

2011 University of Guam Research Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

The University of Guam (UOG) is the only 4 year public institution of higher education on Guam. Agriculture Experiment Station being a part of UOG since 1975 has had major impact on the agriculture research on Guam as well as many islands in the American Western Pacific. Western Pacific Tropical Research Center associated with the research division in the Land Grant collage accurately reflects our mission and research priorities. Western Pacific Tropical Research Center faculty and administrators formulated clear and attainable goals and adopted the following mission: "Excellence in research in support of the land grant mission of discovery, learning and engagement. We excel in the areas of tropical agriculture, environmental and life sciences." Our mission is well aligned with University of Guam mission of responsiveness to the specific needs of Guam and other Western Pacific island communities, thereby, contributing to their economic growth and stability.

It was already mentioned in the previous Plans of Work that since 2001 major university reorganization CES was transferred to the Office of the VP for University Outreach and Community Engagement This transfer of CES was done to promote the Land Grant mission to a wider audience. In 2007 the CES was transferred from the office of the VP for University and Community Engagement back to CNAS and the Dean of CNAS was appointed Director of CES. In 2008, inspired by the recent merger of CES and AES, administration of the College of Natural and Applied Sciences requested a CSREES review of the college focusing primarily on the research, extension and administrative areas.

According to NIFA (CSREES) report the current organizational structure was generally viewed as an improvement over having Cooperative Extension administratively separate from the college. By reuniting WPTRC and CES within the same college, faculty confirm that future program integration could be significantly improved. Faculty were looking forward to this future, but it was agreed that because of a divergence of programmatic priorities of the two units in recent years, it will take time for optimal integration can be achieved. Both the WPTRC and CES still have many programmatic issues of importance to address with very limited staffing and operational resources. Most of the issues to be addressed require an interdisciplinary approach and, in order to provide the most impact, require the researchers to develop information and answers and information specialists to deliver findings to appropriate audiences. We believe that the most efficient mechanism to achieve this is to foster an optimal close working relationship between both faculty and administrators of the WPTRC and CES.

The relatively small but very diverse group of WPTRC researchers has considerable local and regional knowledge and experience. Our expertise, experience and specialized knowledge give us a competitive edge in securing funding from USDA and other federal and private sources. Due to the uniqueness of the communities we serve, we frequently qualify for additional grants available to institutions serving minority populations. We undertake steps to increase the range of potential funding sources, both within and outside of the field of agriculture. Issues such as environmental protection, invasive species control and detection, genomic research, bio-fuel, bio-control measures, extinction of native species and habitat loss are within our field of expertise.

WPTRC researchers collaborate with scientists around the world working with esteemed foreign institutions as well as with respected national universities.

WPTRC researchers collaborate with local authorities (Customs and Quarantine, Department of Agriculture, EPA, Guam Visitors Bureau, Guam Airport Authority) as well as with other UOG units and centers including WERI, Marine Lab, Cooperative Extension Service and local farmers, golf courses and individuals in the community.

Guam's economy is driven by tourism therefore the natural beauty and fragile environment of the island is the major concern for the island's future prosperity. The military is Guam's second largest industry in terms of value. An agriculture even relatively small, has a significant importance. In the recent years the majority of our activities revolved around preserving natural environment, protecting natural tropical forests, as well as landscapes around businesses and various residential areas. Military build-up that will result in moving over 20,000 military personnel and their dependents to Guam will require an increase in environmental research, waste management research, improvements in landscape management around newly build residential areas and increases in ornamental horticulture research in general. Besides environmental and ornamental research, there has been a strong demand for research allowing production of fresh vegetables and local fruits. With the projected increase in Guam's population this demand is also going to increase. Unfortunately current Guam's market prices are still not competitive with imported food. WPTRC researchers continuously look for ways to increase added value of existing products and/or increase consumer demand for new products.

The scope of work conducted by WPTRC scientists is quite broad and researchers are regarded as experts in the fields of plant and animal sciences, bio-technology, food and nutrition, aquaculture, soils science, tropical agro-ecology, technical networking, and agricultural economics. Overall, there are nine faculty members in WPTRC actively involved in research and each of them covers one major area of agriculture related to their field.

WPTRC scientists are perceived by the community as experienced in training Guam's work force in the field of natural and applied sciences, education and extension. WPTRC continues to focus on issues addressing better understanding of the natural environment, protection and sustained management of natural resources, maintaining species diversity, management and prevention of invasive species, development of aquaculture, better waste management practices, improvements in water quality, enhancement and protection of forest resources, safety and improvement of food products, and growth of local markets, especially fruits and produce. Our objective is to further increase collaborative research across the region and around the globe.

Our facilities include spacious buildings, three field stations, an aquaculture hatchery, sufficient lab space, and good internet connections. The field stations in operation cover all of the major soil types on Guam and offer university researchers places to conduct field experiments. The stations not only provide facilities and support for research activities, but also provide support and facilities for teaching university classes and extension and outreach programs.

We have a considerable amount of specialized equipment set up to conduct entomology, plant pathology, chemical ecology, soil science, horticulture, pomology and food science research. The Plant and Soil Testing Laboratory has been offering analytical services to the Guam community and the Micronesian region for approximately 20 years. Clients of this laboratory include farmers, home gardeners, golf courses, contractors, federal and local government agencies, schools, researchers, and landscapers.

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

Year	Extension		Research	
	1862	1890	1862	1890
2011	0.0	0.0	9.0	0.0
2012	0.0	0.0	9.0	0.0
2013	0.0	0.0	9.0	0.0
2014	0.0	0.0	9.0	0.0
2015	0.0	0.0	9.0	0.0

II. Merit Review Process

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

- Combined External and Internal University Panel

2. Brief Explanation

Because of the small size of WPTRC, review of individual Plans of Work and projects has been conducted mostly by WPTRC administrators (Director and Associate Director). They usually utilize external reviewers as well as their knowledge and experiences to ensure that the planned programs and activities address the critical issues of strategic importance, including those identified by the stakeholders during the development of 2006-2011 Strategic Plans. All new research proposals (such as Hatch, McIntire Stennis, Regional Research etc.) are being submitted to WPTRC Associate Director who checks the proposal for completeness and format. There are very few peers at the university with expertise to review research proposals in agriculture fields. Therefore a draft proposal that is ready for review is being submitted to external ad hoc Peer Review Committee. Committee is comprised of three faculty members from other universities who are familiar with the issues addressed by the project. Based on the review, that includes assessment of (1) significance, (2) need, (3) approach, (4) new knowledge to be generated, (5) potential for impact, and (6) potential for success, WPTRC administrators are making decisions regarding allocation of resources.

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?

The crucial issues addressed by WPTRC planned programs fall within the strategic goals of WPTRC adopted by the faculty during Strategic Planning Retreat. It was agreed that all programs must address issues that are relevant to the needs of the region, serve interest of scientific community and are linked to the needs of our stakeholders. Indeed, numerous research projects address environmental issues, integrated plant protection, biocontrol as well as serve ethnic needs of local population. Giving some examples WPTRC scientists in 2011 will work on biological control in pest management systems, food safety education and traditional food modification, plant genetic resources conservation and utilization, carbon sequestration and distribution in eroded soils, ecophysiology of Guam's endemic and indigenous forest species, best management practices for papaya production, production of local seeds and tissue-cultured plants, improvement of vegetable production, shrimp research and economics of aquaculture on Guam. soil management practices for agricultural sustainability and environmental quality, integrated pest management of aphids and whiteflies on cucurbits and vegetables, genetic structure of the cycas population in the mariana islands, bionomics of the chromolaena gallfly, biological control of cycad aulacaspis scale semiochemical attractants and trapping systems for monitoring and control of invasive scarab beetles in Micronesia, development of sustainable aquaculture on Guam, research on diseases of traditional pacific island crop plants, development of efficient semiochemical-based control methods for weevil pests, evaluating the influence of ant attendance on natural enemies and their hosts on cycas micronesica, phytochemicals, biological properties, and safety of tropical and subtropical foods, plants, or herbals, a small-scale integrated farming system in an insular urban environment., as well as beneficial and adverse effects of natural, bioactive dietary chemicals on human health and food safety.

In addition they will participate in yearly meeting, exchange information and coordinate their multistate activities.

2. How will the planned programs address the needs of under-served and under-represented populations of the

The vast majority of Guam's inhabitants belong to the ethnic groups and cultures that often are not sufficiently served by federal programs. WPTRC (AES) administrators encourage new programs that address specific needs of under-served populations on Guam.

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

WPTRC (AES) administrators require annual reports to be submitted for all projects. Reports must contain sections called outputs and outcomes. Reported outcomes are categorized as short, medium and long term. Overall, AES projects produce valuable outcomes and impacts for our stakeholders and represent sound investments of our federal funding. WPTRC (AES) scientists have been able to obtain additional, significant funding from non-federal sources to support some of our programs. These types of funding indicate that conducted research is appreciated and considered to be trustworthy.

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

University of Guam organizational structure integrate agricultural research, and agricultural extension. After the time of split , AES and CES agricultural programs are becoming more effective and recent progress has been remarkable. Our faculty again established integrated projects that incorporate research, extension and education activities in the college.

IV. Stakeholder Input

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

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public

Brief explanation.

WPTRC will employ several of stakeholder input methods including soliciting input from individual farmers, farmers groups and organizations, representatives of the industry and representatives from federal and local agencies. Because of relatively small number of faculty and stakeholders on Guam, it has been a long-lasting practice to invite stakeholders for various functions in the college and give them frequent opportunities to express their needs in informal settings such as personal contact with faculty members. Periodically, stakeholders (farmers,

golf course superintendents, owners of nurseries etc.) are invited to the college to make presentations and express their needs and concerns in more formalized manner. Both methods seem to work well and WPTRC administrators plan to continue with this way of providing stakeholders' input.

Of particular importance is to generate good understanding (between stakeholders and AES) why issues related to the natural environment receive so much of attention and need stakeholders' support. We plan that our future stakeholders will include producers, consumers, decision-makers, students, alumni, and members of the business community.

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

- Open Listening Sessions
- Other (Guam's stakeholders are well identified)

Brief explanation.

Guam's stakeholders are well identified. There are not more than 50 farmers and not more than 200 individuals who supplement their income with some sort of agricultural production. Their participation and input to define agriculture research ranges from substantial (full time farmers) to insignificant. Farmers do not form strong and focused commodity groups. Their associations are rather loose and based on personal contacts, friendships, etc.

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 groups
- Meeting with traditional Stakeholder individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Most WPTRC faculty work closely with stakeholders. These include individual farmers, golf course superintendents, homeowners, school teachers, state legislature and government agencies. Informal and formal input is provided to WPTRC on a regular basis during workshops, open houses, telephone calls, and letters. Several faculty members conduct research on stakeholders' farms. Some faculty and administrators are invited for informal or formal meetings such as for example Guam Soil and Water Conservation District where WPTRC receives an input and feedback from stakeholder groups.

3. A statement of how the input will be considered

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

Brief explanation.

Stakeholder input has been used extensively in developing the current WPTRC Strategic Plan. As a result of the received input, WPTRC faculty modify their research plans to improve service and to provide specific opportunities for continued feedback. Information will be disseminated to communities through newsletters, local newspaper coverage, radio and sometimes television programs. Administrators use stakeholders input to prioritize resource allocations. Recommendations from various groups of stakeholders are useful in developing research programs that reach the island community.

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Sustain, Protect, and Manage Guam's Natural Environment and Resources.
2	Development and Protection of Guam's Diversified Tropical Plant Systems, and Aquaculture.

V(A). Planned Program (Summary)**Program # 1****1. Name of the Planned Program**

Sustain, Protect, and Manage Guam's Natural Environment and Resources.

2. Brief summary about Planned Program

With less than 1% of arable land on Guam and just a handful of truly commercial farms, WPTRC research efforts concentrate on the protection of natural environment. Major areas addressed by research include: agricultural waste management, soil erosion, soil quality, and carbon sequestration in eroded soils. Research efforts into preserving, protecting, and renewing Guam's natural resources continue to be an area of focus. This planned program will strengthen our capabilities in management of agricultural and natural resources, and to manage the impacts of human activities in ecosystems and mitigate natural environment.

3. Program existence : Mature (More than 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**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			100%	
	Total			100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Guam is a home for 170,000 inhabitants as well as tourist destination, mostly from Asia. The sustainability of natural resources, its use and management is vital for maintaining prosperity of the island. Water erosion is the most severe form of soil degradation on Guam. Eroded sediment carries away valuable soil nutrients and poses a serious threat to humans, resources, and environments downstream. The badlands of southern Guam are a prime example. Transport of sediment out of a badland basin and into a new sedimentary system promotes a spectrum of environmental and ecological changes ranging from wetlands formation and river turbidity to coastal modification and habitat destruction. The natural areas affected are integral parts of both the quality of life for residents and the viability of the tourism industry. Both are severely altered by unchecked badlands formation. WPTRC soil scientist is developing an integrated approach to control the accelerated soil erosion and restoration of the land resources in southern Guam. In his research, he and his colleagues evaluated a variety of options, including the effects of Vetiver Systems on the watershed areas for controlling the sedimentation and preventing water pollution downstream, hence protecting the coral reefs.

Increased tourism as well as systematic increase of consumption on the island resulted in some harm to the environment as well as increased production of waste. For example, parts of coral reef around Guam are severely damaged and existing landfill is overloaded. A new landfill construction is on the way regardless of strong opposition from nearby residents. Effective management of the environment and natural resources must balance competing interests. Developing and applying sound management strategies, combined with thorough understanding of complex interdependences of natural systems, can yield sustainable benefits from land resources and urban development. WPTRC will focus on development of knowledge base that achieves maximum benefits from natural resources. Through advances in scientific knowledge and effective application of that knowledge WPTRC can help in achieving harmony between economic growth and preservation of

Guam's precious natural resources.

2. Scope of the Program

- In-State Research
- Multistate Research

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

1. Assumptions made for the Program

At least one qualified researcher and supporting staff is available.

Additional external funds and other resources are available.

Partnerships with other agencies such as NRCS and other universities will continue, will coordinate efforts and share resources.

Basic Information on best management practices exists for the management of natural resources.

Government and other stakeholders are willing to implement best management practices.

2. Ultimate goal(s) of this Program

To achieve the balance between urban development and sustainability of natural resources.

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
2011	0.0	0.0	1.0	0.0
2012	0.0	0.0	1.0	0.0
2013	0.0	0.0	1.0	0.0
2014	0.0	0.0	1.0	0.0
2015	0.0	0.0	1.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

We will develop various techniques, methodology and soil management practices to maintain Agricultural sustainability and environmental quality under different farming practices.

We will study the effects of surface crop residues and subsurface macroporosity on water infiltration into the soil profile. Effect of crop residue on soil quality improvement for agricultural sustainability.

We will improve watershed management and use of Vetiver Technology for trapping sediment to control soil erosion on slopping lands and to slow storm water flow and trap sediment and nutrients for improving water quality downstream.

We will study the dynamic relationship between soil and water and chemical transport within the soil matrix.

We will conduct various experimentations by employing innovative techniques such as cat-scan tomography and dyes and tracers to measure the parameters of solute transport and chemical movement throughout the soil profile.

We will attempt to develop management techniques to slow and/or retard preferential macropore flow as a preventive technique for reducing the risk of groundwater contamination under no-tillage production system.

We will attempt to develop techniques to evaluate the effects of nutrient distribution under conservation management practices as an alternative to a sustainable production system.

We will attempt to develop techniques to evaluate the effects of no-till management and inter cropping on chemical, physical and biological properties of the soil.

We will study the effect of composted organic wastes on soil quality, crop production and agricultural sustainability.

We will promote waste management and composting as an alternative to land filling of solid organic waste and use of compost for soil quality enhancement as an alternative to synthetic fertilizers for crop production and for environmental integrity of natural resources.

We will study bio-remediation of contaminated soils by using organic material for the enhancement of biological activities in the contaminated soils.

We will investigate the use of Vetiver System (VS) for the bio-remediation of sewage water and drainage from storm water for water quality improvement and the restoration of water reservoirs and marine environments near the seashores.

We will study the use of composted organic waste to increase organic matter content for improving soil physical properties in order to reduce soil erosion.

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

Extension

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> • Workshop • One-on-One Intervention • Demonstrations 	<ul style="list-style-type: none"> • TV Media Programs • Web sites

3. Description of targeted audience

More extension component in this program's will be developed. However, in Guam's CES there is no soil scientist or faculty with similar expertise

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 Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	10	100	0	0
2012	10	100	0	0
2013	10	100	0	0

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2014	10	100	0	0
2015	10	100	0	0

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

2011:0 2012:0 2013:0 2014:0 2015:0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	1	0	0
2012	1	0	0
2013	1	0	0
2014	1	0	0
2015	1	0	0

V(H). State Defined Outputs

1. Output Target

- Conference Presentations

2011:2 2012:2 2013:2 2014:2 2015:2

- Journal Publications

2011:1 2012:1 2013:1 2014:1 2015:1

- Newspaper, magazine and other non peer reviewed publications.

2011:2 2012:2 2013:2 2014:2 2015:2

V(I). State Defined Outcome

O. No.	Outcome Name
1	<p>Action outcomes :</p> <p>Adopt sustainable natural resource management practices.</p> <p>Condition Outcomes: Enhance the economic and environmental sustainability of Guam's agriculture Improve the lives of Guam's citizens through positive human development</p> <p>Learning Outcomes:</p> <p>Aspire to contribute to ecological health and biodiversity Learn about nutrient sources, recycling and delivery methods that are compatible with crop, soil and production systems Learn about water and land interaction, and related water-quality issues</p>

Outcome # 1

1. Outcome Target

Action outcomes :

Adopt sustainable natural resource management practices.

Condition Outcomes: Enhance the economic and environmental sustainability of Guam's agriculture

Improve the lives of Guam's citizens through positive human development

Learning Outcomes:

Aspire to contribute to ecological health and biodiversity

Learn about nutrient sources, recycling and delivery methods that are compatible with crop, soil and production systems

Learn about water and land interaction, and related water-quality issues

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0

2012:0

2013:0

2014:0

2015:0

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Natural disasters such as typhoons do occur on Guam frequently. Damage to research plots, and equipment can be very extensive. When the economy is poor, funding decreases. Small institution as WPTRC (AES) feels impact of financial difficulties very suddenly.

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

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Description

Program is long term. Journal and other types of publications measure its success.

2. Data Collection Methods

- Sampling
- Observation
- Journals

Description

Typical for basic and applied research.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Development and Protection of Guam's Diversified Tropical Plant Systems, and Aquaculture.

2. Brief summary about Planned Program

Guam's commercial agriculture is small and almost all food is imported. This is not likely to change and only small quantities of high value specialty crops for certain niche markets will be produced by Guam's farmers. Guam relies heavily on its environment to provide excellent living conditions for the residents as well as major attractant for the visitor industry. Diversity and health of plants plays an essential role by providing tropical character to hotels, shops and residential areas. In addition the golf industry attracts many visitors who come to Guam specifically to play golf. The planned research program will address development of specialty crops produced on Guam, ornamental plants in our landscapes, as well as protect a diversified flora in natural environments. Recently, the University of Guam WPTRC initiated new research to support aquaculture development in Guam and the region. Aquaculture Development and Training Center is responsible for the production, maintenance, and distribution of specific pathogen free (SPF) shrimp stocks worldwide. Pests threaten agricultural products as well as natural and urban ecosystems. Through basic and applied research, host-pathogen interactions can be identified; control measures can be developed and researched. An important component of ecosystems management is mitigation of alien invasive species. Invasive species threaten Guam's native plants and damage economically important ornamental species.

The invasion of new pests and pathogens, including insects, and disease causing organisms, can devastate the expensive niche crops that Guam's farmers produce thereby destroying their limited economic opportunities. All programs must address issues that are relevant to the needs of the region, serve interest of scientific community and are linked to the needs of our stakeholders. Indeed, numerous research projects address environmental issues, integrated plant protection, biocontrol as well as serve ethnic needs of local population. Giving some examples in 2011 we will work on biological control in pest management systems, food safety education, plant genetic resources conservation, production of local seeds and tissue-cultured plants, improvement of vegetable production, improvement of aquaculture on Guam, integrated pest management, genetic structure of the cycas population, biological control of cycad, trapping systems for monitoring and control of invasive scarab beetles, development of sustainable aquaculture on Guam, research on diseases of traditional Pacific island crop plants, biological properties, and safety of tropical and subtropical foods, plants, or herbals, a small-scale integrated farming system in an insular urban environment., as well as beneficial and adverse effects of natural, bioactive dietary chemicals on human health and food safety.

3. Program existence : Mature (More than 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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources			15%	
205	Plant Management Systems			10%	
211	Insects, Mites, and Other Arthropods Affecting Plants			15%	
212	Pathogens and Nematodes Affecting Plants			10%	
215	Biological Control of Pests Affecting Plants			20%	
216	Integrated Pest Management Systems			10%	
307	Animal Management Systems			15%	
601	Economics of Agricultural Production and Farm Management			5%	
	Total			100%	

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

1. Situation and priorities

Physical isolation of the island and its year round favorable growing conditions created unique ecosystems, extremely susceptible to invasion by undesirable plants, insects, microbes, and other invasive species. Invasive species, especially insects are considered the greatest threat to Guam's economy and natural environment. Invasive species cause great losses, sometimes the extinction of native species, and in general significant destruction of native forests. Sometime pests such as brown tree snake, change natural environment and quality of life forever. Despite federal and state quarantine regulations, many species become imported mostly with shipped products. Some are harmless but some cause a significant impact on Guam's economy. Research will be aimed at eradication of invasive species in localized outbreaks. In areas where eradication may not be immediately possible, control measures will be researched to minimize its spread and reducing the population.

2. Scope of the Program

- In-State Research

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

1. Assumptions made for the Program

Other agencies will cooperate.

External funds and resources will be available.

Several faculty will actively work and collaborate on IPM projects.

At least two faculties will devote their research efforts to address issues related to increased production of cash crops.

Aquaculture will be supported by local government

2. Ultimate goal(s) of this Program

Eradicate specific invasive species or at least improve management of targeted invasive species.

Reduce introductions of invasive species to Guam.

Quickly detect new introductions and eradicate them as soon as possible.
 Increase collaboration with USDA Services and other territorial and federal agencies.

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
2011	0.0	0.0	8.0	0.0
2012	0.0	0.0	8.0	0.0
2013	0.0	0.0	8.0	0.0
2014	0.0	0.0	8.0	0.0
2015	0.0	0.0	8.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Here is an outline of the major research thrusts of the next 5 years.

- biological control in pest management systems,
- improvement of vegetable production,
- improvement of aquaculture on Guam,
- improvement in integrated pest management,
- monitoring and control of invasive pests
- research on diseases of traditional Pacific island crop plants,
- development of a small-scale integrated farming system in an insular urban environment.,
- develop environmental safe control methods for the invasive species by integration of semiochemicals and biocontrol agents.
- introduce specific pathogen free shrimp production and development of an export market -study cycad pollination biology, cycad toxicology and biochemistry.
- implement Aquaculture Development Plan for Guam and hire one more faculty.

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

Extension

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Workshop ● One-on-One Intervention ● Demonstrations 	<ul style="list-style-type: none"> ● TV Media Programs ● Web sites

3. Description of targeted audience

Our target audience are research community, federal and territorial agencies, farmers, landscapers general public etc.

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 Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	100	1000	0	0
2012	100	1000	0	0
2013	100	1000	0	0
2014	100	1000	0	0
2015	100	1000	0	0

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

2011:0 2012:0 2013:0 2014:0 2015:0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	12	0	0
2012	12	0	0
2013	12	0	0
2014	12	0	0
2015	12	0	0

V(H). State Defined Outputs

1. Output Target

- Journal publications

2011:12 2012:12 2013:12 2014:12 2015:0

- Newspaper, magazine, and other non peer reviewed publications.

2011:20 2012:20 2013:20 2014:20 2015:20

- Abstracts and conference presentations.

2011:20 2012:20 2013:20 2014:20 2015:20

V(I). State Defined Outcome

O. No.	Outcome Name
1	<p>Action outcomes Adopt healthy lifestyle practices, Adopt independent living practices, Adopt sustainable living practices, Adopt sustainable natural resource management practices, Implement food safety practices at all stages of the food handling system, Improve and expand Integrated Pest Management.</p> <p>Condition Outcomes: Enhance the economic and environmental sustainability of Guam's agriculture and aquaculture. Improve the lives of Guam's citizens through positive human development, healthy lifestyles and nutrition</p> <p>Learning Outcomes Aspire to contribute to ecological health and biodiversity Learn about integrated pest management (IPM) Learn about invasive species Learn about IPM technologies and benefits Learn about new crops and varieties Learn about nutrient sources, recycling and delivery methods that are compatible with crop, soil and production systems Learn about principles of aquaculture resource management Learn about the environmental risks of handling and applying pesticides Learn about the risks of not handling food safely Learn about water and land interaction, and related water-quality issues Learn alternative pest management techniques that minimize pesticide use Learn appropriate food safety practices Learn proper food handling practices Learn sustainable living skills Learn to apply pesticides safely and effectively Learn to identify invasive species</p>

Outcome # 1

1. Outcome Target

Action outcomes

Adopt healthy lifestyle practices, Adopt independent living practices, Adopt sustainable living practices, Adopt sustainable natural resource management practices, Implement food safety practices at all stages of the food handling system, Improve and expand Integrated Pest Management.

Condition Outcomes:

Enhance the economic and environmental sustainability of Guam's agriculture and aquaculture.
 Improve the lives of Guam's citizens through positive human development, healthy lifestyles and nutrition

Learning Outcomes

- Aspire to contribute to ecological health and biodiversity
- Learn about integrated pest management (IPM)
- Learn about invasive species
- Learn about IPM technologies and benefits
- Learn about new crops and varieties
- Learn about nutrient sources, recycling and delivery methods that are compatible with crop, soil and production systems
- Learn about principles of aquaculture resource management
- Learn about the environmental risks of handling and applying pesticides
- Learn about the risks of not handling food safely
- Learn about water and land interaction, and related water-quality issues
- Learn alternative pest management techniques that minimize pesticide use
- Learn appropriate food safety practices
- Learn proper food handling practices
- Learn sustainable living skills
- Learn to apply pesticides safely and effectively
- Learn to identify invasive species

2. Outcome Type : Change in Knowledge Outcome Measure

2011:10	2012:10	2013:10	2014:10	2015:0
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3. Associated Knowledge Area(s)

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

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Typhoons are always possible on Guam and may delay advances of research.

Lack of funding (cuts in formula funds and unsuccessful efforts for competitive funds) may reduce the scope of research.

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

1. Evaluation Studies Planned

- During (during program)

Description

Program will be evaluated every year

2. Data Collection Methods

- Sampling
- Observation
- Tests

Description

Research data will be collected and analyzed according to the standard methods.