

2013 University of Puerto Rico Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The mission of the University of Puerto Rico Agricultural Experiment Station (PRAEXS) within the College of Agricultural Sciences (CAS) is to conduct scientific research that promotes an economically viable agricultural sector, the conservation and enhancement of natural resources and the environment, and a better quality of life in rural and urban areas. Our research also supports the industries that process agricultural raw materials, and provides the technological base required for solving the problems affecting farmers, farming operations, public and private institutions, and rural development. The PRAEXS coordinates its academic activities with the teaching Faculty of Agricultural Sciences and the Agricultural Extension Service, and incorporates into its research program the faculty of these other two institutional units of the CAS. Although for the Plan of Work (POW) cycle that covers this annual report the PRAEXS and the Puerto Rico Agricultural Extension Service were filing separate submissions, we already prepared a combined Research and Extension POW for next year.

The PRAEXS has administrative offices and carries out research activities at two main centers: Río Piedras, in the northern San Juan metropolitan area, and Mayagüez, on the west coast of the island, where the CAS Campus is located. In addition, the PRAEXS has six substations comprising more than 2,000 acres of land distributed in the different geographical and ecological zones of Puerto Rico. This wide distribution allows for the evaluation of crop and animal production systems adapted to the conditions of different ecological zones.

Core funding for the PRAEXS's research program is provided by various sources. State funds are primarily used to cover salaries of academic and support personnel. USDA funding is crucial for directly financing the research program and supplementing salaries of faculty and staff. Formula-funds include Hatch Regular, Hatch Regional, McIntire-Stennis and Animal Health; however, in this annual report we are only including under the planned programs' reports FTEs funded through Hatch and Hatch Multistate funding lines. Activities and results reported include, nevertheless, the totality of our efforts, a significant proportion of which are funded by external sources and performed with the volunteered efforts of our staff. For FY2013 the Hatch allocation for Puerto Rico was \$4,195,003. Along with state matching funds, other program income, and carry-over funds, the actual dollars spent in our planned programs in FY2013 were \$7,118,593.

During last year the PRAEXS continued to direct its research programs toward the solution of the most pressing problems identified by our stakeholders and faculty. Fourteen new projects were begun to address concerns related to a wide array of agrofood and natural resources problems.

In the **Milk and Meat Production Systems** program research conducted in support of the local dairy industry included topics in nutrition, heat stress, internal parasitism, mastitis, raw milk quality, and farm management. Research with beef cattle included: testing of selected grass-fed crossbred heifers for growth performance and carcass and meat characteristics; collaboration with the USDA-BEGL to study genes associated with the slick hair trait in Senepol and Holstein cattle; and comparison of varying lengths of postmortem aging on meat tenderness. Forage research topics encompassed, among others, the evaluation of Pennisetum hybrids, including Maralfalfa, one of great interest to local farms; propagation

and use of bush-type species for browsing by small ruminants; and testing of diverse leguminous genotypes. An appreciable portion of this work was either conducted at stakeholder farms or involved analyses of material samples or data originating at such farms, thus fostering stakeholder interest and trust in the practicality of the results. Program evaluation findings indicated that research in dairy cows crossbreeding to provide better breeds tolerant to heat stress is promising and should be continued. The improved forage resources evaluated under this program were also considered promising for the design of alternative feeding strategies for dairy producers experiencing increases in the price of imported high-energy feeds. During 2013 PRAEXS allocated 3.7 FTE/SY and 30% of our Hatch funds to this program.

In the **Integrated Management of New and Emerging Pests and Diseases (IMNEP)** program significant advances were made in 2013 with research conducted at the PRAEXS. The use of molecular tools by the Plant Disease and Insect Clinic (PDIC) led to the detection and identification of a new disease caused by the Tomato Chlorotic Spot Virus, a Tospovirus associated with thrips in tomato, lettuce and pepper, and in jimsonweed. Three workshops were held directed to APHIS/PPQ, Extension Specialists, and growers to alert them about this new disease in PR. PDIC also analyzed approximately 765 samples from 27 different crops and conducted 2,394 determinations using conventional, pace serological and molecular techniques. New disease reports for Puerto Rico include Soybean dwarf virus (SbDV, Luteovirus) affecting soybeans, common beans and common jack bean. With respect to citrus greening, a program was initiated for the certification of the nurseries of Adjuntas, Isabela, and Corozal Substations and of the "Enseñad" nursery of the Department of Agriculture. The program included the five graft transmitted diseases in the protocol: Citrus Tristeza Virus, Citrus Variegated Chlorosis, Citrus Greening, Citrus Canker and Citrus Leprosis. The development of disease management strategies for Black Sigatoka was also concluded last year. Progress continues in the development of biological control strategies to mitigate invasive species such as the *Harrisia Cactus Mealybug* and the coffee berry borer. A program evaluation was conducted centered in the implementation of the citrus greening management program. Highlights of its results are included in this report. Twenty-three percent of our Hatch funds were dedicated to the IMNEP program during 2013.

The **Plant Genetic Resources, Breeding and Production Systems (PGRBPS)** program is at the core of PRAES efforts to improve food security in Puerto Rico and other tropical regions of the world. Last year work continued on the selection and purification of germplasm of traditional crops and on the development of new varieties. The introduction and evaluation of different crops also continued. In plantains, the FHIA 21 variety with resistance to black sigatoka disease is being evaluated for production and for culinary acceptance by consumers against the Maricongo, the principal variety grown in PR. In citrus, three rootstocks were released by the PRAEXS: 'Swingle', 'HRS812' and 'Carrizo'. The PR Department of Agriculture, based on the advise of PRAEXS, began implementing a program for the production of propagating material of citrus under protected structures. In coffee, the INCAPER 8151 tropical robusta coffee variety is being evaluated for production at sea level. The PRAEXS at Adjuntas produced a total of 300,000 coffee seedlings and 2,600 pounds of coffee seeds for distribution to growers. At Lajas the production of certified organic seeds of 45 different crops (vegetables and aromatic herbs) were distributed to farmers advancing pioneering projects in organic agriculture. In 2013, the PGRBPS program engaged 7.4 FTE/SY and received 28% of our Hatch funds.

The main goal of the **Natural Resources and Environment** research program continues to be to develop, perform and support scientific research regarding the impact of agricultural practices on the environment and natural resources of Puerto Rico. The program addresses key Agricultural Experiment Station mission goals by supporting both the Department of Agriculture and the Natural Resources Department. During 2013, program activities continued with their focus in: measuring the impact of agricultural operations in the environment; development of pollution prevention and mitigation practices and thresholds for the protection of watershed and soil resources; development of soil improvement and maintenance practices; development and promotion of sustainable agricultural practices; determining the pathways of entry and ecological impact of non-native species; and in developing management

approaches for conserving and restoring biodiversity. Several projects presented their final reports and demonstration activities during the year. Among them the windrow composting of agricultural residues project, which demonstrated this technology and its potential for composting large quantities of organic wastes (coffee pulp) at relatively low operational costs. PRAEXS allocated to this program 2.6 FTE/SY and 15% of its Hatch funds in 2013.

In the **Agricultural Economics, Marketing and Community Development** program research was undertaken to identify new market niches and promising new 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. Research was also undertaken to improve natural resource use by farmers and to support the policy-making process by government officials in order to achieve greater economic and material sustainability. Researchers in this program identified a highly profitable new market niche for Puerto Rico's farmers and have taken the lead in convincing a group of farmers to try producing the crop. The program evaluation performed during 2013 was centered in gaining input for improving the possibilities of success of this initiative. This program is still the smallest of our Hatch funded efforts with only 0.25 FTE/SY and receiving less than 1% of the total allocation.

During 2013 the **Food Safety, Science, Technology and Childhood Obesity** program offered a total of nine seminars on the Food Safety Program. Educational programs were conducted in food safety and related topics (GMP, GAP, HACCO and SQF) with approximately 150 persons attending the seminars. Twenty industries contacted the program requesting collaborations that included chemical and/or microbiological analysis of food, nutritional fact analysis, physico-chemical properties of food, and literature search. Efforts toward helping the food industry in the improvement and development of new food products continued throughout the year. The FTE/SY devoted to this program in 2013 was 1.2; funds allocated amounted to 2% of Hatch funds. No Childhood Obesity activity was performed or proposed last year.

The **Sustainable Energy** program was created in 2011 in response to NIFA's request to include a Sustainable Energy goal among our local programs. Although no Hatch-funded project has been approved since its inception, we have opted to keep it in our POW with the expectation that formula funded projects can be initiated in the future in this area. High energy costs are one of the most important factors contributing to hike production costs and affecting the competitive position of agroindustries in Puerto Rico and we believe that research efforts initiated with external funding should continue to address this critical constraint. Most of the research projects active in this program, however, reported final results during last year. Among them, one geared towards establishing the viability of an anaerobic digester with the capacity of handling the waste load of small and mid-sized pig farms. The biodigester proved to be a viable alternative for energy generation and for the recovery of nutrients present in the waste, and its design is being evaluated by regulatory and extension agencies as an alternative to be recommended for the treatment of pig farms wastes. Final results were also obtained from a project established to study the technical and economical aspects of the implementation of solar energy systems at milk parlors. Findings offer guidelines with which different local customers, specifically from the farming sector, could establish projections and make decisions about the implementation of similar systems.

The total FTE/SY effort devoted to our programs last year and reported in this annual report is 63.8. This figure includes a significant amount of volunteer effort donated by our faculty for the fulfillment of our goals. Depending on the base figure used (with or without volunteer efforts) Hatch funding supported between 26% and 34% of our scientists FTEs in 2013, providing an important leverage for attracting much needed additional funding to our programs. Within our continuing budget constraints an effort was made to distribute funds to support initiatives in need of being strengthened, such as crop protection studies, and improving the research infrastructure serving our IMNEP, Natural Resources and Environment, and Breeding and Production Systems programs. Partnering with government departments who shared our goals and pooling our resources in support of mutual priorities, has enabled us to expand

the impact of our work in these trying times.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	61.8	0.0
Actual	0.0	0.0	63.8	0.0

II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review

2. Brief Explanation

There was no significant change in our merit review process since our last year update was submitted. We continued to allocate part of our Hatch-funded research to competitive project grants selected on the basis of an annual call for proposals with the year's revised priorities. More specifically, the scientific peer review process of Hatch proposals was the following:

A call for proposals including the year's revised research priorities was prepared and distributed by the PRAES 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 proposals to a local peer reviewer and to an external reviewer for their written comments on the scientific merit of the proposed research and compliance with the PRAES strategic plan. Proposals and their 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 make adjustments as appropriate. These proposals were then sent to the USDA-NIFA Office of the Administrator, where the respective national program leaders reviewed them. Once the proposals were approved in Washington, the new or revised projects were included in the PRAES 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

Brief explanation.

First, the PRAES continues to celebrate an annual meeting with researchers, extension faculty, farmers and other members of the public interested in the work performed by the different programs or commodity groups. 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 in 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 an interest in the commodity's work and related research programs. The Associate Dean sends personal invitations to relevant government officials and positional leaders of stakeholders groups. These meetings are also announced in the PRAES web page and frequently printed in the local agricultural monthly newspaper. The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a meeting of commodity group leaders, program coordinators and research administrators, where final decisions are made concerning research priorities. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects.

Second, commodity group leaders, program coordinators and directors of integrated academic departments have organized thematic workshops, seminars, and field days where research results have been shared and alternative views on the subject--including further research and extension needs, or public policy determinations-- have been discussed. The feedback received in these activities continues to inform the current process of program assessment for our rolling five-year POW.

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.

Stakeholders were identified through commodity leaders, project directors knowledgeable of their targeted audience, extension agents, and through local advisory committees established by CAS administrators. Stakeholders are asked about the most critical issues affecting their commodities and localities and about our research priorities. This information is summarized in a report made by the commodity and program leaders.

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 individuals

Brief explanation.

Input from stakeholders is collected at the meetings convened by commodity and program leaders, and in activities with non-traditional groups such as organic farmers. At the end of the meeting stakeholders are asked to fill a written evaluation that includes questions about the most critical issues affecting their commodities, localities, or production systems, and about our research priorities. This information is summarized in a report made by the commodity, program leader, or administrator convening the meeting.

3. A statement of how the input will be considered

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

Brief explanation.

Stakeholders input has been used in the determination of the research priorities of each planned program and commodity group, and these in turn, have guided the request for proposals released by the PRAES Research Office during the year. The inputs received during past years from traditional and non-traditional stakeholders and from government officials were also critical for starting a pilot organic experimental farm and for investing in the remodeling of research infrastructure to better meet the threats presented by invasive species.

Brief Explanation of what you learned from your Stakeholders

The most important continuing concerns of stakeholders participating in commodity meetings and program evaluations are: (1) the lack of quality seed availability in the island; (2) the need of alternative management strategies for the control of new pests and diseases; and (3) the need to find economical alternatives to expensive production inputs driving up local production costs--energy, fertilizers, and labor in particular. In response to these concerns PRAEXS has been expanding the production and distribution of improved cultivars developed over the years in our substations around the island; have increased crop protection studies and research activities related to the detection and management of damaging pests and diseases; have upgraded research infrastructure facilities, recently inaugurating a new Center of Excellence in Quarantine and Invasive Species; and continues to adapt its programs' outlook towards the search for economical management practices. In our Meat and Milk Production Systems program, for example, crop rotations including annual legume green manures are being evaluated for the production of high quality forages, in an effort to control costly synthetic fertilizers applications. In other programs, studies are in progress on other alternative fertilization methods which can potentially increase output while controlling costs, and in the evaluation of sustainable energy alternatives with the potential of reducing energy costs. Stakeholders have also provided recommendations on how to improve the ways in which we traditionally share information with them. In response to these latter suggestions researchers are using other alternative methods, such as podcasts and web pages, to extend results to a wider audience.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	4195003	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4167024	0
Actual Matching	0	0	2849844	0
Actual All Other	0	0	101725	0
Total Actual Expended	0	0	7118593	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	496267	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger - Milk and Meat Production Systems
2	Climate Change - Integrated Management of New and Emerging Pest and Diseases
3	Global Food Security and Hunger - Plant genetic resources, breeding and production
4	Climate Change: Natural Resources and Environment
5	Global Food Security and Hunger - Agricultural Economics, Marketing, and Community
6	Food Safety - Food Safety, Science, Technology and Childhood Obesity (FOSTCO)
7	Sustainable Energy
8	Childhood Obesity

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger - Milk and Meat Production 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			4%	
205	Plant Management Systems			22%	
301	Reproductive Performance of Animals			8%	
302	Nutrient Utilization in Animals			15%	
303	Genetic Improvement of Animals			12%	
306	Environmental Stress in Animals			8%	
308	Improved Animal Products (Before Harvest)			15%	
311	Animal Diseases			4%	
313	Internal Parasites in Animals			4%	
601	Economics of Agricultural Production and Farm Management			8%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	0.0
Actual Paid Professional	0.0	0.0	3.7	0.0
Actual Volunteer	0.0	0.0	2.4	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	1345252	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	726250	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	72730	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research conducted in support of the local dairy industry included topics in nutrition: effects of different proportions of ingredients in and schedules of feeding concentrate feeds to cows in confinement; (2) heat stress: alleviation of hyperthermia in a tropical climate by means such as dietary supplements with social emphasis on reproductive efficiency; (3) internal parasitism: confirmation of the existence of anthelmintic-resistant nematodes in dairy replacement heifers of local herds; (4) mastitis: initial work on the use of IRT for early detection of udder inflammation; (5) raw milk quality: development of the capacity to carry out sophisticated methodology and initial use thereof to evaluate the raw milk from local herds in biochemical-enzymatic-microbiological terms and relate these characteristics to SCC and shelf life after pasteurization; (6) farm management : data collection in a survey of management practices currently in use at private dairy operations, aimed at creating a manual in non-technical language to help farm managers improve their efficiency. Research with beef cattle included: testing of grass-fed crossbred Senepol X Charolais and Senepol X Bos indicus heifers for growth performance and carcass and meat characteristics; collaboration with the USDA-BEGL to study genes associated with the slick hair trait in Senepol and Holstein cattle; comparison of varying lengths of postmortem aging on meat tenderness forage research topics encompassed: evaluation of Pennisetum hybrids, including one of great interest to local farms, Maralfalfa; propagation and use of bush-type species for browsing by small ruminants; use of inoculants to improve silage fermentation characteristics and aerobic stability; weed control in pastures; and testing of diverse leguminous genotypes. An appreciable portion of this work was either conducted at stakeholder farms or involved analyses of material samples or data originating at such farms, thus fostering stakeholder interest and trust in the practicality of the results.

2. Brief description of the target audience

- (1) Commercial-scale producers of livestock and related products including: milk and cheese from bovines and small ruminants; replacement dairy cattle, beef cattle, meat-type sheep and goats, swine rabbits, poultry for eggs and meat and commercialized forages.
- (2) Personnel of the Agricultural Extension Service of UPRM-Administrator Specialist and County Agents.
- (3) Pertinent professionals of the Puerto Rico Department of Agriculture and of USDA.
- (4) Government policy makers at the Commonwealth and Federal levels.

- (5) Personnel of financial institutions that make loans to the producers listed above.
- (6) Self-employed professional providing consulting services.
- (7) Non-research faculty members with interests in animal production.
- (8) University undergraduate and graduate students in agriculture.
- (9) Students of Vo-Ag High Schools.
- (10) International colleagues and visitors with related interests.
- (11) Members of the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	7	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of meetings held with stakeholders to discuss the industry's situation and research priorities

Year Actual

2013 4

Output #2

Output Measure

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

Year	Actual
2013	3

Output #3

Output Measure

- Number of field days held in research facilities and/or private farms to demonstrate RMPs based on research results.

Year	Actual
2013	7

Output #4

Output Measure

- Number of publications in refereed scientific journals.

Year	Actual
2013	7

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of livestock producers participating in field days willing to adopt the RMPs demonstrated.
2	On farm income from sale of livestock and related products, as percentage of base year 2010-2011.

Outcome #1

1. Outcome Measures

Number of livestock producers participating in field days willing to adopt the RMPs demonstrated.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Under the present difficult economic situation producers must increase their knowledge of and attitude toward adopting RMPs to improve the biological efficiency and profitability of their operations.

What has been done

Three field days were carried out: one on the forage Maralfalfa, another on weed control in pastures, and a third on artificial insemination in swine.

Results

It was not possible obtain quantitative information of this sort, but at the three field days held keen interest was evident among a considerable part of the nearly 100 producers in attendance.

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
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

On farm income from sale of livestock and related products, as percentage of base year 2010-2011.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Other (Loss of agricultural lands)

Brief Explanation

Economy

The so-called long recession that began in Puerto Rico in 2006 and worsened after 2008 has now lasted approximately 8 years and shows no sign of ending soon. At present there is a crisis of Commonwealth Government financing, that has been several decades in the making and will be very difficult to overcome, which threatens to reduce considerably the operating funds (including those for agricultural research and extension) of UPR.

Appropriation changes

Both governments (Puerto Rican and USA) experienced great difficulty with unbalanced budgets and partisan pickering over how to cut expenses in 2013. Neither were private sources of funding as abundant as they once were. The resulting reduced level of funding obviously had an impact on research and extension under this Program Area. However, continued progress was made in improvements to physical facilities such as the dairy at the Lajas Substation, and the research projects were able to continue although with less than planned scope in some cases.

Other factors

Continuing in 2013 was the decades-long loss of farmland to non-agricultural uses in Puerto Rico that has had a major negative influence on the local agriculture in general and especially so with regard to land available for grazing or harvesting forages. Urgent action is required, but this is a matter of public policy beyond our reach. Additionally, much of the still available farmland is owned by people with no inclination to undertake agricultural activities. As for human resources, the number of young people choosing productive agriculture as their occupation is inadequate to meet the present and future needs. Another negative factor is the unregulated importation of food products, which is especially harmful to the local beef cattle industry. High costs of productive inputs, especially in recent years ingredients for concentrate

feeds and synthetic fertilizers, put Puerto Rico at a competitive disadvantage relative to other lower cost countries

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Research and outreach carried out under this Program Area covers a broad collection of fields. Below is a brief summary of the major issues brought about in the meetings of the subsectors where the program was evaluated. The program coordinator also included his comments on areas where little research activity takes place. The information is subdivided as follows:

(1) Milk production and milk quality - Closing of the dairy operation at the Gurabo Substation precluded further studies on milk production with heavy reliance on grazing well-managed pastured, while pasture improvement at the Lajas Substation has hardly made any progress. Feeding experiments with confined cows at Lajas produced some useful results on supplementation of fair quality conserved forages, but progress on the production and utilization of highly nutritious forages has been slow. Otherwise the Lajas dairy facilities have been underutilized based on the amount of research conducted there. Work on slick-haired Holsteins is promising, but still at an early stage. Preparations to use sophisticated technology has undergone perfecting and useful results on early detection of mastitis and characterization of the raw milk produced in Puerto Rico are anticipated in the post 2013 years. Gathering of data on how private dairy farms are functioning is serving to increase contact with stakeholders and should lead to improved farm management in the future.

(2) Bovine meat production and meat quality- The Work Group on Bovine Meat Production has consistently maintained close contact and communication with producers and pertinent government authorities and rendered valuable consulting services. The unique asset of Montaña Farm and its Senepol herd has seen continued development recognized by stakeholders in their evaluations. Research has been conducted on evaluation of crossbred animals and procedures for raising grass-fed beef and on carcass and meat quality, with assistance of molecular markers. Although some progress have been made there is still a backlog of research results pending publication.

(3) Forages- This field is outstanding for the research published and MS theses completed on diverse forage topics. Germplasm of tropical grasses, legumes and bush-type non-leguminous plants has been evaluated agronomically and as feed for ruminants (often including sheep and goats), whether when grazed or cut green or conserved as silage, haylage or hay. Small-scale experimental silos have served this purpose well and in 2013 machinery was acquired and began functioning to fill industrial-scale silos at Lajas. This will make possible future experimentation with large numbers of animals. Producers participating in field days where the program was evaluated were enthusiastic about the perspectives these results open for improving animal nutrition and production.

(4) Meat production from other farm animals- For many years research conducted by this institution with poultry, swine and rabbits has had little funding or FTE of scientists. It has consisted mostly of some MS thesis projects but with few peer reviewed papers published and little application on producers' farms.

Key Items of Evaluation

- Work on slick-haired Holsteins is promising, but still at an early stage. Continued research in dairy cows crossbreeding to provide better breeds tolerant to heat stress is one of the long-term strategically important directions emphasized in our 2015 combined POW with Extension.
- The improved forage resources evaluated under this program are promising for the design of alternative feeding strategies important for dairy producers experiencing increases in the price of imported high-energy feeds.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change - Integrated Management of New and Emerging Pest 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			24%	
212	Pathogens and Nematodes Affecting Plants			33%	
215	Biological Control of Pests Affecting Plants			24%	
216	Integrated Pest Management Systems			19%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	14.1	0.0
Actual Paid Professional	0.0	0.0	1.5	0.0
Actual Volunteer	0.0	0.0	2.5	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	1016545	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	643331	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The goal of enhancing our capacity to conduct disease diagnostics continues to be met: two new diseases caused by viruses affecting soybean and other legumes were identified last year. A new Tospovirus in Puerto Rico was also characterized using Reverse Transcriptase Polymerase Chain Reaction (RT-PCR), leading to the first report of Tomato Chlorotic Spot Virus (TCSV) in tomato, pepper, lettuce and jimsonweed. In 220 accessions of wild and cultivated cucurbits using RT-PCR the presence of Potyvirus (ZYMV and PRSV) was confirmed. Papaya Ringspot Virus (PRSV) was found in *Parthenium hysterophorus* L. and *Xanthium occidentale* Bertol. Citrus Greening caused by *Candidatus Liberibacter asiaticus* (CLA) was detected by PCR assay in 23 of 345 samples. Using serological methods Citrus Tristeza Virus (CTV) was detected in 42 samples negative for CLA, and Citrus Variegated Chlorosis (CVC) in one sample. The presence of Phytoplasmas was detected by PCR in a consistent manner in the north transect of the highlands, while their absence from south coast samples was noticed. Phytoplasma DNA has been detected in native palms and in several of Fulgoroidea.

Progress in the development of biological control strategies to mitigate invasive species has been accomplished for *Harissia cactus* mealybug in the Guanica Dry National Forest Reserve and in Cabo Rojo Natural Reserve, with the integration of biocontrols and cultural practices. Findings related to the epizootic enhancement of *Beauveria bassiana* in the coffee berry borer (CBB) in coffee plantations throughout the rainy season (July-September) indicated that infection levels were higher in the shaded-grown coffee than in sunlit. Correlations between percent shade (UV) and *B. bassiana* were found. Sun intensity (UV) seems to be more important than relative humidity for enhancing epizootic of *B. bassiana* in Puerto Rico's coffee plantations. These results suggest that important changes in the use of this biocontrol should be made for the management of the coffee berry borer.

The development of disease management strategies for Black Sigatoka, compatible with a sustainable food production system in Puerto Rico, was concluded. The use of mechanical de-leafing combined with chemical control produced the highest yields. The intensive use of systemic fungicides will be, however, needed in the humid mountainous areas, while in the northwest area of Isabela fewer applications will be needed.

Scientists have disseminated research results in twenty-three conferences and twelve seminars. A total of forty-three refereed and non-refereed publications have been released, and two field days were organized. To reach our target audiences of extension specialists and agents, government partners, students, producers, consumers and environmental agencies, the faculty of the program have continued to participate in national and international events.

2. Brief description of the target audience

- Coffee, citrus and vegetable growers
- Banana and plantain growers
- Ornamental growers
- Landscaping, plant nursery industry and growers of cucurbits - southern 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), PR Dept. of Natural Resources, US Fish & Wildlife Service, International Institute for Tropical Forestry.
- American Phytopathological Society (APS), Agronomy Society of America, Horticultural Society, Puerto Rican Agricultural Sciences Society, Entomological Society of America.
- Consumers and homeowners

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	1	8	9

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of 'Pest Management Strategic Plans' (PMSPs) developed

Year	Actual
2013	2

Output #2

Output Measure

- Number of peer-reviewed articles in major scientific journals resulting from program activities.

Year	Actual
2013	8

Output #3

Output Measure

- Peer reviewed articles in local Scientific Journals resulting from program activities.

Year	Actual
2013	6

Output #4

Output Measure

- Abstracts or oral presentations in professional scientific society meetings resulting from program activities.
Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Poster presentations in professional scientific society meetings resulting from program activities

Year	Actual
2013	32

Output #6

Output Measure

- Number of joint Research-Extension activities that include pest diagnostics and identification, use of reduced impact pesticides, or research on pesticide impact assessment on non-target beneficial organisms.

Year	Actual
2013	4

Output #7

Output Measure

- Number of program-sponsored scientific events, like symposia, topic conferences, and open houses

Year	Actual
2013	7

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects (Short Term)
2	Number of persons who adopted reduced risk pesticides and practices
3	Number of farmers reporting decreased losses due to key and emerging pests
4	Number of stakeholders knowledgeable of climate changes issues and their importance in agricultural production.

Outcome #1

1. Outcome Measures

Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects (Short Term)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	474

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fusarium oxysporum f. sp. cubense tropical race 4 (Foc TR4), which is attacking banana in Asia, represents a threat to the banana and plantain industry of Latin America and the Caribbean which is almost completely based on subgroups that are susceptible to Foc TR4. Raising awareness to this threat is important in order to prevent its entrance to the Americas. Accurate disease detection and education on management alternatives is vital for maintaining the productivity of crops affected by new and emerging pests and diseases.

What has been done

In 2013, a workshop directed to 8 laboratory technicians and scientists was held for Fusarium race 4 identification. This initiative included a conference with 100 participants, including agronomists, extension specialists, producers and government personnel. Three workshops on Tospovirus and thrips? vectors were held at the Juana Díaz Substation with a total of 128 attendants. Information about the disease etiology, epidemiology and vector management was provided. Information about the effect of Tospoviruses in vegetables was delivered via trainings, publications and presentations in scientific meetings and informal discussions.

Results

The Plant Disease Clinic (PDC) at Juana Díaz (Southern Plant Diagnostic Network) communicate closely with the agronomists of 6 different seed companies and growers that submit diseased samples. A total of 246 visits to the Plant Disease and Insect Clinic provided an opportunity to educate the clientele in the importance of accurate disease and pest detection.

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 #2

1. Outcome Measures

Number of persons who adopted reduced risk pesticides and practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	83

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New and emerging diseases compromise the production of important crops for the food security of the island and for export trade. Farmers lack of awareness of reduced risk pesticides and practices makes them prone to adopt more chemical intensive methods which may affect biological and other alternative control practices.

What has been done

PRAEXS completed the Strategic Management Plan for Black Sigatoka and for the coffee berry borer. The practices in banana include chemical and cultural practices for two different ecological zones. An extension document about Tospoviruses in vegetables was prepared in collaboration with Puerto Rico Department of Agriculture. The identification of a Tomato Chlorotic Spot Virus affecting tomatoes and peppers in the southern coastal production area provided an opportunity to raise awareness and prevent the dissemination of the vector and the disease.

Results

Approximately 83 growers received recommendations for disease and pest management and adopted IPM practices. Banana and plantain farmers changed their management practices by adopting the IPM recommended practices for the control of Black Sigatoka.

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 #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers increasingly visit plant disease and insect detection facilities in Juana Diaz in search of diagnostics and recommendations for diseased crops.

What has been done

The Plant Disease and Insect Clinic in Juana Diaz engages growers who visit the clinic in the process of disease detection and identification. This is essential for growers and general public acquisition of knowledge and to promote ownership of the disease and pest detection process. Disease and Pest detection has been fast and accurate and improvement in the methods used for pathogen identification is reflected in the number of new diseases identified, and in the number of publications submitted and published.

Results

The largest producer of tomatoes and several hydroponic producers of lettuce, tomatoes and peppers in Puerto Rico have adopted the recommendations issued for Tomato Chlorotic Spot Virus (TCSV) prevention. By scouting the thrips vector and producing seedlings in insect-proof facilities plus the eradication of symptomatic plants, losses were decreased in the hydroponic facilities and less incidence of TCSV was reported in field tomatoes.

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 #4

1. Outcome Measures

Number of stakeholders knowledgeable of climate changes issues and their importance in agricultural production.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Other (Reduction of AEXS personnel)

Brief Explanation

While the continued stagnation of the Puerto Rican economy affects everyone it is increasingly difficult to keep pace with the rapid entry of new diseases in the island with a reduced faculty roster due to retirement and a freeze on new hirings at the university. Personnel limitations are perhaps the biggest obstacle we have for making more progress toward meeting our goals.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

During the annual meetings of the different commodity groups, the program progress and results were compared with the objectives planned. Last year the program evaluation was centered in the implementation of the citrus greening management program. Some of the highlights of this process are:

- The new orange cultivars 'Swingle', 'HRS 812' and 'Carrizo' were released by the fruit program.
- The State Department of Agriculture extension agents were educated in the recommendations for citrus greening management that include a nutritional program and the vector control. These recommendations are being delivered to the citrus growers.
 - A request for additional funds to respond to the citrus greening outbreak was successfully delivered to the Legislature. Additional funding for the growers was approved for the implementation of management practices.
 - Citrus growers implemented the education program for citrus greening.
 - The certification of disease free citrus plants was implemented at the substations of Isabela and Adjuntas. The successful protocol of this initiative will be applied in the nurseries and orchards of the State Department of Agriculture to provide disease free citrus plants to the growers.

- Two hundred and seventy three growers, extension agents and agronomists received training in Citrus greening management in 8 different workshops. During these events an evaluation form was handed out to the participants. Results of these evaluations have not yet been made available to PRAEXS program coordinator by our collaborators in Extension and the Dept. of Agriculture, but are expected to be shared in future meetings of the integrated work group created for citrus greening management.
- The broad participation and attendance to the meeting organized by the Fruit Commodity Program is a measure of the success of the workshops and of the widespread interest in the information being delivered by the different research programs.

Key Items of Evaluation

Last year the program evaluation was centered in the implementation of the citrus greening management program.

- The State Department of Agriculture extension agents were educated in the recommendations for citrus greening management that include a nutritional program and the vector control. These recommendations are being delivered to the citrus growers.
- A request for additional funds to respond to the citrus greening outbreak was successfully delivered to the Legislature. Additional funding for the growers was approved for the implementation of management practices.
- The certification of disease free citrus plants was implemented at the substations of Isabela and Adjuntas. The successful protocol of this initiative will be applied in the nurseries and orchards of the State Department of Agriculture to provide disease free citrus plants to the growers.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger - Plant genetic resources, breeding and production 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
201	Plant Genome, Genetics, and Genetic Mechanisms			10%	
202	Plant Genetic Resources			40%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			8%	
204	Plant Product Quality and Utility (Preharvest)			7%	
205	Plant Management Systems			35%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	18.7	0.0
Actual Paid Professional	0.0	0.0	7.4	0.0
Actual Volunteer	0.0	0.0	6.9	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
0	0	1077561	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	942569	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

Work continued on the selection and purification of germplasm of traditional crops and development of new varieties. Two new bean varieties, Badillo (light red kidney bean) and Beniquez (white bean) were released by the PRAES and are being sold to farmers.

The introduction and evaluation of different crops continued. In plantains, the FHIA 21 variety with resistance to black sigatoka disease is being evaluated for production and for culinary acceptance by consumers against the Maricongo, the principal variety grown in PR. Other plantain and banana varieties continue to be evaluated for the size of the bunches, disease resistance and culinary traits. In citrus, three rootstocks were released by the PRAEXS: 'Swingle', 'HRS812' and 'Carrizo'. The PR Department of Agriculture, based on the advise of PRAEXS, began implementing a program for the production of propagating material of citrus under protected structures; protocols were established for a certification program. In pineapple, disease-free planting material of Cabezona variety are being sold to farmers. The M-D2 variety has been accepted by farmers as an alternative to the Cabezona.

The INCAPER 8151 tropical robusta coffee variety is being evaluated for production at sea level. The PRAES at Adjuntas produced a total of 300,000 coffee seedlings and 2,600 pounds of coffee seeds for distribution to growers. Active research continues for biological and integrated pest management of the coffee berry borer.

In tanners, seed of the Nazareno yellowed fleshed variety developed by PRAEXS is being produced for a third year for distribution to farmers. A third year of field testing was completed before the release of the Berrocales pigeon pea variety. Organoleptic and nutritional tests were conducted for pumpkin germplasm.

At PRAEXS-Lajas production of certified organic seeds of 45 different crops (vegetables and aromatic herbs) were distributed to farmers and other interested parties in 32 PR municipalities, as well as to Fla, Tx, Ma, Ga, OH, Spain and Venezuela.

2. Brief description of the target audience

Targeted audience consists of farmers, government professionals, legislators, county agents, scientists, USDA professionals, professionals from the private sector and nonprofit organizations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of farmers planting newly released varieties developed by PRAES.
 Not reporting on this Output for this Annual Report

Output #2

Output Measure

- The number of 'hits' on project-related web sites. Records of the sale of hard copies of AES publications.

Year	Actual
2013	1200

Output #3

Output Measure

- Records of the number and type of germplasm accessions distributed to scientists and the public.

Year	Actual
2013	600

Output #4

Output Measure

- Number of participants in the field days coordinated with Extension

Year	Actual
2013	884

Output #5

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 #6

Output Measure

- Number of refereed publications.

Year	Actual
2013	8

Output #7

Output Measure

- Number of non-refereed publications.

Year	Actual
2013	24

Output #8

Output Measure

- Number of presentations in scientific meetings.

Year	Actual
2013	23

Output #9

Output Measure

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

Year	Actual
2013	9

Output #10

Output Measure

- Number of MS Thesis related to Global Food security and hunger.

Year	Actual
2013	8

Output #11

Output Measure

- Number of new varieties released by AES

Year	Actual
2013	2

Output #12

Output Measure

- Number of collaborations established with public sector institutions to address production problems in agriculture

Year	Actual
2013	18

Output #13

Output Measure

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

Year	Actual
2013	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders to adopt the proposed BMPs.
2	Records of the sales of seed of improved cultivars at the Substations.
3	Percentage of locally produced food.
4	Number of locally produced starchy crops with increased output according to Dept. of Agriculture statistics
5	Number of fruit crops with increased output according to Dept. of Agriculture statistic
6	Number of vegetable crops with increased output according to Dept. of Agriculture statistics

Outcome #1

1. Outcome Measures

Number of stakeholders to adopt the proposed BMPs.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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 packages of production practices for different crops are distributed to farmers, extension agents and specialists, PR and Federal Government officials, educators, private sector professionals in agriculture and the public. Technological packages for pumpkin and onions were published in 2013 and a draft for cabbage is in final stages of completion. BMP are presented and discussed at field days and workshops by the PRAEXS and the Extension Service.

Results

PRAEXS provides vital support for the continued production of traditional crops because seed (especially vegetative propagated ?seed?) is not available from the private sector in PR. The number of stakeholders, especially farmers, attending commodity meetings, field days, seminars and workshops sponsored by PRAEXS has continued to increase which suggests an increased willingness of farmers to adopt BMPs.

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 #2

1. Outcome Measures

Records of the sales of seed of improved cultivars at the Substations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Lack of seeds of improved germplasm continues to be one of the major production constraints 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 sexual and vegetative seeds as well as seedlings for distribution to growers. The Isabela Substation sold sexual seeds of beans, and vegetative planting materials of taniens to growers. The Adjuntas Substation produced 130,000 coffee seedlings and 2,600 pounds of coffee seeds for distribution to growers. Each of the six substations produces seeds for growers.

Results

The land area planted with improved varieties has been increasing over the past few years. In addition to the above mentioned, records at the substations show that 5, 721 lbs. of beans and 28,968 lbs. of taniens were sold to farmers and public wishing to expand their plantings.

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 #3

1. Outcome Measures

Percentage of locally produced food.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Puerto Rico imports 85% of the food we consume.

What has been done

The PRAEXS has been conducting its research program to provide farmers with results that will help optimize yields that are economically viable, sustainable and in harmony with the environment.

Results

The PRAEXS has published its research accomplishments in the Journal of Agriculture of the University of Puerto Rico. It also publishes technological packages with BMPs for most of the crops grown in the island. Dissemination of our work with improved varieties and the distribution of seeds produced in the substations has halted the decline of many farming subsectors

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Number of locally produced starchy crops with increased output according to Dept. of Agriculture statistics

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Production of root and tuber crops has decreased by more than 80% in the past sixty years, while consumption has decreased by a much lower percent.

What has been done

The PRAES has an active research program in starchy crops. New varieties have been developed locally or have been imported. Management practices have resulted in increased yields. Research results on starchy crops, together with outreach by the extension specialist and agents should result in increased production.

Results

The PR Extension Specialist on starchy crops informs that local production of plantains increased 5%, and that cassava and sweet potato had slight production increases. Bananas, yams, taniens, taro and arracacha did not increase in production in 2013. PR's Department of Agriculture statistics have not been updated since 2011, leaving us unable to provide more accurate estimates.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of fruit crops with increased output according to Dept. of Agriculture statistic

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fruit crops are an important sector of PR's agricultural production. Diseases such as Citrus greening, Phytophthora root rot of avocados, anthracnose of mangoes, among others, and poor management practices by some farmers, offer severe constraints for maintaining or expanding fruit crop production.

What has been done

During the past year research has concentrated in Citrus Greening and other citrus diseases, and in purifying pineapple varieties whose seeds seemed to have been degenerating.

Results

The PR Extension Specialist in Fruit Crops informs that according to his estimates production of pineapples increased 30%, exotic fruits 20%, mango 5 to 10%, papaya 5%, and avocado 2%. Citrus production decreased 10% in 2013. These are in-house estimates since the PR Department of Agriculture statistics have not been updated since 2011.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Number of vegetable crops with increased output according to Dept. of Agriculture statistics

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

The amount of rainfall in at least two of the research substations increased significantly. The economy of Puerto Rico has been in recession for over six years, thus affecting funding for the PRAEXS. Research faculty have been retiring and in most cases they have not been replaced.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation results are yet available for this program. A new program coordinator was recently appointed and is currently gathering the data available at the substations on the performance of the seed production and distribution programs. He will also be deciding on a calendar for the collection of stakeholders opinions on the new technologies being validated for the different crops and on other aspects of the program's implementation.

Key Items of Evaluation

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			7%	
102	Soil, Plant, Water, Nutrient Relationships			10%	
111	Conservation and Efficient Use of Water			7%	
112	Watershed Protection and Management			11%	
121	Management of Range Resources			6%	
123	Management and Sustainability of Forest Resources			9%	
133	Pollution Prevention and Mitigation			18%	
136	Conservation of Biological Diversity			20%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
403	Waste Disposal, Recycling, and Reuse			7%	
405	Drainage and Irrigation Systems and Facilities			2%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	11.1	0.0
Actual Paid Professional	0.0	0.0	2.6	0.0
Actual Volunteer	0.0	0.0	2.3	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
0	0	621777	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	458554	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	28995	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The main goal of the Climate Change, Natural Resources and Environment research program continues to be to develop, perform and support scientific research regarding the impact of agricultural practices on the environment and natural resources of Puerto Rico. The program addresses key PRAEXS mission goals by supporting both the Department of Agriculture and the Natural Resources Department in the protection, utilization and management of soil, water, natural resources and quality of the environment through the improvement of agricultural practices. Past and ongoing research activities:

- Quantify the contribution of agriculture in relation to pollution source, and measure the short-and-long term impact of agricultural operations on the environment.
 - Develop pollution prevention and mitigation (practice, measure, thresholds) for protection of watershed and soil resources.
 - Develop soil improvement and maintenance practices.
 - Develop and promote sustainable agricultural practices as a key component to foster agricultural-led economic growth in the island.
 - Determine the factors that influence the sustainable agricultural production practices adoption in Puerto Rico.
 - Determine the pathways of entry, ecological impact, and management of non-native species on biodiversity.
 - Develop management approaches for conserving and restoring biodiversity.
 - Publish research advancements in journals, bulletins, newspaper articles, and popular magazines.
- In addition to publications, projects results have been disseminated through farm/field day visits, workshops, conferences, websites, podcasts, and exhibitions.

2. Brief description of the target audience

Extension specialists and agents, Faculty members and students, government partners, producers, consumers, and community-based groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Oral or poster presentations in professional scientific society meetings resulting from program activities

Year	Actual
2013	36

Output #2

Output Measure

- Number of Peer Reviewed publications.

Year	Actual
2013	6

Output #3

Output Measure

- Number of trainings, research demonstration activities and meetings with stakeholders to discuss research results and priorities.

Year	Actual
2013	17

Output #4

Output Measure

- Number of graduate students completing a MS degree and submitting theses under research projects in this program

Year	Actual
2013	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge on natural resources enhancement, dry forest ecology and management, microirrigation scheduling, and other soil enhancement and water conservation practices
2	Number of farmers adopting microirrigation management practices
3	Number of persons adopting practices that prevent biodiversity threats and losses.
4	Number of farmers adopting methods to increase soil organic matter content
5	Number of farmers reporting increased water use efficiency in their farms
6	Number of farmers that adopted practices to improve water resources.
7	Number of stakeholders gaining knowledge on organic agricultural practices.
8	Number of persons gaining knowledge effects of non-native species on biodiversity.

Outcome #1

1. Outcome Measures

Number of stakeholders gaining knowledge on natural resources enhancement, dry forest ecology and management, microirrigation scheduling, and other soil enhancement and water conservation practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	100000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Education is a first line of defense for the conservation and management of natural resources. PRAEXS access to stakeholders through traditional outreach methods is limited. Being the web an efficient and inexpensive tool to reach masses, in order to maximize outreach efforts several scientists of this research program have used this technology to reach a broader audience.

What has been done

The outreach of research activities has been varied and performed across disciplines in interdisciplinary groups. Several seminars, videos and symposiums have been celebrated. These activities have been documented through web videos, web seminars and podcasts. A special seminar series "Coloquio AgroAmbiental" have been developed to discuss major issues regarding the natural resources and environment.

Results

The use of web sites, podcasts and blogs expands the exposure of our work to different audiences. The number of visitors to the Colloquium and selected projects' web pages are: Colloquium (6 videos, 52 hits; Recycling and manure 60,000+; sustainable agriculture 37,000+) other topics have registered 8,000; 17,000 and 62,000 hits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
123	Management and Sustainability of Forest Resources

Outcome #2

1. Outcome Measures

Number of farmers adopting microirrigation management practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farmers need of better micro-irrigation scheduling methods to reduce water, nitrogen and energy losses.

What has been done

Multidisciplinary studies have been performed in order to develop understanding and efficient technology to improve water conservation and management. Major outreach efforts have been carried out to increase micro-irrigation management and practices among the fruits, vegetables and root crops producers in the island.

Results

Micro-irrigation management and practices have been developed for crops such as avocado, pineapples and citrus located at northern and central regions of Puerto Rico, and root crops farmers at southern dry plains. Research results have been successfully disseminated through publications (2 peer reviewed papers and a book), field days, workshops and demonstrations. A web-based site provides vital information for irrigation needs in the different agricultural areas <http://pragwater.com/daily-reference-eto-for-haiti-and-the-dominican-republic/web.page>. The page was redesigned to estimate evapotranspiration coefficients for other Caribbean countries. These outreach efforts has provided vital knowledge for micro-irrigation management to farmers and growers in the island.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of persons adopting practices that prevent biodiversity threats and losses.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The impact of non-native species poses a serious challenge that requires a decision-making framework based in the prioritization of species for their control, as well as regulatory and public education programs. Public awareness and adoption of practices to prevent biological invasions are vital to this goal.

What has been done

Several multidisciplinary research studies have been performed in order to assess the impact of invasive species on agricultural and natural ecosystems. Different models, methods and practices for invasive management have been evaluated.

Results

Probabilities maps detailing suitability and survival of two invasive weeds were developed. A model of invasive species spread over time under alternative scenarios and control programs was developed. Public awareness of the invasive species problematic was improved through research outreach activities such as meetings, educational material and use of the Internet to reach a broader audience.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #4

1. Outcome Measures

Number of farmers adopting methods to increase soil organic matter content

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

To increase the outreach efforts of sustainable agricultural management and practices in order to promote their adoption by farmers and growers.

What has been done

Outreach efforts were incremented through different activities across disciplines and interest groups. Major efforts have been devoted to field days, meetings, seminars and workshops; several training and research demonstrations were also performed. Graduate students recruitment and mentoring was pursued in the program to ensure knowledge awareness and professional capacity development in the topic.

Results

Research results were presented in seminars, workshops and field demonstrations. More than seventy organic farmers, students, and general public were instructed about sustainable agricultural practices and organic soil amendments. Several videos were posted on the web site <http://www.youtube.com/watch?v=bYhkbiHjESA>. Two graduate students completed their master degrees under associated projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #5

1. Outcome Measures

Number of farmers reporting increased water use efficiency in their farms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The southern region of Puerto Rico, the most active agricultural area in the island is characterized by its low rain fall. Drip irrigation is widely used in that region. However, farmers are not using irrigation scheduling methods, so years of ground water pumping are reducing the aquifers and causing salt water inclusion from the sea.

What has been done

A research project to evaluate Subsurface Drip Irrigation (SID) and cropping systems on vegetables was conducted in the southern region. Another ongoing project is a collaborative effort between the University of Alabama to create a remote sensing product for solar radiation for Puerto Rico, Haiti and Dominican Republic to estimate the evapotranspiration and the surface energy and water budgets.

Results

Research findings indicate the SDI contributes to a better water use efficiency for vegetables production in the semiarid region of southern Puerto Rico. Outreach activities have been performed to teach farmers the importance of using irrigation methods to increase water use efficiency on agricultural production. Judging from participants evaluations of outreach activities, project recommendations are likely to be adopted by approximately thirty participants. A committee was organized to produce an Irrigation Manual designed for use of farmers, Cooperative Extension Agents and government agronomists.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
405	Drainage and Irrigation Systems and Facilities

Outcome #6

1. Outcome Measures

Number of farmers that adopted practices to improve water resources.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
405	Drainage and Irrigation Systems and Facilities

Outcome #7

1. Outcome Measures

Number of stakeholders gaining knowledge on organic agricultural practices.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Organic stakeholders need more information on agricultural practices that improve soil quality in tropical soils. Information to achieve reductions in inorganic fertilization is needed by farmers in transition to organic production.

What has been done

A project to evaluate the effects of organic fertilization in soil quality and crop yield was established. The study gathered information on the development and use of compost in the tropics and its effect on organic matter build up, mineralization and crop yield. Another study evaluated the use and efficiency of the windrow composting technology for the composting of coffee residues.

Results

? Development of a high quality compost from coffee hulls and validation of the windrow composting technology

? Results and findings of this research were shared with the academic community (extensionists, researchers, students) and stakeholders at an AES open house, scientific meetings and a demonstrative greenhouse workshop.

? Ten educational videos and one conference regarding composting procedures, management and use were posted at Ytube and InfoCast respectively; more than 100,000 viewers have accessed both sites.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #8

1. Outcome Measures

Number of persons gaining knowledge effects of non-native species on biodiversity.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The introduction of non-native species to both natural and agricultural ecosystems represents a serious threat to biodiversity, wildlife habitat, and agricultural production. A great number of extremely damaging agricultural pests have become established in Puerto Rico as a result of both accidental and intended introduction.

What has been done

Several research projects on biodiversity and conservation threats to agriculture and natural ecosystems have been established and are reporting progress in their work. The program coordinator has mentored a community group in the development of a bio-conservation project to restore the native fireflies habitat in the mountain region of the island.

Results

? Six predaceous coleoptera species have been identified in association with the Harrisia Cactus Mealybug.

? Four insect and one acari species have been introduced for the control of non-native aquatic weeds in the island's watersheds. The introduction of these biocontrol agents have rendered between a 40-100% of control in the released areas.

? A new DNA extraction protocol was developed for palm and insect tissues.

? Research and Outreach activities have been performed to teach all targeted audiences how to prevent biodiversity threats and losses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

136	Conservation of Biological Diversity
211	Insects, Mites, and Other Arthropods Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

Budget restrictions at the university continue to affect the performance of programs like this one, addressing multiple issues and with multi-disciplinary faculty.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Several outreach activities were performed to collect the program participants and stakeholder's inputs. Seminars and meetings are among the activities conducted. Methods used to collect information include surveys, personal interviews, end section questionnaires, and document review and analysis. Outreach activities have been documented through web videos, web seminars and podcasts. A special seminar series "Colloquio AgroAmbiental" have been developed to discuss major issues regarding the natural resources and environment. In addition, research results have been successfully disseminated through web sites, podcasts and blogs. Reaching these wide audiences has provided us with lots of inputs from concerned parties that came in the form of consultations, comments, and inquiries regarding services and major agricultural and environmental issues. Evaluation results will be used to improve the research program activities in order to enhance and achieve the stated goals and objectives according to the stakeholders needs.

Key Items of Evaluation

As a result of the gathered data several major issues have been identified some of them are common ground among the wide number of participants. Among the critical issues are; soil management and erosion control; need for guidelines for quality control and pollution prevention in watersheds; nutrients management; and providing a digitalized inventory of agricultural land for use in crop production and other land uses. Another major concern is the impact of non-native and/or invasive species in agricultural production systems and natural ecosystems. Finally, our audience shows a great interest in sustainable agricultural production in the context of food security. The capacity to comply with these research needs will depend on budget and human resources availability.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Global Food Security and Hunger - Agricultural Economics, Marketing, and Community Development

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			25%	
602	Business Management, Finance, and Taxation			5%	
604	Marketing and Distribution Practices			25%	
605	Natural Resource and Environmental Economics			10%	
606	International Trade and Development			5%	
607	Consumer Economics			5%	
608	Community Resource Planning and Development			10%	
610	Domestic Policy Analysis			15%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.7	0.0
Actual Paid Professional	0.0	0.0	0.2	0.0
Actual Volunteer	0.0	0.0	0.3	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
0	0	19013	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	21071	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

Research was undertaken to identify new market niches and promising new 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. Studies were undertaken to identify the diverse strategies that local food system stakeholders are currently using or might use to create and manage ongoing or potential change, and information needs of these stakeholders. Research was undertaken to improve natural resource and environmental use by farmers and to support policy-making process by government officials in order to achieve greater economic and material sustainability. In collaboration with Extension faculty and agents, promising results were translated into recommendations for farmers and community organizers. Publications were prepared and presentations to producers' associations and agricultural professionals also took place.

2. Brief description of the target audience

Farmers, extension professionals, community leaders and organizers, producer associations, academic community, local and state government officials, and other professionals.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	3	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of refereed publications

Year	Actual
2013	3

Output #2

Output Measure

- Number of scientific presentations in scientific meetings

Year	Actual
2013	9

Output #3

Output Measure

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

Year	Actual
2013	14

Output #4

Output Measure

- Number of participants attending workshops coordinated with Extension on program's results

Year	Actual
2013	200

Output #5

Output Measure

- Number of new or improved innovations (models, software, processes, etc.) made

Year	Actual
2013	2

Output #6

Output Measure

- Number of activities/events organized (e.g., workshops, seminars, training events, educational events)

Year	Actual
2013	1

Output #7

Output Measure

- Number of research-based extension presentations

Year	Actual
2013	9

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge about public policy issues relevant to local agriculture and natural resources.
2	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, or Natural resources and environmental management
3	Number of adopters of new or improved practices/tools in: Consumption decisions, Production management, Marketing decisions, Institutional arrangements and organizational capacities, Public policy decisions, or Natural resources and environmental management
4	Total number of participants (this year) in new market-niches generated as a result of program research

Outcome #1

1. Outcome Measures

Number of stakeholders gaining knowledge about public policy issues relevant to local agriculture and natural resources.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

Outcome #2

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, or Natural resources and environmental management

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	500

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
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
607	Consumer Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

Outcome #3

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, or Natural resources and environmental management

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Total number of participants (this year) in new market-niches generated as a result of program research

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Programmatic Challenges
- Other (logistics of harvesting process)

Brief Explanation

Due to logistics problems, seed was not sown on time for expanding the new market niche that the program is trying to foster based on a particular exotic crop. This hindered our ability to reach new participants in this "new market-niche." Improvements in this outcome metric will be reflected in next year's report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The program evaluation was centered in the goal of expanding niche market alternatives for the farmers of Puerto Rico. It was performed in a meeting specially convened to discuss the progress achieved in the program's implementation. Participants included only faculty associated to the program and one of the farmers interested in partaking in the new niche market alternative being developed. A summary of the input received and of the status of this initiative is presented below.

Researchers in this program identified a highly profitable new market niche for Puerto Rico's farmers. The program has taken the leadership in this initiative and has been successful in both recruiting researchers from other program areas to study this new crop, and in convincing a group of farmers to try producing the crop. However, several problems have been faced when executing the proposed research and outreach agenda. At the research level, it has been difficult to justify the use of federal funds for this project as the new crop only grows in the tropics (federal grants favor projects that benefit as many states as possible). At the outreach level, logistics problems have prevented all but one interested farmer to begin producing this new fruit. This logistic problem is expected to be solved in the next two years, as new seedlings reach transplanting stage. A survey-based evaluation will be implemented as soon as a critical mass of adopters initiates production of the new crop.

The program's other traditional areas of research have continued to be addressed without major modifications. Given the limited SY/FTEs working in this program (3.3), and the fact that its expertise is requested by most of PRAEXS other programs, its outputs seem reasonable, although there was agreement with remarks suggesting that other outcome measures more adequate to the actual work performed should be devised.

Key Items of Evaluation

- The program evaluation was centered in the goal of expanding niche market alternatives for the farmers of Puerto Rico.
- Researchers in this program identified a highly profitable new market niche for Puerto Rico's farmers.
- The program has been successful in both recruiting researchers from other program areas to study this new crop, and in convincing a group of farmers to try producing the crop.
- Progress has been affected by difficulties in accessing continued research funds to advance this initiative and by logistics problems encountered with producing the seedlings needed to start or expand production by interested farmers.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Safety - Food Safety, Science, Technology and Childhood Obesity (FOSTCO)

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			38%	
503	Quality Maintenance in Storing and Marketing Food Products			12%	
504	Home and Commercial Food Service			25%	
701	Nutrient Composition of Food			25%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.0	0.0
Actual Paid Professional	0.0	0.0	0.9	0.0
Actual Volunteer	0.0	0.0	0.5	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	86876	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	58069	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The mission of the FOSTCO program is to promote the quality of life and economic viability of the agricultural sector and rural communities by continuous improvement of current and development of new food and non-food products and their respective manufacturing and other related processes. In so doing, the Program considers such aspects as food safety, nutritional value, environmental impact, needs for education and information dissemination, consumer and industry support, and technology development, transfer and adaptation.

In order to accomplish our mission, during this year a total of nine seminars were offered on the Food Safety Program. Educational programs were conducted in food safety and related topics (GMP, GAP, HACCO and SQF) and a total of approximately 150 persons attended the seminars. In an effort to help the food industry in the improvement and development of new food, a total of 20 industries contacted us requiring some type of collaboration. The collaboration with the industry included chemical and/or microbiological analysis of food, nutritional fact analysis, physico-chemical properties of food and literature search. A project on the Impact of Current Packaging Technologies on the Quality of Minimally Processed Tropical Pumpkin was initiated and the first part of the edible film project ended. This project was conducted to help food industry to extend the shelf live of fresh peeled orange. The results show that is possible to extend it to 30 days at refrigerated temperature using an edible film with a preservative. Another project focused in the development of a minimally processed tropical fruits ended with the production of a fruit salad, which have 25 days of shelf life. Two theses were published: one related to extraction of pectin from mango (mayaguezano variety) and another one on development of edible films with bacteriophages. Two posters were presented on the Annual Meeting of the Institute of Food Technology (Scientific Program).

2. Brief description of the target audience

- Extension Specialists and Agents
- Academic Programs Faculty
- Consumers
- Federal and State Agricultural Agencies (PRDA)
- Food Industry representatives

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Courses, seminars and workshops offered on the topics covered by the Program

Year	Actual
2013	9

Output #2

Output Measure

- Number of projects or industry collaboration agreements established

Year	Actual
2013	20

Output #3

Output Measure

- Number of people attending seminars and workshops

Year	Actual
------	--------

2013 120

Output #4

Output Measure

- Amount of grant funds (internal or external) of active projects

Year	Actual
2013	76000

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Total Number of Enterprises Impacted by the Program.
2	Food Manufacturing Exports in million dollars
3	Food Manufacturing Imports in million dollars.
4	Number of improvement or development projects focused on safety or nutritional aspects of product or production processes
5	Number of projects on postharvest or packaging
6	Number of projects focusing on definition of quality parameters
7	Number of projects dealing with residues, wastes or effluents

Outcome #1

1. Outcome Measures

Total Number of Enterprises Impacted by the Program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The literature reports improper postharvest practices as a main contributor to product losses and quality deteriorations. It is important that food producers understand and adopt food safety practices. Puerto Rico producers need to pay particular attention to management and handling practices after harvest if we are to seriously address food security issues.

What has been done

Different types of physical, chemical and microbiological analysis were conducted to 18 food products. In addition, nutritional facts were developed for 27 new products. Some of the food Industries that requested our services came as part of an agreement between the Food Science and Technology Program and Puerto Rico Industry Development Corporation (PRIDCO). A total of approximately 9 seminars were conducted in food safety areas such as GMP, HACCP, and GAP. A project in current packaging technologies on quality of minimally processed tropical pumpkin was initiated.

Results

Twenty different food Industries were attended in the program and seven of them obtained the Health Department license to start the production of food products. Approximately 120 food industry employees (food processors and farmers) were trained in food safety. A project on edible films provided data and experience to help the citrus industry in Puerto Rico.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

504 Home and Commercial Food Service
701 Nutrient Composition of Food

Outcome #2

1. Outcome Measures

Food Manufacturing Exports in million dollars

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Food Manufacturing Imports in million dollars.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of improvement or development projects focused on safety or nutritional aspects of product or production processes

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Coffee remains one of the top economically important enterprises of Puerto Rico. This industry faces several important challenges such as the shortage of labor, increases in production costs, reduced government contributions, and control of the coffee berry borer, considered the worst pest of this crop. It is necessary to establish and promote new strategies to increase the profits of the industry.

What has been done

Agricultural engineers and food scientists collaborating with this program are working in the development of more efficient methods to produce dry parchment coffee, taking under consideration the climatic conditions of Puerto Rico. They are also developing high quality coffee cordials and schnapps from locally harvested coffee.

Results

The results showed that the drying temperature has a significant effect on energy consumption and drying time. Contrary to expectations, the use of high temperatures during the first stage of the drying of parchment coffee promotes a more efficient process. At the second stage of drying the use of higher or lower temperatures had no significant effect. Lower temperatures are therefore recommended to avoid overheating of coffee grains, which could affect the product's overall quality. It is expected that the adoption of more efficient drying recommendations will help reduce the high energy costs incurred in coffee drying operations. A coffee cordial was also successfully formulated using coffee aroma extracts obtained from extractive distillation methods with vapor infusion of ethanol. The commercialization of this product will help to increase the available markets for the specialty gourmet coffee elaborated in Puerto Rico.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
701	Nutrient Composition of Food

Outcome #5

1. Outcome Measures

Number of projects on postharvest or packaging

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Minimally processed fruits and vegetables consist of raw fresh cut produce, which have undergone a minimal processing such as peeling, slicing or shredding to make them ready-to-use. Convenience foods preserved by mild methods are one of the strategies being developed to increase the consumption of local crops by time-challenged consumers.

What has been done

Studies have been conducted to prolong the shelf life of peeled orange fruits at refrigerated temperature by using edible films, and of low-density polyethylene (LDPE) bags as a packing material that could be used to maintain the quality of pumpkin pieces in storage. The PRAEXS developed 'Taina Dorada' variety was used for the latter study.

Results

The use of edible films proved to be a viable method to extend the shelf life of peeled oranges. The peeled orange coated with hydroxymethyl cellulose and potassium sorbate had the best appearance at the end of 28 days of storage, with no effect observed on the fruit's physico-chemical characteristics or color attributes. In the case of pumpkins, results showed that at a temperature of 4°C, pumpkin pieces treated with an antimicrobial solution and sealed with and without vacuum in LDPE bags, can be maintained for 20 days in a condition acceptable to consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

Outcome #6

1. Outcome Measures

Number of projects focusing on definition of quality parameters

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One of the research priorities resulting from the program evaluation survey conducted at last year's coffee commodity meeting and technology forum was the need to characterize the quality of coffee beans according to their production zone in Puerto Rico. Sixty-percent of the surveyed participants included this research need in their assessment. Objective criteria to establish the quality of particular coffees is critical for the development of a gourmet specialty coffee sector in Puerto Rico with the certified quality to command higher prices for its produce.

What has been done

A research project on the chemical characterization of coffee was approved and is being conducted. The quality of coffee is largely dependent on factors such as temperature, climate and altitude. The chemical characterization of coffee produced at different altitudes is a useful tool to associate the sensory properties of a product with the specific families of compounds present in them. The research design includes the evaluation of two coffee varieties grown at two distinct altitude zones.

Results

Preliminary results show that the effect of height and variety is significant, which may affect the organoleptic quality of coffee grown in Puerto Rico. The associated benefits from this research are: 1) the establishment of a data bank of chemical precursors of aromas and flavors of both coffee varieties at selected regions, 2) the quantification of differences in terms of chemical precursors of aroma and flavors in coffee, and 3) the development of a tool to identify the best cultural practices for specialty coffees and associated performance criteria.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
701	Nutrient Composition of Food

Outcome #7

1. Outcome Measures

Number of projects dealing with residues, wastes or effluents

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Economy - Puerto Rico is currently suffering the economic recession affecting the rest

of the world. Although it is expected for the economy to pick up, while the recession prevails, the amount of funding available to invest in research or new ventures will be limited.

Competing programmatic challenges - Program resources are not dedicated to the program. Instead, they belong to other departments and they need to address issues as their respective programs so require. Thus, we have a pool of researchers who are constantly entering and leaving.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In order to fulfill our mission and to adapt research and new knowledge to Puerto Rico's food industry and agriculture, the Food Safety, Science, and Technology Programmatic area was evaluated. A small survey was conducted. The questionnaire was answered by 70 people including: farmers, agronomists, private industries, Puerto Rico Department of Agriculture employees, members of the College of Agricultural Science teaching faculty, Experiment Station scientists and Agriculture Extension Service personnel.

The results of the evaluation indicate that participants believe that the Food Safety, Science and Technology area needs to perform research on: 1) use of new or improved existing technologies for processing and to extend the shelf life of agricultural crops, 2) post-harvest treatment of crops, 3) new product development using Puerto Rico's traditional crops as raw material, 4) risk assessment on possible chemical contaminants in food sold to Puerto Rican consumers (including imports), 5) quality assurance during storage and distribution of fresh produce, 6) determination of new quality cultivars with economical potential in our land. While some of these research lines are already present in our program, others will be evaluated for inclusion if more human and financial resources become available in the future.

To improve the performance of the Program, a series of questionnaires' will be prepared to collect more specific stakeholders input. This information will help to identify areas where the Program may be improved and as a tool to measure its progress.

Key Items of Evaluation

The results of the evaluation indicate that participants believe that the Food Safety, Science and Technology area needs to perform research on: 1) use of new or improved existing technologies for processing and to extend the shelf life of agricultural crops, 2) post-harvest treatment of crops, 3) new product development using Puerto Rico's traditional crops as raw material, 4) risk assessment on possible chemical contaminants in food sold to Puerto Rican consumers (including imports), 5) quality assurance during storage and distribution of fresh produce, 6) determination of new quality cultivars with economical potential in our land. While some of these research lines are already present in our program, others will be evaluated for inclusion if more human and financial resources become available in the future.

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			20%	
402	Engineering Systems and Equipment			40%	
403	Waste Disposal, Recycling, and Reuse			40%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.2	0.0
Actual Paid Professional	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.7	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	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

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Most of the research projects active in this program reported final results during this year. Salient accomplishments include:

--An anaerobic biodigester with the capacity to handle the waste load of 282 pigs was designed and established in the farm of a cooperator producer. The biodigester proved to be a viable alternative for energy generation and for the recovery of nutrients present in the waste. Agricultural Extension Service agents present in Project demonstrations, and personnel from the local Environmental Quality Board, are interested in obtaining more detailed information on this technology to include it among the options recommended for the treatment of wastes of small and mid-sized pig farms.

--A research project was established to study the technical and economical aspects of the implementation of solar energy systems at milk parlors. One of the objectives of the study was to provide an analysis with which different local customers, specifically from the farming sector, could establish projections and make decisions about the implementation of similar systems. Based on a case study and on solar radiation measurements taken at different locations the project's conclusions show that:

- The average maximum solar radiation for the locations studied from December 2011 through July 2013 is 995.26 W/m. — 1059.42 W/m. with a standard deviation of 126.4W/m. —199.6W/m. The average sun-hours were 3.2 hrs — 4.2 hrs. Given these results, it is clear that solar energy is a highly available source of renewable energy for PR.
- Using a cash flow criterion, the implementation of a solar energy generation system (SEGS) in PR is feasible, given that a positive cash flow prevails through the equipment's life cycle.
- The payback period is independent of the generation target. This is one of the drawbacks of investing in the implementation of a SEGS on businesses based on a fixed demand market.
- Under the conditions considered in this study, using a dynamic criterion, the return on investment (ROI) of a SEGS in PR is 5 years. On the other hand, using a more conservative criterion, the ROI of a SEGS in PR is 8 years.
- To decide which criterion is appropriate for a unique case, a risk assessment would be helpful.

2. Brief description of the target audience

- (1) Specialists and County Agents of the Agricultural Extension Service of UPR.
- (2) Professional personnel of the Puerto Rican Department of Agriculture and of the USDA.
- (3) Policy makers in the Commonwealth and Federal Governments.
- (4) Personnel of the Farm Credit Service and other financial institutions that make loans to producers.
- (5) Professionals engaged in private enterprises related to renewable energy projects.
- (6) Faculty members and university graduate and undergraduate students.
- (7) Farmers and managers of agroindustrial operations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of active research projects in the program

Year	Actual
2013	3

Output #2

Output Measure

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

Year	Actual
2013	0

Output #3

Output Measure

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

Year	Actual
------	--------

2013 0

Output #4

Output Measure

- Number of meetings held with stakeholders to extend results and technologies

Year	Actual
2013	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants in meetings held with stakeholders to extend project's results and technologies devised
2	Number of government agencies and other type of institutions willing to collaborate in projects promoting energy efficiency and renewable energy technologies
3	Number of farmers or agroindustrial operations becoming more energy efficient and adopting renewable energy alternatives

Outcome #1

1. Outcome Measures

Number of participants in meetings held with stakeholders to extend project's results and technologies devised

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	150

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

Outcome #2

1. Outcome Measures

Number of government agencies and other type of institutions willing to collaborate in projects promoting energy efficiency and renewable energy technologies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse

Outcome #3

1. Outcome Measures

Number of farmers or agroindustrial operations becoming more energy efficient and adopting renewable energy alternatives

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

This program has only been in existence during the last three years. Only a few projects were active in this area and the time commitment of researchers to them is relatively small. Last year no FTE was budgeted for these projects and work was performed on an Ad-Honorem volunteer basis by the faculty involved.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program was created in 2011. During its first year the initial program goals were established and a tentative logic model rationale was developed based on the objectives of faculty's current research projects and their broader interests in this area. This model still needs to be refined to ensure that cooperating faculty agree on the program's goals and underlying needs, on what they seek to accomplish, on how it will be done, and on which measures of progress and impact should be defined and collected. Conducting an outcome evaluation during this initial stage would not be adequate or yield fruitful results. We concluded that a more useful approach was to conduct a process evaluation that could provide better insights on the program's ongoing implementation and could suggest changes we may want to make to improve its chances for success.

An online survey was designed by the program coordinator and distributed to 15 faculty members from the teaching, research and extension faculty of the CAS which had manifested interest in sustainable energy alternatives. Questions were focused on program design (Are program goals and priorities adequate? Are inputs and activities adequate? Is there an adequate program coordination?); outputs (Is the program producing the outputs it was intended to produce? Are the targeted audiences aware of the program's outputs/results?); Resources (Are resources reasonable relative to the objectives? How could additional resources be leveraged?); general strengths and weaknesses; and needed program modifications (How can the program be modified to increase effectiveness in achieving goals?). Four responses were received. The following list summarizes the input

received:

On the program design: all respondents believed the situation and priorities, and the ultimate goal descriptions to be adequate and the assumptions to be reasonable (75%). Yet, while 50% considered the proposed activities to be adequate for achieving the expected outcomes, the other half believed they were barely adequate. Half of the respondents also believed that the FTEs budgeted were barely adequate to perform the planned activities.

Outputs and outcomes indicators: respondents believed the current measures miss important local success indicators such as demonstration projects enabled by the program, and graduate students trained under the projects.

Comments and suggestions offered:

- Respondents remarked that it would be hard to implement some of these projects when little funding is available.
- On the other hand, some believed we now have two good case studies on energy that can be showcased in upcoming years (particularly the biogas one) and can be used for evaluating the program's success.
- This program, as well as many others, is limited to researchers in the field that are willing to undertake research that could lead to energy savings on farms. More expertise is needed within the CAS in this area.
- The program activities should have closer ties with extension and farmers so that a participatory research approach can be implemented.

Key Items of Evaluation

- Respondents remarked that it would be hard to implement some of these projects when little funding is available.
- On the other hand, some believed we now have two good case studies on energy that can be showcased in upcoming years (particularly the biogas one) and can be used for evaluating the program's success.
- This program, as well as many others, is limited to researchers in the field that are willing to undertake research that could lead to energy savings on farms. More expertise is needed within the CAS in this area.
- The program activities should have closer ties with extension and farmers so that a participatory research approach can be implemented.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Childhood Obesity

- Reporting on this Program

Reason for not reporting

The PRAEXS has no research activity in this area. This program was created with all parts in blank by NIFA's suggestion in 2011 when alignment with five national goals was required from all state institutions. Any future activity in this area will be reported in our current Food Safety, Science and Technology program or contemplated in a future joint plan of work submission with Extension.

V(B). Program Knowledge Area(s)

- 1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Calls for proposals in the area of childhood obesity will be distributed to interested faculty.

Until a critical mass of projects is available related activities will be reported under our FOSSTCO program.

2. Brief description of the target audience

Families, Extension Educators, Teachers in the Educational System, school children in general; university faculty with interests in this area.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

{No Data Entered}

V(H). Planned Program (External Factors)

External factors which affected outcomes

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}