



UNIVERSITY OF GUAM SEA GRANT
INSTITUTIONAL PROGRAM
2024 – 2027 STRATEGIC PLAN



Photos: Luke Fernandez



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The entire island of Guam has been locally and federally designated as a coastal zone, containing 19 watersheds in the southern half of the island and an aquifer in the north of the island (DAWR, 2006). The northern half of the island is a volcanic rock covered by a Pleistocene limestone plateau, which rises nearly 200 meters above sea level in some places (Burdick et al 2008). In contrast, the southern half of the island is weathered volcanic clay with scattered limestone outcrops.



Figure 2. The highest point of the island is Mt. Lam Lam in the south and rises to an elevation of 406 m. Grasslands and ravine forests characterize the vegetation in the south (DAWR, 2006).

In addition to comparisons among shallow coastal waters, Guam and the Mariana Islands feature a wide variety of unique ocean assets. This area encompasses the nation's largest pelagic fishery, true atolls, and the greatest marine diversity recorded for any area of comparable size (Paulay, 2003). The Western Pacific waters are some of the least spoiled places left on the planet, and most retain considerable conservation potential, including the submarine volcanoes lying along the Mariana Archipelago, the Mariana Trench, the Jellyfish Lakes of Palau, and the world's first (Palau) and largest (Republic of Marshall Islands) shark sanctuaries. Each of these ecosystems host a mosaic of habitats and a myriad of species found nowhere else on Earth, and yet, ironically the anthropogenic effects of global climate variability, pollution, and environmental degradation also profoundly impact them. Ever since the first Chamorro

inhabitants made the Mariana Islands their home, sustainability, and environmental literacy were critical mandates for survival – the archaeological and historical record, which spans over four millennia, clearly illustrates these cultural achievements.

The major employer on the island is the Government of Guam, employing nearly 12,000 workers. The economy is intimately tied to Asian markets, driven by tourism, transportation, and the military, and to a lesser extent, by real estate and construction. A large part of Guam's economy is fueled by U.S. Military spending. The Department of Defense (DOD) continues to build Guam's defense infrastructure capacity and is expected to accelerate with preparation for the Marine Corps relocation from Okinawa, Japan. During the last decade, DOD construction contracts have totaled over \$2 billion and have averaged nearly \$240 million annually for the most recent years. In 2016, the House Armed Services Committee (HASC) passed fiscal year 2017 National Defense Authorization Act (NDAA) that appropriated \$253.858 million for military construction for Guam (GEDA, 2022).

Guam faces unprecedented challenges, being on the threshold of a Department of Defense build-up that will put significant pressure upon our existing infrastructure and the sensitivity of our natural environments (UOGSG Coherent Area Program application circa 2012. Citations contained in that document).

About the University of Guam

The University of Guam (UOG) is a public, open admissions, four-year, land grant and sea grant institution located on the island of Guam, the southernmost island in Mariana Islands chain (see location on map above). Founded in the early 1950's as the College of Guam, the university was first accredited as the University of Guam in 1968. Consistent with this long history, the university has general degree approval for bachelor's and master's degrees. An eleven-member Board of Regents (BOR) governs UOG. Under the guidance of BOR policy and Guam law, ongoing planning and decision making is realized through a strong partnership between the administration and the faculty senate.

The University of Guam is an open-admissions, U.S. land-grant and sea grant public comprehensive university offering on a semester basis 15 master's degree programs, 25 bachelor's degree programs, and several certificate programs in both onsite and online course offerings. These programs are administered by the College of Liberal Arts and Social Sciences ("CLASS"), the College of Natural and Applied Sciences ("CNAS"), the School of Business and Public Administration ("SBPA"), the School of Engineering ("SENG"), the School of Education ("SOE"), and the School of Health ("SOH"). In addition, continuing education unit (CEU) classes, professional development training, and English language training are offered through the Global Learning and Engagement (GLE) Office. The Enrollment Management & Student Success ("EMSS") Division supports student success and student life with services from Admissions & Records, Financial Aid Office, Residence Hall, Student Counseling, Student Health, Student Life Office, and TRiO Programs. Fanuchånan (Fall) 2020 student enrollment was 3,449. The University of Guam has conferred over 19,600 degrees over the past 69 years. Guam offers exciting research opportunities found nowhere else in the world. Research at UOG is supported by the Office of Research and Sponsored Programs (ORSP). The ORSP supports faculty members and eligible University personnel to conduct research activities in collaboration with the various Micronesia colleges, as well as select public and private agencies locally, nationally, and internationally (UOG Fact Book, 2021).

The vast majority of UOG's students are undergraduates (95% by FTE), who enroll as freshmen rather than transfers (~ 3% of undergraduates). Nearly three quarters of UOG students are full time (74%, as of fall 2020). The student body reflects the region the university serves; 46% are Pacific Islanders (Chamorro, Micronesian, and Marshallese), 46% Asian, 3% Caucasian/Non-Hispanic, 1% Hispanic, 0.5% Black/African American, 0.1% Native American/Alaskan, and 3% unknown. According to the university, many of its undergraduates are first generation and 75% receive financial aid, with 59% on Pell grants. Since 2004, UOG's enrollments generally have steadily increased, with UOG's 2021 headcount of over 3450.

UOG's mission, *Ina, Diskubre, Setbe* (to Enlighten, to Discover, to Serve), is delivered by the equivalent of a 180 full time faculty members (FTF), 149 (79%) of whom are tenured or tenure

track and 34 (21%) non-tenure track, together with 737 staff, and 36 administrators. UOG's academic programs are administered through two academic colleges, the College of Liberal Arts and Social Sciences (CLASS) and the College of Natural and Applied Sciences (CNAS), and three professional schools, Business and Public Administration, Education, and Nursing and Health Sciences. UOG also supports eight research units, the faculty of which contribute primarily to graduate education: Cancer Research Center, Center of Excellence in Developmental Disabilities Education, Research and Service, Center for Island Sustainability, Marine Laboratory, Micronesian Area Research Center, Water and Environmental Research Institute, and the Western Pacific Tropical Research Center.

UOG is committed to its land and sea grant missions to serve the region, focusing its education, research, and service contributions on issues and challenges specific to Guam and Micronesia, including its indigenous Pacific Islander populations. In February 2020, the 11th president of the University of Guam, Dr. Thomas W. Krise, launched a new strategic plan designed to build on the University's strengths and capacities developed over the last 20 years. The five-year plan, dubbed "[Para Hulo](#)" — CHamoru for UOG's Latin motto "excelsior," or "ever upward" — will prepare UOG for its next WASC Senior College and University Commission accreditation site visit in 2024 and continue UOG's desired trajectory toward greatness. Para Hulo' focuses on six strategic initiative areas that will further enhance UOG's ability to provide a valuable education and an engaging experience to its students, serve the needs of its communities in Guam and the region, and enhance the recognition of the University of Guam as the flagship research and partnership institution for all of Micronesia: 1) Being recognized as a research university centered in island wisdom; 2) Leading as a partnership university; 3) Enriching the student experience; 4) Becoming a model for operations and customer service in Guam and all of Micronesia; 5) Growing our financial resources; and 6) Building and sustaining our infrastructure.

The Strategic Planning Process

The University of Guam Sea Grant Program (UOGSG) is the youngest program in the Sea Grant family of 34 and was designated as an institutional program on April 2022. UOGSG serves the people of the island of Guam and often assists with neighboring U.S. affiliated Pacific Islands on issues within Sea Grant's purview. A sharper focus has emerged and with the results from leadership, an expansion of staff professional, feedback from a recent program status review, and a stakeholder listening session held in August 2016 and June 2022.



Figure 3. UOGSG Listening Session 2022. Photo: UOGSG

UOGSG received feedback from a program review in October 2018 and October 2022. Coupled with information from the stakeholder listening sessions, and with the experiences of our new core employees, this helped shape the framework of this strategic plan. The plan was developed with broad input from coastal constituents, nonprofit organizations, extension and research faculty, local elected officials, local, state, and federal agency staff and the University of Guam Sea Grant Advisory Board. The first step of the process was a listening session of the above-mentioned entities. Coincident with this event, break-out sessions facilitated by staff from the UOGSG, comprised of extension 'work action groups' (fisheries, aquaculture, ecosystem health, education, etc.) developed preliminary goals and outcomes in those particular areas to support a draft plan. The process culminated with a workshop at the Hyatt Regency on Guam attended by approximately 40 people representing the groups identified above. That draft plan was reviewed by our Advisory Board.

When the 2018-2021 plan was extended for two years, a new process was developed that incorporated information obtained during the 2018 site review visit, and an addendum of projects from the previous plan are carried over into this plan.

UOGSG is a rapidly growing program with ample resources to address issues that fall under the priorities of the program and based on budget and employee time and expertise.

National Focus Areas Supported by This Plan:

Healthy Coastal Ecosystems
Sustainable Fisheries and Aquaculture
Resilient Communities and Economies
Environmental Literacy and Workforce Development

About the University of Guam Sea Grant Program

The formal program establishment of the University of Guam Sea Grant Program (UOGSG) was August 2008, prior to that it was a *Project* starting in October 2004 and a *Pre-Extension Program* starting in October 2000. The UOGSG was a *Coherent Area Program* from 2012 until its new designation of *institutional* status in April 2022.

Our **vision** is *a future where people live, work, and play along our coasts in harmony with the natural resources that attract and sustain them.*

Our **mission** is *to apply research, extension, and education activities that sustain and develop island environments while integrating the knowledge and culture of island people.*

Our **core values** are essential and enduring tenets that influence the organization and support its mission. The core values support a culture of integrity and scientific neutrality enabling Guam Sea Grant to serve as an honest broker. Guam Sea Grant will continue to be:

- **Visionary** - Advance innovative solutions that address emerging challenges (science and stewardship) and encourage creativity, initiative, and innovation.
- **Engage** – UOGSG will develop partnerships that leverage its strengths. Be responsive and accessible, respectful of partners, integrate diverse expertise and provide the science and knowledge needed to inform stakeholders, and support decision making

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- **Dedicated to Sustainability** - Communicate the importance of good stewardship and the value of the services that the coastal and ocean ecosystems provide to the community in Guam.
- **Strategic**— UOG Sea Grant will leverage opportunities that are uniquely suited to its program to maximize the impact of our resources, and resources available within the Sea Grant network.



Figure 4. UOG Sea Grant Headquarters

Cross Cutting Principles – Partnerships, Diversity, and Inclusion

By its very nature, diversity is part of everyday life in Guam. The citizens and students we serve, the people we employ, the interns we engage, and the volunteers on our Advisory Board represent the people of Guam. Our Sea Grant program gets our work done with the help and support of our partnerships and cooperation of local and federal agencies, village mayors, citizens, colleagues at the University of Guam and Guam Community College, and volunteers.

We have undergone a refresh in program leadership in 2018 and front-line employees that will give UOGSG a more precise focus and more measurable outcomes and impacts.

Leadership and Management

Upon the designation of institutional status, the UOG Sea Grant is now known as the Center for Island Sustainability and Sea Grant (CIS-SG). The UOGSG director is of the CIS-SG under the purview Office of Research and Sponsored Programs (ORSP). The CIS-SG Director also has an academic reporting line to the College of Natural & Applied Sciences (CNAS). The diagram below illustrates the 2022 operational structure of UOGSG.

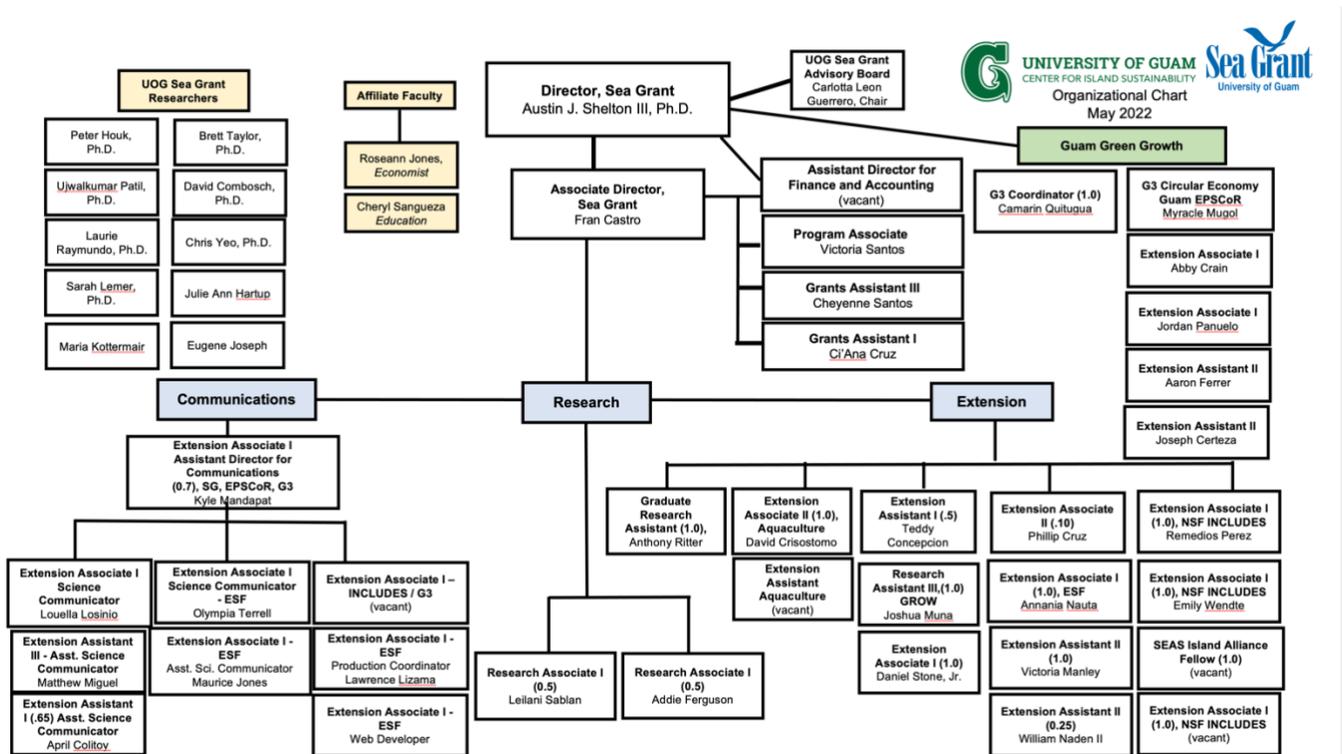


Figure 5. UOGSG Organizational Chart 2022

Stakeholder Input and Advisory Board

We communicate at least twice a year with our Advisory Board, stakeholders and key partners, as seen from this list:

- ◆ Guam Department of Agriculture, Division of Aquatic and Wildlife Resources
- ◆ Guam Bureau of Statistics and Plans
- ◆ Guam Environmental Protection Agency
- ◆ Guam Coastal Management Program
- ◆ Guam Waterworks Authority
- ◆ The Nature Conservancy
- ◆ Guam Fishermen's Cooperative
- ◆ Guam Nature Alliance
- ◆ Guam Soil and Water Conservation Districts
- ◆ Micronesia Conservation Coalition
- ◆ Micronesia Climate Change Alliance
- ◆ National Oceanic and Atmospheric Administration (NOAA)
- ◆ Northern Marianas College (NMC)
- ◆ Traditions About Seafaring Islands (TASI)
- ◆ U.S. Fish and Wildlife Service
- ◆ U.S. Environmental Protection Agency
- ◆ U.S. Forest Service
- ◆ U.S. Department of Agriculture
- ◆ U.S. Coast Guard
- ◆ U.S. Joint Region Marianas
- ◆ U.S. Department of Defense
- ◆ U.S. National Park Service

Naturally, this group can generate more ideas than there is funding to support, so we hosted a listening session on August 30, 2016, and June 14, 2022, to brainstorm a large list of possible work projects that ALL groups might be able to address. From this list found in the Appendix, we have chosen a few efforts and have narrowed our strategic focus to a list of manageable areas with projects to be determined in our Plan of Work.

UOG Sea Grant's Strategic Focus Areas in the 2024-2027 Omnibus

The UOGSG has included the four national focus areas in its plan which are Healthy Coastal Ecosystem, Environmental Literacy and Workforce Development, and since its designation as an institutional program in 2022, UOGSG has added Sustainable Fisheries and Aquaculture and Resilient Communities and Economies.

In a rare circumstance, the UOG CIS-SG was given a new program classification midway during the 2018–2022 Omnibus. After the Omnibus was extended for an additional two years (2022–2023), UOG CIS–SG updated the program to reflect its new status by adding two new focus areas. Furthermore, after receiving additional money, the program's budget for 2022 and 2023 was brought into line with that of most Sea Grant programs.

The UOG CIS-SG also has a congressionally-mandated waiver of local match up to \$200,000 which is applied to each new grant proposal submitted. As such, our ability to leverage non-federal dollars in work partnerships is somewhat limited. Of the funding UOGSG receives each year, about 71 percent is allocated to salaries, research, extension, education, and indirect costs. In addition, many of our collaborators in Guam are federally funded, rather than local funded. Upon the completion of a status review for institutional level, UOGSG was advised by the status review committee comprised of three National Sea Grant Advisory Board members, a Sea Grant Director, and a NSGO program officer to include two additional focus areas to our program along with UOGSG's current focus areas of *Healthy Coastal Ecosystems* and *Environmental Literacy and Workforce Development*. Below is a description of the types of work we will do in these areas and where they fit into the National Sea Grant Strategic Plan for 2024-2027.

1. **Healthy Coastal Ecosystems (HCE)**

The entire island of Guam is both locally and federally designated as a coastal zone. Healthy coastal ecosystems are largely dependent on responsible land-use activities. The northern half of the island is made of limestone, and there are no standing streams. Pollutants

including sediment, fertilizers, pesticides, and hydrocarbons often travel into waterways. In some areas, stormwater runoff flows directly from roads and other impervious surfaces into ocean outlets without first entering ponding basins or filtration systems. The southern half of the island is comprised of 19 watersheds with volcanic soils and dozens of running streams and rivers. The main environmental concern in southern Guam is accelerated terrestrial erosion, which is caused by poor development practices, wildland arson, uprooting of vegetation by feral ungulates, and irresponsible usage of recreational off-road vehicles. There are 8,908 acres of high priority planting areas in southern and central Guam that include bare 'badland' sites where topsoil and nutrients have completely eroded away (Mafnas, 2010). Land-based pollutants entering the ocean adversely affect the growth, survival, reproduction, and recruitment of corals in coastal coral reefs. The Guam Restoration of Watersheds (GROW) project is a core initiative of UOGSG using research to develop new watershed restoration techniques with the potential for quick and wide-scale application. The GROW Project will also test methods to filter pollutants out of stormwater runoff. The tie-in to the National Sea Grant Strategic Plan is:



Figure 6. Using innovative technology to restore our watersheds. Photo: UOGSG

Focus Area: Healthy Coastal Ecosystems

GOAL 1: Habitat, ecosystems, and the services they provide are protected, enhanced, and/or restored.

ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
<p>Develop and share scientific understanding, decision support tools, technologies, and approaches to protect and restore ecosystems.</p>	<p>Scientific understanding and technological solutions inform and improve conservation and the management of natural resources.</p>	<p>Conduct UOGSG-funded and directed applied research on local natural resource conservation and management challenges</p>
	<p>Ecosystem science and conservation priorities developed through stakeholder participation are addressed.</p>	<p>Include select research topics on UOGSG research agenda (GROW) and RFPs from 2016 UOGSG Listening Session Schedule stakeholder meetings to set priorities for future research topics</p>
	<p>Greater awareness and understanding of ecosystem functions and services they provide improves stewardship efforts.</p>	<p>Disseminate UOGSG-sponsored data, tools, and publication through website and other outlets as appropriate to audience demographic</p>
<p>Sustain the habitat, the biodiversity, and the abundance of coastal ecosystems, fish, wildlife, and plants.</p>	<p>Declining biodiversity, habitats, and ecosystem functions and services are restored and sustained.</p>	<p>Develop and test tools for habitat restoration, improvement of ecosystem functions and services</p>
	<p>Improved collaborative planning and decision-making leads to enhanced stewardship.</p>	<p>Participate in interagency work groups (i.e., Government of Guam-led Assembly of Planners, Coral Reef Local Action Strategy working groups)</p>

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GOAL 2: Land, water, and living resources are managed by applying sound science, tools, and services to sustain ecosystems.		
ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
<p>Support a sound science- and management-driven framework that integrates observations, monitoring, research, and modeling to provide a scientific basis for informed decision-making.</p>	<p>Collaborations with partners and stakeholders support planning, research and technological solutions to address resource management needs.</p>	<p>Leverage research at multiple UOG institutes with UOGSG funds or other resources</p> <p>Contribute to the Micronesia Challenge Coral-Reef Monitoring Database project</p> <p>Respond to Cooperative Ecosystem Studies Unit (CESU) to work with military partners on base projects.</p>
	<p>Citizen science initiatives are engaged and contribute to improving our knowledge with respect to coastal communities and ecosystems.</p>	<p>Develop citizen science initiatives and utilize the official service learning website, and through UOGSG and collaboration with EPSCoR, UOG Marine Laboratory, and UOG Center for Island Sustainability</p>
	<p>Communities have access to sound science, data, tools, and the training to be effective in planning and decision-making processes.</p>	<p>Disseminate UOGSG-sponsored data, tools, and publication through website and other outlets as appropriate to audience demographic</p>
	<p>Resource managers understand the risks, the options, tradeoffs, and impacts of their decisions.</p>	<p>Provide technical assistance to resource managers through extension activities and participation in interagency work groups</p>

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ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
<p>Identify and promote case studies and strategies that enhance resilient ecosystems and watersheds in the context of changing conditions.</p>	<p>Communities have access to information and understand projected changes within coastal ecosystems and how changes will impact coastal ecosystems.</p>	<p>Disseminate curated collection of coastal ecosystem scientific literature, case studies, and extension guides through appropriate outlets</p>
	<p>Communities can access case studies, training and tools to improve their ability to plan, prepare and adapt to future ecosystem conditions.</p>	<p>Work with RFK Library at UOG to make resources available to students, communities, and researchers</p>

2. *Environmental Literacy and Workforce Development (ELWD)*

The UOGSG will continue its active programs in environmental literacy and workforce development, expanding it to include a greater array of opportunities for K-12 STEM education and recent graduates to transition into the coastal workforce through targeted internship programs. Greater efforts will also be made to reach underserved stakeholders.

A series of extension workshops will transmit coastal science to the local community in a useful and usable format. Extension activities will include the Guam Green Growth, a local initiative, Micronesia Challenge, a regional initiative, numerous conservation projects, and disaster preparedness projects. UOG Sea Grant staff will participate as facilitators and recorders in community meetings for the Office of the Governor of Guam and UOG's



Figure 7. UOGSG Staff at outreach event. Photo: UOGSG

Guam Green Growth initiative funded by the Office of the Governor through the Office of Insular Areas, Department of the Interior. These meetings are a major component of Guam's largest comprehensive action framework to address the U.N. Sustainable Development Goals locally. The UOGSG will have significant outreach collaboration with the undertaking. UOG Sea Grant will continue disaster preparedness (e.g., tsunami, typhoons) activities, expanding the distribution of the Sea Grant funded *Mariana Islands Homeowner's Handbook* as well as coordinating workshops, extension and training activities on the benefits and uses of aquaculture.

UOG Sea Grant will provide important coastal science and resource information to the Guam tourism industry as it plans to welcome a large increase in visitors to the island post-pandemic. The outlook for Guam's tourism in 2022 is more optimistic than its predecessor. Current visitor arrival forecasts project an increase of about 111% over FY2021. This relatively conservative recovery anticipates a stronger ramp up in arrivals in the second half of the financial year.

Comprehensively, this information indicates that UOG Sea Grant is extremely well positioned to be the primary coordinator for the delivery of science-based information about coastal resources, in relationship to the tourism industry. UOG Sea Grant will interpret scientific and socioeconomic information about coastal resources for government and commercial tourism industry stakeholders, with the long-term goal of establishing viable models for sustainable tourism and development practices in Guam.



Figure 8. UOGSG Extension and Outreach staff display the UOGSG outreach trailer. Photo: UOGSG

Focus Area: Environmental Literacy and Workforce Development

GOAL 1: An environmentally literate public that is informed by lifelong formal and informal opportunities that reflect the range of diversity of our communities.

ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITES
<p>Enable the public to engage in community planning processes with respect to adaptive management to changing conditions by providing the best available information.</p>	<p>Communities are knowledgeable and equipped with the best available science and technology in order to contribute to adaptive management planning processes and stewardship.</p>	<ul style="list-style-type: none"> • Implement science-based extension activities (i.e. workshops, field trips) on locally significant coastal resource topics (i.e., changing coastline adaptations for homeowners) • Produce culturally competent and appropriate extension education materials (i.e. factsheets, apps, outreaches)
<p>Increase effective environmental literacy instruction for K-12 students by formal and informal educators.</p>	<p>Teachers and students are better informed in science, technology, engineering, and mathematics fields and can employ their knowledge to support sustainable practices within their communities.</p>	<ul style="list-style-type: none"> • Deliver STEM presentations to students and teachers in partnership with NSF INCLUDES Alliance • Participate in local science fair coordination, mentoring, and judging effective and strategic communication • Application of knowledge and lessons taught • From education to implementation, interactive experiences, field trips and site visits, creating network experiences, and participation of service learning •

<p>Increase opportunities for undergraduate and graduate students to gain knowledge and experience in the science and management of watershed, coastal, and marine resources.</p>	<p>College level courses and internships provide increased literacy, experience, and preparedness in areas of watershed, coastal, and marine ecosystems for all students, particularly those from underrepresented groups.</p>	<ul style="list-style-type: none"> ▫ Connect college students with external research experiences and internship opportunities ▫ Fund student research, internships, and other development opportunities targeting underserved populations in coastal science or resource management fields ▫ Mentor and advise students
	<p>Undergraduate and graduate students, particularly those from underrepresented groups, are supported and have access to formal and experiential learning, training, and research experiences.</p>	<ul style="list-style-type: none"> ▫ Implement authentic STEM learning experiences, mentorship through graduate fellowships and undergraduate student worker and internship positions targeting underserved populations ▫ Train students in extension and outreach skills ▫ Connect students to research experiences and conferences through National SG network and service learning activities ▫ Participate in professional groups and networks that promote the advancement of underserved populations in STEM fields

GOAL 2: A diverse and skilled workforce is engaged and enabled to address critical local, regional, and national needs		
ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
Grow awareness among the nation’s diverse population of career paths that support the needs of the nation’s coastal communities.	All members of a community are enabled to explore and pursue the variety of occupations that are essential to sustain the nation’s coastal communities and ecosystems.	Implement science-based workshops, activities, and learning opportunities that promote or educate about occupations related to the coastal sciences (i.e. workshops, field trips)
Prepare a responsive and diverse workforce to advance and benefit from sectors that support the needs of the nation’s coastal communities and ecosystems (e.g., industry, research, government, etc.), and to adapt and thrive in changing conditions.	Employment in all sectors of the U.S. coastal resource enterprise expands and diversifies.	Engage local businesses in sustainable management of coastal resources through stakeholder needs assessments and participation in regularly scheduled meetings Developing industries with the circular economy, Entrepreneurship – how to start your own business with
	The existing and future workforce can adapt and thrive in changing environmental, social, and economic conditions.	Provide professional development resources and opportunities for UOGSG affiliated collaborators and clients (including students) Participate in career development events (i.e. career day, science fair, educator symposia)
Increase effective environmental literacy communication to stakeholders, including how ecosystem change affects economic, social, and cultural values, as well as implications for conservation and management	Stakeholders develop a sense of awareness, understanding and stewardship in order to sustain watershed, coastal, and marine ecosystems and resources.	Implement science-based workshops and activities (i.e. workshops, field trips) on locally significant coastal resource topics (i.e., changing coastline adaptations for homeowners) Produce culturally competent and appropriate extension education materials (i.e. factsheets, apps, outreaches)
	Stakeholders develop a sense of awareness, understanding and stewardship in order to sustain watershed, coastal, and marine ecosystems and resources.	Implement science-based workshops and activities (i.e. workshops, field trips) on locally significant coastal resource topics (i.e., changing coastline adaptations for homeowners) Produce culturally competent and appropriate extension education materials (i.e. factsheets, apps, outreach)

3. Sustainable Fisheries and Aquaculture

Coastal fisheries are generally in decline throughout Micronesia region (Houk, 2012). Published studies show many signs of declining stocks along a gradient of human footprints that define fishing pressure. At present, sound science on how to improve fish stocks has been produced and published by academic researchers but are not always applied by managers to support fisheries policies and regulations. Evidently there's a need in Guam to bridge the science to communities, leaders and lawmakers. This focus area creates an opportunity for UOGSG to engage in translating science to communities on Guam and to expand our extension services.



Figure 9: Reef fish. Photo: David Burdick

It is common knowledge amongst fishers, consumers, managers, and scientists that Guam's fisheries have declined. While fisheries management has always been a priority of the local fisheries agency, there continues to be insufficient data and research to understand the status of Guam's fisheries. Furthermore, funding for fisheries research, aquaculture, and its management is limited in the region, thus making it harder to implement strategies and actions to achieve a sustainable fishery. The UOGSG's new focus area of sustainable fisheries and aquaculture provides researchers, resource managers, and the community an

opportunity to expand their knowledge on the state of the fisheries on Guam through research and education while piloting the backyard aquaculture project with communities.

The Governor of Guam has identified aquaculture as a priority and established the Guam Aquaculture Task Force which the UOGSG Director is a member. UOGSG is working to develop an aquaculture program with the main objective to encourage aquaculture practices that combine traditional knowledge with recent advances and techniques for long-term sustainability. To achieve our objective, UOGSG began introducing the concept of backyard aquaponics systems, creating educational materials to be used by the public and assist community members with their aquaponics system processes. The outcome will be implementation of sustainable strategies in blue economies, more professional development opportunities, and a blue industry workforce that is able to adapt and thrive in changing environmental, social and economic conditions. UOGSG will also explore opportunities for marine/offshore aquaculture and participate in the West Coast and Pacific regional working group, and Pacific aquaculture hub activities.



Figure 10: Aquaponics System. Photo: UOGSG

Focus Area: Sustainable Fisheries and Aquaculture		
GOAL 1: Fisheries, aquaculture and other coastal and freshwater natural resources supply food, jobs, and economic and cultural benefits		
ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
Develop a trained workforce and enhance technology transfer in domestic aquaculture	Increased understanding and technological solutions aid aquaculture management and production	Develop and implement 30-hour training program in Recirculating Aquaculture Systems for Community backyard Program and the general public
	Partnerships enable the aquaculture industry to adapt and acquire innovative technologies	Creating collaboration between commercial farmers, community NGO's, Land Grant, GovGuam agencies, and others to leverage ideas, manpower, and funds to introduce innovative technologies.
Promote and support harvest and processing techniques that lead to safe, sustainable, high-quality food, including economic and ecosystem benefits	Coastal resource industries employ technologies and reinforce strategies to ensure safe and sustainable seafood and products	Work in collaboration with regional entities to educate fishermen and the public about restoration of marine species using aquaculture hatchery technology and on appropriate steps to maintain product quality control.
	Coastal resource industries employ strategies that balance economic, community, cultural, and conservation goals	Work towards installing a living demonstration to show the ecosystem balance that is achievable with a cultural balance. This will be used to approach a discussion on community use of marine resources and how it can be used with constraint to achieve economic and conservation goals at the same time.

Focus Area: Sustainable Fisheries and Aquaculture		
<i>GOAL 2: Natural resources are sustained to support fishing communities and industries, including commercial, recreational and subsistence fisheries and aquaculture.</i>		
ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
Ensure sound science, services and tools are available and accessible to resource managers, the fishing and aquaculture communities and consumers	Commercial and recreational fishermen and aquaculturists are knowledgeable about efficient, sustainable, and responsible tools, techniques, and uses of coastal and freshwater resources.	Work with the Department of Agriculture in the collection of fisheries data to improve data streams, and further understand the status of fisheries in Guam, and for the purposes of extension and education activities
	Resource managers and fishing and aquaculture communities have access to science and tools to increase their capability to adapt to future resource management needs.	Work with local fishers and management agencies to generate and deliver high quality scientific information on fish stocks that will inform local and regional fisheries management, and the community
	Consumers understand the health benefits of seafood and purchase/harvest safe and sustainable products	Will develop a fact sheet and outreach materials on fisheries and seafood safety.

1. **Resilient Communities and Economies (RCE)**

Global impacts include sea level rise, increasing frequency and intensity of storms, and warmer sea surface temperatures are threats to Guam. Island communities can build resilience to these impacts by reducing local environmental stressors, assessing vulnerability, and planning adaptation strategies. The entire island of Guam is a coastal zone, and Guam communities and their assets, quality of life and safety are at high risk from natural hazards. Guam is frequently impacted by intense wind, storm surge, and heavy rainfall from tropical storms and typhoons. Guam's dynamic landscape also faces numerous natural hazards such as earthquakes, tsunamis, floods, drought, wildfire, and extreme heat. With 244 kilometers of coastline, communities throughout Guam are highly exposed to a variety of coastal-flood related threats. Guam is also located within Typhoon Alley and is particularly vulnerable to tropical storms and typhoons. In the last ten years alone, Guam has been impacted by Typhoons Hagibis (2019), Wutip (2019), Yutu (2018), Mangkhut (2018), and Dolphin (2015) (FEMA 2021).

Severe storm events can cause devastating impacts, including contaminating the freshwater system. Climate change further threatens Guam's communities and ecosystems through coral bleaching, ocean acidification, rising sea levels, and variability in rainfall and water supply, among other impacts. Climate projections indicate that while there may be fewer tropical cyclones in the future, they are expected to increase in intensity (Wang & Zhang 2016). The impacts from severe storm-related flooding will be further exacerbated by rising sea levels (Grecni et al. 2020).

The UOGSG will continue to support an integrated program of research, outreach and education to help stakeholders - residents, businesses, communities, planners and agencies - understand and employ best management practices and policies for sustainable development and for preparing for and responding to disasters. This includes informing citizens and communities about adaptation options to climate change and adverse environmental events.

UOG Sea Grant

Strategic Plan 2024-2027

Through the [Guam Green Growth](#) (G3) Initiative, UOGSG participates in efforts to cultivate an ecosystem for transformative action to achieve a more sustainable, prosperous, and equitable future for Guam. The G3 framework is a ten-year strategy to advance tangible solutions to sustainability challenges and contribute to a green economy for the island. The UOGSG Director is the overall co-chair of G3 Steering Committee, and the Associate Director is the co-chair of the *Thriving Natural Resources Team* which focuses on *Life on Land*, *Life Below Water*, and *Climate Action* goals aligning with UOGSG focus areas.



Focus Area: Resilient Communities and Economies		
GOAL 2: Water resources are sustained and protected to meet existing and emerging needs of the communities, economies and ecosystems that depend on them		
ACTIONS	DESIRED OUTCOMES	UOGSG ACTIVITIES
Inform community members about how actions impact water quality and availability	Community members understand watershed functions and the ecosystem services they provide that support communities and economies	Continue to engage community members in the Guam Restoration of Watersheds (GROW) project
	Community members understand how actions will impact water quality and quantity and are able to make informed decisions	Studies on water quality and quantity are made available through the Guam Green Growth Thriving Natural Resources Working group.
Collaborate with stakeholders to develop and share best management practices (BMP) and measures to protect water resources	Communities have access to sound science, data, tools and services to understand and anticipate changes in water quality and quantity	Continue to inform community members about how actions impact water quality and availability through news articles, social media, workshops and trainings.
	Communities have access to science, tools and technologies to protect and sustain water resources and make informed decisions	Demonstration projects will be established and expanded to community groups. Trainings in integrating aquaculture with plant crops, and watershed restoration techniques will be emphasized as a BMP

CROSS-CUTTING THEMES

1. Supporting Sea Grant's International Efforts

As appropriate, UOGSG may assist the National Sea Grant office with collaborating Sea Grant programs in the Asia region. These may include the current programs in South Korea and Japan, and future programs in Indonesia and the Philippines. Guam is within four hours of most east and southeast Asian capital cities and is very well positioned for the strategic expansion of Sea Grant programs in the region. We propose to make initial contacts in coordination with the International Programs Division of NOAA, Sea Grant leadership in NOAA, University of Hawaii Sea Grant, and the WESTPAC IOC organization to promote exchanges and mutual support for these international programs.

2. Traditional Local/Ecological Knowledge (TLK/TEK)

UOGSG recognizes the importance of traditional local knowledge in our island culture and want to align efforts with the NSGO's network visioning efforts in TLK and TEK.

To implement the visioning plan developed by the NSGO traditional local knowledge team, UOGSG provides an opportunity for students to learn about the importance of preserving and maintaining TLK practices through course instruction by a traditional leader. UOGSG has been working with Master Navigator Larry Raigetal to offer traditional seafaring courses which includes an element of climate adaptation as it pertains to celestial navigation. UOGSG will continue to host TLK classes to encourage students to learn more about traditional knowledge, celestial navigation, and climate adaptation.



Figure 11. Master Navigator Larry Raigetal in the traditional wear. Photo: UOGSG

3. Cooperative Ecosystem Studies Unit (CESU) - Endangered Species Monitoring

Endangered species particularly sea turtles play an important role in ocean ecosystems by maintaining healthy seagrass beds and coral reefs, providing key habitat for other marine life, helping to balance marine food webs and facilitating nutrient cycling from water to land.

The U.S. Department of Navy and Joint Region Marianas installation on Guam have an obligation to meet the goals and objectives of their Integrated Resources Management Plan. Competitive requests are often solicited to conduct monitoring of endangered species such as green sea turtles. UOGSG has been successful in applying for these opportunities as these projects are relevant to our focus areas. Taking on monitoring projects for green sea turtles at Anderson Air Force Base on Guam and in the Northern Mariana Islands have increased the capacity of UOGSG staff biologists and has exposed UOGSG in building a network of partners in both local and federal agencies.



Figure 12. Turtle Hatchling. Photo: UOGSG

The G3 Working Group was established in September 2019 through Executive Order 2019-23 and its facilitation was assigned to the University of Guam Center for Island Sustainability. UOGSG is an active participant in the G3 Initiative. The UOGSG Director is the overall co-chair of G3 and the Associate Director is the co-chair of the *Thriving Natural Resources Team* which has a focus on *Life on Land*, *Life Below Water*, and *Climate Action* goals aligning with our current focus areas. UOG CIS and UOGSG facilitate the overall G3 process and hosts several Sea Grant employees working part-time on G3 projects.

4. National Science Foundation - Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES) Supporting Emerging Aquatic Scientists (SEAS) Island Alliance

To advance the Environmental Literacy and Workforce Development focus area, as well as contribute to the National Sea Grant Diversity, Equity, and Inclusion Community of Practice, UOGSG applied for and received a National Science Foundation (NSF) INCLUDES Design &

Development Launch Pilot (2017-2019) and later an NSF INCLUDES Alliance award (2019-2024). NSF INCLUDES is a comprehensive national initiative to enhance U.S. leadership in discoveries and innovations by focusing on diversity, inclusion, and broadening participation in STEM at scale. The NSF INCLUDES: SEAS Island Alliance addresses the grand challenge of increasing islander representation in the nation's STEM enterprise, particularly in the marine and geosciences. The NSF INCLUDES Islands Alliance will use a collective impact approach to build upon two successful NSF INCLUDES Design & Development Launch Pilots (DDLPs) in the U.S. Virgin Islands and Guam to establish a national network focused on coastal geoscience pathways in seven U.S. or U.S.-affiliated island jurisdictions (U.S. Virgin Islands, Puerto Rico, Guam, Commonwealth of the Northern Mariana Islands, Republic of Palau, Federated States of Micronesia, and the Republic of the Marshall Islands). UOGSG coordinates the Guam Hub of the alliance and the UOGSG director serves as PI. Partners include the National Sea Grant network, Maryland Sea Grant, and Puerto Rico Sea Grant.

5. The Micronesia Challenge+ 2030

The Micronesia Challenge is a regional initiative between the governments of Palau, FSM, Marshall Islands, CNMI, and Guam. The initiative was originally launched in 2006 with a declaration to effectively conserve 30% nearshore marine resources and 20% terrestrial resources by 2020. Governments have renewed their commitment and launched the new scaled-up conservation targets through the Micronesia Challenge Plus 2030 (MC+ 2030) to effectively manage at least 50% marine resources and 30% terrestrial resources across Micronesia. UOGSG has been a host for Guam's Micronesia Challenge Champion for two consecutive years. This is an internship funded by the Micronesia Challenge to promote the initiative on Guam through education and outreach. The young champions were assigned to work on UOGSG outreach and extension projects and promoting Guam's goals towards the Challenge. We hope to continue hosting interns in our office to build capacity and interest in the environmental and natural resources field. For more information about the Challenge, please visit www.micronesiachallenge.org.





Figure 13. National Sea Grant Director Jon Pennock presents UOG President Thomas Krise with the institutional plaque. August 11, 2022. Photo: UOGSG

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Performance Measures and National Targets 2024-2027

National Sea Grant Performance Measures, Metrics and Targets for 2024 – 2027			
University of Guam Sea Grant Program - Performance Measures, Metrics and Targets for 2024 – 2027			
	2024-2027 National Performance Measure and Metrics	6-Year Targets (2024-2027)	Brief Justification (If targets are significantly different from the last 4-year cycle)
1	Number of resource managers who use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities	5	Limited number of resource agencies and personnel on island and in the region and we will attempt to work with them all.
2	Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities	10	During this period, we will focus on developing habitat restoration tools and promote their wide scale adoption in future years but cannot guarantee wide scale use at this time.
3	Number of fishermen, seafood processing and aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities	3	
4	Number of communities that adopt/ implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities	5	
5	Number of communities that adopt/implement hazard resiliency practices to prepare for and respond to/minimize coastal hazardous events as a result of Sea Grant activities		
	Number of Communities	1	
	Number of hazard resiliency training/ technical assistance provided	1	
	Community hazard resiliency improved	2	
6	Number of Sea Grant products that are used to advance environmental literacy and workforce development	8	
7	Number of people engaged in Sea Grant-supported informal education programs	5000	

8	Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation.	3	
9	Number of Sea Grant tools, technologies and information services that are used by our partners/customers to improve ecosystem-based management.		
	Number of Products 'developed'	8	
	Number of Products 'used'	5	
10	Economic and societal impacts derived from Sea Grant activities impacts derived from Sea Grant activities (market and non-market; jobs and businesses created or sustained)		
	Economic Benefit	\$1,000,000	Guam's reefs generate \$127,000,000/yr in value according to a 2007 study. Our work can help keep the quality of the reefs up and thus continue or create additional value per year.
	Jobs Created	5	
	Jobs Sustained	2	
	Businesses Created	0	
	Businesses Sustained	2	
	Patents	0	
11	Number of Marinas Certified as "Clean Marina" by the Clean Marina Program as a result of Sea Grant Activities	0	
12	Number of individuals certified or recertified in Hazard analysis critical control point (HACCP) as a result of Sea Grant activities	0	
13	Number of peer-reviewed publications produced by Sea Grant	4	UOGSG has 1 PhD and UOG does not have a PhD program and so this number is purposely conservative.