofitable.

What has been done
Information about alternative practices to control pathogens and insects have been disseminated during field days in the vegetable producing areas of the island. In local conferences and field days, Extension Service agents and researchers from the different Agricultural Experiment Stations have presented information directed to using alternative practices to control the Psyllid vector of citrus greening. The Plant Diagnostic Clinic has provided farmers with diagnoses of pathogens and other pests in vegetables, and management recommendations as well.

Results
In 2016, two new diseases were identified in tomatoes and sweet chili peppers and early detection has prevented outbreaks in other vegetable producing areas. As a result of timely diagnostic clinics, vegetable producers adopted reduced risk pesticides and the recommended management techniques.

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 #7

1. Outcome Measures

Number of persons who adopted reduced risk pesticides and practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	271

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Solanaceous and cucurbit crops are the main vegetable crops in the southern part of the Island. Continuous cultivation and inadequate rotation and cultural practices have resulted in the increase of diseases and insects. Vegetables are grown under drip irrigation, plastic mulch, high pesticide and fertilizer use. In 2016, viruses and bacteria have impacted tomato, pepper, sweet chili pepper and watermelon production.

What has been done
In addition to field days in the vegetable producing areas of the island organized by the the Extension Service specialist, the personnel of the plant diagnostic clinics have visited farms where disease outbreaks have occurred and shared best management practices for control of viruses and bacterial pathogens in tomatoes, watermelon, sweet chili peppers, and other pests in vegetables.

Results
The clientele of the Plant Diagnostic Clinic (PDC) at Juana Diaz Substation answered a survey and reported that the identification of the diseases and pests is carried out in a timely manner and helps them in their management decisions. Results of both the PDC and the Mayaguez Diagnostic Clinic have helped producers adopt reduced risk pesticides and management techniques.

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 #8

1. Outcome Measures

Number of farmers reporting decreased losses due to key and emerging pests.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Citrus Huanglongbing (HLB) is one the most destructive diseases in Puerto Rico. Successful management will require the use of several alternatives beginning with the use of pathogen-tested citrus plants (healthy), biological control of the psyllid, supplemental nutritional programs and selected insecticides for management of the vector.

What has been done
Citrus growers received recommendations for better agronomic practices to improve citrus orchards management. The Extension Service and researchers have also provided information in local conferences and field days on the use of alternative practices for the control of the psyllid vector of citrus greening.

Results
Citrus growers adopted IPM practices for Citrus Greening disease. A total of 132 citrus growers adopted two or more IPM practices in their orchards, including a scheduled fertilization plan and practices for the management of the psyllid. It is difficult to determine the increase in losses due to emerging pests and 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 #9

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
2016	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Banana bunchy top, caused by Banana bunchy top virus (BBTV), is regarded as the most important viral disease of banana, causing significant yield losses worldwide. The virus is transmitted from plant to plant by aphids and is also transmitted through infected planting material. Fusarium wilt of banana (also known as Panama disease) is caused by Fusarium oxysporum f. sp. cubense. A new variant, Tropical race 4, threatens the production of bananas--that are now based on Cavendish cultivars--and other locally important types such as the plantains. Knowledge about these destructive diseases that affect banana and plantain will help prevent entrance and outbreaks.

What has been done
In 2016, three seminars were presented on preventing new diseases including Banana Bunchy Top and Fusarium race 4. Information shared in these activities aimed at recognizing of symptoms and quarantine measures to prevent the establishment of new pathogens. An article "Talking about bananas" was published in a newspaper with a monthly distribution of 15,000.

Forty extension specialists and agronomists participated in two field days to discuss the findings of research on plantain 'Maiden' as well as concern about the situation and priorities of banana and plantain production on the island.

Results
Seminars on Banana Bunchy Top and Fusarium race 4 reached 200 growers, extension personnel and researchers. The main outcome of the educational program was an increase in growers' understanding of these diseases. As a result of conferences and field days presented by Extension Service specialists and researchers, banana growers are more aware of how to recognize symptoms to prevent the establishment of these diseases on their farms.

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
- Appropriations changes
- Competing Public priorities

Brief Explanation

Puerto Rico's extreme weather conditions, ranging from severe drought to high precipitation, affected planned research and extension activities. Extreme weather conditions promoted pest and disease outbreaks that affected agricultural production. The introduction of new and emerging pests and diseases poses a threat to important crops. The Citrus Greening disease continues as a major constraint on this crop. In banana and plantain, the excessive rainfall pattern during 2016 promoted a high incidence of the Black Sigatoka disease. The banana rust thrips is the major problem affecting production.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

N/A

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%		8%	
102	Soil, Plant, Water, Nutrient Relationships	0%		11%	
103	Management of Saline and Sodic Soils and Salinity	0%		1%	
104	Protect Soil from Harmful Effects of Natural Elements	25%		8%	
111	Conservation and Efficient Use of Water	25%		13%	
112	Watershed Protection and Management	25%		13%	
121	Management of Range Resources	0%		1%	
123	Management and Sustainability of Forest Resources	0%		1%	
125	Agroforestry	5%		0%	
132	Weather and Climate	5%		0%	
136	Conservation of Biological Diversity	0%		8%	
141	Air Resource Protection and Management	0%		2%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		7%	
212	Diseases and Nematodes Affecting Plants	0%		3%	
213	Weeds Affecting Plants	0%		1%	
215	Biological Control of Pests Affecting Plants	0%		1%	
216	Integrated Pest Management Systems	0%		3%	
403	Waste Disposal, Recycling, and Reuse	15%		19%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	7.7	0.0	3.1	0.0

Actual Paid	11.1	0.0	3.0	0.0
Actual Volunteer	0.0	0.0	0.9	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**
529125	0	451113	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
264562	0	273543	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

Extension Activities

1. This year, a curricular guide on Soil Health was developed and training was offered in collaboration with NRCS personnel to all Extension Agents as well as personnel in the State Department of Agriculture. The training included videos, presentations and demonstrations. Also a review on important topics such as soil structure, composting and its contribution to soil microorganisms, demonstration on recommended soil conservation practices and an exercise on soil diagnostic.
2. An ongoing effort to provide non-formal education on soil erosion control to encourage the adoption of recommended practices continues.
3. Training continues to be offered on water harvesting and storage. Water harvesting and efficient use of water on the farm remains in high demand as part of the non-formal education course requests.
4. Collaboration with the Caribbean Climate Hub continues in the development of educational materials and activities for farmers.
5. Education continues on forest fire prevention in collaboration with the Fire Department.

Research activities

1. Conducted trials on the effect of drip irrigation and foliar fertilizers on the incidence of citrus greening in lemons cv. Meyer. Preliminary results showed the cultivars could be grown successfully under this management practice.
2. Continued experiments involving different management practices and subsurface irrigation in growing taro in the southern region of PR. Results to date show that the dry conditions prevailing in the region do not favor the development of the Taro Leaf Blight that limits production in other regions of the island.
3. Developed biological indicators of stressor conditions in rivers and streams of Puerto Rico, an essential component for the preparation of regulatory limits to control nutrient over-enrichment in these bodies of water.
4. Surveyed and revised information on non-native insect and weed species from agricultural and wildlife lands on the Puerto Rican archipelago. Among findings, results showed that 26 invasive insect species were introduced in the archipelago during the last decade.

5. Developed soil improvement and maintenance practices.
6. Developed management approaches for conserving and restoring biodiversity.
7. Published research advancements in journals, bulletins, newspaper articles, and popular magazines.

2. Brief description of the target audience

Extension activities targeted Extension personnel, the State Department of Agriculture, farmers, community leaders, producers, youth and volunteers.

Members of the target audience included farmers, policy makers, scientists, university students, conservation practitioners and managers, extension specialists and agricultural agents, the communications officers of the agricultural research centers, NGOs, water and land managers, agricultural producers with an interest in cover cropping and sustainable agricultural practices, government agency personnel, natural resources professionals and bio-prospectors. People interested in soil management and conservation, and regulators working in agricultural non-point pollution mitigation were also included.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2326	11269	1367	3293

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	4	5

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
2016	519

Output #2

Output Measure

- Number of participants in non-formal educational courses on water collection, storage and re-use for agricultural purposes.

Year	Actual
2016	447

Output #3

Output Measure

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

Year	Actual
2016	229

Output #4

Output Measure

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

Year	Actual
2016	49

Output #5

Output Measure

- Number of people who received capacity development on prevention of brush or forest fire.

Year	Actual
2016	124

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
2016	92

Output #7

Output Measure

- Number of stakeholders receiving research information on best management practices for agricultural and natural ecosystems.
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

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

Year	Actual
2016	37

Output #9

Output Measure

- Number of research proposals submitted.

Year	Actual
2016	19

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
2016	4

Output #11

Output Measure

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

Year	Actual
2016	8

Output #12

Output Measure

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

Year	Actual
2016	148

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 non-formal education courses in climate change.

Year	Actual
2016	1290

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 people reporting willingness to adopt best management practices to improve conservation and efficient use of water.
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 stakeholders gaining knowledge on what constitutes acceptable levels of periphyton biomass for recreational purposes in rivers of PR.
12	Number of people who increased knowledge on practices to improve soil quality through an integrated soil management system.
13	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.
14	Number of people gaining knowledge about tropical forests landscaping models developed to enhance management decisions.
15	Number of people reporting having gained knowledge of program activities through podcasts websites, and web videos.

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
2016	453

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
132	Weather and Climate
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
2016	145

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Most of the farms and public lands have access through dirt roads. These roads if they are not maintained can contribute to increase sedimentation levels due to the surface erosion which end up at the water sources.

What has been done
Educational activities were developed (workshops, practical excercises, and demonstrations) and offered to promote best management practices (MMP's) for dirt roads. These practices have not only been proved to be efficient at reducing soil erosion, but also contribute to the expansion of the dirt roads life spans.

Results
Forty people were benefited from the educational activities offered including contractors, environmental groups, environmental planners, engineers, farmers, Department of Natural Resources and Environment, Forest Service and Municipal Road and Transportation Department. Besides the knowledge gained on soil erosion and its consequences, they also learned practical ways to determine slope and soil erosion capacity and were able to examine BMP's established in demonstrative roads in the El Yunque Forest. Farmers and visitors have requested visits and orientation on how to establish the recommended practices in their farms, properties, communities and beach access.

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
2016	257

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the past years, Puerto Rico suffered a drought that severely affected the central mountain region and the southern part of the Island. People are concerned and taking measures to be prepared for the future.

What has been done
Trainings were offered on water harvesting and storage.

Results
From a total of 447 people who participated in trainings, 257 (57%) reported the adoption of recommended practices for water storage and reuse efficiency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

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
2016	76

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
2016	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico's topography is characterized by step slopes (mountains) and mainly clay soils. Often, soil can be found exposed without or with little coverage prone to erosion.

What has been done
Farmers and other professionals are required to comply with the Environmental Quality Board regulations to continue it's operations.

Results
Forty nine people received capacity development in soil erosion and water regulations, 45 (92%) were able to comply with the requirements.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management

Outcome #6

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	31

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

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
2016	27

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
112	Watershed Protection and Management

Outcome #8

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
2016	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Commercial taro production in Puerto Rico was devastated in the last decade due to the fungal disease known as taro leaf blight. Our traditional production areas in wetlands and riverbanks were severely affected, alarmingly reducing seed production and availability. Researchers believed that adopting advances in irrigation technology and scheduling, and changing the region and system of production, could be the key to maintaining taro seed production programs, and eventually increasing the production of the crop while improving water use efficiency and conservation.

What has been done
Experiments involving different planting and management systems of taro under subsurface irrigation in the southern region of PR have been made and data on yield results have been analyzed. A field day to demonstrate the best management practices to date for this crop was held and taro seed was distributed to interested farmers. Researchers have given individual follow-up to selected farmers adopting the technology and production system.

Results
The dry climate of the southern region has proved to be adverse for the establishment and/ or development of the fungus and has allowed the production of taro with good yields and excellent quality. During last year 42,359 seeds of taro were distributed to 28 farmers and there is still a

waiting list of interested producers that have expressed their willingness to follow the recommended practices and augment the available seeds in their farms. The irrigation management system developed in these experiments is one of the key practices behind the success achieved in the plantings of this crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
212	Diseases and Nematodes Affecting Plants

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
2016	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Federal and local agricultural agencies have identified the need to develop and enhance the professional and global competencies of the Natural Resources and Agricultural Sciences workforce in areas relevant to the College of Agricultural Sciences. The training of outstanding students at the undergraduate and Master?s levels contributes to fill expertise needs in the Agricultural and Natural Resources sciences.

What has been done
Funding from research grants has been allocated to support students? training, provide work experience and completion of master?s degree in identified priority need 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 in order to build up science competitiveness throughout actual research activities and experiences.

Results

During the previous year, undergraduate and graduate students have received training and work experience in this research program which provided field and laboratory research experience for more than a dozen undergraduate students; 10 were females and all of them were students from underrepresented groups in the agricultural sciences. During FY 2016 this Research Program sponsored 12 graduate students (8 with Hatch funds) and 16 undergraduates as part-time help (i.e., between 0.25 and 0.5 FTE/each). Training experiences varied among projects, e.g. three undergraduates participating in the course "First Professional Experience" were trained in sampling forest structure and species composition, and data collection techniques. Whereas students participating in Biodiversity research projects were trained in field and laboratory activities, including sampling, identification and curation of specimens. All students were active in laboratory data analysis and curatorial activities at the Museum of Entomology and Tropical Biodiversity insect collection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants

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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	141

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Given the Island topography and an annual precipitation of 53.01 inches (NOAA 2007), soil erosion is of great concern. Soils have been depleted and most of it organic matter is gone. Beside it?s water contamination potential, there is an effect on the agricultural production.

What has been done
This year a curricular guide was developed on Soil Health. Several training sessions were offered covering soil structure, soil ecosystems and benefits, organic soils, SH management and diagnostic (exercise) and recommended practices to protect the soil. Also, the role that soils plays in carbon sequestration was discussed. Participants were mostly Extension Agents and State Department of Agriculture personnel.

Results
Personnel who attended the SH courses/training sessions gained knowledge and it was confirmed through a post-test.

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 stakeholders gaining knowledge on what constitutes acceptable levels of periphyton biomass for recreational purposes in rivers of PR.

Not Reporting on this Outcome Measure

Outcome #12

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

2016 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To increase soil organic matter, many growers have adopted soil conservation practices such as cover crops, crop rotation and soil amendments. The effect of these practices on soil quality parameters such as recalcitrant soil organic matter (RSOM), cation exchange capacity, redox potential, pH and microbial activity have not been well studied in Puerto Rico. These parameters are critical for a better management of NPK fertilization.

What has been done
Experiments were conducted at the Corozal Agricultural Experiment Station with an integrated soil management system that includes the use of two soil conservative practices: cover crops and effective microorganisms. The cover crops used were Sun Hemp and Sorghum. Soil samples before and after a one cover crop cycle and one application per month of effective microorganisms (EM) were analyzed for organic carbon, enzymatic activity and humic acids content and characteristics.

Results
Results to date show that application of compost, cover crops and EM had profound effects on the amount and quality of soil organic matter (SOM), pH, soil enzymatic activities and humic acids concentration. Decomposition of SOM on the highly eroded Corozal soil was accelerated. However, results also showed that when the original SOM is higher than 0.6% the application of EM, compost and cover crops has the effect of decelerating organic matter decomposition, and increasing the rate of humic acid formation. The highly eroded soil used on this study with an organic carbon content between 0.6 and 1.3 % improved its agronomic properties (quality) by the augmentation of SOM, improving the soil enzymatic activities and soil resilience. Results were disseminated through four presentations to participants in scientific conferences and through personal communications with agronomists and students wishing to improve their knowledge of agricultural practices to improve 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 #13

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	80

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Invasive species pose a serious challenge that requires a decision-making framework based on the prioritization of species for control, regulatory and public education programs. Priority lists have been the domain of regulatory agencies and the scientific community; however, few have been developed according to specified procedures and criteria. As a result assessing the full impact of non-native species is challenging and imprecise. The significant economic and ecological costs of these species require that methods be developed to identify the ones inflicting the greatest impacts so as to prioritize those that should be targeted for control.

What has been done
Both field and laboratory-based activities were concluded. In addition to field collections, efforts have been placed on securing reliable identification methods using museum and herbarium reference materials, extant literature, and historical collections. A total of 75 and 5 invasive insects and weeds, respectively, have been identified and mapped.

Results
From 2011 to 2016, we surveyed and revised information on non-native insect and weed species from agricultural and wildlife lands on Puerto Rico, 90% of which confronts problems with more than 80 invasive organisms. Five non-native weed species, and 75 non-indigenous insect species were reported of concern. Twenty-six of the invasive insect species were introduced during the last decade. We have documented the presence of new potential pests. The non-native weeds and non-indigenous insects earlier mentioned are by no means a comprehensive or prioritized list of invasive species threatening the island. Rather, they provide examples of the many threats and problems caused by the spread of invasive species on the island, including competitive displacement or crowding, predation and herbivory of native species, hybridization with native species, transmission of diseases, and dramatic changes in ecosystem processes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants

Outcome #14

1. Outcome Measures

Number of people gaining knowledge about tropical forests landscaping models developed to enhance management decisions.

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

Number of people reporting having gained knowledge of program activities through podcasts websites, and web videos.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1000000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
the web is an efficient Tool to reach audiences. Several scientists in our research program have used this technology to maximize outreach efforts.

What has been done
Outreach of research activities in this area has been varied and performed across disciplines, particularly in interdisciplinary groups. This activity has been documented in web videos, web seminars and podcasts.

Results

Research results have been successfully disseminated mainly through website videos, podcasts and blogs. More than a million visits have been recorded at the website for accessing the different topics offered. As the most popular topic, the recycling and manure management videos, produced every two weeks, represent the largest number of information requests and hits at www.youtube.com/user/compostapr

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
132	Weather and Climate
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes

Brief Explanation

There is no doubt that the climate is changing. In previous years, the Island experienced some degree of drought. But, in 2016 it displayed a different weather conditions. In November, there was a 300% precipitation in comparison to other months in this year. In the period from November 1 to 23, a 14.26 inches of rain were registered, more than 9.62 inches over. This caused mud slides, affecting water services and an estimated of $2.7 millions lost in crops. Some towns in the central mountain region registered over 20 inches of rain in the same period.

Puerto Rico is frequently exposed to the impact of hurricanes, drought and heavy rains that complicate existing problems of soil erosion and nutrient transport, particularly in the central mountain region. Budget reductions at the university, and increases in the cost of higher education for students may affect the number of scientists and graduate students working under this program.

Climate changes in an island ecosystem are expected to negatively affect natural resources such as water and soil and the livelihood of its inhabitants. Natural resources are at stake because of increasing demand to satisfy the needs of the human population and because of pressures brought on by an ever-increasing dependence on imported goods and products. Any changes in world markets are greatly felt on economic activity in Puerto Rico. The government has a very important role to play in addressing climate change, mostly in the way public policy is implemented.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

During March and April 2016 a survey was conducted to collect the responses of Agricultural Agents regarding the results of educational efforts conducted on climate change. The plans were to first prepare a curricular guide on climate change, followed by train-the-trainer activities for the ag agents and afterwards develop awareness among farmers and the community, and follow-up on the adoption of recommended practices.
Fifteen agriculture agents were identified to participate in the e-mail survey. We received eight responses (53% response rate).

During 2013-2015, 23 courses, training sessions and workshops were offered on climate change, for a total of 539 participants. Participants included mainly farmers, youth and adults. Example of topics offered were:

- Soil erosion control and storm water management
- Organic farming
- Water harvest and reuse for farming purpose
- Brush fire prevention
- Natural disaster plans

A summary of survey results is as follows:
Forty seven (47) farmers adopted recommended practices to cope with climate change. Some of the practices adopted were:

- Contour planting
- Water harvesting
- Changes in the traditional plantain sowing season
- Use of pumpkin varieties that are rain tolerant
- Water conservation in drought season
- Farm roads to protect against fires
- Use of cover crops

Several methods were used to determine the adoption of practices, such as:

- Farm visits
- Follow-up visits
- Informal talks with farmers
- Interviews
- Meetings
- Counseling

Another question asked was how to identify factors that limit the adoption of practices besides the economic factor. The results were:

- People adopt practices according to their felt needs
- Keeping with the educational effort might make people adopt practices
- Constant changes in the weather
- Lack of interest
- Farmers attitude not to change what they have been doing
- Frustration

This survey conveys the agricultural agents' opinions and experiences. It will be interesting to find out the farmer's point of view, which we plan to discover in 2017.

For an applied perspective, the multiple data collection activities to compile input from the program participants and stakeholders: survey, workshops and seminars, website questionnaires, document review and analysis, were not always successful. The most efficient were workshops, seminars and websites, particularly web-videos and podcasts, through which the university audience expanded exponentially. Another advantage of those outreach tools was the inquiries that revealed the real needs and interests of a broader audience with interests of their own. The satisfaction with these tools is evident by the number of hits and comments at the websites. Moreover, this method is more efficient in facilitating outreach than the others.

Key Items of Evaluation

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%		5%	
502	New and Improved Food Products	0%		45%	
701	Nutrient Composition of Food	0%		40%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	100%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	4.4	0.0	1.8	0.0
Actual Paid	10.4	0.0	1.6	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**
499463	0	41979	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
249732	0	11049	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

During 2016 work continue to be conducted in collaboration with other agencies to offer education to consumers through course using Safe Handling Curriculum. This curriculum includes At-Risk population. In order to expand our dissemination effort, exhibits, information centers, radio shows were used to provide general information and to create awareness. Another audience that participated in courses offered were the Food Managers in the Food Safety Courses.

Other research and education activities performed included:

- Training in HACCP, GAP, GMP
- Research in new product development using wastes from the food industry and agricultural commodities
- Risk assessment of the quality of water used for lettuce and other leafy vegetable production in hydroponic systems.

2. Brief description of the target audience

- Extension Family and Consumer Science Professionals and other professionals
- Parents and persons that plans/buys/prepares food for the family
- Consumers with an emphasis on at-risk population
- Food Managers
- Food Industry representatives
- Farmers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	11504	3485	329	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	2	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of consumers completing one Food Safety educational curriculum for consumers.

Year	Actual
2016	1507

Output #2

Output Measure

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

Year	Actual
2016	3636

Output #3

Output Measure

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

Year	Actual
2016	20

Output #4

Output Measure

- Number of active research projects in the program.

Year	Actual
2016	3

Output #5

Output Measure

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

Year	Actual

2016 4

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 enterprise participants impacted by the program that acquired knowledge of technologies based on scientific research
5	Number of improvements in technologies developed focusing on safety or shelf life extension.
6	Number of enterprises impacted by the program that improved their food technologies based on scientific research
7	Number of new food products being developed and evaluated in the program.

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
2016	1130

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Foodborne illness is an important public health issue. CDC (Center for Disease and Prevention) estimates that every 1 in 6 Americans become ill, 128,000 are hospitalized, and 3,000 die because of foodborne illnesses. According to Cairnduff, et.al.(2016) consumers do not know how important safe food handling practices are when trying to prevent foodborne illnesses. Many think that all food safety responsibilities rely on manufacturers.

What has been done
PRAES Home Economists offer Families be Food Safe curriculum. Among the topics are: Most Common Foodborne Illnesses, Proper Hand Washing, Cleaning and Sanitizing, How to Shop Safe Food, Food Preparation, How to use a Food Thermometer, and other lessons which they can add, depending on the clientele needs. Other topics included: At-Risk Population, Food Safety for Moms to Be, Safe Food and Water during Emergencies, Food Safety for Vegetable Gardens.

Results
1,507 consumers completed Food Safety courses that included at least 3 lessons. 75% adopted at least one safe food handling practice. Among the practices that were adopted are: Cleaning and sanitizing food contact surfaces (62%); proper hand washing frequency (75%); avoided cross contamination by separating ready to eat food from food that would be cooked (54%); cooked at recommended temperatures (46%). 25 moms to be completed Protect Your Baby Curriculum and 100% adopted at least 1 safe handling practice; 44% cleaned and sterilized baby bottles; 88% handled maternal milk safely; 88% handled infant food safely.

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
2016	3619

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food handler training is seen as a method to increased food safety (Adesokan,H.K., 2015) and to reduce critical food safety violations (Kassa,H. et.al, 2010). Food Safety training could offer long-term benefits to the food industry (adesokan,H.K.,et.al., 2015). Between training and knowledge, there is a significant association.

What has been done
PRAES CFC Educators trained and certified offered 134 courses throughout the year. The course consists of 12 lessons. During the course, Food Inspectors explained the Inspection Report and gave advice on how to implement the acquired knowledge in running a food establishment.

Results
3,636 Food Managers completed the Food Safety Course and 3,619 (99%) passed the test with 70% or more.

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
2016	1010

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to CDC (2014), 60% of outbreaks occur in restaurants. Food Safety training could offer long-term benefits to the food industry (Adesokan,H.K.,et.al., 2015). Food establishments with a food safety certified manager have lower risk of outbreaks.

What has been done
PRAES prepared a food safety course that complies with Food Code 2013 knowledge areas. With the participation of a Health Inspector in our courses, Food Managers have the opportunity to clarify any doubts the participants have. Food managers see the Inspector as facilitator more than a compliance officer because they get to ask questions without the pressure of an inspection. 3,636 Food Managers were trained, of which 3,619 approved the course's test. Among the participants we had 1,401 (38%) that worked for At-risk populations like Head Start Program, School Lunch Program, homes for the elderly, among others. 2,235 worked at other types of food establishments that served the general population like fast foods, sit-in restaurants, street vendors, and others.

Results
3,636 Food Managers completed Food Course. 84% adopted at least 3 safe handling practices. Among the safe food practices that were adopted: 85% washed their hands every time they changed tasks or food items; 73% avoided cross contamination by using color coded cutting boards to separate ready to eat food from food that were going to be cooked; 69% verified holding temperatures every 2 hours; 77% used utensils or disposable gloves when handling ready to eat food; 78% cleaned and sanitized equipment and utensils properly; 73% contracted a licensed Pest Management Professional; 80% thawed food appropriately; 79% kept food at 135°F; 76% prepared a written procedure for cleaning and sanitizing vomits.

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 enterprise participants impacted by the program that acquired knowledge of technologies based on scientific research

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Number of improvements in technologies developed focusing on safety or shelf life extension.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
1. White cheese is very popular with Puerto Rican consumers, but the disposal of acid whey, a byproduct of cheese making, forced the industry to cease white cheese production. The whey contains 50% of milk nutrients such as protein and calcium, which could be used to expand the range of products elaborated. While whey is used in making other products, it requires some processing (dehydration and concentration) before use.
2. Farmers need to know their water quality to be able to comply with new standards (Fresh Produce Rule).

What has been done
1. Research to develop products with a high concentration of nutrients and low in fat, using acid whey with minimal processing, was conducted. Whey has been used for the formulation and sensory evaluation of a frozen dessert high in protein content and for yogurt. Sensory and economic impact analyses were conducted for both products.

2. Risk assessments of water quality in hydroponic systems were performed using leafy greens produced in hydroponics.

Results

1.Results showed that increasing protein concentration increased the fat content of the frozen dessert. For the sensory analysis, a ranking test was conducted. Results showed that formulation with protein concentrations of 4.82% and 6.37% obtained a similar ranking number. The 6.72% protein content received the lowest ranking. Due to the ranking results we can infer that acceptability was best for a product with lower protein concentration. Yogurt elaboration using whey as a major ingredient was achieved. We found that the formulation of whey presented similar behavior to the control or commercial formulation in terms of viscosity and water retention.
2. Risk assessments conducted in leafy green hydroponics showed that the microbial load of agricultural water was higher than that allowed by the Fresh Produce Rule. A remediation strategy will be tested.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Number of enterprises impacted by the program that improved their food technologies based on scientific research

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of new food products being developed and evaluated in the program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers of traditional crops in Puerto Rico need new alternatives that add value to their produce and improve their viability.

What has been done
1. Pumpkin is economically important in Puerto Rico. Even though pumpkin flowers and immature fruits are considered an important source of nutrients and antioxidants, at present they are not exploited in the Caribbean. A product made from pumpkin flowers was developed and a consumer acceptability test conducted.
2. The Nazareno is a promising new tanier (Xanthosoma spp., a root crop) cultivar developed by PRAEXS that encompasses the best characteristics of this species. To take full advantage of the plant?s large corm (central stem), studies are being conducted to elaborate a multifunctional flour and to obtain starch from the tanier corm.

Results
1. Pumpkin flowers were packed in a plastic film tray. The shelf life of flowers stored at 10˚C without modified atmosphere packaging (MAP) was 2 days, while flowers stored under MAP had a shelf life of 7 days with 1.23% water loss and a good appearance. A total of 88.2% of test panelists rated acceptance as ranging from 5 to 9 on a 9-point scale.
2. The tanier corm cannot be consumed naturally due to its high content of calcium oxalate, a nonnutritional factor that imparts an acrid and bitter-astringent taste to the product. Several processes were tested to remove calcium oxalate from the corm. The most efficient one, soaking in distilled water at 28° C for 72 h under constant stirring, reduced oxalate content by 79%. Considering the efficiency of the soaking process, large-scale flour production was achieved with three washes, obtaining a recovery of 81% of the flour after the soaking process. Preliminary results indicate the potential of tanier corm flour in the elaboration of various products.

4. Associated Knowledge Areas

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

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

Puerto Rico, as many other places in the world, is going through a major financial crisis, which may or may not be solved soon. We expect changes in the amount of money assigned to our government's budget. This will create a domino effect on agencies and instrumentalities, as well as public policies and regulations.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No evaluation was made.

Key Items of Evaluation

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
601	Economics of Agricultural Production and Farm Management	0%		10%	
602	Business Management, Finance, and Taxation	20%		0%	
604	Marketing and Distribution Practices	0%		30%	
607	Consumer Economics	0%		25%	
608	Community Resource Planning and Development	40%		10%	
610	Domestic Policy Analysis	0%		25%	
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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	24.3	0.0	0.6	0.0
Actual Paid	29.2	0.0	1.5	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**
1398162	0	28154	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
699081	0	16240	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

In the PRAES:

• The CRD program focused on strategies to promote self-employment through entrepreneurship training, and diverse occupational and craftsmanship skills training. Regarding community organizational development, PRAES CRD focused on community-oriented initiatives that fostered sustainability, self-reliance and empowerment, resulting in better-organized communities with better decision-making systems.

On the research side:

• Research was undertaken to explore the potential of new market niches for our new and traditional products, as well as to determine farmers' costs of production, consumer preferences, marketing margins, and farmers' and other participants' shares in the marketing channels of selected agricultural commodities.
• Proposals to study the market and demand for regular coffee, specialty coffees, and substitute beverages in Puerto Rico were submitted and approved.
• Studies to determine the effect of the USDA SNAP and School lunch program on the food industry of Puerto Rico were begun.
• Research on public policy issues education was undertaken taking land use conflicts in a land-grant institution as a case study.
• In collaboration with Extension faculty and agents, results and recommendations have been communicated to farmers and community organizers.
• Information from the program has also been delivered through publications in academic journals, newspapers and a regular PRAEXS podcast program.

2. Brief description of the target audience

Farmers, community leaders and organizers, women and children living in poverty and other vulnerable populations, research and extension faculty, producers associations, land grant administrators, government officials and policy makers, consumers, food industry participants, coffee industry components (growers, roasters, coffee shop owners, etc.), community participants and organizations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	34842	15662	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	5	2	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of presentations in scientific meetings

Year	Actual
2016	2

Output #2

Output Measure

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

Year	Actual
2016	8

Output #3

Output Measure

- Number of new technology generated (models, software, processes)

Year	Actual
2016	1

Output #4

Output Measure

- Number of persons trained in community-based business.

Year	Actual
2016	94

Output #5

Output Measure

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

Year	Actual
2016	582

Output #6

Output Measure

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

Year	Actual
2016	458

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.

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
2016	300

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
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
607	Consumer Economics
608	Community Resource Planning and Development
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
2016	25

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
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
607	Consumer Economics
608	Community Resource Planning and Development
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
2016	124

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Farmers Family Market (FFM) is a collaborative project between the Puerto Rico Departments of Agriculture and of the Family, financed in part with funding from the federal Farmers Market SNAP program. It was started in 2013 as a pilot project aimed at improving the health and nutrition of Nutrition Assistance Program (PAN) recipients while promoting local food production. Data on its impact and implementation process were needed to determine if the markets could be extended to additional municipalities and on a more permanent basis.

What has been done
A study of the FFM was conducted in 2014 which included surveys of a sample of farmers and consumers participating in the markets, and interviews with FFM managers and administrators. Results of the study have been shared with local officials in charge of the program, USDA administrators of the Farmers Market SNAP program, participating and prospective farmers of the FFM, and agricultural extension agents and agronomists of the local agricultural agencies involved in the promotion of new niche markets.

Results
Study results showed the FFM is the preferred marketing channel for 83% of participating farmers, all of whom have farms of less than 80 acres. They also agreed that the program had significantly improved their former agricultural income. On the consumer side, 99% believe the FFM to be beneficial due to the quality and diversity of produce offered, better prices than in other outlets, local origin of produce, and accessibility of the market. Participating farmers have doubled in numbers, from 62 in 2013 to 124 in 2016. Last year, government officials recognized that results from this study were decisive for the permanent approval of the SNAP Farmers Market in Puerto Rico.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
607	Consumer Economics
608	Community Resource Planning and Development
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
2016	80

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
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

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
2016	21

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico is experiencing one of its widest economic crisis in its history. The government capacity as principal generator of economic activity and employment generation is bankrupt. The need to foster opportunities that lead to self-employment and community based economic initiatives are more important today than ever.

What has been done
Using the curricular guide "Community's Entrepreneurial Tool Box", individuals and community groups were trained in business creation and entrepreneurship skills development in order to promote the creation of new small and community based business. A total of 21 new businesses have been created.

Results
A renewal in farms operation that were inoperative have occurred in Cabo Rojo where a new female agro-entrepreneur has reestablished cattle raising operation in a family farm that has been inoperative for more than a decade; in Maricao where a 17 years older inherited from his grandfather a coffee plantation that has been inoperative for 15 years and is now being developed as a Special Coffee (i.e., Gourmet) plantation; in Cayey where a struggling hog raisers? group created a producers cooperative in order to share expenses in required new sanitary facilities and have being able to reduce costs by buying farms inputs in bulk. Community based enterprises are also among the new economic ventures with the establishment of a community bazaar in Arecibo and an artisan market in Cidra. These initiatives resulted in the creation of 30 new employments.

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
2016	141

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 #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
2016	795

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
2016	13

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

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
2016	71

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Puerto Rico is a Caribbean island susceptible to weather extremes such as droughts, hurricanes, earthquakes, tsunamis, and even pest diseases such as dengue, chikungunya, and most recently Zika. Our training curricula in Climate Change and Emergency (i.e., disasters) and safety plans has empowered communities and families in vulnerable geographical areas to be equipped with skills that will allow them to be ready for, increase the chances of surviving, and become resilient after, a national disaster or emergency.

What has been done
During 2016 a total of 458 community leaders and residents were trained in Climate Change and Emergency (i.e., disasters) and safety plans.

Results
Thirteen communities and 71 family emergency and safety plans were developed and are in place in communities prone to floods, tidal waves, ground displacement and forest fires.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

In 2016, Puerto Rico was in the middle of a massive economic crisis after 10 years of consecutive negative growth. The government announced that it can no longer keep with debt payments and defaulted in its debt repayment. As a consecuence, investment in the local economy halted and only essential services such as health, security and educational services were kept flowing with limited resources. At the end of 2016, US Congress appointed a Fiscal Supervision Board that is in charge of dealing with the economic crisis in Puerto Rico, adding to the unstable investment climate. In the last 5 years, an average of 76,000 persons a year have been migrating to other jurisdictions in the U.S. Those migrating are mostly the recent college graduate (i.e., the young, best educated and best qualified). This has affected our programs offerings by limiting both the amount of participants and the amount of economic enterprises being developed.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No program evaluation was carried out in 2016.

Key Items of Evaluation

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	65%		100%	
405	Drainage and Irrigation Systems and Facilities	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	0.0	0.0
Actual Paid	3.3	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**
156202	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
78101	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

• Workshops and meetings to discuss aspects of sustainable energy with emphasis on structures, waste management and irrigation equipment, and energy conservation.
• Established collaborations with government agencies (Environmental Quality Board; Puerto Rico Electric Power Authority; Department of Agriculture; Environmental and Natural Resources; Department of Education; 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.
• Designed and made plans that included and promoted energy sustainability and efficiency in structures, waste management systems and irrigation systems (new facilities or improvement to existing facilities).
• Started a research project related to energy generation and nutrient recovery from agricultural wastes and optimization of biodigesters design.

2. Brief description of the target audience

Extension professionals, government personnel (professional), professionals from the private sector and farmers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	724	664	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	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
2016	555

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
2016	20

Output #3

Output Measure

- Number of active research projects in the program.

Year	Actual
2016	1

Output #4

Output Measure

- Number of new proposals submitted targeting the program's priorities.
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	70

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 #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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	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
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

Outcome #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

A weak economy is a factor that precludes people from investing in improving infrastructures. The deep recession and increasing cost of inputs may limit farmers' ability to adopt other types of technologies with long-term payoffs. When the general feeling is

that the economy is strong, people tend to be more aggressive with infrastructure investments. The availability of economic incentives is decisive in making final decisions that require capital investment, and the government of PR has decreased the number of incentives over the last two years. Changes in public policies have made people change priorities and postpone projects. We have also experienced emigration changes, with many skilled and productive people leaving the island. It is likely that emigration has reduced the number of people who would invest in renewable energy.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No evaluations were made.

Key Items of Evaluation

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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	9.5	0.0	0.0	0.0
Actual Paid	8.0	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**
387036	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
193518	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

• Developed joint action at community level to promote and implement physical activity programs and nutrition education for adults, parents, caregivers and kids.
• Taught about the importance of healthy practices at work , to have breakfast, lunch, and snacks in schools and other institutions to comply with communication 2-2007-2008 that rules expenditure and consumption of food and beverages with a minimum nutritional value.
• Taught participants about portion size control, adequate meal patterns, supermarket tours, meal planning, and shopping lists to ensure healthy food choices within a budget.
• Demonstrated easy, healthy food recipes to encourage the consumption of fruits, vegetables, and whole grain foods.
• Encouraged the importance of gardening to increase physical activity and the consumption of fruits, vegetables and healthy foods.
• 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?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10047	1852	19375	4217

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	0	1

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
2016	5473

Output #2

Output Measure

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

Year	Actual
2016	3704

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 daily 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
2016	3352

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to YBRSS 2013, more thant 22% of Puerto Rican youth were consuming 3 or more cans of soda per day while the daily consumption of fruits and vegetables were low, which might contribute to 25% of youth being overweight or obese.

What has been done
Nutrition Education Curriculum was designed to promote healthy eating and physical activity for school-aged children and teens. Professionals were educated in the areas of portion control, healthy snacks, reading food labels, and healthy choices and behaviours such as having breakfast and consuming more fruits and vegetables using My Plate. Training of teens to teach youngest on healthy recipe preparations, sugar content in common drinks, among other practices, helped to change behaviours in teens, children and caregivers.

Results
Ther was 61% increase in healthy food selection in children and youth who participated in nutrition education courses. As a success story, six teens were selected to teach 116 children in healthy eating by teaching recipes, My Plate and why to avoid unhealthy foods. The six teens improved their eating habits to select healthier foods while all the children impacted expressed they wanted to consume less sugary foods.

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
2016	1805

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Adult obesity rates (BRFSS, 2013) continue to rise in Puerto Rico being 27.9% of the population considered as obese and 38.7% as overweight. The low consumption of healthy foods such as fruits and vegetables is seen in this group. Only 17.7% of the Puerto Rican adults consume the recommendation of 5 fruits and vegetables a day. More than 3/4 of the population do not engage in daily physical activity.

What has been done
A complete nutrition education and physical education curriculum was designed for adults and caregivers. FCS Educators were trained by the Nutrition Specialist. Nutrition education and activities related focused on the importance of consuming healthy foods for weight management and reduction of health risk factors and were given to adults and caregivers.

Results
After participating in the nutrition education course, 51% of participants increase their consumption of fruits and vegetables and selected healthier foods when eating away from home.

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
2016	1568

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
2016	801

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
2016	2889

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 daily 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
2016	371

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
2016	994

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
2016	711

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

- Economy
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

1. Puerto Rico economic situation is facing a difficult time. Community participants are forced to find extra jobs. As a result, the attendance to education programs has been reduced. There are limitations in the amount of education materials to be prepared due to reduced funds.
2. Many employees are retiring and the positions are vacant. As a consequence, it is more difficult to outreach community.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A post evaluation study was conducted among a sample of 4-H members that completed the nutrition education intervention in their 4-H clubs. The educational intervention consisted of a short course about nutrition topics and My Plate, and a one-day educational activity named the Nutrition State Festival. This activity was conducted as a state level with

4-H members from all the five regions of Puerto Rico's Agricultural Extension Service. During this one-day educational activity, the participants attended different booths with diverse educational activities where they could put their knowledge into practice. After having completed the visits to the educational booths, the participants were administered on-site a post-test survey to be completed before they leave. The post-survey consisted of questions about consumption of fruits, vegetables, whole grains, water, low fat milk and engagement in physical activity. Categories for answers were: more than before (the intervention), same as before, less than before and don't do it. Participants were also asked about consumption according to the Dietary Guidelines and My Plate.

RESULTS: At the end of the Nutrition Festival, 120 participants completed the post-survey. Participants' ages ranged from 12 to 18. The average age was 15 years old. 73% were female and 27% were male. After participating in the educational intervention, participants reported the following changes:

Increases in Food Consumption Patterns after the Educational Intervention: Of the total 120 participants, 52% reported consuming more fruits; 28% reported consuming more vegetables; 44% reported consuming more whole grains; 76% reported consuming more water, this was the behavior change most reported by the participants; 31% reported consuming more low-fat milk and 75% reported consuming breakfast every day.

Food Consumption According to My Plate: Participants were also asked how their typical plate was distributed compared to the recommendations of My Plate. 38% reported that half of their plate includes fruits and vegetables, therefore consuming their meals according to My Plate; 45% reported that less than half of the plate includes fruits and vegetables and 17% reported having no fruits and vegetables in their plate.

Food Consumption According to the Dietary Guidelines: 28% of participants reported consuming 3 servings of fruits daily; 26% of participants reported consuming 2 servings of vegetables daily and 20% of participants reported consuming 3 glasses of milk daily. These results showed a positive pattern towards healthy eating, however most of the participants are still below the recommended serving portions in the Dietary Guidelines.

Increases in Physical Activity Patterns after the Educational Intervention: 63% of participants reported engaging in more physical activities after the educational intervention and 57% reported engaging in 60 minutes of physical activity daily, after the educational intervention. These findings show that more than half of the participants increased their physical activity patterns.

Key Items of Evaluation

Increases in food consumption and physical activity patterns among Puerto Rican 4-H members after a nutrition education intervention.

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	30%		0%	
801	Individual and Family Resource Management	20%		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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	31.0	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**
1035285	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
517643	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

Meetings, educational campaings at state level, courses, workshops, orientations, interagency collaborations, billboards with educational information, informative brochures, websites, curriculum and educational material were developed and as well as participation in radio programs.

2. Brief description of the target audience

Extension agents, FCS professionals, FCS specialists, professionals from other agencies and institutions, parents, population at risk, low income families, children, youth at risk, volunteers, elderly and general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20883	7345	2600	561

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	3	0	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of persons that completed courses in parenting and related areas.

Year	Actual
2016	1110

Output #2

Output Measure

- Number of persons that completed courses in aging aspects.

Year	Actual
2016	1360

Output #3

Output Measure

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

Year	Actual
2016	958

Output #4

Output Measure

- Number of persons that completed courses in nutrition, health, and/or physical activity

Year	Actual
2016	1375

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 nutrition, health, and/or physical activity 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
2016	978

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
2016	1188

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The increase of domestic violence towards women in Puerto Rico, is a major social problem that affects the qualities of life of Puerto Rican women and their children. According in 2016, 7,749 women have been victims of domestic violence by their partners. (Source: Women Prosecutor Office, 2016)

What has been done
To attend this situation, the Extension's Family Life Specialist developed a curriculum in which the objective was to establish a project to empower this audience. Twelve (12) special projects were developed island wide to address specific family development issues. FCS educators developed these projects through different methodologies and educational strategies.

Results
As a result of these special projects, two hundred thirty five (235) women were benefited and reported improvement in their self-esteem, anger management, and parenting behaviours. Also, based on these needs, an educational campaign island wide was developed to prevent and attend these issues that are affecting family relations.

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

2016	1273

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 nutrition, health, and/or physical activity behaviors

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1672

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Chronic diseases are long term diseases that develop slowly over time. Heart disease, cancer, diabetes, arthritis, and Alzheimer's disease are the leading causes of disability and death in Puerto Rico. (Source: Puerto Rico Department of Health, 2015)

What has been done
To attend these health issues, the FCS Extension Educators, offered non-formal educational courses on promoting healthy lifestyles to 844 participants.

Results

From the total of participants, 428 (51%) individuals reported engaging in more physical activities and 277 (33%) reported that have been able to control their blood sugar levels and cholesterol levels; therefore, decreasing their risks for chronic diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The following external factors might have affected the outcomes reported: economic issues due to the economic crisis in the Island which had affected the priorities of low income families, an increase in migration of families and individuals out of the Island, and public policy changes.
These factors are related to a decrease in the active participation of people in our programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations studies are conducted periodically. During this fiscal year 2016, there were no evaluation studies made. However, these will be conducted during fiscal year 2017.

Key Items of Evaluation

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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	32.4	0.0	0.0	0.0
Actual Paid	34.3	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**
1639042	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
819521	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.
- Camping and outdoor activities.

- Curriculum developed in life skills, leadership and community service.
- Participation in mass communication to promote 4-H as a positive organization for youth.
- Communications projects in radio, press and TV/public presentation, and social media.
- Projects where youth and adults volunteers develop skills that enable them to make a positive contribution to society.
- Contests activities/events.
- Field trips/fairs/field days/exhibitions activities/events.

2. Brief description of the target audience

Youth and 4-H members, Extension professionals (Agricultural Agents, Extension Specialists, Family and Consumer Sciences Educators), 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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6174	0	50244	6748

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	5	0	5

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
2016	7557

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 in 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

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
2016	1568

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
2016	2148

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Peer education is a broad concept that seeks to train and to motivate young people to undertake informal or organized educational activities with their peers with the aim of increasing their knowledge and improve communication skills in youth. Those activities gave this youth the opportunity to develop confidence when speaking in front of groups. When young people understands how their voices can be a powerful tool to become a community leader and to make an impact in their community, they assume with commitment their role as leader and spokesperson.

What has been done
Our 4H program offered several educational experiences to improve communication skills and feel confidence when speaking in front of groups. Through a collaborative project with the Puerto Rico's Department of Health and El Angel Foundation we celebrated two internships where 78 4-H leaders were trained to become health promoters. Also we trained 55 teen-teachers to deliver healthy lifestyle initiatives in communities and schools. The initiative was sponsored by the 4H National Council and the Walmart Foundation. 25 youth leaders participated in the State Conference to improve communication skills. This group assume leadership developing videos, showing self-confidence when speaking in front of groups.

Results
4H leaders participated in Healthy Lifestyles initiatives offering 352 presentations in schools and communities, benefiting 3,009 kids and youth. Teen teachers and 4H staff organized 34 healthy living community activities including World Physical Activity Day. 115 youth participated in the 4H PR State Conference where they reinforced their communication skills. 12 youth leaders prepared a 4H pledge video which was presented in 2016 National 4H Extension Agents Meeting and 2016 National 4H Congress. Melvin Soto was selected for the 4H Congress Youth Leadership Team where he expressed: "It was amazing to see our work at the national level". Mariangelie Torres, 4H Health Promoter, also commented: "4H helped me feel confident when speaking in front of groups and also gave me the resources to be a 4H spokesperson".

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
2016	3393

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Adolescence is a critical time for the development of lifestyle's practices, attitudes and beliefs related to health and well-being. Work with peers gives adolescents the opportunity to develop life skills such as team work, empathy, conflict resolutions and emotions management.

What has been done
We created a variety of activities where youth have the opportunity to work with other youth. "Muevete a una sana alimentacion" was an activity where 4-H members participated in a healthy living rally. Through this activity 4Hers had the opportunity to understand the importance of a healthy eating and physical activity, work as a team, strengthen decisions skills, and collaborative work among youth. In another educational activity, the State Conference, we created a supportive environment where teens felt safe to express thoughts and feelings.

Results
Through an evaluation process, 100 participants of "Muevete a una sana alimentacion" said they enjoyed having the opportunity to work with other youth as a team, learning with fun, be in contact with nature, sharing with club peers, and staying active during the day. At the State Conference, 115 youth worked in dialogues' tables to address health and youth well-being issues. At the end, they communicated youth health needs, challenges, opportunities and how they can assume responsibilities to improve community health. As a result, we established an agreement with PR Health Department to expand health promotion initiatives in 4H. Maria Robles (a 4H member) said "4H experiences helped me to design my professional career to study FCS. I want to create healthy educational spaces for the youth".

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 in through community service.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1838

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One of the goals of the Puerto Rico's 4H Program is to train and involve youth to understand the impact of climate change in El Yunque National Rainforest and the impact of human in natural resources. Its philosophy also stands in that encouraging youth to make a difference in the community guarantee responsible citizens for the good of their communities, their country and world.

What has been done
Sponsored by the US Forest Service and other environmental organizations, we developed and participated in projects where youth and adults volunteers developed skills to make a positive contribution to society. We made activities like camps, field trips, beach-clean up and community services projects to make a difference and protect natural resources. A group of volunteers helped us to educate and promote youth participation. Nilda García, a 4H volunteer, contributed in the participation of our youth in many environmental activities and habitat preservation.

Results
2,208 4Hers developed skills and participated in projects that made a difference in their communities. We had a permanent place in El Yunque National Rainforest (4-H Tree House) to educate and contribute in forest protection. US Forestry renewed an agreement with the 4H Program to provide resources to strengthen our environmental work. Three 4H youth leaders presented their works on El Yunque to the USDA Secretary, Mr. Thomas Vilsack, who greeted the 4Hers for their extraordinary work and commitment to make the difference. Volunteer Nilda García was nominated to Salute to Excellence Award for her outstanding work. She was selected Southeast Region Outstanding Lifetime Volunteer 2017. She coordinated state ecological 4H camps and other activities focused to proctect wildlife.

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
2016	2769

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

- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

We have an unstable economy. 2016 statistics showed that a 58% of our kids and youth live below poverty level. This has affected the participation of our youth in some activities.

Also, changes in government camps and outdoor activities policies have affected the celebration of those activities.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A post evaluation study was conducted among 4-H members' participants in the State Annual Conference to evaluate the development of life skills. For this purpose, a post-survey was administered on site to 82 4-H members' participants in the Conference. Questions from the post-survey were adopted from the National 4-H and Youth Development Outcomes and Indicators (Common Measures). Questions were framed to evaluate the outcomes after participating in the educational experiences of the 4-H Program.
The 4-H members participants in this evaluation study have completed at least one year in a 4-H club. Therefore, have participated in the diverse educational experiences offered by the 4-H Program. These 4Hers represented all the five regions of the PR Agricultural Extension Service. Their mean age was 16 years old and 80% were female and 20% were male.
RESULTS: The following data presents the mean for 7 life skills or outcomes according to the following scale: (4) strongly agree; (3) agree; (2) disagree; (1) strongly disagree. Life skills or outcomes measured were: I respect people from other cultures (3.80); I am a person that wants to help others (3.78); I can make a difference in my community through community service (3.74); I can work successfully with adults (3.67); I have a plan for reaching my goals (3.62); I talk to my friends about issues affecting my community, state or world (3.45); and I like science (3.32). These results show that this group of 4Hers agree that they have developed or improved these life skills due to their participation in the 4-H experience. In terms of how often they put in action another set of life skills, the 4Hers answered based on the following scale: (4) always; (3) usually; (2) sometimes and (1) never. I take responsibility for my actions (3.83); I use information to make decisions (3.57); I listen well to others (3.57); I work well with other youth (3.56); I consider the consequences of my choices (3.52); I an resist negative social pressures (3.52); and I have the confidence to speak in front of groups (2.90). The 4-H participants were also asked what type of community service projects they have participated in, as part of their 4-H experience. There were three major projects in which they have participated: recycling projects (67% of participants), garden projects (65%), and beach clean-up (51%). These results show that the 4-H Programs contributes to produce positive outcomes in their participants that can help them become responsible citizens for the good of their communities, their country and the world.

Key Items of Evaluation

Puerto Rico's 4-H members, life skills evaluation

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: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	3.7	0.0	0.0	0.0
Actual Paid	3.7	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**
176056	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
88028	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

Eight (8) training meetings were offered to farm producers which are: four to family farm market farmers; three to the Lajas Valley Farmers Cooperative; one to beef producers. These training sessions covered a variety of themes, such as: new and improved food processing technologies, plant management systems for starchy crops and vegetables, and also on market economics.

Thirty six (36) community gardens projects were established in 23 municipalities in collaboration with the USDA Strike Force. This effort respond to the nutrition and hunger to low income population.

Land Use Plan was developed by the Puerto Rico Planning Board which was presented to Extension personnel. The Land Use Plan is a tool which can be accessed online.

2. Brief description of the target audience

Farmers, government professionals, county agents, agricultural entrepreneurs, homeowners and professionals 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

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	19449	43639	5925	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed
NONE

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of agricultural enterprises feasibility studies.

Year	Actual
2016	0

Output #2

Output Measure

- Number of youth participating in food system educational program.

Year	Actual
2016	3348

Output #3

Output Measure

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

Year	Actual
2016	6174

Output #4

Output Measure

- Number of first detectors trained in early detection and rapid response of plant pests, animal pests and diseases.

Year	Actual

2016	0

Output #5

Output Measure

- Number of communities trained in agricultural disaster preparedness.

Year	Actual
2016	29

Output #6

Output Measure

- Number of food security extension publications and presentations.

Year	Actual
2016	0

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 consumers that adopted the food basket as a guide for food security at the household level.
5	Number of home gardens established.
6	Number of acres in conservation tillage or other BMP.
7	Number of new or improved value-added products that can be sold by producers (and other members of the food supply chain).
8	Number of marketing agreements established between local farmers and distributors or other components of the food supply chain.
9	Number of producers and other members of the food supply chain that have increased revenue.
10	Number of communities that have written agriculture and food considerations into disaster preparedness plans or procedures.
11	Number of networks prepared to mitigate biological and abiotic disruptions
12	Number of youth that improved knowledge of food systems.
13	Number of adults improved knowledge of food systems.
14	Number of food councils and institutes created to promote practical food systems policies.
15	Number of research and extension advisory councils and boards.
16	Number of communities that retained farm lands due to educational interventions.

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
2016	22

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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
2016	361

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Puerto Rico, we import 85% of the food that we consume. Efforts to increase production at the local level includes farmers training in post-harvest practices for more productivity in the farm.

What has been done
Four courses were offered to 132 producers who participated in family markets.

Results
These 132 producers adopted one or more post-harvest recommended practices which resulted in a 5% increase in starchy crops production for the family markets.

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

2016	2155

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is of utmost importance to continue efforts to increase agriculture production for local consumption.

What has been done
Several training sessions were offered on planting and production to increase farm production acreages to reduce fresh produce imports.

Results
Farm production was increased by 2,155 acres for a variety of agriculture products.

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 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
2016	591

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 #5

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
2016	540

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Puerto Rico we don't produce enough food to supply the local demand. Therefore, we depend on food import.

What has been done
Over 100 short courses were offered and completed using the Vegetable Gardening Curricular Guide, during the Annual Vegetable Festival. Also, through a collaboration with USDA Strike Force and the Food, Rural Development and Nutrition Services to assist low income families.

Results
Five hundred and forty (540) vegetable gardens were established around the Island. Over 1,000 people acquired knowledge on vegetable production.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Number of acres in conservation tillage or other BMP.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	809

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
307	Animal Management Systems

Outcome #7

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
2016	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently in Puerto Rico, we need to diversify our agricultural production and add value to our local products. Consumers are changing patterns and want more fresh produce.

What has been done
Training sessions were offered on added value to farm production. The on campus Food Technology personnel were able to provide training on food processing technology available that could be applied to transform the farm products into a more attractive market product for the consumer.

Results
Twenty (20) farmers were able to add value to their products which provided a 10% increase in their revenue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

Outcome #8

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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2016	38

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is very important to develop market's agreements with the food chain components and the local farmers. Such actions facilitate the coordination between production and the consumer, increasing efficiency between demand and farm production planning.

What has been done
Through two courses on marketing offered to 50 producers, enable them to understand how to plan for sow and the need for products in the food chain.

Results
From those 50 producers who participated in the training, 38 were able to get market agreements with distributors and others components of the food supply chain in Puerto Rico, which in turn, reduced the food imports in about 3%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
603	Market Economics

Outcome #9

1. Outcome Measures

Number of producers and other members of the food supply chain that have increased revenue.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	62

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Puerto Rico, there is the need to reduce the imports of food products. Eighty five percent (85%) of our food is imported, this affect negatively the cost of effectiveness and the market of

local products.

What has been done
One hundred and fifty (150) producers were trained in marketing and food supply chain. These farmers learned how to succesfully work it.

Results
From those 150 producers, 62 increased their income in farm sales.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics

Outcome #10

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
2016	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Due to it's location in the Caribbean, Puerto Rico is exposed to different climate conditions. These events ranges from hurricanes to severe draughts.

What has been done
By using the Natural Disaster Emergency Planning, 16 communities were trained on the importance of an emergency management plan in which food security aspects were incorporated. (Preparation and Procedures)

Results
With the assistance and knowledge gained from the training, these communitites were able to write their Natural Disaster Emergency Plan which will benefit over 200 people.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

Outcome #11

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
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

Outcome #12

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
2016	3237

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Puerto Rico, it's important for our youth to know where the food products, that we consume, came from. Besides, to know the benefits of eating locally produced fresh products. From a total of 3,348 young participants, a 3,236 (97%) individuals gained knowledge.

What has been done
By using the Home Gardening Curricular Guide, young people between the ages of 8-18, were trained on producing vegetables and fruits at home.

Results
Over 1,000 youth improved their knowledge on vegetable and fruit production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population

Outcome #13

1. Outcome Measures

Number of adults improved knowledge of food systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2406

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The central mountain area of Puerto Rico does not provide much economic opportunities other than farming, besides being distant from market centers. Since 2002 to 2007, according to the Census data in the town of Maricao, the population has diminished, and so the farms. The residents has to struggle with middle man to market their farm products.

What has been done
Seven local farmers received assistance on programs available for them and information on farm markets.

Results
Now, they can sell their fresh farm products directly to the consumer. As an example: one family diversified it's farm production by including new products, and thus were able to buy farm products from 10 neighboring farms. These farm families have increased their income and self esteem.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
In Puerto Rico, it is necessary that our adults know from where the agricultural products we consume came, and the posibility to produce them locally.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis

Outcome #15

1. Outcome Measures

Number of research and extension advisory councils and boards.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

307	Animal Management Systems
501	New and Improved Food Processing Technologies
610	Domestic Policy Analysis

Outcome #16

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
2016	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Due to it's limited territorial area, in Puerto Rico it is vital to protect the land. Specially, those with high agricultural value. There is a local initiative that goes hand-in-hand with Land Use Plan Policy which limits and protects the farm land.

What has been done
Several years ago, a curricular guide was developed: Communities in Rescue of their Land. This curricular guide was implemented to teach how to protect the farm land in the municipalities.

Results
Eighteen (18) communities got the knowledge regarding the proceedings and actions that need to be taken to protect the agricultural land in their municipalities. They have been actively involved in the development of the Land Use Plan for Puerto Rico.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

This year we have more than an usual precipitation. This severely affects the vegetable production. Besides, Puerto Rico is experiencing a very difficult economic situation.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No evaluation were made.

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
3352	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.