V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustain, Protect, and Manage the Environment and Natural Resources of Guam and Micronesia.

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%		10%	
136	Conservation of Biological Diversity	15%		15%	
202	Plant Genetic Resources	10%		20%	
205	Plant Management Systems	15%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		20%	
215	Biological Control of Pests Affecting Plants	15%		15%	
216	Integrated Pest Management Systems	10%		10%	
723	Hazards to Human Health and Safety	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	12.0	0.0
Actual Paid	7.3	0.0	12.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
272022	0	803365	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
188571	0	469600	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

Little fire ant (LFA) was detected on Guam in 2011 and continues to spread in Guam. A delimiting survey was completed in a GovGuam Conservation Forest that includes planted acacia trees interspersed with shrubs and bushes. The areas was treated with Tango, a pesticide that contains the insect growth regulator s-methoprene, and Siesta, a granular formulation of a chitinase inhibitor, metaflumizone. Following the application of the pesticides, the worker ants ingest a sublethal dose of the active ingredient of either pesticide, feed it to the queen upon returning to the main colony. Once the queen dies, the workers and ultimately the entire colony gradually dies out. Initial results indicated that LFA's numbers decreased by about 60%.
Work on coconut rhinoceros beetle has focused in detecting biological control organisms than can be effective in Guam. Whereas control with virus imported from New Zeland failed, two viruses recently brought from Papua New Guinea have been deemed promising for bio control.
CNAS faculty provide service and training on species invasive identification, serve in the Invasive Species Council and other committees, and participate in the National Plant Diagnostic Network.
Plant inventories of urban landscapes have continued. Data are entered into the Plan-it Geo Treeplotter database. Propagated and out-planted Guam rare plant species are establish in protected sites. Plants are monitored and maintained using adaptive management until they are established. Monitoring included documenting pest problems.
Agriculture and forest lands are affected by climate change, but also contribute to it through greenhouse gas emissions. Soil organic C, in turn, could be increased by feedback loops caused by climate change. Results from studies consisting in applications of biochar and compost in limestone soils in Northern Guam suggested positive effects on corn yields and trends to lower CO_2 emissions.
Here is an outline of the major research thrusts over the next 5 years.
- implementation of biological control to mitigate damage from invasive species
-improvement of integrated pest management of agricultural and natural resource systems
- monitoring of invasive pests and their impact on insular environment
- conduct urban forest inventory on Guam
- characterization of genetics of threatened and endangered plants on Guam and the region
- investigate how to enhance carbon content of Guam soils
-maintenance and improvement of biological collections and biodiversity information systems

2. Brief description of the target audience

Our target audience is the general public, farmers, landscapers, the research community at large, and federal, territorial, and regional government agencies and NGO's. In addition, certain issues such as

invasive species have moved CNAS to be a regional, national, and international partner.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1325	55871	1208	2893

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	16	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of workshops

Year	Actual
2018	27

Output #2

Output Measure

- # of one-to-one contacts

Year	Actual
2018	737

Output #3

Output Measure

- # of popular articles in newsletters, magazines and newspapers

Year	Actual
2018	31

Output #4

Output Measure

- # of Extension publications (fact sheets, white papers, web-based learning modules, etc)

Year	Actual
2018	21

Output #5

Output Measure

- # of research or extension advisory boards and councils

Year	Actual
2018	0

Output #6

Output Measure

- # of peer-reviewed research publications

Year	Actual
2018	21

Output #7

Output Measure

- # of presentations at professional international, national, or regional conference

Year	Actual
2018	19

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# participants indicating improved knowledge and skills or recommended practices
2	# of strategic plans and policies implemented as a result of this program
3	# of cooperative agreements/partnerships initiated or continued as a result of this program

Outcome #1

1. Outcome Measures

participants indicating improved knowledge and skills or recommended practices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	83

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Invasive species have large detrimental effects on Guam's environment and people. These species continue to arrive to Guam because of increasing commercial, military and public activities. The cycad scale, the coconut rhinocero beetle and the little fire ant are the most common invasive species but other species are detected periodically by our extension and research personnel.

What has been done
Numerous workshops and meetings have been conducted to increase awareness of the invasive species problem and explain strategies to reduce their spread and impact. Extension and research faculty participate in the Guam Invasive Species Council and collaborate with APHIS to identify new insects and pathogens and assess the chances of invasion. They also work regionally to prevent invasions in Micronesia, Polynesia and the Western United States.

Results
Approaches to conduct surveillance of the coconut rhinocero beetle and the little fir ant have been delivered throughout Micronesia. Information and assistance have also been provided for monitoring and rapid responses to invasions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
202	Plant Genetic Resources

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

# of strategic plans and policies implemented as a result of this program

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Strategic plans and policies about invasive species, environmental degradation, and ecological restoration need to be develop further in Guam through the collaborative effort of federal agencies, Guam government, University of Guam, and local communities.

Results
Guam Invasive Species Master Plan and CNMI Invasive Species Master Plan both completed, published, and submitted to the respective legislatures in 2017.

In addition, there is continued growing awareness on the part of policy makers and general public.

Many plans have been developed by local and federal government agencies, but implementation remains problematic due to funding limitations and lack of professional capacity.

What has been done

In regard to invasive species, CNAS research and extension personnel have continued working on different initiatives to reduce their the impact, improve detection and preventing them for infecting other islands. The Guam Invasive Species Master Plan will be revised to incorporate more actionable items.

Results
Guam Invasive Species Master Plan and CNMI Invasive Species Master Plan both completed, published, and submitted to the respective legislatures in 2017.

In addition, there is continued growing awareness on the part of policy makers and general public.

Many plans have been developed by local and federal government agencies, but implementation remains problematic due to funding limitations and lack of professional capacity.

What has been done

In regard to invasive species, CNAS research and extension personnel have continued working on different initiatives to reduce their the impact, improve detection and preventing them for infecting other islands. The Guam Invasive Species Master Plan will be revised to incorporate more actionable items.

What has been done
The Guam Invasive Species Master Plan is being revised with the participation of CNAS extension and research personnel to include actionable items. Viruses that may control the coconut rhinoceros beetle are being tested in CNAS laboratories.

Results
Awareness of invasive species has increased in Guam and is now a main focus of government and community initiatives in the territory. Research by CNAS scientists have led to successful

translocation of three endangered orchid species threatened by land use changes. Strategic plans for ecological management of military lands have been refined.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
202	Plant Genetic Resources
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215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

# of cooperative agreements/partnerships initiated or continued as a result of this program

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Protecting island resources from invasive species has been considered one of the top five concerns in Guam.

What has been done
The Forest Inventory Analysis (FIA) cooperative agreement will continue until 2021. Technicians were sent to Alaska to be trained in FIA measurement practices and they are now conducting field work in Guam and other islands.

-CNAS research and extension personnel participates in the Cooperative Agriculture Pest Survey (CAPS) program aimed to conducting national and state surveys targeted to plant pests, diseases, and weeds identified as threats to agriculture and the environment.

-The Arborist Certification program for Guam is run at CNAS.

-Endangered native orchids were re-established at the Anderson Air Force base with 87% success rate in partnerships with the U.S. Department of Defense

Results

-Relocation and protection of endangered native snail species in Guam has been successful through collaborative efforts involving efforts by CNAS and several agencies.

-Partnerships with the U.S. Military has led to relocation of endangered native orchid species caused by land use changes and to the establishment of seedlings of a native trees species with only one remaining adult individual left.

- Advise was provided to federal agencies on issues regarding federally listed plant species. APHIS has acknowledged the relevant role of CNAS in generating knowledge and spreading information about invasive species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
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723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Two severe storms required to follow contingency plans and caused delays in projects.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Federal agencies periodically conduct evaluation of extension and research projects and positive reviews have been received. Feedback from stakeholders is requested following workshops, focus groups and other activities.
The M.S. program in Sustainable Agriculture, Food and Natural Resources created in 2017 at the College of Natural and Applied Sciences have progressed through the teaching efforts of extension and research faculty, and has increased enrollment with students scheduled to graduate in 2019. Initial evaluations from the UOG Graduate Council have been positive.
Research faculty are evaluated yearly by the WPTRC director to allocate HATCH funds based on a standard matrix to assess research productivity and impact.

Key Items of Evaluation

Overall satisfaction with content and delivery of workshops, focus groups, and other activities was high (> 85% positive responses), Participants expressed strong interest in participating in conservation initiatives.