

April 30, 2019

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# Message from the **DIRECTOR**

**H**afa Adai! Welcome to the April 2019 issue of Man, Land, and Sea newsletter. In this issue, we are featuring stories about our island's natural resources that play a major role in supporting the physical, spiritual and economic health of the island. As our island continues to grow, we need to be more aware and proactive in keeping our island green, clean, and sustainable for future generations.

The mission of the Bureau of Statistics and Plans, Guam Coastal Management Program is to create the responsible and balanced use of Guam's coastal resources through improving resource management and optimizing government services. We continue to work toward increasing public awareness of the value and responsibilities associated with coastal resource development; and the need for a responsible management program that encourages prudent development.

Recently the Department of Defense released the Supplement Environmental Impact Statement for the Marianas Island Testing and Training activity (MITT). As I testified to the legislature, the Leon Guerrero/Tenorio Administration's approach to the MITT will be proactive and will carry out our mandate under the Federal



Consistency process to ensure our voice is heard so that activities associated with the MITT will not adversely affect our way of life, our culture, and our resources. The Coastal Zone Management Act (CZMA) requires that all federal actions (ie. the military buildup) that may affect resources of our community's coastal zone be consistent with enforceable policies of the territory's coastal management program. Guam has 17 enforceable policies that work to protect our island's environmental heritage and foster responsible and balanced growth.

You can read more about BSP's work in this issue. Featured this month are articles about the 4th Annual Assembly of Planners, Guam Nature Alliance Local community "Earth Month", Shrimpressive Discovery, Bamboo Removal, The Asan Ridge Trail Opening Ceremony, and "What in the World Is This?". I hope you will find this month's issue both enjoyable as well as informative.

Si Yu'os Ma'ase,  
Tyrone J. Taitano  
*Director of Statistics and Plans*

## Local community celebrates Earth Month with a focus on island sustainability

**A**s an island, our natural resources are important for our economy, our culture, and our lives in different ways. This year, April was proclaimed both Earth Month and Island Sustainability Month by Governor Lou Leon Guerrero. On April 6, Guam kicked off Earth Month with nearly 150 people from the community, school groups, local and federal resource management agencies, and non-profit organizations. Families went on snorkeling tours of Tumon Bay Marine Preserve to explore colorful vibrant coral reefs that are only twenty feet from shore. Tãsi (ocean) bingo, native plant tours in the park, marine debris scavenger hunt, nature poetry



*Mwar mwar were made using flowers and other natural materials*

writing, and other games were fun ways people learned about Guam's environment.

A new addition to Earth Month activities were "eco-crafts," which showed people how to upcycle used

materials or turn natural materials into useful products, as a way to reduce waste entering Guam's landfills. Luffa sponges made from local squash, creating pollinator habitats, t-shirts repurposed into reusable bags, and even an eco-stuffed animal filled with a cotton-like material from local Kapock trees were eco-friendly giveaways attendees made and can easily do at home. Mwar-mwar-making and slinging were fun activities to reconnect people with cultural activities that are environmentally sustainable. Find out about the latest events by following Guam Nature Alliance on Facebook or visiting <https://guam-naturealliance.org>.

*Snorkelers pose after their fun snorkeling adventure.*



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The Man, Land, and Sea newsletter is funded by a grant from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) through the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management and the Guam Coastal Management Program (GCMP) of the Bureau of Statistics and Plans, Government of Guam through Cooperative Agreement Award NA17NOS4190202.

# A Shrimpressive Discovery

Ashton Williams, National Park Service,  
War in the Pacific National Historical  
Park

**A** “shrimpressive” discovery: scientists describe a new native shrimp species in Guam’s rivers

A brand-new new species of native freshwater shrimp was recently described in Guam’s streams. The shrimp belongs to the genus *Caridina*, which are very small shrimps (less than a centimeter long) that live in tropical streams and rivers. There are nearly 300 species of *Caridina* shrimps. Few people pay attention to such tiny shrimps, especially on such a small island as Guam. For many years, scientists believed that Guam had two species of *Caridina* shrimps, *C. brachydactyla* and *C. mertoni*. Recently, however, scientists noticed that the shrimps on Guam looked a little different than the shrimps in other places. They started to believe that the shrimp on Guam was something entirely different—that it was actually its own species, but had been misidentified as something else. To test their theory, they collected shrimps from several rivers around Guam using nets and sequenced the shrimps’ DNA.

DNA testing revealed that the scientists’ hunch was correct: the shrimp on Guam were genetically different from *C. brachydactyla* and *C. mertoni*. They decided to call this new species *Caridina variabilis*. They noted that the new species had a few interesting features, such as a variable rostrum (nose) length. This is important information for scientists who study the shrimps, because many species always have the same rostrum length, and their rostrum length is used to identify their species! The shrimps on Guam, however, do not all have the same rostrum lengths, which is why scientists originally believed there were two species. In reality, it turns out to be just one (new) species whose rostrum can be a range of sizes.

So far, this newly-described species has only been found in two places: Guam and Babeldaob, the main island of Palau. Despite the long

distance (1300km) between the two islands, there was evidence that genetic exchange happened long ago between the two shrimp populations. Scientists can see if two populations are related by looking for “haplotypes,” which are changes in DNA that are passed along from generation to generation. The shrimp on Guam all share a single haplotype, and this haplotype was also the most common among the Palau population. This shared haplotype means that sometime in the past, the shrimps on Guam and Palau were mixing together. This might seem surprising because Guam and Palau are so far apart—however, about 35 million years ago, Guam and Palau were actually much closer together! The Mariana Islands (including Guam) moved away from Palau over time, due to volcanic activity and plate tectonics. The ancient haplotype remains in their DNA as a living record of their shared history.

How did Guam’s shrimps get mistaken for other species for so long? To put it simply, it was because most *Caridina* shrimps look very alike. In fact, many species look alike but are actually genetically different! For hundreds of years, taxonomy (the way we classify and categorize living things) was based solely on physical characteristics. Animals and plants were grouped by size, shape, color, number of legs or leaves, and so on. The discovery of DNA in 1953 was a game-changer because it gave scientists the ability to sequence the genetic code of living things. By comparing the genetic codes of different animals and plants, we can tell how related they are. We may discover that two things we thought were close-related are actually not very related, or vice

versa. For example, bees and wasps were once thought to be very closely related because they look so similar, but genetic sequencing revealed something surprising: bees are more closely related to ants than they are to wasps! Another genetic surprise? The horseshoe crab, despite its name and appearance, is more closely related to spiders and scorpions than to crabs! Sometimes genetic sequencing may even reveal that what we think are two species are in fact a single species. For example, some types of corals grow to look different ways depending on what part of the reef they are in, leading taxonomists to classify them as different species. However, genetic sequencing has revealed that despite their visual differences, they are actually not two species, but just different growth forms of a single species! Genetic sequencing has become

one of the most useful tools in biology because DNA can reveal things that physical characteristics cannot.

The discovery of this new shrimp species on Guam highlights the importance of protecting our delicate and unique island environment. Guam’s streams, rivers, and coral reefs are threatened by pollution, sedimentation, and a variety of invasive species. If we do not

act to protect our environment now, we could lose our native species before we can discover they exist. About 15,000 new species continue to be discovered every year. Who knows how many more species are waiting to be discovered on Guam and throughout Micronesia? Guam’s unique biodiversity is one of our island’s greatest treasures. Even though it is just a centimeter long, *Caridina variabilis* is an exciting addition to Guam’s list of native species, and it deserves our protection so that future generations may see this tiny shrimp for themselves.



# Bamboo Removal in Merizo

*Patrick Orr Keeler, Watershed Coordinator, Bureau of Statistics and Plans*

Anyone who has spent even a small amount of time on island inevitably hears the phrase “invasive species”.

Guam has had invasive species problems as far back as the introduction of wild pigs and deer (ungulates) by the Spanish hundreds of years ago. Things have gotten much worse in the past couple of decades thanks to the invention and continual technological progress of air and sea travel. With the sheer volume of products being imported to the island on a daily basis, the threat of invasive species is higher than ever before.

There is one particular invasive species, that as the watershed coordinator at the Bureau of Statistics and Plans, I have a particular vendetta against: *Bambusa vulgaris*. *Bambusa vulgaris* is a species of clumping bamboo that can be found all throughout the island. This invasive plant is damaging to Guam’s ecosystems in many ways. The bamboo shades out native species that are essential to erosion and sediment control. In addition to altering vegetation patterns, the clumps often topple into stream reaches, damaging infrastructure and property, as well as creating flood conditions that are significant problems for many villages and their residents and a major contributing factor in degrading water quality for the near shore marine habitat.

The Bureau of Statistics and Plans, alongside their local agency partners at Guam Forestry and NOAA, have been working on refining a method in which to effectively remove this damaging invasive. The bamboo removal project began as a small-scale, pilot project near the Geus River located within the village of Merizo. The basics of the methodology tested is as follows:

- Cut bamboo with chainsaw as low to the ground as possible. By cutting bamboo instead of digging up root ball we avoided the need for

specialized permitting, which can be difficult to obtain.

- Immediately apply herbicide to bamboo stumps with a paintbrush. It is important to note that the person responsible for applying the herbicide had a license for herbicide applica-

about this step was that herbicide was never applied during or within a few hours of precipitation events. Application days required sunny, clear skies.

- Finally, bamboo was removed from site by contractors and volunteers to be disposed of at green waste facilities.



We found this methodology to be successful, and therefore decided to begin upscaling the project scope. As a result of this success, NOAA funded a bamboo removal project in 2018 off of the Manell River. The same methodology was applied and initial reports from nearby residents stated that the removal did seem to have a positive effect on reducing flood severity and frequency. We observed over the project time period, that as bamboo was removed, native species of vegetation were naturally self-recruiting and flourishing.

One major issue we did encounter, that required a creative solution, was what to do with the removed bamboo. Bamboo is a very fibrous plant and breaks down slowly. For the initial project we simply removed the bamboo, which seemed like a waste. Bamboo is used for a variety of products: i.e. furniture, utensils, building materials, etc. The problem was that this particular species of bamboo, was not ideal for many of these products. For our next bamboo removal project we will be testing out different applications for bamboo bi-products. We hope to be able to successfully use the bamboo as a mulch and/or biochar for soil remediation and potentially as a source of revenue for the private sector or non-profits.

Due to the success of these two bamboo removal projects, we at the Bureau of Statistics and Plans and partnering agencies, plan to continue upscaling bamboo removal in targeted areas to reduce flood risk, improve water quality, and reduce the threat to nearby infrastructure and residents.

Whenever handling hazardous chemicals it is important to do so with proper permitting and precautions. By painting on herbicide we minimized the possibility of herbicide permeating into the surrounding area. Another important thing to note



*Governor Lou Leon Guerrero gives opening remarks and welcomes participants during the 4th Assembly of Planners.*



*Welcoming remarks from Tyrone Taitano, Bureau of Statistics and Plans, Director.*



*Participants engaging in activity "World Café Rotation".*

## Assembly of Planners Symposium 4

The Office of the Governor and the Bureau of Statistics and Plans (BSP), Guam Coastal Management Program (GCMP) held its 4th Assembly of Planners' Symposium on February 6, 2019 at the Pacific Star Hotel. During the event over 170 participants from federal and local government, private industry, and non-governmental agencies were in attendance.

"The purpose of the Assembly of Planners Symposium is to advance comprehensive planning that works to improve the quality of life for Guam's people," explained Tyrone J. Taitano, Director of the Bureau of Statistics and Plans. "This year's symposium focuses on key issues such as land-use, conservation management to enhance natural ecosystems,

the interrelation between tourism and our villages, and new technology to help with land use permitting," said Taitano. These topics are "...areas of great interest for my Administration," said Governor Lou Leon Guerrero in her opening remarks.

This one-day symposium highlighted the achievement of a major milestone in our Government Process Policy through the rollout of Coastal Arc Online, which is a geo database and online system to automate the Application Review Committee process as well as Federal Consistency application process. This symposium brought together key agencies and partners such as the Guam Economic Development Authority and engineering communities to talk about economic prosperity, healthy

ecosystem and strong communities that grow together. Our Attorney General's office also provided a much-needed training on drafting administrative rules. The symposium included discussion and appreciative inquiry where all participants were actively engaged in the discussion on conservation which will help advance the Guam Forestry Legacy Act of 2012. The symposium proved to be a successful forum to bring national, local and federal agencies together to discuss leverage points in coastal hazard reduction through the participation of the Coastal States Organization, U.S. Army Corps of Engineers and the Office of Civil Defense.



*Over 170 participants attended Assembly of Planners Symposium.*

# The Asan Ridge Trail Opening Ceremony

## The Culmination of the Āmot yan Nengkanno' Active Trails Project

Amanda O'Brien, Education Assistant

War in the Pacific National Historical Park, Guam

What began as a non-descript thing of necessity has been restored into a place of beauty, with a focus on nature, culture, and learning. At the Asan Beach Unit of War in the Pacific National Historical Park, the Asan Ridge Trail, as we know it today, began as a humble jeep trail. It was most likely flattened, widened, and put to heaviest use during and immediately following the World War II Battle for Guam in July 1944. Over time, it evolved into an undeveloped walking trail, where visitors could explore remnants of the World War II battle (i.e. gun emplacements, defensive structures, etc.), take in bird's eye views of the invasion beach, and enjoy nature.

"This land that you stand on today has a long history going back thousands of years. Ancient voyagers arrived on Guam approximately 4,000 years ago. On board their voyaging canoes they carried everything, including about 24 plants, needed to establish a successful settlement in a new land. These ancient CHamoru developed a unique culture that is found nowhere else in the world," said Barbara Alberti, Park Superintendent, in her welcoming remarks at the June 16, 2018 ribbon cutting ceremony.

Since the arrival of the ancient voyagers almost 4,000 years ago, the area of Asan beach has had many uses, with its landscape constantly altered. In the late 1800's it was the site of a leper colony. It was a prison camp for exiled Filipino insurgents in the early 1900's and for the crew of



Left: Theo Chargualaf, Supervisory Facilities Operations Specialist at War in the Pacific National Historical Park in Guam gives a speech during the June Ribbon Cutting Ceremony for the Asan Ridge Trail

the Cormoran, a German ship, for three weeks during World War I. In 1922, a U.S. Marine Corps camp was established there. Before World War II, it was the site of Asan village with coconut trees and rice paddies. The village was destroyed during World War II and relocated further inland, where it remains today. Following the war it serves as a Seabee (U.S. Navy Construction Battalion) camp, a Naval Hospital Annex, and a refugee camp for Vietnamese in 1975. War in the Pacific National Historical Park was established in 1978.

Various attempts were made over time for static interpretation of the trail through booklets, brochures, or wayside informational signs. Almost all of these endeavors focused on the World War II history of the site. The booklets and brochures became

obsolete. The harsh tropical climate wreaked havoc on the structural integrity of the signs, causing some to become sun-bleached and illegible and others to simply fall into the ocean as their metal posts rusted and eroded due to constant exposure to salty ocean spray. For the last five years, no signs at all have existed along the trail.

"The idea really began over 10 years ago as a discussion between our former [Natural] Resource Ranger, Jenny Coffman, and I. We thought that our park had a hidden resource amongst all the World War II history that was worthy of sharing; the importance of our local plants for its use as either food or medicine, a constant for the people



Cultural Practitioners, Pa'a Taotao Tano' performed a bendishon (traditional blessing) for the opening of the trail. This included blowing the kulu (the conch shell) to call people together and chants to entreat the ancestors to be present at the gathering.

**"Thousands of naturalists, historians, archaeologists and other specialists are engaged in the work of revealing, to such visitors as desire the service, something of the beauty and wonder, the inspiration and spiritual meaning that lie behind what the visitor can with his senses perceive."**

– Freeman Tilden



From left: Theo Chargualaf; Pa'a Taotao Tano' member, Vivian Amon; former NPS Maintenance Ranger, Megan McAlonis; Suruhana, Bernice Nelson; DYA Hâya Youth Center youth, Adam Buendicho; DYA Hâya Youth Center staff, Corrine Buendicho; Active Trails Program Coordinator, Amanda O'Brien; Park Superintendent, Barbara Alberti, and Native Plant Specialist, Dr. Robert Bevacqua and his grandchildren Akli'e' Bevacqua (the 8 yr old boy with the hat) and Sumahi Bevacqua (the 11 yr old girl with no hat).

Continued on page 7

of our island through history until now. After a few efforts to obtain other sources of project funds, we finally were able to obtain the grant through the National Park Foundation and with the efforts of our team, ... we were able to provide, what I hope ... [is] a lasting visitor experience for our park visitors,” said Theo Chargualaf, Chief Facilities Manager for the park, during his speech at the ribbon cutting ceremony.

Our park was notified in late 2016 that it would be the recipient of the National Park Foundation’s 2017 Active Trails Grant. The National Park Foundation is the official charity of America’s national parks. For approximately a decade, the Active Trails program has supported healthy living by getting people out and active in national parks. These projects include hands-on learning, hiking, kayaking, snowshoeing, volunteering, and more. These grants are critical to helping maintain and enhance the 17,000 miles of land and water trails across the National Parks System.

Active Trails activities are designed to:

1. Motivate community members to get outside and get active in the parks
2. Deepen connections between national parks and local communities through active partnerships
3. Inspire the next generation of park visitors and supporters through healthy, nature-based activities
4. Raise awareness of parks as places for trail-related activities (recreation, service, education, volunteering or wellness)

The 2017 Active Trails Grant project at War in the Pacific National Historical Park in Guam was titled, “Āmot yan Nengkanno’: A Discovery of Traditional Uses for the Flora along the Trails of Asan Beach”. The trails and walkways of Asan Beach have plant species that have traditionally been used for food (Nengkanno’) and medicine (Āmot). This project sought to protect, highlight, and share these valuable natural resources with our park visitors. The Āmot yan Nengkanno’ project encouraged and educated our island’s youth of the importance many plants hold for island cultural uses in food, medicine, and the day-to-day lives of island people across the Pacific. Tied specifically to the Asan Ridge and Asan Point areas of a National Register historic battlefield, this project was a partnership with various government and non-profit organizations.

The park assembled a team to help plan and execute the project, which was broken into two phases. Phase I of the project consisted of seeking community partners to help implement the educational component of the grant. The students involved in the Department of Youth Affairs (DYA) who are based out of the Håya Youth Center in the southern village of Agat were chosen to participate in a two-week project. One week consisted of outreach, learning, and preparation at the youth center and one week of outreach and training in the park, where they would work alongside Park Rangers and education staff, a native plant biologist, a suruhana (CHamoru traditional medicine



Left: Active Trails Program Coordinator, Amanda O'Brien and Park Superintendent, Barbara Alberti unveil the new trailhead informational wayside, as Dr. Bevacqua looks on.

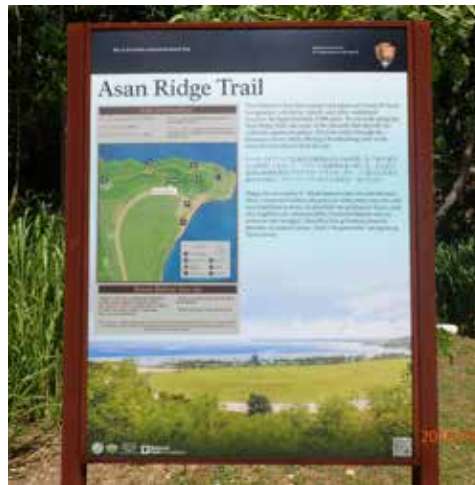
#### Remembrance.

Throughout the rest of 2017, countless volunteers, through various events, helped maintain the hard work the students had begun. Dr. Robert Bevacqua was hired as our Native Plant Specialist to help determine which plants along the trail to highlight and to help educate the youth about their important uses. He also wrote an in-depth report on the six traditionally and culturally significant plants we should highlight along Asan Ridge Trail. “The six plants highlighted along the Asan Ridge Trail are used for medicine (Āmot), food (nengkanno’), and other traditional practices and are deeply entwined in the 4,000 year old history and culture of the CHamoru people”, said Alberti at the ribbon cutting ceremony. Breadfruit (lemmai), coconut (niyok), limeberry (lemmon di china), Indian mulberry (ladda or noni), pandanus (kaffo’), and half-flower (nanāso) were chosen. Dr. Bevacqua also helped choose the best specimens in the optimal locations along the trail to feature. Once his report was complete, we began Phase II of the project in June 2017.

Phase II of the 2017 Active Trails Grant project’s objectives included three tangible interpretive media installations. The first was to develop and install six small interpretive signs at key locations of the trail to highlight the “particulars” of each plant species and their traditional uses, as well as an introductory wayside for the trailhead location. The second interpretive media was the development and creation of an educational brochure. The third interpretive media was the development of QR code to allow for additional content to be delivered to a visitor via a “link” through a smart phone to the park website.

Two graphic artists and a sketch artist helped to complete the designs of the signs and educational brochure. Once the design of the signs were completed, we worked with the Interpretation Rangers to get content uploaded on the park website to connect to the QR codes on the signs and the educational brochure. After a few hiccups and unplanned delays in fabrication, shipping, and installation the signs finally arrived on island and were able to be installed along Asan Ridge Trail. The June 16, 2018 ribbon cutting ceremony held at the trailhead of Asan Ridge Trail officially opened the new trail experience available at the park.

Now for the first time in at least five years, visitors do not need to rely on the presence of a ranger to engage in part of the story of Asan Ridge Trail. Through the guidance of new signs, the educational brochure, and the QR code link to the park website, families can roam the former jeep trail and soak in over 4,000 years of culture, nature, and history. As William Cullen Bryant so eloquently directed, we entreat park visitors to, “Go forth, under the open sky, and list to Nature’s teachings.”



The new trailhead informational wayside for Asan Ridge Trail, designed by Graphic Artist, Aileen Carroll.



A close-up of one of the six new plant specific signs installed along Asan Ridge Trail, designed by Carroll, with original plant artwork by Sketch Artist, Nina Peck.

expert), and traditional cultural practitioners. DYA Håya youth would engage in discussions about culture and conservation and attend outdoor field days at Asan Beach to gain a greater awareness of the importance of stewardship for our island community. During the outdoor field days, they would partake in an array of hands-on activities aiding in understanding the medicinal benefits of native plants, and their important place in Guam’s history and culture. The project would also educate the youth about the adverse effects of invasive species on the flora and fauna of Guam. The youth would work to improve the trail and plant habitat conditions to encourage the targeted plant species to thrive.

We embarked on the two-week Āmot yan Nengkanno’ project in April 2017, which was detailed in the “Active Trails: Āmot yan Nengkanno’” article in the summer 2017 issue of

# What in the world is this?

## TERRESTRIAL HABITATS



DAWR photo by Gary J. Wiles

**ALUTONG (LIMESTONE FOREST)**

**Limestone Forest:** This kind of native forest, called alutong in Chamorro, grows only where limestone rock is present. Most of northern Guam was once covered by limestone forest, but the only large tracts now remaining in this part of the island occur along rugged coastal cliffings and military lands. Other stands occur in parts of southern Guam. The tallest trees in this forest often reach heights of 30-50 feet tall, but are kept from growing even larger by the island's frequent typhoons. Many familiar trees commonly grow in limestone forest, such as wild breadfruit (dokdok), paipai, fãgot, cycads (fadang), pengua, chopak, ifil, banyans (nunu), pandanus, yogga, and âhgao. A variety of ferns and orchids is also present. This forest is the most important habitat for coconut crabs and many of our endangered native birds and fanihi (fruit bats). Introduced deer and wild pigs feed on understory vegetation and are harmful to many plant species. Another serious threat is bulldozing to make room for development.



DAWR photo by Gary J. Wiles

**SESONYAN (WETLANDS)**

**Wetlands:** Rivers, streams, swamps, and ponds are examples of wetlands, called sesonyan in Chamorro. Wetlands hold water for extended periods of the year, are highly fertile and support a variety of animal and plant life able to exist in a saturated environment. Ito' (catfish), uhang sãddok (shrimp) and asuli (freshwater eel) and the endangered Pulattat (Common Moorhen) live only in wetlands. Karisu (grass), uchaga-lane (sedge) and chà'guan sãddpk (pondweed) as well as woody vegetation such as pâgu (hibiscus) and langasat are examples of wetland plants that may be found growing in or adjacent to wetlands. Wetlands are also important to public safety and health. Wetlands reduce the likelihood of flooding by holding rainwater runoff and by trapping eroded soils and retaining pollutants, they improve water quality.



DAWR photo by Gary J. Wiles

**SABÃNA (SAVANNA)**

**Savanna:** Grasslands, called sabãna in Chamorn, occupy large areas of red clay soil in southern Guam. Nette (swordgrass) and foptail are the most common types of grass. Nette grows in dense impenetrable stands that reach 8 feet tall. Other common savanna plants are various shrubs, club mosses, and ground orchids. Fires burn off large areas of grassland every year, which results in heavy soil erosion. Fires, plus the poor nutrient levels of volcanic soils, prevent forests from expanding into the savanna.



The original Fish & Wildlife Fact Sheets were first created and first produced through the Sport Fish & Wildlife Restoration Program, administered by the Division of Aquatic & Wildlife Resources of the Department of Agriculture in collaboration with the Guam Coastal Management Program of the Bureau of Planning. This fourth printing (May 2002) was funded by the Guam Environmental Protection Agency pursuant to the United States Environmental Protection Agency Award # M009063-02 through the Environmental Education Committee of the Water Planning Committee. All inquiries may be sent to the Division of Aquatic & Wildlife Resources, 192 Dairy Road, Mangilao, Guam 96913. To contact them by phone (671) 735-3955/6.

