

Puerto Rico (University of Puerto Rico Mayaguez Campus)

Plan of Work for 2023-2027

Status: Final (Approved 10/4/2022)

Executive Summary Overview

This plan of work (POW) covers the period from 10/01/22 to 09/30/27. It was developed by the Puerto Rico (PR) Agricultural Experiment Station (PRAEXS) and the PR Agricultural Extension Service (PRAES) and shows minor changes from POW 2021. The first 4 critical issues were jointly planned while the last two are exclusively of PRAES. These critical issues were defined considering the priorities set by our programs' stakeholders, the outcomes of Merit Review meetings, and discussions held with collaborators from government and non-government agencies.

FOOD SECURITY, PLANT & ANIMAL SYSTEMS.

The principal issue target is to increase local animal and crop production and consumption. To increase crop production, we will empower small farmer's knowledge through research and extension (R&E). The R&E personnel will continue to study and promote adaptation strategies for resilient agricultural production, post-harvest crop management and improved marketing efficiency. Organic and agro-ecological systems R&E also form part of this issue's approach. To strengthen the integration of Extension Programs, FCSEd will continue promoting consumption of local food.

R&E will continue promoting local food availability by sustainable farm production and urban agriculture. Local urban agriculture is primarily related to vegetables and starchy crops production. Vegetable production for fresh and export markets is being diversified, and PRAES and PRAEXS evaluate disease resistant varieties and practices for the management of vectors. Recent advances in genomic engineering for breeding crops are expected to improve the selection of crops with resistance to biotic and abiotic stresses.

New research efforts towards more efficient production systems involve the assessment of new technologies and improved marketing strategies. Information generated by research about best performing varieties, appropriate cultural practices, integrated pest management, market feasibility and consumer preference studies, will be disseminated to growers and agronomists.

The early detection, correct identification and management of pests and diseases continues to be critical for plant systems R&E. Disease detection and identification methods are carried out by PRAEXS and PRAES Plant Disease Clinics, mainly employing molecular screening tools. Information about new diseases and pests will be available through social media and PRAES online web pages.

Research will continue addressing factors that limit the production of important crops for local and export markets such as coffee and mango. In coffee, evaluation of new planting techniques, control of the coffee berry borer and evaluation of coffee rust resistant cultivars against a new race of *Hemileia*

vastatrix concentrate research efforts. Extension's outreach will highlight research findings and train PRAES personnel and coffee producers. In mango the focus will be on evaluating pollinators, correct identification, and monitoring of fruit-fly species in commercial orchards, and disease management.

R&E efforts in animal production will focus on improvement in the biological efficiency of livestock production, establishment of improved forages, economic returns to the producers, and practices that promote extreme weather resilience. Research initiatives are focusing in the characterization of slick-haired Holsteins and Senepol breeds. New projects geared at strengthening lamb production and meat quality have also started. Extension initiatives are focusing on promoting animal wellbeing in dairy cattle, improvement and business plans for small farmers, and the use of drones for estimation of vegetation biomass and development of waste management plans.

EXTREME WEATHER, ENVIRONMENT, NATURAL RESOURCES & SUSTAINABLE ENERGY.

PRAES will encourage farmers to increase the use of sustainable agriculture practices that help in protecting our natural resources such as cover crops, no-till and rotational grazing. PRAES will aid farmers, families and 4H members to promote renewable energy. To broaden our impact, we will be strengthening collaborations with USDA agencies and State Agencies, such as the Department of Natural Resources and other non-government agencies.

R&E efforts will identify successful adaptations to extreme weather events based on risk exposure assessments and agricultural biodiversity practices. Issues related to soil quality and best management practices, mitigation of threats to water quality, micro irrigation technologies for water conservation and improved crop productivity, and identification and protection of natural enemies of harmful insect pests, will continue in our research program. Projects that research and facilitate the creation of a sustainable forestry industry in PR, and the conservation of melliferous plants for ecosystem recovery and pollinators survival will continue. We will also address the proper definition of wetland boundaries, given the important functions that wetlands perform for the environment, people and other species.

FOOD SAFETY SCIENCE AND TECHNOLOGY.

To reduce foodborne disease outbreaks, PRAES will continue offering: the Food Safety Certification Course to people in charge of retail food establishments, and formal education to professionals that enforce food compliance regulations. The PRAES will also continue offering food safety courses such as the Families Be Food Safe which is adapted to meet the clientele's needs.

Complying with the new Produce Safety Rule (PSR) is challenging for small farmers in PR due to the high cost of sampling agricultural and postharvest water to meet the PSR microbiological criteria. Planned research efforts will be directed towards identifying small farmers in need of water sampling to comply with the PSR, and in conducting water sampling on their farms.

Recent experiences during the pandemic underscore the importance of helping small producers extend the shelf life of fresh products and adopt added value practices. The research and development of new products that add value to local crops such as plantains, sweet potato, and celeriac, and to others such as coffee, watermelon, and papaya, will continue to be important in our research program. New activities will include formulations and processing procedures to manufacture and pack value added commercial products from surplus fruits.

COMMUNITY, ECONOMY, & SUSTAINABLE DEVELOPMENT

R&E activities that contribute to the regeneration of agriculture and employment remain the focus of our work. Promoting better paid employment opportunities and increased labor efficiency are vital to improve the availability of labor for farm recovery and improving community conditions. Planned research activities are geared towards identification and development of profitable niche markets for PR's commodities through valued added alternatives and creation of differentiated products; evaluating technologies that can potentially improve labor productivity; and strengthening local food systems through identification of emerging issues, information gaps and policy alternatives.

In Extension, activities are focused on capacity building in areas of community food systems, emergency plans, volunteer programs, and entrepreneurship. PRAES will continue collaborating with the creation of action plans for the development of economic projects that generate income and jobs; and with education activities related to community self-management, volunteers' resiliency, and to the development of emergency and security plans for families.

FAMILY WELL-BEING

The Family and Well-Being (FWB) component will work to improve the quality of life of our vulnerable populations. The health promotion and disease prevention program targets areas of chronic and infectious diseases and prevention interventions. The family resource management will focus on helping and empowering the individual, family, and community to face current and future financial needs. The FWB program continues attending health disparities issues and educating families on social, health and hygiene challenges. In addition, educational programs on spending and savings plans and on making strategic decisions that favor family well-being continue progressing.

The COVID-19 situation has increased the need for health information, which sometimes maybe be misleading. Through effective health education and communication interventions the FWB program will continue providing clear and unambiguous information about preventive measures to contain COVID-19. Other related topics include disasters preparedness, hurricane and earthquake awareness and communicable and non-communicable diseases.

POSITIVE YOUTH DEVELOPMENT

Teens who can handle the changes and risk factors of adolescence become successful, happy, and healthy adults. Recent natural and biological disasters have dramatically impacted youth's mental health and academic achievements. The 4-H Educational Program will create safe learning spaces, establish positive contacts, and provide opportunities for children and youth to develop skills that positively contribute to our society.

As recommended in our 4-H Merit Review processes, we will continue working with youth leaders to promote emotional support systems for youth volunteer leaders, and efficient coping mechanisms before, during and after natural disasters and emergencies. Our POW will promote educational activities at communities, support youth leaders, and expand 4-H enrichment activities to help kids and youth move forward after natural disasters and emergencies. Through these activities, youth and adults will work and learn about health advocacy, emergency preparedness and diseases prevention, among other topics.

Merit and Scientific Peer Review Processes

The Extension Merit Review process continues to be conducted through four committees representing each of the four major program areas: Agriculture, Marketing and Natural Resources; Family and Consumer Sciences; 4-H and Youth Development; and Community Resource Development. Each committee is composed of at least five members: Internal University members (the program leader, two specialists, one from the Planning and Evaluation Office and one from the major subject area), a researcher from the Agricultural Experiment Station and other faculty members, and external non-University members (representatives of the major government agencies or organizations that work with similar audiences). External Members in the different committees include representatives from government agencies at the regional or state level, such as: Department of the Family, Department of Education, Department of Agriculture, the Mayor's Office, the Governor's Office for Youth Issues, Rural Development Corporation, the Farmers' Association, Farm Service Agency, Consumer Department, Head Start, Police Department, as well as representatives from non-governmental organizations, the religious sector and the private sector, among others. Each committee meets at least twice during the fiscal year to evaluate the proposed plan of work. External committee members evaluate the quality and relevance of the activities and programs to the State goals and offer recommendations in order to continue emphasizing critical areas in our programs. A written report is prepared at the end of each fiscal year by the program leader, in accordance with the committee members. The report is presented to the committee and describes how the committee's recommendations will be addressed and incorporated in the Plan of Work.

No significant changes are expected for the PRAEXS merit review process. Part of the Hatch funds will be allocated for competitive project grants. The competitive funded proposals will be selected on the basis of the year's revised priorities published in our annual call for proposals. The annual call for proposals will be prepared and distributed by the Research and Sponsored Programs Office. This office manages the research activities of the PRAEXS and sponsored projects for both PRAES and PRAEXS.

Part of the budget may also be allocated for specific signature projects of the PRAEXS. These signature projects encourage emerging or incipient agricultural research areas that need to be developed in Puerto Rico. At the same time, the Agricultural Experiment Station will be promoting the management of tropical agroecosystems under changing climatic conditions.

All the proposals (competitive and signature projects) will be submitted to the Assistant Dean for Research with the endorsement of Department Heads, and their scientific merit will be evaluated by internal and external peer reviewers. Final decisions will be made by a panel of College of Agricultural Sciences (CAS) administrators with representation from program coordinators, commodity area leaders and non-CAS evaluators

Stakeholder input: Action Taken to Seek Stakeholder Input

In order to seek input from the stakeholders, the PRAES will make use of traditional media to announce public meetings and listening sessions. In addition, targeted invitations to stakeholder groups or individuals and surveys of stakeholder groups and individuals will be made. Extension's stakeholder input process conveys mainly traditional participants or regular program's clientele who are members of Local Advisory Committees. This clientele has vast experience on the four major Extension program areas and include farmers, homemakers, youth as well as community leaders. State agencies'

representatives with similar clientele, who are also members of the local advisory committees, are invited to participate in the stakeholder input process.

Two types of meetings are held to identify critical issues that PRAEXS programs should address. First, we will continue with commodity meetings where stakeholders can participate by stating their opinion on research priorities. We have currently identified seven commodity groups of importance to Puerto Rico's economy: (1) coffee (2) farinaceous crops (3) fruits (4) vegetables and basic grains (5) milk and forage (6) environment, natural resources and renewable energy; and (7) meat production. Each commodity group has a yearly meeting. Organizers identify and invite members of producers' associations, individual farmers, faculty and students, government officials and community organizations with an interest in the commodity and related research programs. These meetings are also announced on the PRAEXS web page, podcasts, social media, and radio programs. Second, workshops, seminars, field days and symposiums are periodically held; here research results are shared and the research and extension needs or public policy determinations are discussed. Participation in these thematic activities is encouraged through internal university communications, emails sent to stakeholders, press releases, podcasts, and the use of social media such as Facebook and Twitter.

Stakeholder input: Methods to Identify Individuals and Groups

PRAES methods to identify the stakeholders entails the use Advisory Committees, Internal Focus Groups or Needs Assessments. In some instances, the use of a survey could be employed. Extension's stakeholders are mostly the local (municipal) advisory committee members.

PRAEXS uses commodity meetings to identify groups and individuals from which to collect information. In addition, the use of workshops and symposiums where farmers and the scientific community meet is another method of identifying stakeholders. Since many meetings are also announced on the PRAEXS web page, interested public, not targeted by these invitations, also attend the meetings.

Stakeholder input: Methods for Collecting Stakeholder Input

The methods to collect information most often used by PRAES are meetings with traditional stakeholder groups or individuals, survey of traditional stakeholder groups or individuals, survey specifically with non-traditional groups or individuals, focus groups and or electronic communications. Input from Extension's stakeholders is collected at the local advisory committee's meetings. Stakeholders are asked about the issues affecting their livelihood within the areas included in our educational program areas that cover: agriculture, families, youth and communities. PRAES stakeholders are also asked to prioritize these needs or issues. Focus groups are commonly conducted to ensure the priorities identified. A written report is prepared by the local Extension personnel in collaboration with the committee members and sent to the PRAES Planning and Evaluation Office at the State level, which collects and analyzes the written information and data collected. The information collected in a report at the local (municipal) level for the Stakeholder Input is designed for this purpose. It shows the date of the meeting or activity, attendance, summary of needs and priorities selected, procedure to determine and set priorities, limiting factors and suggested research needs. Another tool at the local level is a form to collect demographic data which is updated every five (5) years. This document provides a broad picture of the local situation, regarding the following items: population (changes, ages, gender); economy (agriculture, industries, tourism), social factors (employment, education, families, social programs), and environmental factors (water supply, contamination sources, recycling programs, natural reserves).

PRAEXS collects stakeholder input through personal communications and evaluation forms distributed at the end of meetings, workshops, field days, seminars, and symposiums. Stakeholders are asked about the most critical issues affecting their commodities and local areas, and recommendations about which of these should be research priorities. This information is summarized in a report prepared by the commodity and program leaders. Increasingly, stakeholders contact researchers through social media (e.g., Facebook, Twitter) and make comments to podcasts (uprm.edu/desdelaeaa). Stakeholders initially identified by these means are included in subsequent commodity or research activity invitations and their concerns are also included in the reports presented to the CAS administration.

Stakeholder input: A Statement of How the Input Will Be Considered

All the information collected from the stakeholders is considered in the budget distribution, identification of emerging issues, redirection of extension programs, staff hiring process, action plans and setting priorities. In order to set priorities for our educational programs, input collected from the Extension's stakeholders will be received at the state level and discussed with program leaders, the Planning and Evaluation Office, and the Associate Dean. Data collected from the stakeholders at local level, will also be shared with the specialists, according to the area of need. Needs related to the area of agriculture will be collected in a report to be sent to PRAES specialists that participated in the commodity joint meetings with PRAEXS. When there are issues that require attention, the programs are redirected to address the issues. Also, new emerging issues are identified through these processes and analyzed according to the staff and resources available to address. At the local level, input offered by the stakeholders is used to set priorities for their local plan of work. Statistical data from the State Health Department, Agriculture Department, Social Services, School of Family Science and Consumer Education, are also considered to respond to public policy issues. When there are issues that need to be emphasized, programs are redirected to address these issues. This process may also be used to make decisions about recruitment of new faculty members.

Research activities subsidized by the Hatch funds are partially aligned with the priorities disclosed by the stakeholders. The list of priorities assembled through the process described previously guides the year's call for proposals for new Hatch and Special projects and is also considered by researchers when applying for externally funded grants. In special cases, specific research projects could be created in order to meet stakeholders' urgent requests. In cases where the needs expressed by stakeholders cannot be met by PRAEXS, an internal evaluation will be performed to consider the possibility of recruiting new faculty members with the desired expertise. In 2022 this type of evaluation was carried out and several new appointments are in process. When there are issues which need to be emphasized, programs are revised to address these issues.

Critical Issues

Community, economy & sustainable development

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Intermediate (1-5 years)

The regeneration of agriculture and employment are long term issues exacerbated by the devastation that Hurricanes Irma and María inflicted on Puerto Rico in 2017. A recent 6.4 earthquake and the COVID-

19 pandemic further challenge ongoing recovery efforts. New research and extension activities will continue to focus on the promotion of potentially profitable markets for local products, value-added alternative to increase the price of agricultural commodities, best practices and models for addressing complex food-system issues, sustainable employment creation through entrepreneurship and self-management skills training, and community participation organizational skills training to better address community needs. Research and extension initiatives targeting resiliency, land tenancy, financial, labor market participation, and public policy issues, will also be explored.

Science Emphasis Area

Bioeconomy, Bioenergy, and Bioproducts, Education and Multicultural Alliances

Extreme weather, environment & sustainable energy

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Long-term (>5 years)

IPCC findings showed that the tropics and islands are most vulnerable to extreme weather events, increasing the risks for agricultural production. With extreme weather events becoming more common, we face the challenge of generating a food system that can absorb and recover from such stressors. Vital resources such as soil and water are especially susceptible; invasive species threats and urban sprawl complicate the island's outlook. Recent weather events forced PRAES to assist with and encourage the adoption of renewable energy options in agriculture. Our educational plan conveys workshops, meetings and demonstrations. Research efforts continue to focus on issues related to soil quality and best management practices, mitigation of threats to water quality, microirrigation technologies for water conservation and improved crop productivity, and on the identification and protection of natural enemies of harmful insect pests. Lessons learned from Hurricane Maria's impact on forest resources and on the status of bee populations are being integrated into projects that research and facilitate the creation of a sustainable forestry industry in Puerto Rico, and the conservation of melliferous plants for ecosystem recovery and pollinator survival.

Science Emphasis Area

Environmental Systems, Sustainable Agricultural Production Systems

Family well-being

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Intermediate (1-5 years)

Puerto Rico was hit in 2017 by two hurricanes. Prior to these hurricanes, the island was facing social, economic and public health challenges that both storms worsened. Poverty level in the months following the hurricane increased from 44.3% to 52.3%. Almost half of the population, including children, youth and elderly were living below the federal poverty level. Pre-existing health concerns that affected these vulnerable individuals were exacerbated by: mosquito's outbreaks diseases, increase of chronic and infectious diseases such as diabetes and sexually transmitted, mental health issues including

depression and suicide. In addition to problems in family relations, obesity is increasing. It is important to educate our families in order to improve their health and general well-being.

Science Emphasis Area

Family & Consumer Sciences, Food Safety, Human Nutrition

Food safety, science and technology

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Intermediate (1-5 years)

To reduce food borne disease outbreaks, public health agencies require that food managers take and approve a food safety course. Puerto Rico adopted the Food Code in 2000 which requires food managers to demonstrate food safety knowledge. PRAES continue offering courses to people in charge of retail food establishments, and to professionals on compliance regulations. Homes are also at risk. The majority of the food consumed by people is prepared at home where there is a greater chance of unsafe food handling practices. To implement the new Food Safety and Modernization Act, the FDA has developed a series of regulations, currently being enforced, making local food industries comply with it in order to achieve a safe food supply. Compliance with these rules is the only way that local farmers and food industries can become fully competitive in current markets. To help farmers and local food companies comply with the applicable rules, PRAEXS will continue providing food safety training to food industries and local farmers. Research efforts that address local producer needs related to adding value and extending the shelf life of fresh produce, will also continue to be important in our research program.

Science Emphasis Area

Food Safety, Human Nutrition

Food security, plant & animal systems

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Long-term (>5 years)

Puerto Rico imports over 80% of the food consumed, which travel thousands of miles from its place of origin. During the last 5 years Puerto Rico has faced many challenges including hurricanes, earthquakes and now the COVID-19 pandemic, among other risks that underscore the vulnerability of our food chain. For this reason, PRAES and PRAEXS will collaborate on increasing public awareness of the vulnerability of our current food system. Improving the system's biosecurity will demand that well planned programs are adopted by farms that supply food products. The focus of this effort will be to increase local animal and crop production and consumption. Research and Extension approaches will target the adequate use of inputs and efficient use of energy and water for a sustainable local animal and crop production system that promotes food security. Crop production systems research will focus on the availability of quality seeds; characterization, evaluation and development of crop germplasm; identification and management of key pests and diseases; and on the adoption of sustainable practices. Animal science research will remain focused on strategies to improve production in warmer climates, particularly through studies of a slick hair phenotype/gene that appears to be an adaptation of cattle to heat stress;

production strategies to add value to cattle raised grazing tropical grasses; and studies to improve the production, management, and well-being of small ruminants and add value to their sub products such as goat milk.

Science Emphasis Area

Human Nutrition, Sustainable Agricultural Production Systems

Positive youth development

Initiated on: Nov 26, 2019

State: Puerto Rico

Term Length: Long-term (>5 years)

Youth and 4-H Program will direct their efforts to create safe spaces for learning, establish positive contacts and offer opportunities and experiences for children and young people to develop skills and abilities that allow them to become healthy and committed leaders and adults. Cultivating youth and adult partnerships will be our milestone. Positive youth development initiatives and theories consistently agree that youth who receive mentoring and adult support can achieve healthy and affirmative relationships. When adults express interest in the well-being and care of the young they provide them with opportunities for growth, it inspires, and provides a genuine environment to raise the voice of the young people allowing new opportunities of working relations and joint projects.

Science Emphasis Area

Youth Development