

# Man, Land, & Sea

A publication by Guam Coastal Management Program

May 16, 2025



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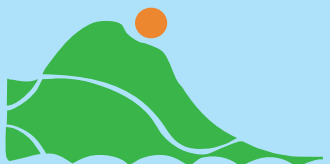


**Guam Watershed  
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*Protecting Guam  
from Ridge to Reef*



# Catching Up with the Guam Coral Reef Initiative's Coral Reef Restoration Efforts

By: *Olivia Bañez, Coral Reef Policy and Communications Coordinator, Guam Coral Reef Initiative*

Are you curious about local efforts aimed at protecting and restoring Guam's coral reefs? Meet the Guam Coral Reef Initiative (GCRI), a subdivision of the Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR). From tano' to tasi, the vision of GCRI is to develop a comprehensive program for the conservation and effective management of Guam's coral reef ecosystems through sustainable use and wise preservation. To support this mission, GCRI recently began coral reef restoration: a process of growing coral fragments in a nursery and then outplanting them on the reef to restore their health. GCRI built its first underwater coral nursery in the Piti Bomb Holes Marine Preserve in June of 2024 and recently built a second nursery in Apra Harbor in February of 2025. Establishing coral nurseries is an essential part of GCRI's reef restoration efforts and the team is very excited to join the UOG Marine Lab in their efforts to increase coral cover and boost reef health in Guam through coral restoration activities.

GCRI's reef restoration efforts began in June of 2023 when the National Marine Sanctuary Foundation awarded the team a grant to fund coral restoration; this included new job positions as well as supplies and equipment for restoration activities. GCRI then researched which species of corals to use for restoration and chose 7 species representing a diverse selection of branching and boulder coral species that fulfill different roles on the reef. Once the team received the necessary permits, they built and deployed nursery structures to house the coral fragments they would collect. While there are many types of structures used for coral nurseries, GCRI uses a structure called a coral tree. A coral tree, as the name implies, is shaped similar to a tree with a central support and several branches. Coral fragments are attached to the branches, where they have continuous access to high water flow, nutrients, and sunlight. GCRI uses two types of coral trees: branching trees and wing trees. Branching trees have coral fragments hanging from a piece of fishing line and are best for branching coral types, while wing trees have coral fragments growing on a flat tray and are best for boulder coral types. Once the 3 branching trees and 3 wing trees were built and installed, the GCRI restoration team collected fragments from coral colonies around the island and attached the fragments to the coral trees. In the weeks following, the team watched and waited as these baby corals began to grow.

Installing nursery structures and collecting coral fragments is just the beginning of the reef restoration process. Coral nurseries require maintenance over time, such as the removal of algae, sediment, and other nuisance organisms that may impede the growth of the small coral fragments. The GCRI restoration team has come up with some creative, low-tech solutions to reduce algal overgrowth, including upcycling old toothbrushes to scrub algae off of coral fragments and changing the orienta-



Recent photo of the branching tree holding the *Acropora latistella* corals, which have grown significantly larger since the summer! Photo by Natalie Scott



GCRI program manager, Ashton Williams, proudly displays coral fragments collected for the nursery. Photo by Olivia Bañez.



*Galaxea fascicularis* fragments on day 173. Photo by Natalie Scott.

tion of the wing tree trays to reduce the build-up of sediment. The team routinely monitors the health of corals in the nursery as well as the corals they collected fragments from (also known as donor colonies). Monitoring donor colonies ensures that they don't sustain any long-term damage from collections and allows the team to compare changes in nursery corals vs reef corals. Monitoring data also helps the GCRI team identify heat-tolerant corals, priority sites for restoration, and the best methods for growing and collecting corals.

So how are the GCRI nursery corals doing now? Due to unseasonably warm waters island-wide this past fall, a few corals in GCRI's nursery unfortunately bleached and died. Coral bleaching is when environmental stressors cause corals to eject the tiny algae that normally live with them, leading the coral colony to turn white and rapidly decline in health. For one coral species, many of the fragments in the nursery bleached. However, for this particular species, the donor colony on the reef also bleached, indicating that this colony happened to be less heavy-tolerant than the rest. This highlights the importance of monitoring both nursery corals and donor colonies. Overall, the team was pleased that the majority of the corals growing in GCRI's nursery did not bleach. One factor that may have contributed to this was the installation of shade cloths to keep the nurseries

cool, which the GCRI restoration team installed early in the bleaching season as a preventative measure.

As of January 2024, water temperatures have decreased to the lower 80s, thus ending the bleaching season. The nursery currently houses over 1,200 fragments and they are doing well with an average survivorship of 81%. The GCRI team has resumed collecting coral fragments from the reef to increase the number of fragments in the nursery and to increase the genetic diversity. Also, two more coral trees have been added to the Piti Nursery for a total of eight. GCRI's permit to build a second nursery at Dogleg Reef was also approved in January, so two nursery trees have been deployed and coral fragments will be collected and added to this second nursery within the next few weeks. Having two nurseries not only increases the number of corals that GCRI can house but also minimizes the risk of loss: if something harms coral fragments in one nursery, there are clones of that same individual growing at the other nursery, acting as a backup copy. If all goes according to plan, once enough nursery corals have grown big enough, the GCRI team will begin the process of outplanting these colonies back onto the reef, bolstering the health of the ecosystem as a whole.

Visit the GCRI website, [www.guamcoralreefs.info](http://www.guamcoralreefs.info), or follow GCRI on Facebook and Instagram @guamcoralreefs for updates on GCRI's coral restoration efforts!



# Guam Silver Jackets: Working to Reduce Flood, Erosion, and Coastal Hazard Risk



*By: James Pangelinan, Planner, Guam Coastal Management Program*

The Guam Silver Jackets, a collaborative group of local and federal agencies working to address natural hazards, recently convened to review ongoing projects and discuss future initiatives. The meeting focused on key areas such as current and future Silver Jackets projects, flood risk mitigation, data sharing, and policy development.

Progress on the Mean High Mark Campaign, an initiative to install flood warning signs, was discussed, with flood areas addressed by various municipal offices. The successful completion of the Stormwater Drainage Manual Training Workshop on the updated flood tool was done on November 14, 2024. Recommendations for future training sessions to better integrate the tool into permitting processes were given by participants from the public and private sectors. Updates were also provided on several key projects, including the Manell River Project, Agat Shoreline Project, East Agana Shoreline Protection Project, and Umatac River Stabilization Project. A confirmation from key partners from the National Oceanic and Atmospheric Administration - National Weather Service, Guam Fire Department, and the Guam Department of Agriculture - Forestry and Soils Resource Division to take part in the Table Top Exercise on wildland fires was confirmed. The Table Top Exercise will bring the partners together to discuss their roles and functions, the challenges faced, as well as an integrated approach in combating wildland fires immediately and in the long-term timeframe through resiliency planning.

The meeting highlighted the critical need to address data gaps, such as the lack of rainfall data throughout the island and a comprehensive inventory of existing data to bolster future Silver Jackets projects. The potential for collaboration with the Guam Department of Agriculture - Forestry and Soils Resource Division to utilize their weather station for data collection was offered and discussed with members.

The need to address flood policy issues, particularly those related to stormwater management in smaller subdivisions, was re-recognized. The ongoing draft of the 2050 Guahan Sustainability Plan was identified as a potential avenue for addressing some of these policy concerns.

The meeting explored the possibility of establishing steering committees to focus on specific areas, such as technology and data, flood policy, and capital improvement projects, in order to streamline and optimize the planning process for future Silver Jackets projects. The need for brainstorming sessions to generate potential Silver Jackets project proposals was also emphasized.



*The Silver Jackets Guam charter was signed and adopted by six agencies within the government of Guam and federal partners in 2019. The Silver Jackets team comprises multiple agencies that merge to develop an all-encompassing solution. By applying their shared knowledge, their goal is to work with communities to enhance an area's resilience to natural disasters such as flooding. They can provide education, support, and resources in order to do so.*

The Silver Jackets team will schedule and conduct a Table Top Exercise on wildland fires. Planning meetings will be coordinated to develop potential Silver Jackets project ideas. Further training on the Stormwater Drainage Manual Flood Tool will be provided, and additional planning meetings will be held to discuss data and technology needs for Silver

Jackets projects.

The meeting underscored the importance of continued collaboration and information sharing among agencies to effectively address the challenges posed by natural hazards and enhance community resilience in Guam.



# Exploring the Impact of Fire, Watershed Restoration, and Marine Conservation on Guam

## Inalåhan Middle School Students Participate in Guam Coastal Management Program's Coastal Ambassador Program

Submitted by: Joshua J.C. Reyes, Science Teacher, Inalåhan Middle School

In an engaging and educational two-day field trip, 80 students from Inalåhan Middle School (IMS) participated in a program aimed at deepening their understanding of Guam's environmental challenges and solutions. This field trip was part of the Guam Coastal Management Program's Coastal Ambassador Program, organized by the Bureau of Statistics and Plans (BSP) and Joshua J.C. Reyes, Science Instructor, IMS. The program was designed to empower these young students with the knowledge and tools needed to advocate for and protect Guam's coastal and marine ecosystems. Through site visits, hands-on activities, and thought-provoking discussions, students learned about the interconnectedness of fire, watershed health, and marine conservation, and their vital role in preserving the island's natural resources.

### Training Goals:

The field trip had three central goals:

- To understand how pollutants from fire affect land, freshwater, flooding, and the marine ecosystem.
- To learn about the causes of fire, the elements of fire behavior, and current preventative methods for controlling fire spread.
- To inspire students to recognize that they have the power and responsibility to contribute to positive environmental change in the future.

### Learning Objectives:

Throughout the field trip, students were expected to achieve the following learning objectives:

- Gain knowledge of the fire triangle, the fire behavior triangle, the common causes of fire on Guam, and red flag warnings.
- Learn about the structure of Guam's coral ecosystems, including the food web, biodiversity, and the role of microorganisms in maintaining marine health.
- Understand the effects of watershed degradation and its impact on water quality, flooding, and coastal reef systems.

### Summary of the Field Trip

In line with the goals of the Guam Coastal Management Program's Coastal Ambassador Program, the



field trip took students across four significant sites, each contributing to their understanding of environmental conservation and restoration. Here is a summary of each site visited during the trip:

### Site 1: As Gadao, Malesso' – Forest Restoration and the Aftereffects of Fire



Students witnessed the impacts of a recent fire on the watershed, which had caused soil degradation and increased the risk of erosion. The students participated in a forest restoration project, planting native seedlings in an effort to restore the watershed.



This site emphasized how fire not only devastates land but also compromises water quality by contributing to runoff and sedimentation. The students were engaged in discussions about how this process pollutes freshwater systems and harms marine environments, particularly coral reefs. They learned that soil degradation also increases the likelihood of flooding, which further affects both land and sea.

### Site 2: Ugum Watershed – Watershed Health and Long-Term Restoration

The second site, Ugum Watershed, on Cross-Island Road, Santa Rita, provided students with the opportunity to see a healthier, fire-free watershed. Here, they observed how ecosystems can naturally recover over time when left undisturbed by human activity.

Students participated in planting efforts to further restore the area and were taught about the importance of preserving watersheds for the long-term benefit of both the island's residents and its biodiversity. The discussion highlighted how protecting these watersheds is crucial for maintaining a clean and sustainable freshwater supply, particularly for residents in southern Guam. It also underscored the role that healthy watersheds play in maintaining the ecological balance of both land and sea.

### Site 3: Cross-Island Road – Understanding Fire Causes and Prevention Methods

At Cross-Island Road, students learned about the primary causes of fires on Guam, with a focus on the fact that human activity is the leading cause. Through lessons on the fire triangle—fuel, heat, and oxygen—students understood how fires start and how they can be prevented.

Students also participated in practical fire prevention activities, including the creation of firebreaks by removing combustible vegetation. Additionally, they took part in a role-playing exercise where small groups represented various government agencies tasked with finding solutions for protecting watersheds, reducing pollution, and addressing the potential for flooding. This exercise highlighted the importance of coordinated efforts across different sectors to safeguard Guam's natural resources and ensure community safety.

### Site 4: Marine Lab – The Effects of Pollution on Marine Life and Coral Ecosystems

The final stop, the Marine Lab, focused on the impact of pollutants from land-based activities, such as fire-induced erosion and sedimentation, on marine ecosystems. The students learned about coral ecosystems, marine biodiversity, and the importance of microorganisms in maintaining healthy ocean environments.

At this site, the students explored how increased sedimentation from damaged watersheds smothers corals, disrupts marine food webs, and reduces biodiversity. They learned that protecting Guam's watersheds is crucial for maintaining the health of its coastal and marine ecosystems. The students left with a deeper understanding of how pollutants from land activities can harm the ocean, and the importance of keeping watersheds intact to prevent this damage.



### Key Insights & Reflections

The field trip was an enriching experience for Inalåhan Middle School students, who gained a comprehensive understanding of the challenges facing Guam's ecosystems. By visiting key sites across the island, students learned that the impacts of fire, watershed degradation, and pollution extend far beyond the land—directly affecting the health of the ocean and its marine life.

Through the Guam Coastal Management Program's Coastal Ambassador Program, the students were empowered to take on the responsibility of protecting their environment. They recognized the need for action to prevent soil erosion, protect watersheds, and reduce pollution. They also learned how their own actions—whether through fire prevention, watershed restoration, or advocating for marine conservation—could make a tangible difference.

The role-playing exercises and discussions on fire management, land conservation, and collaborative decision-making helped reinforce the idea that working together as a community is essential to ensuring a sustainable future for Guam's ecosystems.

### Conclusion

This field trip, as part of the Guam Coastal Management Program's Coastal Ambassador Program, was a powerful and educational experience for Inalåhan Middle School students. It connected classroom learning with real-world environmental issues and gave students the tools to advocate for the preservation of Guam's natural resources.

By visiting the four sites, students were able to see firsthand the impact of fire, watershed degradation, and pollution on the environment. They gained a deeper understanding of the importance of preserving both terrestrial and marine ecosystems and were inspired to take proactive steps to protect their island's future.



The trip not only fulfilled the educational goals of the program but also ignited a sense of environmental stewardship in the students. Armed with knowledge and practical skills, they are now better equipped to contribute to the ongoing conservation efforts and ensure a healthier, more sustainable Guam for generations to come.



# Guam Watershed Planning Committee Convenes- Focuses on Forest System Plan, Tumon Bay Storm Water Management Plan, and Funding Opportunities

By: Christian Paul Benitez, Planner, Guam Coastal Management Program

The Guam Watershed Planning Committee held its quarterly meeting on December 30, 2024, convening key stakeholders to address critical environmental issues. A significant portion of the meeting centered around the recently passed Guam Forest System Plan, a landmark achievement in conservation efforts.

The committee discussed the pivotal next steps for the successful implementation of the Guam Forest System Plan. These include the development of a comprehensive programmatic agreement to guide activities within the designated forest areas, ensuring sustainable practices and minimizing environmental impact.

A primary concern highlighted was the pervasive threat of invasive species. The committee emphasized the urgent need for effective strategies to address and mitigate the impact of these invasive species on the fragile ecosystems within the forest system. This includes developing and implementing robust land restoration plans to re-establish native plant and animal populations. The committee also actively explored potential funding sources to support the implementation of the Forest System Plan and related conservation initiatives.

Another key topic of discussion was the development of a comprehensive stormwater management plan for Tumon Bay. Recognizing the significant environmental challenges facing the bay, the committee outlined a multi-pronged approach. This includes a thorough investigation to identify the primary sources of pollution, particularly focusing on non-point source pollution from urban runoff.

To address these challenges, the committee will strategically leverage a robust foundation of existing data and pertinent research. Furthermore, the project will integrate the specialized technical expertise of valued partner agencies, including the University of Guam Water and Environmental Research Institute (WERI) and the American Institute of Architects (AIA). This collaborative approach will be instrumental in informing the development of demonstrably effective and sustainable mitigation strategies. Our exploration will encompass innovative green infrastructure solutions and the implementation of best management practices specifically designed to minimize detrimental stormwater runoff and tangibly improve overall water quality within the project area.

The meeting also saw discussions on several other critical initiatives:

- **Technical Training Assistance:** The committee explored a partnership with the Center



for Watershed Protection to provide comprehensive training on watershed planning methodologies. This training will equip stakeholders with the necessary knowledge and skills to effectively address watershed management challenges.

- **Humatak Revitalization:** The committee discussed the potential for restoring portions of the El Camino Real Trail, a historic trail, and integrating it into a broader watershed restoration and public access project. This initiative aims to enhance both environmental health and recreational opportunities for the community.

- **Funding Opportunities:** The commit-

tee explored various funding avenues, including the Department of Defense's Readiness and Environmental Protection Initiative (REPI) program and grants from organizations like NOAA.

The meeting underscored the critical importance of interagency collaboration and stakeholder engagement in addressing the complex challenges facing Guam's watersheds. The committee emphasized the need for continued dialogue and coordination among government agencies, non-profit organizations, and community members to ensure the successful implementation of watershed management plans and the long-term sustainability of Guam's environment.



# Guam Takes Steps Towards a Comprehensive Guam Seashore Reserve Plan

By: Camille R. Quichocho, Biologist, Guam Coastal Management Program

On January 23rd, BSP-GCMP brought together representatives from DOAG, Guam EPA, SHPO, UOG/GLUC, UOG CIS, and BSP for the first Seashore Reserve Plan Advisory Meeting of 2025. It was a great opportunity for everyone to contribute to the ongoing development of the Plan.

At the heart of this initiative is 21 GCA Chapter 63, the Territorial Seashore Protection Act of 1974, which established the Seashore Reserve in Guam. The Act emphasizes the importance of creating a Seashore Reserve Plan (SRP) to protect and manage our precious resources for today and for generations to come. The goal is to keep development to a minimum while providing clear guidelines for permits and development areas.

The SRP aims to ensure that the Seashore Reserve remains a special place for all of Guam's residents, both now and in the future. To make this happen, we've established several key objectives:

- Maintain, restore, and enhance the overall quality of the Seashore Reserve's environment, including its beauty and amenities.
- Support a thriving population of all living organisms.
- Strike a balance between using and preserving the reserve's resources based on solid conservation principles.
- Avoid making irreversible commitments of the reserve's resources.
- Ensure everyone has access to enjoy the visual and physical beauty of the area.

The Plan will include important components, such as definitions of public interest, ecological principles, land reservations, and recommendations for government policy. It will focus on six essential elements: land use, conservation, public access, recreation, population, and education or scientific use, and these elements can be adjusted as our vision for the reserve evolves.

There's quite a history behind the Seashore Reserve Plan, originally intended to be completed in the 1970s, but we're still working on it as of 2025. In 1993, a conceptual plan was commissioned, leading to a draft plan created by various agencies in 1994. By 2000, funding was secured for a consultant to push the project forward, which resulted in a preliminary draft plan being adopted by the Guam Seashore Protection Commission. There was some confusion about its adoption from 2002 to 2013, during which an Agency Working Group was formed to revise the Plan. Things slowed down until 2021, when planners from BSP-GCMP started a comprehensive study, which continued into 2023. As of 2024, the BSP-GCMP lead Biologist has taken over the project, with a hopeful outlook on bringing it to a successful completion.



## History of the Seashore Reserve Plan.



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Newsletter  
May 16, 2025**

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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 NA24NOSX419C0027

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**Organizing  
a Beach  
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We can help!**

Contact the Guam Coastal  
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Call 671-475-9647  
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\*Limited supplies available  
per cleanup event.



# GUIDEBOOK FOR DEVELOPMENT ON GUAM

This Guidebook informs the public about Guam's development laws, regulations, permits, clearances, and guidelines. It summarizes each requirement, identifies the responsible agency, describes the application process, provides sample applications, links to codes and regulations, and suggests additional resources/references. It serves as a streamlining tool for successful development and environmentally compliant projects on Guam.

## TO EFFECTIVELY EDUCATE THE PUBLIC AND ADDRESS AS MANY INFORMATION GAPS AS POSSIBLE, THIS GUIDEBOOK:

- ✓ Outlines and summarizes the permit application process, procedures, and requirements.
- ✓ Provides a checklist for plan review and document submissions.
- ✓ Provides process flow charts.
- ✓ References Executive Orders, Laws, Rules and Regulations, AG Opinions, and other supplemental information.
- ✓ Lists a permitting matrix.
- ✓ Provides latest agency forms.
- ✓ Provides fee structures and schedules.
- ✓ Provides updated license and permitting agency directories.
- ✓ Provides links to decision support tools, resources and manuals available online.

**For more information on the Guidebook  
and Permitting, please visit us online at:  
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