2012 University of Puerto Rico Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

1. Executive Summary

The mission of the University of Puerto Rico Agricultural Experiment Station (PRAES) 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 PRAES 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 PRAES and the Puerto Rico Agricultural Extension Service were filing separate submissions, we are already planning for a joint submission next year.

The PRAES 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 PRAES 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.

Until 2006, research efforts in the PRAES were organized along traditional commodity lines. Commodity groups are still active and constitute an important link with our stakeholders, but they are no longer the basic unit structuring our research program. Adopting federal guidelines, in 2006 we began a transition towards defining and organizing research programs following the LOGIC model. In 2011, following new NIFA guidelines, all planned programs were reviewed and recontextualized to address both local goals and, when possible, the five national priorities of Global Food Security and Hunger, Climate Change, Sustainable Energy, Childhood Obesity and Food Safety. The names of our planned programs were slightly modified and hyphened to include the national priority addressed.

Core funding for the PRAES'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 programs' FTEs funded through Hatch and Hatch Multistate funding lines, and emphasizing on activities and results leveraged by this support. Along with federal and state funding, there are extramural research grants and contracts such as those with the Natural Resources Conservation Service, Environmental Protection Agency, USDA-ARS, Puerto Rico's Department of Agriculture, Puerto Rico's Department of Natural and Environmental Resources, and other agreements with US-Universities and private donors. For FY2012 the Hatch allocation for Puerto Rico was $4,349,143. Along with state matching funds, other program income, and carry-over funds, the actual dollars spent in our planned

programs in FY2012 were $7,212,478.

During last year the PRAES continued to direct its research programs toward the solution of the most pressing problems identified by our stakeholders and faculty. More than twenty new projects were begun to address concerns related to a wide array of agrofood and natural resources problems. Given the increasing pace of introduction of new pests and diseases, crop protection studies figured prominently in the roster of projects approved.

The **Milk and Meat Production Systems** program seeks to improve the biological efficiency of livestock production and economic returns to producers in the Island. Last year the forages, small ruminants, beef, and dairy working groups were the most active at addressing program's priorities, publishing research results, and maintaining close contact with stakeholders. The list of recommended management practices (RMP) based on research results continued to expand, especially with regard to production and utilization of highly nutritious forages and improved quality of locally produced beef. Research and extension efforts for dairy and livestock producers continue emphasizing on strategies that could reduce production costs and differentiate our product from the imported one on the basis of quality. During 2012 PRAES allocated 3.7 FTE/SY and more than 30% of our Hatch funds to this program.

During 2012 PRAES **Integrated Management of New and Emerging Pests and Diseases** (IMNEP) program continued strengthening working partnerships with the Department of Agriculture of Puerto Rico, USDA/ARS and APHIS/PPQ for the surveillance, identification and management of exotic pests and diseases in the Island. At the Juana Diaz substation Disease Clinic, 1224 determinations were made from 408 samples analyzed. Information on the importance of crop disease prevention and insect control was delivered to growers in the different production regions of Puerto Rico. The Black Sigatoka disease severely affected plantain production; total crop output dropped 50% when compared to the previous year. Alternative management practices were evaluated and research results were disseminated in partnership with the Extension Service and cooperating growers. Last year, research geared toward establishing an integrated management program for the Coffee Berry Borer focused on the use of natural enemies for the suppression of this pest. Among the different strategies studied, emphasis was given to the mass rearing of three imported parasitoids and to their field release in selected coffee plantations. In addition, workshops and meetings were conducted with the Seed industry and with citrus growers to deliver relevant information for preventing the spread of the soybean nematode and of citrus greening. Close to 19% of our Hatch funds and 3.2 FTE/SY were dedicated to the IMNEP program.

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 improved cultivars. White-seeded bean lines with resistance to common diseases and pests and with earlier maturity were selected to provide local growers greater flexibility in the harvest of green-shelled beans. Five tropical-type sweet potato genotypes with improved ability to sustain low irrigation regimes were also selected as potential releases. Evaluation of germplasm collections of different crops continues around the island. Research activities on production systems focused on devising alternatives for inorganic fertilizers, given the increase in the price of this input in recent years. Information was also collected from stakeholders on issues of importance to this program such as the presence of Phytophtora fungus on citrus commercial fields with different rootstocks. Lack of quality seed remained one of the major production constraints identified by growers in our yearly meetings with stakeholders. To help palliate this need, the seed production programs established at the Isabela and Lajas substations continued to increase the seed bank of conventional and certified organic seeds. Bean, pigeonpea, corn, squash and tanier seed sales generated the greatest amount of income at Isabela. We believe this increased sale of seeds and seedlings to be an indicator of farmer support and adoption of the improved cultivars developed over the years by our plant breeding programs. In 2012, the PGRBPS

program engaged 11.3 FTE/SY and received 33% of our Hatch funds.

The principal goal of the **Natural Resources and Environment** program is to develop, perform, and support scientific research regarding the impact of agricultural practices on the environment and natural resources. Significant achievements last year include: (1) calibration/validation of remotely sensed solar radiation, which forms the basis of evapotranspiration estimates for Puerto Rico, an important component of computerized programs for scheduling irrigation in the Island; (2) demonstration that application of mature compost enhanced physical, chemical and biological properties of four tropical soils; (3) initiation of a project geared towards establishing the framework for the development of biologically based guidelines for regulating nutrient over-enrichment in rivers of Puerto Rico; and (4) development of activities providing preliminary insights into the role of emerging or invasive insect pest species in Puerto Rico. In addition, agricultural waste disposal and recycling practices have been developed for crops such as coffee and for dairy farms. More than 1,000 tons of coffee pulp have been composted and distributed for its use. Research results have been successfully disseminated mainly through web sites and blogs. Compost procedure and management videos have been posted at projects' websites holding more than 2,000 members. Research to determine the irrigation schedule most suitable for the crop needs on the south coast area also continues. A simplified scheduling technique for Puerto Rico, based on remote sensing data, has been made available at the website: http//pragwater.com/2012/03/29/simple-irrigation-scheduling-tool-for-puerto-rico/. Training on sound water management practices has been given to students, farmers and personnel of the regulatory agencies. PRAES allocated 3.3 FTE/SY and 15% of our Hatch funds to this program during 2012.

The **Agricultural Economics, Marketing, and Community Development** program remains the smallest in our Hatch-funded research portfolio, with only 0.9 FTE/SY supported by formula funds and receiving just 1% of the total allocation. Research efforts last year were largely concentrated in the collection, analysis and dissemination of data from selected commodities of economic or food security importance to the Island. Results from a survey of 633 grain-producing farmers concluded that the small size of their plantings and the lack of a producer organization, hinder their ability to influence government policy and their chances of being considered as a sector with economic growth potential. Moreover, the small size of their individual output also inhibits their access to supermarket chains demanding a continuous supply of produce. Research was also undertaken to improve natural resources and environmental use by farmers and to support the policy-making process by government officials. In collaboration with Extension faculty and agents, results deemed useful to farmers, community organizers, or government officials were disseminated by means of presentations, electronic media, posters and publications.

During 2012 the **Food Safety, Science, Technology and Childhood Obesity** program continued with research efforts towards formulating value added products and improving the shelf-life and security of Puerto Rico's tropical crops. Faculty working on the evaluation and design of an extraction process to obtain essential oils that can be used commercially in the preparation of coffee cordials assessed a distillation process by infusion of gaseous alcohol in the sample of coffee. Tests performed indicated that this method is the most adequate to obtain high quality extracts with uniform intensity and very pleasant aroma. Producers in Puerto Rico need to pay particular attention to post-harvest management and handling practices in order to address food safety issues. Approximately 19 seminars were conducted in food safety areas such as GMP, HACCP, and GAP. In addition, projects were initiated on edible films using starch and preservatives and their application on food to prevent moisture loss and microbial deterioration. The program staff also collaborated with 13 industries requiring help with the improvement and development of new products by aiding them with the chemical analysis of food, nutritional fact analysis, water activity determination and literature search. The FTE/SY devoted to this program in 2012 was 1.2; funds allocated amounted to 2% of Hatch funds. No Childhood Obesity activity was performed or proposed last year.

The **Renewable Energy Alternatives for Small Islands program** was created in our 2011 POW in response to NIFA's request to include a Sustainable Energy goal among our local programs. Although no Hatch funds were allocated last year to this program we have opted to keep it in our POW with the expectation that formula funded projects can be initiated in the near 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. Only a few projects were, nevertheless, active last year. Their achievements include: (1) the collection of raw data on the energy consumption of equipment in 100 dairy milking parlors, a first step in the techno-economical viability study of installing photovoltaic cells as an energy alternative for dairy operations; (2) the design of a biodigestor with the capacity to handle the waste load of 282 pigs; and (3) the making of project presentations to government agency representatives, extension and research faculty, and students.

Hatch funding supported 35% of our scientists and professionals FTEs in 2012, providing an important leverage for attracting much needed additional funding to our programs. Within our continuing budget constraints an effort was made to redistribute part of these core 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: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	56.4	0.0
Actual	0.0	0.0	67.2	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.

Two types of meetings are held in Puerto Rico to identify critical issues that should be addressed by PRAES research programs. Stakeholder input is also considered during the establishment of research priorities.

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
- Other (consultations with local extension agents, commodity leaders, and project 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.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Other (Written evaluations)

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

As has been already pointed out in the executive summary above, the most important continuing concerns of stakeholders participating in commodity meetings and in other activities 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. In response to these concerns PRAES 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, 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 have also begun on other alternative fertilization methods which can potentially increase output while controlling costs. Stakeholders have also provided recommendations on how to improve the ways in which we traditionally share information with them.

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	4349143	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4248537	0
Actual Matching	0	0	2910068	0
Actual All Other	0	0	53873	0
Total Actual Expended	0	0	7212478	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	599974	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	Childhood Obesity
8	Sustainable Energy - Renewable Energy Alternatives for Small Islands

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			5%	
205	Plant Management Systems			15%	
301	Reproductive Performance of Animals			10%	
302	Nutrient Utilization in Animals			15%	
303	Genetic Improvement of Animals			15%	
305	Animal Physiological Processes			5%	
306	Environmental Stress in Animals			5%	
308	Improved Animal Products (Before Harvest)			10%	
311	Animal Diseases			5%	
313	Internal Parasites in Animals			10%	
601	Economics of Agricultural Production and Farm Management			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.5	0.0
Actual Paid Professional	0.0	0.0	3.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	1443844	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	736188	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	53873	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The institutional work groups in forages and small ruminants (two groups that were practically inseparable) and in beef production and meat quality, showed a high level of productivity in conducting and publishing research and maintaining close contact with stakeholders, whereas the dairy cattle group gradually gained momentum, the swine group was less active and the poultry industry received very little attention. Researchers of these groups gave 20 presentations of research results at meetings of scientific societies in Puerto Rico and abroad. The list of recommended management practices (RMP) based on research results continued to expand, especially with regard to production and utilization of highly nutritious forages and improved quality of locally produced beef. Field day activity to demonstrate RMP was less than desirable due in part to termination of funding for the UCAR programs of the Commonwealth Government. However, local producers planted on their farms considerable areas of recommended forages. Economic studies on beef cattle operations in Puerto Rico were provided as requested by government officials and producers' associations. Three new proposals for research projects with dairy cattle were submitted dealing with: (1) artificial insemination technology, (2) genetic improvement of animals for thermal stress tolerance, and (3) control of subclinical mastitis.

2. Brief description of the target audience

(1)Commercial-scale producers of the following types of livestock and related products: bovine milk and replacement dairy cattle, beef cattle, sheep and goats, swine, rabbits, poultry for meat and eggs, and forages for sale.
(2)Specialists and County Agents of the Agricultural Extension Service of UPR.
(3) Professional personnel of the Puerto Rican Department of Agriculture and of the USDA.
(4) Policy makers in the Commonwealth and Federal Governments.
(5) Personnel of the Farm Credit Service and other financial institutions that make loans to livestock producers.
(6) Professionals engaged in private enterprises such as consulting services.
(7) Faculty members and university graduate and undergraduate students.
(8) High school students of vocational agriculture.
(9) Interested members from the general public.
(10) Foreign colleagues and visitors with related interests.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	14	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
2012	7

Output #2

Output Measure

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

Year	Actual
2012	1

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
2012	1

Output #4

Output Measure

- Number of publications in refereed scientific journals.

Year	Actual
2012	14

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants 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 participants 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
2012	12

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
An educational effort has been carried out.

Results
25 participants gained knowledge about innovative RMP and 12 of them are candidates for early adoption on their farms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
313	Internal Parasites 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As for dairy production, the most important farm enterprise in Puerto Rico, the long-used escape valve of paying higher per unit prices to milk producers and passing the increased cost to consumers has nearly reached its possible limit, thus the challenge facing the dairy industry is obvious. Other livestock industries face the challenge posed by lower priced imports.

What has been done
Research and extension efforts on BMP for dairy and livestock producers continue, emphasizing on strategies that could reduce production costs and differentiate our product from the imported one on the basis of quality.

Results
Data availability from the Statistics Section of the Commonwealth Department of Agriculture is behind schedule. The latest two fiscal years for which final data on items included under this Program Area can be compared are 2010 and 2011. The overall year to year increase in monetary terms was equivalent to a relative increase of 10.4%. Almost all of this increase is represented by higher gross returns from the sale of milk and broilers, whereas the increases and decreases registered for other types of meat, eggs, replacement dairy heifers, change in value of animal inventories and commercial forages, essentially cancel one another. In the case of dairy, all of the increased income from milk resulted from a higher price per unit sold by producers, whereas the volume of product decreased.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals

303	Genetic Improvement of Animals
306	Environmental Stress in Animals
601	Economics of Agricultural Production and Farm Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Other (Loss of agricultural lands, Food)

Brief Explanation

Natural disasters did not occur in 2012, but the economic climate with which the local livestock industries had to deal continued to worsen during the year.

Appropriations- although the budget situation of the institution was very tight in 2012, there were improvements to certain physical facilities, notably those of the Lajas dairy; also several recent PHD recipients were incorporated into the faculty of the Animal Industry Department.

Other- The loss of a considerable part of the land comprising the Gurabo Substation, including pasture areas, to non-agricultural uses, was narrowly avoided. New research efforts were, nevertheless, halted until the conflict was resolved. Political pressure was also evident regarding efforts to intervene in lands belonging to Finca La Montaña in ways incompatible with the present pattern of use. As for the private lands, Puerto Rico is badly in need of an island-wide Land Use Plan designed to save the remaining areas suitable for agriculture.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A formal program evaluation is being scheduled for the Fall of 2013. The results available from the evaluation of activities performed last year show, as portrayed in our outcomes section, that 48% of participants in these trainings were willing to adopt the recommended management practices in their farms.

Key Items of Evaluation

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			21%	
212	Pathogens and Nematodes Affecting Plants			30%	
215	Biological Control of Pests Affecting Plants			21%	
216	Integrated Pest Management Systems			28%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	14.1	0.0
Actual Paid Professional	0.0	0.0	3.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	847010	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	502882	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 primary food security constraints in Puerto Rico are new and emergent plant diseases added to changes in rain patterns that result in excess moisture or drought affecting agricultural production. In the Yabucoa Valley, Black Sigatoka severely affected plantains because of favorable environmental conditions for the disease. Plantain production in the Island dropped 50% compared to last year. Alternative management practices were evaluated and research results were disseminated in partnership with the Extension Service and the growers. Field trials with Musa acuminata, AAA, 'Grand Nain' studied the effect of fungicides and cultural practices, such as mechanical de-leafing and de-sucking, on Black Sigatoka.The IR-4 project activities strengthened the evaluation and registration of new pesticides to control plantain diseases. The benefit of rotations with Mucuna deringiana, the use of organic matter, and sanitary measures were evaluated for the management of plant-parasitic nematodes on plantain.

Different strategies were used to fight against the coffee berry borer. This year the PRAES focused on the awareness of coffee farmers regarding the negative impact of insecticides for controlling the coffee berry borer (CBB), in order to promote the use of natural enemies for suppression of this pest. Research with Bacillus thuringiensis and B. pumilus as potential biocontrols for CBB continued for the third year. Modification of the conventional agronomic practices in sunlit and/or shaded-grown coffee to promote the development of Beauveria bassiana in the CBB is promising; this study was complemented with the evaluation of coffee grown under different percentage shades.

PRAES continued with the identification of the causal agents of new and emerging diseases affecting important agricultural crops. At the Disease Clinic, 1224 determinations were made from 408 samples analyzed. Immuno-molecular tests were conducted for the detection of Phakopsora pachyrhizi, Pseudomonas syringae pv. syringae, Sclerospora graminicola, Cochliobolus ravanelii, Pantoea stewartii, and Wheat Streak Mosaic Virus. Only P. pachyrhizi was identified in soybeans. A new viral disease in tomatoes caused by a Tospovirus was recently detected in the southern coast of Puerto Rico; the implementation of vector control strategies to avoid its dissemination to other hosts will be a priority. Capacity building for disease detection was accomplished by developing protocols for the detection of citrus diseases in nurseries to ensure the availability of disease-free material in the Island. New initiatives using fertilization and vector control practices recommended elsewhere will be validated in the southern coastal area of the Island. The characterization of Squash Vein Yellowing Virus (SqVYV) affecting other cucurbits and weeds will continue. Advances in the studies of powdery mildews will be published, whereas the database build up was concluded. PRAES continued working with the Department of Agriculture of P.R., USDA/ARS and APHIS/PPQ in the surveillance and identification of exotic pests and diseases in Puerto Rico.

2. Brief description of the target audience

- •Extension Specialists and Agents;
- •Academic Programs Faculty and Students;
- •Producers and Commodity Groups;
- •Consumers;
- •Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS); and
- •Managers of private agricultural companies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	21	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Actual
2012	2

Output #2

Output Measure

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

Year	Actual
2012	4

Output #3

Output Measure

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

Year	Actual
2012	17

Output #4

Output Measure

- Abstracts or oral presentations in professional scientific society meetings resulting from program activities.

Year	Actual
2012	26

Output #5

Output Measure

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

Year	Actual
2012	27

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
2012	2

Output #7

Output Measure

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

Year	Actual
2012	4

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
2012	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New key pests, weeds, and diseases are introduced each year into the Island, threatening the integrity of its agricultural economy and fragile ecosystem. Growers need up-to-date information on the best management strategies to control emerging pests and diseases.

What has been done
Efforts to deliver information on the importance of crop disease prevention and insect control were aimed at growers in the different production regions of the Island. In the southern vegetable production area the information was delivered during field visits to growers in response to disease outbreaks. The use of calendar insecticide applications in vegetables has been discouraged as a result of emerging viral diseases in tomatoes and cucurbits. Meetings have also taken place with government officials concerned with the management of emergent diseases.

Results
Two workshops were organized targeting APHIS/PPQ personnel and the Seed Industry to prevent the dissemination of the soybean nematode present in the northwestern area of the island. Two meetings with 100 growers from the Citrus Industry in Puerto Rico delivered information about management of citrus orchards and nurseries for the control of citrus greening. Meetings have also taken place between PRAES researchers, administrators and Department of Agriculture officials, and an agreement has been reached to lead production efforts of disease-free planting materials and to help in the inspection of citrus-producing nurseries compliance with recommendations.

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
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Coffee farmers are aware of the negative impact that using insecticides for the control of the Coffee Berry Borer (CBB) can have. PRAES researchers are devising more economical and environment-friendly biological control methods for this and other pests.

What has been done
We have been researching and promoting the use of natural enemies for the suppression of the CBB in combination with other control measures for an integrated pest management program.

Results
The impact of the biocontrol measures was estimated as the reduction of losses at the farm level, from 20% ($4.4 million) to 12% ($2.6 million). Therefore, the estimated dollar value of the implementation of the practices is $1.8 million. We expect these practices to result in a reduction of insecticide use, thus protecting the environment, enhancing economic opportunities, and providing for the sustainable well-being of the people in the coffee production areas of Puerto Rico.

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
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Hydroponic vegetable production is an emerging trend in the island as farmers search for crops and production systems that can command premium prices at the market. Recent outbreaks of diseases affecting hydroponic cilantro and lettuce growers undermine the stability of this nascent industry.

What has been done
Growers received recommendations for the prevention of these outbreaks when visiting the Plant Disease Clinic at the Fortuna-Juana Diaz substation.

Results
Growers of cilantro and lettuce under hydroponic systems have reported decreased losses as a result of using practices that prevent outbreaks of Pythium and Phytophthora diseases in cilantro, and Cercospora leaf spot in lettuce.

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

- Appropriations changes
- Other (Reduction of PRAES personnel)

Brief Explanation

The decrease in research funds has impacted the number of projects for IPM at the PRAES.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations will be conducted during the annual meeting with the vegetable producers to be held by the end of April. During this meeting a survey will be delivered to the growers to determine the impact of the research in vegetables and cucurbits on disease and pest management.

Key Items of Evaluation

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			12%	
202	Plant Genetic Resources			30%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			20%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			33%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	17.0	0.0
Actual Paid Professional	0.0	0.0	11.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	1200786	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1174175	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

Last year work continued on the selection and purification of germplasm of traditional crops and on the development of improved cultivars. White-seeded bean lines with resistance to BGYMV, BCMNV and bruchids were selected at the Isabela Substation. We also selected white-seeded lines with BGYMV and BCMNV resistance and earlier maturity. These lines will provide local growers with greater flexibility in the harvest of green-shelled beans.

Evaluation of germplasm collections of different crops also continues around the island. Citrus germplasm collections are being maintained in screenhouses at Isabela and Rio Piedras. Rootstock evaluation of 'Tahiti' lime at Corozal and Isabela is in its third year of harvest. At both localities, rough lemon is the highest yielding rootstock. New citrus rootstocks will soon be released. Regarding our musa gene bank, the FHIA 21 plantain hybrid shows a higher tolerance to the Black Sigatoka disease compared with the Maricongo clone, when the disease is not chemically managed. In root crops, five tropical-type genotypes of sweet potato, previously imported from the Sweet Potato Clonal Repository of the USDA, have been selected as potential releases. This group has improved ability to sustain low irrigation regimes.

Lack of quality seed continues to be one of the major production constraints identified by growers in our yearly meetings with stakeholders. To help palliate this need, the seed production programs established at the Isabela and Lajas substations continue to increase the seed bank. At Isabela, seed sales generated $70,000 in gross income; the economic benefits to farmers far exceded this amount. Production of certified organic seed of adapted crop varieties at the Lajas substation makes an important contribution to the development of an organic agriculture industry in Puerto Rico. Since its inception three years ago, over 15,000 packages of organic seeds have been distributed to growers, homeowners, gardeners and nonprofit organizations throughout the Island.

Research activities on production systems focused on devising alternatives to inorganic fertilizers, given the increase in the price of this input in recent years. Accordingly, studies continued on the evaluation of controlled release fertilizers on plantain; on the liming of acid soils as an approach to increase fertility; on evaluating non-conventional fertilization systems for citrus and pineapple; and on the efficacy of slow and controlled release nitrogen and potassium fertilizer in coffee production.

Collection of information from stakeholders on issues of importance to this program was also an ongoing activity. A survey for the detection of Phytophthora fungus was conducted on citrus commercial fields with different rootstocks on the San Sebastián area, and in experimental plantings at UPR's substations. Program participants continued making the results and accomplishments of their activities available to the research community and to the public at large through field days, scientific journal publications, web-based publications, participation in conferences, and through radio programs.

2. Brief description of the target audience

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

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	16	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

- Focus groups of collaborators' opinion of the new technologies being validated
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

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

Year	Actual

2012	6000

Output #4

Output Measure

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

Year	Actual
2012	1951

Output #5

Output Measure

- Number of participants in the field days coordinated with Extension

Year	Actual
2012	388

Output #6

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 #7

Output Measure

- Number of refereed publications.

Year	Actual
2012	16

Output #8

Output Measure

- Number of non-refereed publications.

Year	Actual
2012	14

Output #9

Output Measure

- Number of presentations in scientific meetings.

Year	Actual

2012	26

Output #10

Output Measure

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

Year	Actual
2012	8

Output #11

Output Measure

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

Year	Actual
2012	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.

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
2012	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers in Puerto Rico need to increase yield and reduce production costs in order to be able to compete in a global economy. In addition to greater efficiency and profitability, more sustainable agricultural practices need to be developed to take advantage of natural services and to minimize negative impact on the environment.

What has been done
Printed copies of technology packages for different crops are distributed to farmers. Electronic versions and organic fact sheets are available on the internet. BMPs are also discussed at field days and workshops sponsored by the PRAES and the Extension Service. Improved cultivars are an important component of BMPs. Seed of these improved cultivars are produced by the PRAES. Organic demonstrative gardens and field plots have been established at two substations.

Results
The PRAES seed program offers for sale seeds and seedlings of improved cultivars that are adapted to local conditions. PRAES provides vital support for the continued production of traditional crops because seed is not usually available from the private sector in Puerto Rico. The number of stakeholders, especially farmers, attending activities sponsored by the PRAES has continued to increase, which suggests an increased willingness of producers 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
2012	1951

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers frequently comment that a lack of high quality seed and propagation material limits the acreage and production of food crops.

What has been done
The PRAES seed programs offered for sale seeds and sets of varieties adapted to local conditions and management systems.

Results
The sale of seeds and seedlings of improved cultivars remained strong during 2012. We believe this is an indicator of farmer support and adoption of improved cultivars developed by the PRAES plant breeding programs. Recorded statistics improved markedly after a digital database was established to monitor the sale of seed at the Isabela substation.

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.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Factors affecting our performance showed little change from those portrayed in past reports. The prolonged economic recession affecting Puerto Rico and the strategies adopted by the government to handle it have resulted in falling appropriations for the state university and concomitant reductions in the local funds available for research. The price of fertilizers and other inputs also remained high, directly affecting the profitability of crop production and farmers capacity to incorporate more of the recommended practices into their operations.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation results are yet available for this program.

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%	
212	Pathogens and Nematodes Affecting Plants			2%	
403	Waste Disposal, Recycling, and Reuse			7%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.5	0.0
Actual Paid Professional	0.0	0.0	3.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	646629	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	423164	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

Current research efforts conducted by faculty, staff, and students from the College of Agricultural Sciences University of Puerto Rico, Mayagüez Campus on this programmatic area are: (1) the development of pollution prevention and mitigation practices for soil and watershed protection and management, including the behavior and fate of pesticides and other pollutants (agricultural residues) in soil and water, and the use of biological indicators to assess watershed nutritional status; (2) the development of soil improvement and maintenance practices; (3) the development and promotion of sustainable agricultural practices; and (4) biological diversity research (particularly the effects of non-native species on biodiversity, on management approaches for conserving and restoring biodiversity, and on the impact of agricultural management practices on natural ecosystems). Significant achievements last year include: (1) calibration/validation of remotely sensed solar radiation, which forms the basis of evapotranspiration estimates for Puerto Rico--an important component of computerized programs for scheduling irrigation in the Island; (2) demonstration that application of mature compost enhanced physical, chemical and biological properties of four tropical soils; (3) initiation of a project geared towards establishing the framework for the development of biologically based guidelines for regulating nutrient over-enrichment in rivers of Puerto Rico; and (4) development of activities providing preliminary insights into the role of emerging or invasive insect pest species in Puerto Rico--for example, the presence of six previously unreported moth species was ascertained.

Outreach/Education

This research program has for many years played a distinctive and integral role in educational outreach activities sponsored by the College of Agricultural Sciences. Research initiatives and results were disseminated last year through: (1) publication of research results in bulletins, newspaper articles, and popular magazines for farmers, and in refereed journals for scientists; (2) development of educational materials for stakeholders interested in the management and preservation of natural resources and agricultural sustainability; (3) seminars, farm/field day visits, workshops, conferences, websites, and exhibitions. Program participants remained committed to the search for more appropriate methods to reach our target audiences, and to the development of strategies and programs to increase community involvement.

2. Brief description of the target audience

Extension specialists and professionals, graduate and undergraduate students, government partners, producers, consumers, environmental groups 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

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	11	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
2012	47

Output #2

Output Measure

- Number of Peer Reviewed publications.

Year	Actual
2012	11

Output #3

Output Measure

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

Year	Actual
2012	51

Output #4

Output Measure

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

Year	Actual
2012	3

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 watersheds for which Total Maximum Daily Load (TMDL) for nutrients have been developed.
8	Number of stakeholders gaining knowledge on organic agricultural practices.
9	Number of persons gaining knowledge effects of non-native species on biodiversity.
10	Number of stakeholders gaining knowledge on pollution prevention and mitigation practices for soil and watershed protection and management
11	Number of persons adopting practices for watershed protection
12	Number of stakeholders gaining knowledge of efficient water use and water conservation practices
13	Number of stakeholders gaining knowledge on managing approaches for conserving and restoring biodiversity and on the impact of agricultural management practices on natural ecosystems
14	Number of stakeholders gaining knowledge on invasive species management practices
15	Number of persons gaining knowledge on biodiversity threats and losses, and on prevention practices

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

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Number of farmers adopting microirrigation management practices

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

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
2012	3000

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

Issue (Who cares and Why)
The need for better methods for agricultural waste disposal and management as an opportunity to increase soil organic matter content.

What has been done
Several multidisciplinary research studies have been performed in order to develop better waste disposal and increase soil organic matter content.

Results
Agricultural waste disposal and recycling practices have been developed for crops such as coffee and for dairy farms. More than 1,000 tons of coffee pulp have been composted and distributed for its use. Research results have been successfully disseminated mainly through web sites and blogs. Compost procedure and management videos have been posted at the website holding more than 2,000 members.

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 #5

1. Outcome Measures

Number of farmers reporting increased water use efficiency in their farms

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of farmers that adopted practices to improve water resources.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of watersheds for which Total Maximum Daily Load (TMDL) for nutrients have been developed.

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Number of stakeholders gaining knowledge on organic agricultural practices.

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Number of stakeholders gaining knowledge on pollution prevention and mitigation practices for soil and watershed protection and management

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	305

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
USEPA mandate to develop quantitative thresholds of impairment of nutrient for watershed and reservoirs. The target audiences of this project are the local regulatory agencies in charge of water quality protection such as the Environmental Quality Board and the Department of Natural and Environmental Resources.

What has been done
In order to define a biological index for nutrient impairment conditions in rivers and streams of Puerto Rico a research project was developed to assess the use of benthic algae as a biological indicator of nutrient over-enrichment watersheds.

Results
The assessment of biological indicators of stressor conditions is a key component for the development and implementation of regulatory thresholds or standards for the control of impairment of nutrients conditions in rivers and streams of Puerto Rico. Seven seminars and two workshops were presented to different audiences (e.g., scientists, students, farmers and personnel of regulatory agencies); the mean number of attendance was 34.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #11

1. Outcome Measures

Number of persons adopting practices for watershed protection

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
USEPA mandate to develop quantitative thresholds of impairment of nutrient for watershed and reservoirs. The target audiences of this project are the local regulatory agencies in charge of water quality protection such as the Environmental Quality Board and the Department of Natural and Environmental Resources.

What has been done
Trainings, workshops and research demonstrations have been performed, all of which have reached a wide variety of audiences. The expectation is that attendees will be adopting the conservationist practices learned.

Results

The determination of the current nutrient status of rivers in Puerto Rico is a key element to develop water quality guidelines for the establishment of sound pollution prevention and management practices for watershed protection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #12

1. Outcome Measures

Number of stakeholders gaining knowledge of efficient water use and water conservation practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	25000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To remain competitive, farmers need to reduce production costs and increase the output of their farms. The adoption of microirrigation systems by farmers in the south coast of Puerto Rico, where drip irrigation is already popular, can contribute to these goals.

What has been done
Research to determine the irrigation schedule most suitable for the crop needs on the south coast area.

Results
A simplified scheduling technique for Puerto Rico, based on remote sensing data, has been made available at the website: http//pragwater.com/2012/03/29/simple-irrigation-scheduling-tool-for-puerto-rico/. Since its establishment the website has been visited by more than 25,000 users around the world and currently holds approximately 400 followers. Training on sound water management practices has been given to students, farmers and personnel of the regulatory agencies. Research results have been successfully disseminated mainly through web sites and blogs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water

Outcome #13

1. Outcome Measures

Number of stakeholders gaining knowledge on managing approaches for conserving and restoring biodiversity and on the impact of agricultural management practices on natural ecosystems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need for better management approaches for conserving and restoring biodiversity, and the impact of agricultural management practices on natural ecosystems.

What has been done
Several multidisciplinary research studies have been performed in order to assess the impact of agricultural management practices on natural ecosystems. Mitigation practices to enforce conserving and restoring biodiversity have been developed.

Results
Research results have been successfully disseminated mainly through web sites, blogs, seminars, workshops and fact sheets. Trainings, workshops and research demonstrations have been performed, all of which have reached a wide variety of audiences. The expectation is that attendees have been adopting the conservationist practices learned.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Number of stakeholders gaining knowledge on invasive species management practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impact of native or non-native invasive species poses a serious challenge that requires a decision-making framework based on the prioritization of species for their control, as well as regulatory and public education programs.

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. Invasive species management practices and methods have been evaluated.

Results
Research results have been successfully disseminated mainly through web sites, blogs, seminars, workshops and fact sheets. Trainings, workshops and research demonstration have been performed, all of which have reached a wide variety of audiences. The expectation is that attendees have been gaining knowledge about the impact and management of the invasive species.

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

Outcome #15

1. Outcome Measures

Number of persons gaining knowledge on biodiversity threats and losses, and on prevention practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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
212	Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Budget reductions at the university and increases in the cost of higher education for students, may affect the number of scientists and graduate students working under this program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No evaluation resuts are yet available. We will be implementing part of our evaluation plan this year, as described in last year's Plan of Work update.

Key Items of Evaluation

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			20%	
604	Marketing and Distribution Practices			20%	
605	Natural Resource and Environmental Economics			15%	
606	International Trade and Development			10%	
607	Consumer Economics			15%	
608	Community Resource Planning and Development			10%	
610	Domestic Policy Analysis			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual Paid Professional	0.0	0.0	0.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	38254	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	34464	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. Results from a survey of 633 grain-producing farmers concluded that the small size of their plantings and the lack of a producer organization, hinder their ability to influence government policy and their chances of being considered as a sector with economic growth potential. Moreover, the small size of their individual output also inhibits their access to supermarket chains demanding a continuous supply of produce.

Studies were also 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 resources and environmental use by farmers and to support policy-making processes by government officials in order to achieve greater economic and material sustainability. Analysis of a national online survey of natural resources and environment policy issues and education needs among land grant faculty showed that water related issues were the most mentioned by respondents. Energy issues followed and were more prominent in the South. Climate change and farm and food issues were next in importance. Results suggest that while the identification of issues and expertise available in the land grant system is perhaps the initial step towards constructing a new network of collaborators, to be effective in the future, much more deliberation on the approaches and skills needed to succeed in the education process will have to take place.

In collaboration with Extension faculty and agents, results relevant to farmers and community organizers were translated into practical recommendations.

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

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of refereed publications

Year	Actual
2012	4

Output #2

Output Measure

- Number of presentations in scientific meetings

Year	Actual

2012	9

Output #3

Output Measure

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

Year	Actual
2012	18

Output #4

Output Measure

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

Year	Actual
2012	135

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge about new production management or marketing tools (medium-term measure)
2	Number of stakeholders gaining knowledge about public policy issues relevant to local agriculture and natural resources.

Outcome #1

1. Outcome Measures

Number of stakeholders gaining knowledge about new production management or marketing tools (medium-term measure)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	400

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
607	Consumer Economics
608	Community Resource Planning and Development

Outcome #2

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
2012	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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Other (Limited number of faculty conducting research and extension in this program)

Brief Explanation

The prolonged economic crisis of the island, budget cuts at the university, and the university-wide freezing of faculty positions continue to hamper our efforts to expand research and outreach activities, and to evaluate the impact of our programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation results are yet available for this program.

Key Items of Evaluation

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			10%	
502	New and Improved Food Products			15%	
503	Quality Maintenance in Storing and Marketing Food Products			20%	
701	Nutrient Composition of Food			40%	
702	Requirements and Function of Nutrients and Other Food Components			15%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.5	0.0
Actual Paid Professional	0.0	0.0	1.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	72014	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	39195	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.

This past year faculty working on the evaluation and design of an extraction process to obtain essential oils that can be used commercially in the preparation of coffee cordials assessed a distillation process by infusion of gaseous alcohol in the sample of coffee. Tests performed indicated that this method is the most adequate to obtain high quality extracts with uniform intensity and very pleasant aroma. A seminar was also offered on the "Chemical characterization of Puerto Rican coffee" and was attended by approximately 40 people. In an effort to help the food industry in the improvement and development of new products, we collaborated with 13 industries that contacted us requiring assistance. Collaboration with the industry included chemical analysis of food, nutritional fact analysis, water activity determination and literature search. A research on nutrient composition of food was conducted in three non-traditional fruits from Puerto Rico for their potential use as nutraceutical ingredients. A project was also initiated on edible films and their application on food to prevent moisture loss and microbial deterioration. Educational programs were conducted in food safety and related topics and approximately 360 people attended the seminars. Four Master's Degree theses were published related to new product development and one on development of edible films.

2. Brief description of the target audience

- Academic Programs Faculty
- Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS).
- Food Industry representatives

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	2	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
2012	19

Output #2

Output Measure

- Number of projects or industry collaboration agreements established

Year	Actual
2012	13

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 focusing on definition of quality parameters, including chemical properties, safety and nutritional value

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
2012	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Puerto Rico, the food industry is among the top growth industries that could lead the island out of its economic crisis. Total food sales represent about 25% of the island's $35 billion annual retail sales and 15% of local consumer expenditure. The island produces only 15-20% of the food it consumes; nevertheless food products must be safe for human consumption. It is important for food producers to understand and implement food safety practices. Literature reports improper postharvest practices as a main contributor to product losses and quality deterioration. Puerto Rico producers must pay particular attention to post-harvest management and handling practices in order to seriously address food security issues.

What has been done
Chemical composition of 16 food products was determined by chemical analysis. In addition, nutritional fact information was developed for 20 new products. As part of the agreement between the Food Science and Technology Program and the Puerto Rico Industry Development Corporation (PRIDCO), some food industries requested our services. Approximately 19 seminars were conducted in food safety areas such as GMP, HACCP, and GAP. Projects were initiated on edible films using starch and preservatives and their application on food to prevent moisture loss and microbial deterioration

Results
Twenty food industries received technical support and most of them obtained the Health Department license for food production. Approximately 360 food industry employees (food processors and farmers) were trained in food safety. Projects 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
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
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
2012	4

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

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of projects focusing on definition of quality parameters, including chemical properties, safety and nutritional value

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
503	Quality Maintenance in Storing and Marketing Food Products
701	Nutrient Composition of Food

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- 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, as the recession prevails, the amount of funding available for investing in research or in new ventures will be limited.

Faculty working on the program are members of other academic departments; therefore, they need to address other issues as their respective programs so require. Thus, we have a pool of researchers who are constantly entering and leaving the program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation results are yet available for this program.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

At present we have no projects dealing with childhood obesity in our roster. Any activity related to this area will be reported under the Food Safety, Science, Technology and Childhood Obesity program.

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: 2012	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

2. Brief description of the target audience

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	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}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Sustainable Energy - Renewable Energy Alternatives for Small Islands

☑ 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
402	Engineering Systems and Equipment			50%	
403	Waste Disposal, Recycling, and Reuse			50%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.8	0.0
Actual Paid Professional	0.0	0.0	0.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
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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0cm; }

Only a few projects were active in this program last year. Their achievements include:

· Raw data was collected on the energy consumption of equipment in 100 dairy milking parlors, a first step in the techno-economical viability study of installing photovoltaic cells as an energy alternative for dairy operations
· A biodigestor was designed with the capacity to handle the waste load of 282 pigs
· Project presentations were made to government agency representatives, extension and research faculty, and students.

2. Brief description of the target audience

p.MsoNormal, li.MsoNormal, div.MsoNormal { margin: 0cm 0cm 0.0001pt; font-size: 10pt; font-family: "Times New Roman"; }div.Section1 { page: Section1; }
(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.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	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
2012	3

Output #2

Output Measure

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

Year	Actual
2012	1

Output #3

Output Measure

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

Year	Actual
2012	0

Output #4

Output Measure

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

Year	Actual
2012	2

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
2012	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
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
2012	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
2012	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Other (Program is still in its initial years)

Brief Explanation

This program has only been in existence during the last two years. Only a few projects are active in this area and the time commitment of researchers to them is relatively small. Perhaps in the future this type of research activities will be included under our Natural Resources and Environment program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation results are yet available for this program.

Key Items of Evaluation