2008 University of Puerto Rico Research Plan of Work

I. Plan Overview

1. Brief Summary about Plan Of Work

PLAN OVERVIEW

The University of Puerto Rico Agricultural Experiment Station (AES) mission 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, public and private institutions, and for rural development. The AES coordinates its academic activities with the teaching and extension faculty of the CAS, and incorporates into its research program faculty of these other two institutional branches. Although for this Plan of Work (POW) cycle, the AES and the Puerto Rico Agricultural Extension Service have opted to continue with separate submissions, all of our planned programs incorporate the collaboration of Extension faculty in the activities proposed to disseminate results, and many also extend this collaboration to other key aspects of the research process.

The AES 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 AES 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. In addition, to advance regional goals, the AES participates in both multistate research and Special Grants from USDA-CSREES that target agriculture in the Caribbean Basin of the United States.

This POW receives input from stakeholders during yearly meetings of commodity groups and during workshops and field days. This input helps to identify major constraints to agricultural production and establish priorities that should be targeted by our research programs. We continue to conduct these annual meetings in which the progress of projects is discussed, preliminary results are shared, and further input is sought for updating the commodity's research needs and priorities. All of our project proposals, formula funded or otherwise, go through a thorough merit review process following the Administrative Manual for the Hatch (Experiment Station) Act as Amended. In 2005, however, we changed the way in which our Hatch-funded research proposals are initially granted. In response to internal and external evaluations requesting that a portion of Hatch funds be allocated to projects on the basis of an annual call for proposals with the year's revised priorities, part of our formula-funded research is now locally competitively granted.
In contrast with most mainland states, in Puerto Rico the links between agricultural production and food consumption were gradually weakened during the second half of the 20th century. As agriculture lagged behind the growth of other economic sectors such as manufacturing, service and government, the expanded consumption of the population was gradually supplied by imports, distributed mostly through large supermarket chains. By 2004 the agricultural sector's contribution to the Gross Domestic Product (GDP) was less than 1%, even though there have been increased investments by the government in the sector during the last five years.
Overall figures, however, do little to convey the continued vital role played by farming in the economy of Puerto Rico in terms of fostering demand for other final and intermediate goods, creating employment in areas where alternative opportunities do not abound, supplying produce for domestic consumption and local processing plants, and preserving the island's natural resources from alternative urban uses--potentially more damaging to a fragile tropical-island ecosystem. The University of Puerto Rico College of Agricultural Sciences, through its research and education programs, has been an important contributor to the development of enterprises that have had a positive impact on the island's economy. Through technologies that improve and promote diversified agricultural production systems, the CAS has also helped halt the decline of traditional agricultural systems. Current trends in global markets and the challenges they pose to the continued viability of food and agroindustrial operations in Puerto Rico, underline even more the role that a responsive research program can play in the search for alternatives to the needs of stakeholders. Although the North American (NAFTA) and Central American-Dominican Republic Free Trade Agreements (CAFTA-DR) have up to now exempted Puerto Rico from its market pricing policies, it is unclear whether these exemptions will expire in the near future, and how they will affect our agricultural sector, particularly coffee, which has enjoyed a protected status since the 1930s. Moreover, changing market forces, such as the consolidation of wholesale and retail distributors coupled with technological innovations and changing consumer behavior, have dramatically transformed in less than a decade the way in which food business is conducted on the island and the market share of local agriculture in the total food trade. To maintain and regain part of agriculture's competitive position, research must be directed to the analysis and managed solution of problems stalling production, and to the search of alternative uses and markets for our products. In the long term, the goal of our natural and social

science research program is to contribute to Puerto Rico's sustained growth and development through technological and policy recommendations that can potentially increase competitive production, and raise the employment level of the population.

PLANNED PROGRAMS:

1) Milk and Meat Production Systems

The dairy industry has been the main agricultural enterprise of Puerto Rico for more than 20 years. During that period, however, beef production has been steadily declining and poultry production—the leader in the meat category—has suffered marked fluctuations due to hurricane damage, financial difficulties and restructuring of processing facilities. According to Department of Agriculture statistics, income from the production of milk (23%) and meat (19%) represents 42% of the 2004-05 Gross Agricultural Income. Of all the meat consumed in Puerto Rico, we produce only 23.3% locally, thus leaving an ample margin for an expanded market for local products. Both milk and meat productions are limited by a lack of efficiency and production quality.

The AES research program in Milk and Meat Production Systems has a wider scope--in terms of commodities and problem areas--than that targeted by our federally-funded research projects. Formula funded research is concentrated in the dairy industry, including forage production systems, and to a lesser degree, in beef cattle. Given our current research and extension resources, the following three priorities summarize what we expect to be the main foci of our program during the next years: (1) Evaluation of feeding systems under tropical conditions for increasing feed efficiency for more milk and meat production; (2) Development and evaluation of management practices for reducing the effect of environmental stress on productivity and reproductive efficiency under tropical conditions; and (3) Development and evaluation of new milk and meat products elaborated with local produce. Our efforts will be geared towards regaining the market lost in the last decade and reducing the amount of imports of these products in our local market.

2) Integrated Management of New and Emerging Pests

One of the areas identified as most problematic by our stakeholders is the introduction of new pests and diseases into the Island. New key pests, weeds, and diseases are introduced each year, frequently threatening the integrity of the island's fragile agricultural economy. In addition, constantly evolving production systems pose new challenges to Integrated Pest Management (IPM), as pest complexes change and adapt. In response to these concerns, the federally-funded part of our crop protection program is directed towards the development of integrated management strategies to deal with invasive non-indigenous species, and with emerging pests, weeds, and diseases.

Internal evaluations of CAS research and education programs indicated that after the retirement of key scientific personnel, knowledge of pest identification and taxonomy had been largely abandoned by the Department of Crop Protection, and there was a change of focus into areas of applied pest control. This situation is particularly severe for insect, nematode, virus, bacterial and fungal diseases, where a generation of new identification techniques and resources are sadly underutilized. To address this state of affairs, CAS will work towards the development of pest and disease taxonomic expertise and towards establishing a continuous process of strategic evaluation of IPM priorities in consultation with stakeholders. In addition, the PRAES will continue to fund stakeholder-driven priorities in the areas of pesticide registration, testing of ‘reduced risk’ pesticides, and validation and development of integrated management of pests and diseases.

3) Plant Genetic Resources, Breeding and Production Systems

Plant breeding and production systems research is an essential component of the AES research program. The development of improved varieties and better management practices has contributed to the expanded production of many crops. Recent evaluations confirm that the CAS has the expertise, facilities, germplasm and breeding lines needed for continued development of improved cultivars, and better field management of many traditional crops. In order to address local problems, much of the plant breeding and crop production research conducted in Puerto Rico is distinct from agricultural research conducted on the mainland of the U.S. However, this unique research capability produces plant germplasm and recommended production practices that are of value to producers throughout Central America and the Caribbean.

Germplasm collections of crops of economic importance in Puerto Rico are needed to provide material for propagation for commercial production. New germplasm must be evaluated to identify accessions with traits of economic value. Stakeholders have repeatedly pointed out that the lack of seed availability is an important factor limiting the production of many traditional crops. Plant breeders strive to develop improved varieties with local adaptation, improved disease or pest resistance and tolerance to abiotic stress such as acid soils or low soil fertility. Genetic improvement needs to be complemented with the improved efficiency of production systems that include both traditional and new crops.
Building upon our strengths, we plan to continue with the introduction of adapted germplasm that can be used to address certain production constraints, and develop new cultivars of crops which can increase yield or reduce production costs in local farming systems. Research geared towards the development of best management practices (BMPs) for traditional and non-traditional crops in Puerto Rico will also be conducted. BMPs will consider the need to develop production systems that conserve natural resources, increase efficiency, and promote biodiversity and natural services, such as biological nitrogen fixation.
4) Natural Resources and Environment

Water and soil resources are used intensively in any agriculture production system and there is a dire need for their preservation and conservation. In Puerto Rico sixty percent of the cultivated land is in slopes of more than 20%. Data from the Natural Resources Conservation Service indicate there is a 10% annual erosion rate. Agriculture can be a serious source of pollution for the environment, through fertilizer, pesticides residues and soil erosion impacting nearby water resources, and diminishing soil quality. Nevertheless, more reliable scientific data is needed to support these claims, to quantify the contribution of agriculture in relation to other sources of pollution, and to measure the short and long term impact of agricultural operations on the environment.

This program addresses key AES mission goals of supporting both the Department of Agriculture and Department of Natural and Environmental Resources in the management of agricultural practices by (1) developing sustainable practices for watershed protection and management; (2) developing management practices for soil erosion; (3) establishing biological indexes of contamination; and (4) developing strategies for organic residues management. The program's overall objectives are (1) to coordinate the watershed management research program to examine the sources of contamination, emphasizing detection techniques and management strategies; (2) to coordinate the soil erosion management research program in order to examine the contaminant transport routes and nutrient losses, emphasizing evaluation practices and management strategies; and (3) to assess the threats from agriculture to biodiversity and determine which policies are most effective in the protection and conservation of natural resources and biodiversity, particularly in the agricultural areas.

The ultimate goal of the revised Natural Resources and Environment program is to increase our knowledge of natural resource preservation, management and utilization, without jeopardizing agricultural production and income. Formula-funded research will emphasize during this cycle the conservation and efficient use of water resources, particularly through studies related to microirrigation adoption and irrigation scheduling, and on monitoring of water quality standards through development of improved methods for the extraction and analysis of crop management chemicals. Soil erosion and nutrient transport studies will also form part of our priorities and will be focused on developing soil management practices to minimize problems of poorly drained upland soils, and on the evaluation of micronutrient behavior in highly weathered soils.

5) Agricultural Economics, Marketing, Value Added and Community Development

Farming and rural community development in Puerto Rico continues to face constant challenges. The agricultural sector's contribution to the Gross Domestic Product is less than 1%. Even considering the rate of inflation over the last two decades, the Gross Agricultural Income has increased at an annual rate of 0.5% only since 1990. During the last two decades the agricultural land base of the island experienced dramatic reductions, as part of its acreage was converted to alternative urban development uses. In structural terms, significant declines have also occurred in the number and amount of land controlled by mid-sized (50-259 acres) and low sales ($2,550-$9,999) farms. Given these trends, it is reasonable to expect continued production problems in most commodities, and a decline in production efficiency.

As globalization continues to restructure local wholesale and retail distribution outlets, remaining farmers increasingly complain about fewer markets for their crops, whereas many communities lack enough employment opportunities and have limited access to quality fresh foods. Food imports of most items are also rising, thus confirming the poor competitive position of local products vs. imported. The examination of these conditions and related trends is vitally important for the development of local agroindustries with the potential of improving community employment, and for strengthening the marketing and overall situation of our agricultural

and livestock commodities. Puerto Rico needs to diversify the basis of its economic model, and a community-oriented agricultural development strategy is an option that should be incorporated into this plan. In this POW, priority will be given to studies of economic efficiency, marketing, new markets, and community agricultural development. Both research and extension faculties will be involved in all aspects of the program.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	47.6	0.0
2009	0.0	0.0	45.3	0.0
2010	0.0	0.0	45.9	0.0
2011	0.0	0.0	46.1	0.0
2012	0.0	0.0	46.4	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

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

2. Brief Explanation

There has been no significant change in our Program Review Process since our Two-Year update was submitted. In 2005, however, we changed the way in which our Hatch-funded research proposals are initially granted. In response to internal and external evaluations requesting that a portion of Hatch funds be allocated to projects on the basis of an annual call for proposals with the year's revised priorities, part of our formula-funded research is now competitively granted on the basis of said proposals. More specifically, the scientific peer review process of Hatch proposals is the following:
An annual call for proposals which includes the year's revised research priorities is prepared and distributed by the AES Research Office. Proposals are submitted to the Assistant Dean for Research with the preliminary endorsement of the respective Department Head. The Assistant Dean for Research sends the proposal again to the corresponding department head, 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 AES strategic plan. Proposals and their reviewers' input are discussed and evaluated by the CAS Associate and Assistant Deans for Research, and a final decision is taken by the administration. Project directors of the selected proposals are given the opportunity to incorporate reviewers' suggestions and make adjustments as appropriate. These proposals are then sent to the USDA-CSREES Office of the Administrator, where the respective national program leaders review them. Once the proposals are approved in Washington, the new or revised projects are included in the AES research program.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

As previously explained, this POW incorporates the input of researchers and stakeholders who have attended workshops, seminars and commodity group meetings during the past two years. During these activities, participants attempt to identify the most pressing needs that should be addressed by the AES research program. Because the AES cannot address all the issues identified at the same time, annual meeting of the commodity groups will be held to evaluate research progress and to reassess research priorities. The list of priorities assembled through this process will be reviewed by each program coordinator and the CAS

administration, and final recommendations will be prepared for the year's call for proposals for new Hatch and Special Projects. Researchers are also encouraged to review this final list of priorities when applying for grants financed by external funds. Progress toward AES goals will be monitored by the indicators included in this POW and discussed in the yearly program and commodity meetings.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

A truthful evaluation of this question in the context of Puerto Rico requires further specification. Puerto Rico's population is almost totally Hispanic, with 45% of families living below the federally defined poverty line. In addition, joblessness is much higher than in any of the 50 states. Therefore, the vast majority of the island's population qualifies as "under-served and under-represented" citizens in Federal government Programs. Moreover, compared with the assistance that other sectors such as manufacturing have received over the years, agriculture and rural areas in general, have lagged behind in public investment by the Commonwealth government. In this context, this POW planned programs efforts towards the enhancement of natural resources and towards the analysis and managed solution of problems affecting agriculture, with the ultimate goal of increasing the competitive production of our commodities and raise the employment level of the population, is addressing the stated needs of a critical sector and its underlying population.

The above statement does not invalidate the need to further analyze regional and sub-sectors disparities that may still be present in our programs. Within our personnel and budget limitations this POW incorporates measures to ensure that research will benefit organic farmers, small-scale farmers with low educational levels, and rural participants in welfare programs. These groups have been identified as requiring greater attention by AES researchers and administrators. All planned programs, for example, include the formation of integrated work groups between researchers and extensionists, both to conduct the work planned and to translate research results into educational materials for a broad audience. This includes tailoring best management practices (BMPs) to different scales of production, varying cropping systems and the range of soil and climatic conditions found in Puerto Rico. Research on tropical organic systems has been included into the priorities of several commodities and at least one project is underway to provide alternatives to pesticides in transitional organic systems. Documentation of community agricultural projects and of the labor market needs of women participating in Temporary Assistance for Needy Families (TANF) program also forms part of the research and extension agenda under this POW. Altogether, this POW implementation involves the continued education of researchers on the diversity of stakeholders in Puerto Rico and on the need to incorporate their concerns into our programs.

3. How will the planned programs describe the expected outcomes and impacts?

Each program has designed several outcomes to monitor progress. These indicators will be evaluated periodically to make adjustments needed to achieve the desired impacts. Most programs plan to record information about participants in program activities to follow-up on adoption of recommendations, or to assess factors affecting the achievement of the planned goals. Some programs will use official records (of commodity production, water quality in a watershed, sales of improved seeds, etc.) to monitor the impact that program interventions may have had upon the targeted population. Other programs will need to design a study to assess if the expected impacts are being achieved. At present, there is no division in our institution specialized in evaluation studies or in monitoring the impact of our research and extension programs. This deficiency will need to be addressed by the CAS administrationas as we progress in our plan, within the limits of the resources available.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

An effective coordination of research, extension and academic activities is needed to achieve intermediate results and long-term impacts. While there has been an historic connection between these three activities, this is the first time CAS researchers will have to report progress and impacts of research beneath the traditional publications, theses, seminars and field days reported in annual reports. Similarly, while extension education programs are often based on research results, participation by extensionists in research needs to be expanded, particularly in the adaptation of research results to local production systems. Integrated research and extension projects have had important successes in the past that should help model the new integrated programs. Nevertheless, as is the case with other aspects of this POW, only periodical monitoring of the programs' progress will help determine if the program is being effective and help identify ways to improve efficiency.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to 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 AES research programs. Stakeholder input is also considered during the establishment of research priorities. First, the AES will continue 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 the 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 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 will continue to organize thematic workshops, seminars, and field days where research results will be shared and the research and extension needs, or public policy determinations, will be discussed.

2(A). A brief statement of the process that will be 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 and commodity leaders)

Brief explanation.

Stakeholders are identified by commodity group leaders, extension personnel and through local advisory committees established by administrators of the CAS.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder individuals
- Meeting with traditional Stakeholder groups

Brief explanation

Input from stakeholders is collected at the meetings convened by commodity group and program leaders. Stakeholders are asked about the most critical issues affecting their commodities and localities and about our research priorities. This information is summarized in a report made by the commodity and program leaders.

3. A statement of how the input will be considered

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

Brief explanation.

The input received in these meetings from participating stakeholders is summarized, evaluated and presented in a concluding meeting of commodity group leaders, program coordinators and research administrators, where final decisions concerning research priorities are taken. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects. When issues are identified that require greater emphasis, programs will be redirected to address these needs. This process may also help to identify future needs for the recruitment of faculty.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Economics, Marketing, Value Added and Community Development

2. Brief summary about Planned Program

Many of the problems faced by Puerto Rico's agricultural sector have already been partially studied under the research program carried out for decades by the integrated research and extension faculty of the Department of Agricultural Economics and Rural Sociology of the CAS. Nevertheless, the continuing challenges faced by farmers and rural communities in Puerto Rico, coupled with the reduced ability of the government to provide increased incentives or subsidies to these sectors because of a current and prospective fiscal crisis, underline the need to conduct more narrowly defined research of topics identified as vital for farming and rural community growth. Studies planned under this program include those that (1) explore new markets for our traditional products, (2) make effective use of marketing tools to exploit products' full potential, (3) explore new uses for conventional products through processing, (4) research the market for "specialty products" as a possible new alternative for our tropical crops, (5) examine efficiency problems at the level of farm management, (6) evaluate the performance of plans and programs implemented in the areas of agricultural economics, marketing, value added and community development, and (7) document the status of community food systems and alternative community agricultural projects.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 601 5% Economics of Agricultural Production and Farm Management
- 604 50% Marketing and Distribution Practices
- 607 30% Consumer Economics
- 608 10% Community Resource Planning and Development
- 610 5% Domestic Policy Analysis

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Farming and rural community development in Puerto Rico continue to face constant challenges. The agricultural sector's contribution to the Gross Domestic Product is still less than 1%, in spite of increased investment by the government in the last five years. Even considering the rate of inflation over the last two decades, the Gross Agricultural Income has increased only at an annual rate of 0.5% since 1990. During the last two decades the agricultural land base of the island has experienced dramatic reductions, as part of its acreage has been converted to alternative urban development uses. In structural terms, significant declines have also occurred in the number and amount of land controlled by mid-sized (50-259 acres) and low sales ($2,550-$9,999) farms. Given these trends, it is reasonable to expect continued production problems in most commodities, and a decline in production efficiency. Moreover, as globalization continues to restructure local wholesale and retail distribution outlets, remaining farmers increasingly complain about fewer markets for their crops, whereas many communities lack enough employment opportunities and have limited access to quality fresh foods. Food imports of most items are also increasing, thus confirming the poor competitive position of local products vs. imported. The examination of these conditions and related trends is vitally important for the development of local agroindustries with the potential of improving community employment, and for strengthening the marketing and overall situation of our agricultural and livestock commodities. Puerto Rico needs to diversify the basis of its economic model, and a community-oriented agricultural development strategy is an option that should be incorporated into this plan. During this POW, priority will be given to studies of economic efficiency, marketing, new markets and community agricultural development. Both research and extension faculties will be involved in all aspects of the program.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Better knowledge of production costs, consumers' preferences and local markets will translate into marketing strategies that will allow producers to identify niches to penetrate, and support expanded commodity production.
The institutional funding and staff needed to conduct this program will be available.
The technology needed to increase the physical output of the selected commodities is economically available.
An expansion in the agricultural sector production will improve the employment situation of rural communities
A strong extension component will be developed to translate research results into effective marketing and community development strategies.

2. Ultimate goal(s) of this Program

Increase local, marketable, agricultural production and improve the quality of life and food security situation of households and communities, through the development of economic efficiency and marketing studies of selected commodities (such as plantains, yams, beef cattle and swine), community food system profiles, promotion of community agricultural projects, and identification and documentation of alternative marketing channels for farmers and community production.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	1.1	0.0
2009	0.0	0.0	0.8	0.0
2010	0.0	0.0	1.1	0.0
2011	0.0	0.0	1.4	0.0
2012	0.0	0.0	1.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research to determine consumer preferences, marketing margins, and farmers' and other participant's shares in the marketing channels of selected agricultural commodities will be conducted. Also, studies to identify the diverse strategies local food system stakeholders are currently using or might use to create and manage ongoing or potential change, and their information needs. In collaboration with Extension Faculty and Agents, results will be translated into recommendations for farmers and community organizers. Publications will be prepared and presentations to producers' associations and agricultural professionals will also take place.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Farmers, Extension professionals, community leaders and organizers, producers associations and other professionals.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	1	0
2009	1	0
2010	1	0
2011	2	0
2012	2	0

V(H). State Defined Outputs

1. Output Target

- Number of refereed publications

2008 :1 **2009 :**1 **2010 :** 1 **2011 :**2 **2012 :**2

- Number of presentations in scientific meetings

2008 :2 **2009 :**3 **2010 :** 3 **2011 :**2 **2012 :**2

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

2008 :2 **2009 :**1 **2010 :** 3 **2011 :**1 **2012 :**3

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

2008 :70 **2009 :**60 **2010 :** 60 **2011 :**70 **2012 :**85

V(I). State Defined Outcome

1. Outcome Target

Number of stakeholders gaining knowledge about new markets and marketing tools

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
20	80	120	150	200

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices
- 607 - Consumer Economics
- 608 - Community Resource Planning and Development

1. Outcome Target

Number of alternative marketing projects identified as existing in Puerto Rico (long-term)

2. Outcome Type : Change in Condition Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
6	7	7	8	8

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices
- 607 - Consumer Economics
- 608 - Community Resource Planning and Development

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

In Puerto Rico natural disasters such as storms and heavy rains are relatively common. These situations can interfere with data collection, farmers' decisions and consumer priorities. The decisions on what to buy change dramatically after these events. If agricultural production is affected, the supply of fresh foods will be reduced. Also, Puerto Rico is undergoing a period of economic instability in which the capacity of the government to meet its current obligations and service new debt is being reduced. Consumers' attitudes and food preferences may change with the changing economic outlook. Moreover, in volatile economic situations public policy priorities may also shift to meet new demands, and this may compromise the ability of researchers to accomplish their long term plans.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Other (Focus group)

Description

In the fourth year of the program (2010) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.

2. Data Collection Methods

- Other (Focus group)

Description

In the fourth year of the program (2010) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Integrated Management of New and Emerging Pests

2. Brief summary about Planned Program

AES continues its efforts to use stakeholder-driven research priorities in the areas of registering new pesticides; testing 'reduced risk' pesticides; and of validating and developing integrated management alternatives for pests, diseases, and weeds. In addition, AES continues to develop pest and disease taxonomic expertise--largely lost due the retirement of scientific personnel. Finally, AES has begun a systematic process of establishing strategic evaluations of Integrated Pest Management (IPM) needs for key commodities in the form of Pest Management Strategic Plans (PMSPs).
AES is committed to accomplish the following IMNEP strategic research goals: (1) To enhance and strengthen pest and disease diagnostic capabilities; (2) To develop Pest Management Strategic Plans (PMSP) for major crop commodities; (3) To continue testing and registering new and 'reduced risk' pesticides for 'special-needs' commodities, including their effects on target and non-target organisms; and (4) To expand research on locally-developed integrated management solutions.
During 2007-8, AES allocated 14.8 SY to address IMNEP program's goal activities. A brief activity summary follows:
AES enhanced pest and disease diagnostic activities by participation in the Southern Pest Detection Network (SPDN). Docents attended two specialized training symposia, and offered 5 participant training seminars for peers, government and industry. Major efforts are underway in the characterization of weeds, bacterial, viral, and fungal diseases, and insect and nematode pests in major commodities. Diagnosticians have detected eight new pest and disease species, including new records for cucurbits, corn, citrus, sweet potato, and other crops.

For the first time, AES has funded a project designed to establish a Pest Strategic Management Plan (PSMP) for fresh tomato and pepper production. Commodity stakeholder meetings have identified new PSMP activities for tropical fruit commodities. AES has as a goal to establish PSMPs for major commodities, as this is an excellent way of defining priorities for the program.
Last year, AES initiated its first efforts to address new market requirements in transition- and organic agriculture. Due to changes in federal legislation (e.g., the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), and the Food Quality Protection Act (FQPA), timing is now optimal for refocusing efforts into research needs towards new alternative pest control areas. Four new projects (watermelon, citrus nurseries, tomato and avocado) address testing of transition- and organic- agriculture pesticides. In FY2007, AES allocated 2.4 SY (17%) to research on testing the use of alternative and 'reduced risk' pest and disease control chemicals.
Research into integrated pest management of pests, weeds, and diseases continues to be the principal focus area in the IMNEP program. Innovative projects, such as, GIS-based management of pests, management diseases and their vectors, and natural enemy mass-rearing for coffee pests are refocusing this program to cutting-edge solutions. For FY2007, AES allocated 8.2 SY (57%) to research on pest, and disease management.

3. Program existence : New (One year or less)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 211 34% Insects, Mites, and Other Arthropods Affecting Plants
- 212 40% Pathogens and Nematodes Affecting Plants
- 213 2% Weeds Affecting Plants
- 215 4% Biological Control of Pests Affecting Plants
- 216 20% Integrated Pest Management Systems

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Tropical agriculture in Puerto Rico is one of a great multiplicity of crops, most of these grown on small farms, and in intimate contact with growing urban and suburban populations. Each year, the integrity of the Island's fragile agricultural economy is

threatened by new or by emerging pests. The following factors refocus IMNEP priorities:
Generalized decline in knowledge about the taxonomy of key pests, weeds, and diseases. This paucity of knowledge often causes misdiagnosis of pests and diseases, the use of unsuitable control measures, an increased likelihood of illegal pesticide residues in food, the potential for increased health risks to farm workers, and the potential for negative impacts on the environment.
Adoption of Non-Locally Developed IPM Technology without Experimental Validation. The lack of IPM research at the College of Agricultural Sciences has led producers, and extension specialists to use and recommend strategies developed elsewhere (usually in temperate regions), and generally ill adapted to tropical production systems.
Lack of Strategic Approaches to IPM Research. Current circumstances have forced crop protection research to be largely ad hoc and reactive. Long-term strategic planning tools, such as Pest Management Strategic Plans are generally not used. Among the advantages of PMSPs are (1) that they take a pest-by-pest approach to identify IPM needs; (2) that they are used to set research and education/training priorities; and (3) that they are used to identify research needs for an effective transition from conventional to alternative pest management.

Expected increase in demand for organically-produced food. For decades, agricultural production in Puerto Rico was often disadvantaged because most of its most important commodities lacked registered pesticides (e.g., coffee, plantains, tubers, and tropical fruit). Largely due to AES efforts, fewer commodities lack the chemical control tools needed to manage pest and disease outbreaks. Now, market forces are demanding the use of organically-approved or “reduced risk” pesticides for pest control.

To AES, it is central that the IMNEP program is stakeholder-driven. Initially, IMNEP is concentrated on areas of strength (such as IR-4 pesticide registration projects, and the use of classical biological control), and in the development of future direction areas. Priorities can be summarized as (1) fast pest and disease identification and diagnosis; (2) development of PMSPs; (3) increased testing of reduced risk pesticides; and (4) integrated pest management research and extension activities. The goal is to replace reactive research in favor of strategic results-driven research.

Finally, AES is concerned with the latest changes in Congressional appropriations for FY2007. Currently, 6.2 SY (41.6 %) from IMNEP were funded under the Tropical and Subtropical Agricultural Research Special Grant (7 U.S.C. 450). The disappearance of this Special Grant in FY2006, will impact the scope of current research in the program. AES expects negative impacts to its capacity to respond to stakeholder research needs in the area of pest, weed, and disease management.

2. Scope of the Program

- In-State Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The scientists needed to develop this program are available, or will be recruited.
The necessary funds will be available by a combination of internal and external resources.
Research needed to establish the PMSPs for most crops will be conducted.
The input of partners from Extension Service, USDA /APHIS, Puerto Rico's Department of Agriculture and producer groups will be available.
IMP practices suggested in the Pest Management Strategic Plans will be adopted by the producers of the island

2. Ultimate goal(s) of this Program

To decrease crop losses due to key and emerging pests and to decrease the damage inflicted upon the environment and health by unsuitable management practices.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	14.4	0.0
2009	0.0	0.0	14.4	0.0
2010	0.0	0.0	14.4	0.0
2011	0.0	0.0	14.4	0.0
2012	0.0	0.0	14.4	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Develop partner-mediated PMSPs for the crops of Puerto Rico
Foster the use of cutting-edge technology to implement IPM.
Enhance our capacity to conduct fast pest diagnoses
Conduct research on 'reduced risk' pesticides
Foster partner involvement in pest research
Disseminate research results through publications, seminars, field days, conferences, and any other method deemed appropriate to reach our target audiences: Extension Specialists and Agents, Government partners, producers, consumers and environmental groups.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Extension Specialists and Agents;
Academic Programs Faculty and Students;
Producers and Commodity Groups;
Consumers; and
Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS).

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	3	0
2009	4	0
2010	4	0
2011	5	0
2012	5	0

V(H). State Defined Outputs

1. Output Target

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

  2008 :1 **2009 :**2 **2010 :** 3 **2011 :**3 **2012 :**3

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

  2008 :3 **2009 :**4 **2010 :** 4 **2011 :**5 **2012 :**5

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

  2008 :7 **2009 :**9 **2010 :** 11 **2011 :**13 **2012 :**15

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

  2008 :9 **2009 :**11 **2010 :** 13 **2011 :**16 **2012 :**16

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

  2008 :9 **2009 :**10 **2010 :** 12 **2011 :**15 **2012 :**15

- 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.

2008 :3 **2009 :**3 **2010 :** 3 **2011 :**3 **2012 :**3

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

2008 :4 **2009 :**4 **2010 :** 4 **2011 :**5 **2012 :**4

V(I). State Defined Outcome

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :80 **2009 :** 100 **2010 :** 125 **2011 :**150 **2012 :** 160

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems

1. Outcome Target

Number of persons that adopted reduced risk pesticides and practices

2. Outcome Type : Change in Action Outcome Measure

2008 :25 **2009 :** 40 **2010 :** 50 **2011 :**60 **2012 :** 70

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems

1. Outcome Target

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

2. Outcome Type : Change in Condition Outcome Measure

2008 :25 **2009 :** 40 **2010 :** 50 **2011 :**60 **2012 :** 70

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Puerto Rico is frequently exposed to the impact of hurricanes occurring mostly between August and October. It is possible that increases in the frequency or intensity of hurricanes would favor the introduction of invasive species, and undermine efforts geared towards controlling the impact of key pests.
Concern about the effects of cancellation of Special Grants, and changes in funding avenues due to new Farm Bill legislation.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Other (Yearly baseline indicators)

Description

Timely and thorough assessment of program success and direction will be carried out to gauge accomplishments and needed corrections. Base-line indicators will be developed during the first program area meeting by scientists, extension specialists, and stakeholders. Progress monitoring of program outcomes will be tracked using these indicators, and evaluated by program scientists. New Program direction and indicators may arise and evaluated once each year.

2. Data Collection Methods

- Case Study
- On-Site
- Other (Focus group & others)

Description

Researchers, extension personnel and other stakeholders attending annual meetings will establish which indicators of progress are needed and how they will be collected. Surveys, case studies, and any other method deemed appropriate to collect the information of interest will be used.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Milk and Meat Production Systems Resources

2. Brief summary about Planned Program

Given the importance of the livestock industries and forages in the agricultural economy of Puerto Rico, the AES research program in Milk and Meat Production Systems has a wider scope, in terms of commodities and problem areas, than that targeted by our federally-funded projects. Formula-funded research is concentrated in the dairy industry, including forage production systems, and to a lesser degree in beef cattle.

Structural analysis of the dairy industry shows that the number of farms has been declining while the average herd size has increased accordingly. The total land area dedicated to forage production declined by more than 12% during the last decade. Faced with insufficient land for on-farm feed production, many farms rely heavily on imported feed sources to feed their herds. To improve the industry's situation, studies will continue or begin in the following areas: (1) Improving the efficiency of nutrient utilization in dairy herds; (2) Supplementation designed to optimize productivity and efficiency of dairy cows grazing tropical forages; (3) Feeding and management methods to increase dry matter intake and milk production; (4) Defining the physiological characteristics of the heat-stressed dairy cow and developing cost efficient methods of stress alleviation; (5) Pasture renovation strategies to maintain or improve the swards; and (6) Production and utilization of conserved grass and legume forages to support the dairy, beef and small ruminant industries.

In the case of beef, decline in production during the past twenty-five years has left the market participation of the local industry at only 12.7% in 2004-05. Although consumer demand for beef continuous strong, there has never been a quality grading system for the local product to offer consumers quality assurance, and imports keep filling the void left by declining local production. Very low profit margins for cattlemen contrast with the high retail prices paid for local and imported beef, reflecting the industry's organizational and structural problems. However, previous research suggests that local beef from young bulls, mostly grass-fed and free of exogenous hormones, has several nutritional advantages over feedlot-produced imported beef. To expand its share of the market, the industry must capitalize on these selling points and launch a promotional effort to increase local beef consumption. Research to support this effort will be focused mostly on: (1) Develop economic feeding systems to decrease age at slaughter of grass-fed cattle; (2) Characterize the chemical composition and nutritional value of local beef; and (3) Study, under these production conditions, the relationship between age at slaughter and meat tenderness, the most important single determinant of consumer acceptability. The new production and marketing strategies devised should add value and recognition to local beef, thus serving in the long term to increase demand for the local product.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 202 10% Plant Genetic Resources
- 301 10% Reproductive Performance of Animals
- 302 35% Nutrient Utilization in Animals
- 305 5% Animal Physiological Processes
- 306 20% Environmental Stress in Animals
- 308 10% Improved Animal Products (Before Harvest)
- 311 5% Animal Diseases
- 601 5% Economics of Agricultural Production and Farm Management

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The dairy industry has been the main agricultural enterprise of Puerto Rico for the past 30 years. During that period, however, beef production has steadily declined and broiler production, the leader in the meat category, has suffered marked fluctuations due to hurricane damage, financial difficulties and restructuring of production facilities. According to Department of Agriculture statistics, income from the production of milk (23%) and meat (19%) represented 42% of the 2004-05 Gross Agricultural Income. Of all the meat consumed in Puerto Rico, only 23.3% is produced locally, thus leaving an ample margin for an expanded market participation by local products. Both milk and meat incomes are limited by a lack of on-farm efficiency and uneven product quality.

These problems of low production efficiency, unreliable quality of the final product, and little product diversification are compounded by the island's lack of control of imports and the high per unit costs of production, resulting largely from the price of land, labor and feed inputs in Puerto Rico. Under these circumstances, and given our current research and extension resources, the following three priorities summarize the main foci of our program during the five year projection:

Evaluation of feeding systems under tropical conditions for increasing feed efficiency and achieving more milk and meat production.
Development and evaluation of management practices for reducing the effect of environmental stress on productivity and reproductive efficiency under tropical conditions.
Development of new dairy and meat products elaborated with local produce, in addition to improvement of existing products.

Our efforts will be geared toward regaining the market lost in the last decade by substituting for imports of these products.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The institutional funding for new and continued projects and staff needed to conduct this program will be available.
The number of extension agents assigned to work with this program will be adequate to provide direct follow-up to farmers.
Research results on the efficient use of forage and feed resources to increase income over feed costs, will be translated into management practices that will be widely adopted by the local dairy farmers.
Improving the production efficiency and final quality of local meats will help to increase the demand for the local product.

2. Ultimate goal(s) of this Program

To achieve better utilization of forage resources for all kinds and implementation of other improved management practices, leading to increased production levels and decreased production costs, thus permitting high-quality local dairy and meat products to compete with imports.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	11.0	0.0
2009	0.0	0.0	11.2	0.0
2010	0.0	0.0	11.5	0.0
2011	0.0	0.0	11.5	0.0
2012	0.0	0.0	11.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Promote the formation of integrated work groups for each area of production (milk, beef, small ruminants, poultry, swine and forages).
Organize meetings among researchers, extension service personnel and stakeholders to discuss the situation of the industry and research priorities.
Organize field days in research facilities and/or private farms to validate and demonstrate recommended management practices (RMP) based on research results.
Offer seminars and short courses to stakeholders for the dissemination of research formulated RMPs.
Publish research results in a simple layout that can be easily comprehended by stakeholders.
Publish research results in refereed journals for the scientific community.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Dairy farmers, beef cattle producers, poultry producers, commercial hay producers, extension professionals, government personnel, scientists, and private professionals.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	4	0
2009	5	0
2010	5	0
2011	6	0
2012	6	0

V(H). State Defined Outputs

1. Output Target

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

  2008 :4 **2009 :**4 **2010 :** 4 **2011 :**4 **2012 :**4

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

  2008 :3 **2009 :**3 **2010 :** 3 **2011 :**3 **2012 :**3

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

  2008 :4 **2009 :**4 **2010 :** 4 **2011 :**4 **2012 :**4

- Number of publications made in refereed scientific journals.

  2008 :4 **2009 :**5 **2010 :** 5 **2011 :**6 **2012 :**6

V(I). State Defined Outcome

1. Outcome Target

Number of participants in field days willing to adopt the RMPs demonstrated.

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :	2009 :	2010 :	2011 :	2012 :
25	30	35	40	40

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 306 - Environmental Stress in Animals
- 311 - Animal Diseases
- 601 - Economics of Agricultural Production and Farm Management

1. Outcome Target

% market participation of local beef.

2. Outcome Type : Change in Condition Outcome Measure

2008 :	2009 :	2010 :	2011 :	2012 :
14	15	16	17	18

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 306 - Environmental Stress in Animals
- 308 - Improved Animal Products (Before Harvest)
- 601 - Economics of Agricultural Production and Farm Management

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Public Policy changes
- Other (Catastrophic animal diseases)
- Natural Disasters (drought,weather extremes,etc.)
- Economy

Description

Major hurricanes are always a possibility in the Caribbean region. Such an event would affect research by destroying physical infrastructure, such as animal confinement facilities, flooding research plots, and causing delays due to lack of electrical power and potable water. Prolonged drought, especially if combined with persistent winds, could seriously reduce forage yields.

An economic recession could result in less consumer purchasing power and reduce sales of fresh milk and certain types of meat, such as beef.

Public policy could change in the direction of less support for the local agriculture and livestock industries in the face of government budget deficits.

A single case of an animal diagnosed with bovine spongiform encephalopathy (BSE) would cause mandatory slaughter of the entire cattle population of the island. The same is true of classical swine fever.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- Other (Small sample survey)

Description

Researchers will keep abreast of industry indicators compiled by the Agricultural Extension Service and the

Department of Agriculture of Puerto Rico. In conjunction with Extension personnel, researchers will participate in planning and analyzing the results of small sample surveys of dairy farmers and beef producers with regard to implementation of recommended management practices generated from research results..

2. Data Collection Methods

- Sampling
- Unstructured
- Observation

Description

Data collection will be coordinated with Extension Agents, who visit the selected producers at their farms, to conduct interviews and verify first hand whether RMPs are really being implemented as claimed.

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resources and Environment

2. Brief summary about Planned Program

Since its establishment the principal goal of the Research Program of Natural Resources and Environment has been to develop and support scientific research on the impact of agricultural practices in the environment and natural resources. The program addresses key AES mission goals of supporting both the Department of Agriculture and Department of Natural and Environmental Resources in the management of agricultural practices by (1) developing sustainable practices for watershed protection and management; (2) developing management practices for soil erosion; (3) establishing biological indexes of contamination; and (4) developing strategies for organic residues management. The program's overall objectives are (1) to coordinate the watershed management research program to examine the sources of contamination, emphasizing detection techniques and management strategies; (2) to coordinate the soil erosion management research program in order to examine the contaminant transport routes and nutrient losses, emphasizing evaluation practices and management strategies; and (3) to assess the threats from agriculture to biodiversity and to determine which policies are most effective in the protection and conservation of natural resources and biodiversity, particularly in the agricultural areas. A major justification for the proposed program is the need to protect fragile island ecosystems from agricultural unintended consequences to the environment such as contamination through fertilizer and pesticide residues and soil erosion, all of which impact nearby water resources and diminish soil quality. The use of fertilizers and pesticides and land preparation methods turn agriculture into a potential contamination source for water bodies and the soil. Modern agriculture techniques must be accompanied by environmental conservation practices in order to maintain a balance of crop land, public recreational areas, and forest and wildlife preserves.
Some of the topics to be studied in relation to soil erosion and nutrient transport include the following measures: developing soil management practices to minimize problems of poorly drained upland soils; evaluating micronutrient behavior in highly weathered soils; and examining the adaptability of coffee to acid soil conditions via accumulation of soil organic matter. Water quality research will continue with ongoing work on the characterization of the chemical and biological status of the most important watersheds of Puerto Rico. The objective of this research is to establish the framework for developing a Total Maximum Daily Load (TMDL) for nutrients in different watersheds. Studies to quantify off-field nutrient losses in runoff from tropical agroecosystems, as well as factors influencing their transport are also being conducted. Monitoring water quality through research to improve the methodology for the extraction and analysis of crop management chemicals will also be continued. Finally, we will research threats from agriculture to biodiversity and natural resources conservation.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 102 28% Soil, Plant, Water, Nutrient Relationships
- 104 9% Protect Soil from Harmful Effects of Natural Elements
- 111 5% Conservation and Efficient Use of Water
- 112 5% Watershed Protection and Management
- 123 5% Management and Sustainability of Forest Resources
- 132 5% Weather and Climate
- 133 38% Pollution Prevention and Mitigation
- 136 5% Conservation of Biological Diversity

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The AES has personnel experienced in the areas of water quality, soil science and forest management. Although research to address the role of agriculture as a pollutant has been conducted, there is still need for more research. Agriculture can be a serious source of pollution for the environment. More reliable scientific data is needed to support these claims, to quantify the

contribution of agriculture in relation to other sources of pollution, and to measure the short and long term impact of agricultural operations on the environment.
Unlike in the mainland US, in Puerto Rico many farmers use microirrigation systems to achieve adequate yields. Microirrigation requires a high level of management to avoid plant stress and yield reductions as water use efficiency increases. Research to determine the irrigation schedule most suitable to the conditions of different crops is therefore needed and remains a priority of our program. Moreover, given the significant reliance of local producers on crop management chemicals to control diseases and pests, the continuous improvement in the methodology used for the extraction and analysis of these chemicals is vital for monitoring water quality and for general ecosystem management.
In Puerto Rico, Forestry research encompasses studies geared toward enhancing the adaptation of selected germplasm on highly eroded soils, to improve the fertility of these soils and reduce their erosion. Since coffee is an important local crop formerly grown under a canopy of trees, research on the possible benefits of shade trees on coffee plantations also remains an important component of our program.
The main problems to be addressed by this program are the limitations of water and land in Puerto Rico, soil erosion, and protection and conservation of the biodiversity. Priority areas for this new POW cycle are (1) soil erosion management and nutrient transport; (2) water resources quality and management; and (3) conservation and biodiversity.
Emerging research needs, as identified by AES stakeholders during 2006 and researchers for 2007-2008 are:

Knowledge Area	Research Need/Concern
101	Identification of highly productive and potential agricultural lands, using the geographical information systems and remote sensing technology.
111	Development of hidrologic sustainability indicator for agricultural use.
131	Inventory and appraisal of agricultural land use in Puerto Rico.
133	

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

1. Reasonable funds, both internal and external will be available throughout project duration.

2. Personnel with adequate skills and understanding of the subject will be working in the program by virtue of availability or recruitment.

3. Support and input of related agencies, such as the Department of Agriculture of P.R., USDA, NRCS, EPA, Environmental Quality Board and Department of Natural and Environmental Resources of P.R., will be available for the activities proposed and developed.

4. Watershed, soil erosion and biodiversity conservation management practices developed in the program will be adopted by producers and the general public.

2. Ultimate goal(s) of this Program

To decrease the presence of chemical pesticides in the water resources of the island; to increase the efficiency in the use of water on farms with microirrigation systems; to reduce soil erosion and improve the fertility of highly eroded soils; and to develop alternative agricultural and environmental management policies for environmental quality.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	8.7	0.0
2009	0.0	0.0	8.7	0.0
2010	0.0	0.0	6.0	0.0
2011	0.0	0.0	6.0	0.0
2012	0.0	0.0	6.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research on microirrigation scheduling, nitrogen-fixing trees, field extraction and analysis of chemical pesticides, soil conditioners for highly eroded soils, and on biodiversity and conservation in Puerto Rico.
Publish research results in bulletins for farmers and in refereed journals for scientists.
Develop educational materials for stakeholders interested in the management and preservation of natural resources and agricultural sustainability.
Disseminate research results through publications, seminars, field days, workshops, conferences, and any other method deemed appropriate to reach our target audiences.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Extension Specialists and professionals, government partners, producers, consumers, and environmental groups.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	4	0
2009	5	0
2010	6	0
2011	5	0
2012	7	0

V(H). State Defined Outputs

1. Output Target

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

  2008 :10 **2009 :**15 **2010 :** 15 **2011 :**15 **2012 :**20

- Number of Peer Reviewed publications.

  2008 :4 **2009 :**5 **2010 :** 6 **2011 :**5 **2012 :**7

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

  2008 :2 **2009 :**2 **2010 :** 2 **2011 :**2 **2012 :**4

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

  2008 :2 **2009 :**2 **2010 :** 2 **2011 :**2 **2012 :**2

V(I). State Defined Outcome

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :60 **2009 :** 75 **2010 :** 100 **2011 :**125 **2012 :** 150

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 132 - Weather and Climate

- 133 - Pollution Prevention and Mitigation
- 136 - Conservation of Biological Diversity

1. Outcome Target

Number of farmers adopting microirrigation management practices

2. Outcome Type : Change in Action Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
10	20	30	40	40

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water

1. Outcome Target

Number of persons adopting practices that prevent biodiversity threats and losses

2. Outcome Type : Change in Action Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
0	40	50	60	60

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 136 - Conservation of Biological Diversity

1. Outcome Target

Number of farmers adopting methods to increase soil organic matter content

2. Outcome Type : Change in Action Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
30	40	50	60	70

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements

1. Outcome Target

Number of farmers reporting increased water use efficiency in their farms

2. Outcome Type : Change in Condition Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
40	60	80	100	120

3. Associated Knowledge Area(s)

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

1. Outcome Target

Number of persons that adopted practices to improve water resources.

2. Outcome Type : Change in Condition Outcome Measure

2008 :	**2009 :**	**2010 :**	**2011 :**	**2012 :**
0	40	60	80	90

3. Associated Knowledge Area(s)

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

1. Outcome Target

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

2. Outcome Type : Change in Condition Outcome Measure

2008 :	2009 :	2010 :	2011 :	2012 :
0	1	1	1	2

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Puerto Rico is frequently exposed to the impact of hurricanes and heavy rains that exacerbate existing problems of soil erosion and nutrient transport, particularly in the central mountain region.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Other ()
- Before-After (before and after program)

Description

No formal study is planned at this point. However, participating researchers, as part of their ongoing projects' activities, will continue monitoring the status of the principal watersheds on the island.

2. Data Collection Methods

- Unstructured
- Sampling
- Observation

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Plant genetic resources, breeding and production systems

2. Brief summary about Planned Program

Plant breeding and production systems research is an essential component of the AES research program. The development of improved varieties and better management practices has contributed to the expanded production of many crops. Recent evaluations confirm that the CAS has the expertise, facilities, germplasm and breeding lines needed for continued development of improved cultivars and better field management of many traditional crops. Genetic improvement needs to be complemented with the improved efficiency of production systems that include both traditional and new crops. Building upon our strengths, we plan to continue the introduction of adapted germplasm that can be used to address certain production constraints, and develop new cultivars of crops which can increase yield or reduce production costs in local farming systems. Research geared towards the development of best management practices (BMPs) for traditional and non-traditional crops in Puerto Rico will also be conducted. BMPs will consider the need to develop production systems that conserve natural resources, increase efficiency, and promote biodiversity and natural services, such as biological nitrogen fixation.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 201 20% Plant Genome, Genetics, and Genetic Mechanisms
- 202 25% Plant Genetic Resources
- 203 25% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 5% Plant Product Quality and Utility (Preharvest)
- 205 25% Plant Management Systems

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Germplasm collections of crops of economic importance in Puerto Rico are needed to provide material for propagation for commercial production. New germplasm needs to be evaluated to identify accessions with traits of economic value. The introduction of adapted germplasm can be used to address certain production constraints.

A lack of availability of seed is an important factor limiting the production of many traditional crops. Breeding programs for crops such as pigeon peas, tropical pumpkin, and sweet peppers, do not exist in the private sector or in neighboring countries. AES plant breeders can develop lines with local adaptation and can respond to the emergence of disease or pest problems.

There is a need to improve the efficiency of production systems of traditional and new crops. Non-conventional production practices such as hydroponics have unique constraints that need to be addressed with research. Increased mechanization for small-and medium-scale farmers is needed to reduce labor costs. Cropping systems should take advantage of natural services such as the biological control of disease and pests and biological nitrogen fixation.

A re-evaluation of the AES recommendations for traditional production systems is needed (i.e., fertilization and irrigation practices) to provide our stakeholders with recommendations that permit profitable production and natural resource conservation.

Priorities:
Introduction, evaluation and preservation of germplasm and cultivars of crops of economic importance in Puerto Rico
Development of new cultivars of crops of economic importance in Puerto Rico that lead to increased yield, lower production costs or enhanced value.
Development production systems that conserve natural resources, increase efficiency and promote biodiversity and natural

services.
Development of BMPs for traditional and non-traditional crop production systems in Puerto Rico.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

· Long-term financial support for research is needed to permit plant breeding programs to develop improved cultivars and germplasm, and to permit agronomists to update recommended production practices.
· Scientific personnel with the expertise needed to develop crop cultivars, to maintain genetic resources and to conduct crop production research are available in the College of Agricultural Science.
· A seed program will continue to function to ensure the availability of seed of improved cultivars of traditional crops.
· Extreme weather conditions will not destroy field trials, germplasm collections or infrastructure needed to conduct research.

2. Ultimate goal(s) of this Program

To achieve wide scale adoption of improved cultivars and production practices that result in greater or more efficient crop production in Puerto Rico.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	12.9	0.0
2009	0.0	0.0	12.9	0.0
2010	0.0	0.0	12.9	0.0
2011	0.0	0.0	12.9	0.0
2012	0.0	0.0	12.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Development and release of improved cultivars of crops of economic importance
Electronic publication of descriptions of germplasm collections
Distribution of germplasm to scientists and the public
Publish technology packages describing best management practices for crops of economic importance.
Host field days for stakeholders at different Substations in collaboration with the Agricultural Extension Service, and organize field days to seed production fields, germplasm collections and other experimental fields.
Increased on-farm research to validate new technology
Publication of research results in bulletins for farmers and in refereed journals for scientists.
Presentations of research results at scientific meetings

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 **2009 :**0 **2010 :** 0 **2011 :**0 **2012 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	2	0
2009	2	0
2010	2	0
2011	2	0
2012	2	0

V(H). State Defined Outputs

1. Output Target

- Number of stakeholders to adopt the proposed BMPs.

2008 :110 **2009 :**115 **2010 :** 120 **2011 :**125 **2012 :** 125

- Focus groups of collaborators' opinions of the new technologies being validated

2008 : 1 **2009 :** 1 **2010 :** 1 **2011 :** 1 **2012 :** 1

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

2008 : 1200 **2009 :** 1500 **2010 :** 1600 **2011 :** 1700 **2012 :** 1700

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

2008 : 220 **2009 :** 240 **2010 :** 250 **2011 :** 260 **2012 :** 260

- Number of participants in the field days coordinated with Extension

2008 : 120 **2009 :** 125 **2010 :** 130 **2011 :** 135 **2012 :** 135

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

2008 : 120 **2009 :** 125 **2010 :** 130 **2011 :** 135 **2012 :** 135

- Number of refereed publications

2008 : 2 **2009 :** 2 **2010 :** 2 **2011 :** 2 **2012 :** 2

- Number of non-refereed publications

2008 : 1 **2009 :** 1 **2010 :** 1 **2011 :** 1 **2012 :** 1

- Number of presentations in scientific meetings

2008 : 1 **2009 :** 2 **2010 :** 3 **2011 :** 3 **2012 :** 3

V(I). State Defined Outcome

1. Outcome Target

Number of stakeholders to adopt the proposed BMPs

2. Outcome Type : Change in Action Outcome Measure

2008 : 110 **2009 :** 115 **2010 :** 120 **2011 :** 125 **2012 :** 125

3. Associated Knowledge Area(s)

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

1. Outcome Target

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

2. Outcome Type : Change in Condition Outcome Measure

2008 : 110 **2009 :** 115 **2010 :** 118 **2011 :** 120 **2012 :** 125

3. Associated Knowledge Area(s)

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

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Germplasm collections and field trials related to plant breeding or production research are vulnerable to adverse weather, particularly hurricanes and tropical storms. Some field trials can be conducted during seasons when severe weather is less likely to occur. However, some germplasm collections and field trials need to be planted during the hurricane season. The introduction of an exotic disease or pest could also threaten some crops. The proposed activities in the plan of work are dependent on continued programmatic and fiscal support of the USDA and the Puerto Rico Agricultural Experiment Station.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

Records of seed sales of cultivars developed by the Puerto Rico Agricultural Experiment Station will be maintained at the Substations. These records will provide a measure of the impact of the variety development program.
The Puerto Rico Agricultural Experiment Station web sites containing the crop production technology packages will solicit comments and suggestions from the readers.

2. Data Collection Methods

- Other (Focus groups)

Description

Dual moderator focus groups that include farmers, extensionists and researchers will be used to obtain opinions concerning the new technologies being validated. The information from the focus groups will be used to establish research priorities and improve the quality of publications.