

# 2011 University of Guam Research Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

Guam, an unincorporated Territory of the United States, is located in the Western Pacific at 13 degrees north latitude and 144.4 degrees east longitude. It is the largest of 16 islands in the Marianas. It is approximately 3,600 miles west- southwest of the Hawaiian Islands and about 1,500 miles due east of Manila, Philippines. Guam's population is approximately 180,000 and increasing. The ethnic background of the island includes: Chamorro (native islanders), Filipinos, Caucasians (including members of the U.S. Armed Forces and their dependents), other islanders (Micronesians and Palauans) and Asians (Koreans, Japanese and Chinese).

The University of Guam as a member of the 1862 Land Grant institutions. College of Natural and Applied Sciences (CNAS) facilitates the tripartite functions of the college: research, extension and teaching. The Dean of CNAS serves as Director of the Agriculture Experiment Station, and also as Director of Cooperative Extension Service.

In 2006 AES was renamed to Western Pacific Tropical Research Center. This new name more accurately reflects the division's broad mission and research priorities. The primary mission of WPTRC is to conduct applied and basic research in agriculture and to protect the natural environment. The Hatch funds and their respective Government of Guam matching funds are used to maintain operations of the Western Pacific Tropical Research Center.

The Western Pacific Tropical Research Center conducts research for the protection of natural environment as well as the development of the island's agriculture and aquaculture. The University of Guam Cooperative Extension Service translates and delivers technical information and conducts informal education programs for farmers, homemakers, families, youth and the community.

Research productivity over last several years continuously increase. In 2011, ten full time researchers published over 25 refereed journal papers which place us among successful and productive research units. Further significant growth in refereed journal publications as well as substantial increase in successful grant proposals in 2011 was evident. The new aquaculture program resulted in development of a successful activities in both research and teaching. Creation of the new tenure track Chemical ecologist position assured stability in this important field of research. Investments related to the military buildup on Guam had positive impact on the island's economy and local businesses however increased the number of introductions of pests and other invasive species. Overall, 2011 was one of the most successful year in WPTRC (AES) history.

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.0	0.0
Actual	0.0	0.0	10.0	0.0

**II. Merit Review Process**

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

- Combined External and Internal University Panel

**2. Brief Explanation**

Since there are only ten full time scientists at WPTRC, review of individual projects was conducted by WPTRC administrators (Director and Associate Director). Planned programs and activities addressed the critical issues of strategic importance, including those identified by the stakeholders during the development of 2007-2012 Strategic Plans. All new research proposals were submitted to WPTRC Associate Director who checked proposals for completeness and format. Afterwards proposal were sent for review to external ad hoc peer reviewers. 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 submitting proposals to CRIS and make decisions regarding allocation of resources.

**III. Stakeholder Input**

**1. Actions taken to seek stakeholder input that encouraged their participation**

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

**Brief explanation.**

In 2011, numerous research projects were driven by stakeholders demand and addressed environmental issues, integrated plant protection, biocontrol as well as served ethnic needs of local population. Relatively large portion of research aimed to develop control mechanisms for eradication/ suppression of non-indigenous/invasive species, to improve and implement effective early detection and prevention strategies, and to develop Integrated Pest Management strategies for major exotic insect plant pests and diseases. Another important research project continued to define the genetic structure of the Cycads populations among the island habitats of Guam, Rota, Yap, Palau, and the Philippines. We continued to focus on issues that assure the understanding and protection of natural environment and especially the soil. Most of research concentrated on sustained management of natural resources waste management, water quality and other resources vital for people of Guam.

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

**1. Method to identify individuals and groups**

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

**Brief explanation.**

WPTRC researchers employed several input methods to solicit input from individual farmers, farmers groups, representatives of the industry and representatives from federal and local agencies. Because of relatively small number of research faculty and stakeholders, 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 listening sessions, workshops and personal contact with faculty members. In 2011 stakeholders (farmers, golf course superintendents, managers from nurseries etc.) were invited to the college numerous times to express their needs and concerns. Celebrations of University's 60th anniversary (agricultural month) gave even more opportunities for showcasing our activities. Of particular importance is continued understanding and stakeholders' support on issues related to the protection of Guam's natural environment.

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

**1. Methods for collecting Stakeholder Input**

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

**Brief explanation.**

About fifty farmers who supplement their income with some type of agricultural production ranged in their activities from substantial (full time farmers) to hardly significant. One particular hydroponic farm became an important component of local food production. Farmer's associations are rather loose and based on personal contacts, friendships, etc. Their research requests are consequently not strong however researchers are expected to proactively address local farmers' concerns. Some researchers modified their research programs to improve a service to stakeholders and provided additional opportunities for continued feedback. Research Information were disseminated to communities through internet, printed newsletters, local newspaper coverage, radio and television programs.

**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.**

For the most part, our professionals know the primary stakeholders in their particular disciplines, and interact with them regularly in the course of their normal university duties. Input from these interactions allows the faculty to tailor their programs to the unique needs of Guam's diverse community. WPTRC informal and formal contacts with stakeholders work well. Residents of Guam know that their input will be considered and they volunteer their concerns and observations directly to WPTRC scientists. An example of how stakeholder input is translated into action by CNAS is the rapid manner in which UOG is able to react to the sudden appearance of new disease or invasive species. Sudden appearance of invasive fire ants resulted in huge response from stakeholders (Guam's residents). In response to local needs, entomologist modified his research focus and research directions substantially.

**Brief Explanation of what you learned from your Stakeholders**

Research scientists maintain close contacts with local growers, and because of the breadth of experience on other islands in the region, UOG-CNAS scientists and extension agents are able to identify, characterize and provide a rational method of management for invasive species, new disease outbreaks and other concerns on Guam. After identifying challenges researchers apply for funding for more in depth investigations. Examples of such grants could be request for research optimizing management technique to prevent spread of diseases or invasive species.

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	1078475	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	0	0	840000	0
<b>Actual Matching</b>	0	0	650000	0
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	0	0	1490000	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous</b>				
<b>Carryover</b>	0	0	0	0

**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.

**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%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.0	0.0
Actual Paid Professional	0.0	0.0	1.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	90000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	50000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**V(D). Planned Program (Activity)**

1. Brief description of the Activity

Soil management practices for agricultural sustainability and environmental quality study continued on the island of Guam. Result from the study has shown that the soil organic matter as well as soil organic carbon, and soil erosion are all affected by tillage systems. Up to date data indicated that tillage systems, affect the amount of soil carbon sequestration and/or carbon dioxide emission into the atmosphere.

The study showed that the conservation farming practices such as no-till had potential to increase soil organic carbon sequestration as disturbances within the plow layers was reduced to minimum and or to zero. These findings show that residue removal as well as soil disturbances increases the potential for net Green House Gas emission and reduces potential for soil organic carbon content and overall carbon sequestration. The results of this ongoing experiment will contribute to the overall scientific efforts in understanding the role of agriculture in sequestration of carbon in soils, and the ways in which this may reduce atmospheric carbon dioxide. It also provides information pertaining to the local conditions of the island tropical climate as relates to carbon sequestration or carbon loss in the form of carbon dioxide emitted into the atmosphere following the removal of crop residue as well as each disturbances that occur during the tilling process.

In 2011 a study on carbon distribution in soils of eroded landscapes continued. This study investigated the impact of long-term conservation and residue management based cropping systems on Soil Organic Carbon (SOC) levels and soil carbon sequestration on the tropical conditions of the western Pacific island of Guam. Conservation practices, especially No-till, restore SOC and have the added benefit of controlling erosion. Up to date study results have shown that the higher percent carbon content of the soil under the no-tillage (NT) was due to no disturbances to the soil surface during the study period. On the reduced till (RT) plots the percent carbon content also remained high next to the no-till plots mainly due to the reduced disturbances as compared to conventional tillage (CT) practices. Furthermore the data illustrates that the carbon content of the soil near the surface is less than % 1.5 for all treatment regardless of the tillage practices.

**2. Brief description of the target audience**

Farmers, landscapers, research community, USDA-NRCS, EPA, general public.

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10	100	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	0	2	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Conference Presentations

Year	Actual
2011	4

**Output #2**

**Output Measure**

- Journal Publications

Year	Actual
2011	2

**Output #3**

**Output Measure**

- Newspaper, magazine and other non peer reviewed publications.

Year	Actual
2011	6

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	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

**Outcome #1**

**1. Outcome Measures**

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. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	0

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Economy
- Appropriations changes

**Brief Explanation**

Overall poor economy and significant cuts to the university affected outcomes. Reduced appropriation of funds affected outcomes as well.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Performance of this program is rated very high by Guam's stakeholders including farmers, students and general public. WPTRC administrators received many positive signals including letters of appreciation for excellent conductance of this particular program.

### **Key Items of Evaluation**

**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.

**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			10%	
205	Plant Management Systems			20%	
211	Insects, Mites, and Other Arthropods Affecting Plants			20%	
212	Pathogens and Nematodes Affecting Plants			10%	
215	Biological Control of Pests Affecting Plants			10%	
216	Integrated Pest Management Systems			10%	
307	Animal Management Systems			10%	
601	Economics of Agricultural Production and Farm Management			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	0.0
Actual Paid Professional	0.0	0.0	8.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	750000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	600000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

The impact of unidirectional wind on papaya growth was studied further this year. Container studies were designed to disentangle the growth responses at the organ level. Stem extension was significantly reduced and root extension was unaffected by wind exposure.

Leaf decay studies started in 2011 and initial results revealed a tighter relationship of potassium to decay rates than nitrogen or phosphorus. The proportion of remaining litter was positively correlated with initial carbon:potassium relationship close to 1:1.

WPTRC entomologist conducted a survey of invasive ants that affect the survival and efficiency of hemipteran parasitoids on the islands of Guam, Saipan, Rota in the Mariana Islands.

Work on coconut rhinoceros beetle on Guam continued. Field releases of fungal spores into rhino beetle breeding sites were initiated following lab bioassays

Little fire ant, *Wasmannia auropunctata* was identified for the first time on Guam in November 2011. Delimiting surveys conducted immediately after its discovery revealed that it infests about a 2 ha forest site in northern Guam. The sweetpotato weevil, still causes damage in the field and in storage. Conducted studies evaluated numerous characteristics that affect pheromone-based catches, including trap design, trap size, trap color, and height of the traps.

A biological control program has been initiated to control *Chromolaena*, *Coccinia* and *Mimosa* that have been spread in agricultural and forestry areas.

The red spider mite, a pest of several vegetable crops and perennials was further studied. It became a serious pest, particularly affecting eggplant.

Aquaculturist continued genetic and nutritional studies in shrimp. To evaluate the genetic and dietary protein level/source interactions for Pacific white shrimp. Shrimp genetic breeding program continued.

Conservation of local lines of sweet potato and chili pepper continued. Fifteen accessions of sun hemp were obtained. Production of local seeds and tissue-cultured plants in improvement of vegetable production on

Guam study continued. Collection, evaluation and culture of ornamental plants in Guam focused on evaluating wildflower seed mixes that are being imported into Guam.

Research on diseases of traditional Pacific island crop plants continued in 2011. Various banana cultivars were imported in tissue culture. A new tissue culture lab was established.

Phytochemicals, biological properties, and safety of tropical and subtropical foods, plants, or herbals

in the Western Pacific was studied in 2011. The optimum conditions of pasteurization and quality of foods

under refrigeration were determined. Beneficial and adverse effects of natural, bioactive dietary chemicals on human health and food as well as the effect of hot-air dehydration on antioxidant activity of hibiscus tea was studied.

A small-scale integrated farming system in an insular urban environment research continued . On-farm demonstration of non-circulating hydroponic system showed the potential of leafy greens production using simple hydroponic system in the tropics.

**2. Brief description of the target audience**

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

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	50	100	500	500

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	12	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Journal publications

<b>Year</b>	<b>Actual</b>
2011	24

**Output #2**

**Output Measure**

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

<b>Year</b>	<b>Actual</b>
2011	40

**Output #3**

**Output Measure**

- Abstracts and conference presentations.

<b>Year</b>	<b>Actual</b>
2011	60

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	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

**Outcome #1**

**1. Outcome Measures**

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. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2011	0

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

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

**KA Code    Knowledge Area**

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

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Economy
- Appropriations changes

**Brief Explanation**

Lost of local and federal funds (especially TSTAR Special Grant) negatively affected outcomes.

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

Programs are being evaluated by the stakeholders and feedback is positive.

**Key Items of Evaluation**