UNIVERSITY OF GUAM
CENTER FOR ISLAND SUSTAINABILITY

Sea Grant
UNIVERSITY OF GUAM

IMPACT 2023

Impact Report 2023

University of Guam Center for Island Sustainability & Sea Grant

Contributors
Fran Castro, MS
Amanda Dedicatoria
Else Demeulenaere, PhD
Vince Fabian
Maria Louella Losinio
Kyle Mandapat, MBA
Austin Shelton, PhD
Olympia Terral

Photographs
David Burdick, MS
Jeremie Charfauros
Maurice Jones
Lawrence Lizama
Matthew Putnam
Leilani Sablan
Vince Su'e
Brett Taylor, PhD
Marissa Villaverde

Coordinating Editor
Maria Louella Losinio

Cover Art & Layout Design
April Colitoy-Gaerlan

Graphics Support
Clyde Grapa

Welcoming Remarks

Håfa Adai,

It is with great pride that we present the 2023 Impact Report for the University of Guam Center for Island Sustainability and Sea Grant. This year, once again, the Center has demonstrated its unwavering commitment to fostering a sustainable future for Guam and the broader Micronesia region.

The University of Guam, as a Land Grant institution and now a Sea Grant institution, holds a fundamental responsibility to serve our island community. UOG CIS and Sea Grant embodies this spirit through its dedication to research, education, and outreach that directly address the environmental and economic challenges we face.

In 2023, the Center's achievements were truly inspiring. From groundbreaking research on endangered species, fisheries, aquaculture and habitat restoration to innovative programs promoting community gardens and circular economies, UOG CIS and Sea Grant has made significant contributions across a wide spectrum.

This report highlights the Center's collaborative approach. Partnerships with local agencies, community groups, and our fellow institutions are essential to translating scientific knowledge into real-world solutions. By working together, we can ensure that our efforts are not only impactful but also culturally relevant and sustainable in the long term.

Looking ahead, I am confident that UOG CIS and Sea Grant will continue to be a leader in island sustainability, building our conservation and sustainability workforce. The Center's dedication to building a future where environmental health and economic prosperity go hand-in-hand is more critical than ever. As we face ongoing challenges like climate change and resource depletion, the Center's innovative spirit and commitment to collaboration will be essential for ensuring a thriving Guam and Micronesia for generations to come.

I extend my deepest gratitude to the dedicated faculty, staff, students, and partners of UOG CIS and Sea Grant for their exceptional work. Their passion and expertise are truly making a difference.

Anita Borja Enriquez, DBA
President, University of Guam

Håfa Adai,

I am pleased to share the recent achievements of our UOG Center for Island Sustainability and Sea Grant team over the past year.

In May 2023, Typhoon Mawar was the first major storm to directly strike Guam in nearly 20 years. Our team swiftly engaged with the island-wide recovery efforts to clear the island of debris and assist in packaging and distributing over 66,000 lbs of food commodities to those most in need during the critical weeks following the typhoon. Our Sea Grant aquaculture program donated fresh tilapia to residents of Mangilao village nearby our main campus.

Last September, we celebrated our one-year anniversary as an official Sea Grant Institution. For the first time ever, Guam hosted a Sea Grant Association meeting. This occasion brought directors and other representatives from nearly all 34 Sea Grant programs across the U.S. to our island to share best practices and innovations in marine and coastal resource conservation. The meeting spent one day in Saipan and the visitors witnessed the growth potential of the Sea Grant network in our region.

UOG began facilitating Guam Green Growth (G3) in 2020, and it has since become our island's most comprehensive public-private partnership ever created to achieve a sustainable future. A bright spot for sustainable development, we now have the incredible opportunity to share this effective model with our island neighbors. In 2023, our program and the University of Hawai`i Sea Grant received $1.4M in grant funding from the U.S. Department of State via the National Oceanic and Atmospheric Administration (NOAA) National Sea Grant College Program to help other islands in Micronesia establish their own green growth initiatives. We are now advancing our region's collective commitment to achieve sustainability by assisting the Republic of Palau, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, and the Republic of the Marshall Islands.

Please enjoy the impact highlights from 2023 in the pages to follow. Si Yu'os Må'ase to the many partners and funders we work with locally, regionally, and globally. We look forward to our continued impact together as we lead and support a sustainable future for our island region and planet.

Austin J. Shelton III, PhD
Director, UOG Center for Island Sustainability and Sea Grant

Buenas yan Håfa Adai,

Throughout the past year it has been a great experience to work alongside the amazing CIS and Sea Grant team as we pushed to accomplish our goals and continue to move our mission forward.

This year among other projects, we worked closely with partners to continue our restoration efforts in the Ugum watershed, to raise new community gardens, to bring aquaculture systems to villages, to tag and help protect our sea turtle population and to help continue our transition to a circular economy.

Our efforts were recognized as our program was promoted from a coherent area program to full-fledged institutional status by the National Oceanic and Atmospheric Association (NOAA) late last year, making the University of Guam a Land Grant and Sea Grant Institution.

I would like to thank and recognize our grantors, funders and supporters who have helped to get us where we are today, and ready to move into the future. I would also like to thank our diligent team for their dedication and tireless work to make our successes a reality.

While this impact report will give you a glance into the work that this team of high performers has helped to accomplish, we always welcome any community members to join us for our out-planting efforts and other projects and outreach events to share in the experience with us to see first-hand how you can make a difference.

Si yu'os ma'åse,

Fran Castro, MS
Associate Director for Operations & Development, UOG Sea Grant

---

Håfa Adai,

We are excited to share some of our endangered species recovery and forest restoration research with you all in this impact report.

In 2023, our natural resources team grew substantially. We are proud to offer a career in conservation and train the next generation of conservation leaders in natural resources management. Together, we conduct research to advance scientific and traditional knowledge and use it to inform forest management, endangered species recovery, and related policies. We would like to thank our funders and partners in conservation to make this all possible.

The resilience of our island communities and their associated ecosystems was clear this year. Typhoon Mawar devastated many of our homes, yards and låmchos, farms, and our forests. But we prepared as a community before the storm arrived and lent each other a hand after the storm. Our natural resources team focused on ensuring our restoration work aided in a rapid typhoon response after the storm. Not only did we have plenty of seedlings ready to help with reforesting, but we also rescued endangered orchids that were blown off their host trees during the storms.

Our team went the extra mile, and I couldn't be prouder. Each team member represents a family in our community. They share stories with their children about the diverse species that flourish in our forest. This helps their children appreciate and preserve the beauty and spiritual connection to the forest for future generations.

Si yu'os ma'åse,

Else Demeulenaere, PhD
Associate Director for Natural Resources, UOG Center for Island Sustainability

---

Håfa Adai,

As we turn the page on 2023, this impact report invites you to journey with UOG CIS and Sea Grant on a voyage of transformation. Within these pages, you'll witness the ripples of change we've set in motion – ripples born from collaboration, innovation, and a deep commitment to protecting our island home.

2023 was marked by both milestones and challenges. We celebrated the launch of groundbreaking research tackling issues like climate change and coral reef resilience. Our outreach programs empowered our communities with knowledge and resources, fostering responsible stewardship of our natural resources. Yet, the year also highlighted the urgency of our mission. Witnessing the rising tides and intensifying storms, we redoubled our efforts, recognizing that only through collective action can we build a sustainable future for our people.

As we sail into 2024, our course remains steady, guided by our unwavering vision.

Join us on this journey. Whether you're a student eager to make a difference, a policymaker seeking solutions, or a Guamanian concerned about our future, you have a role to play. Through collaboration and shared responsibility, we can navigate the challenges ahead and chart a course towards a more sustainable future for Guam.

Si yu'os ma'åse and I hope to see you as we make more news and history this year!

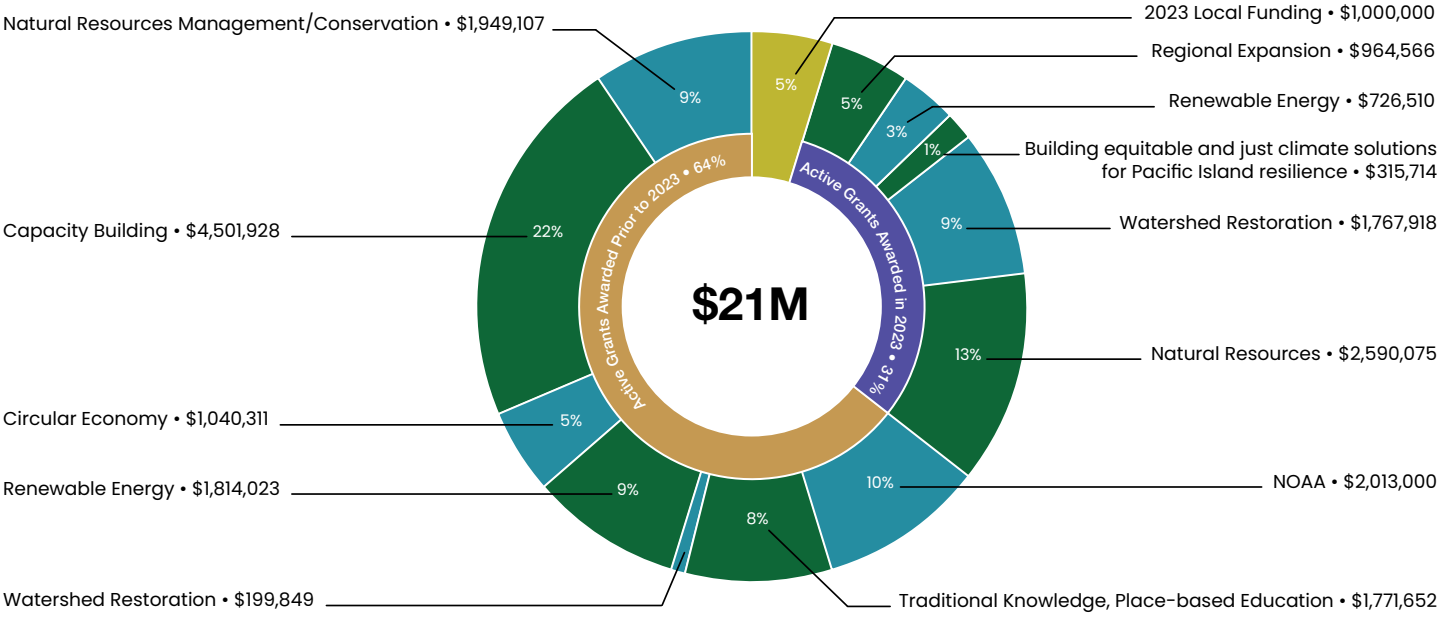
Kyle Mandapat, MBA
Associate Director for Communications and Engagement, UOG Center for Island Sustainability and Sea Grant

UNIVERSITY OF GUAM
CENTER FOR ISLAND SUSTAINABILITY

Sea Grant
UNIVERSITY OF GUAM

BY THE NUMBERS **2023**

Total Funding awarded to University of Guam Center for Island Sustainability and Sea Grant

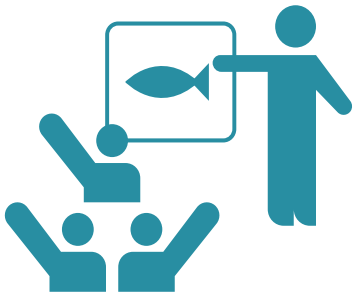


21x Return on Investment (ROI) - For every $1 in local funding, UOG CIS & SG leverages $21 in external funding

OUTREACH

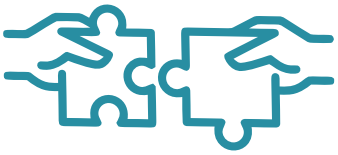
2,553
SCHOOL PARTICIPANTS

6,642
EVENT PARTICIPANTS



Total number of participants including students, teachers, and the public.

141
PARTNERSHIPS
from local and federal government, private sector, non-profits, and other organizations



RESTORATION IN ACTION

Facilitated by Guam Restoration of Watersheds (GROW) Initiative

4,836 NATIVE & PIONEER SPECIES PLANTED

486 VOLUNTEERS

17 PLANTINGS

INVASIVE AND ENDANGERED SPECIES

Key impact metrics facilitated by Center for Island Sustainability Natural Resources

ACRES SURVEYED for endangered and threatened species — **34**

INVASIVE TREES, SEEDLINGS, VINES, SHRUBS REMOVED — **4,410**

DIFFERENT NATIVE SPECIES PLANTED — **25**

CENTER FOR ISLAND SUSTAINABILITY NATIVE PLANT NURSERY

1,051+ SEEDLINGS OUTPLANTED

2,000+ PLANTS PROPAGATED

53 DIFFERENT SPECIES PROPAGATED

CAPACITY BUILDING PROGRAMS

Students supported by Sea Grant, NSF INCLUDES & GUAM NSF EPSCoR

GUAM GREEN GROWTH CIRCULAR ECONOMY AND MAKERSPACE INNOVATION HUB IMPACTS

36

Members of the Guam Green Growth Conservation Corps are graduated and are now gainfully employed or have returned to school to further their education.

265

TOTAL PARTICIPANTS

Total number of participants including members, tours, and presenters

5

BUSINESSES EXPANDED

2023 UNIVERSITY OF GUAM CONFERENCE ON ISLAND SUSTAINABILITY

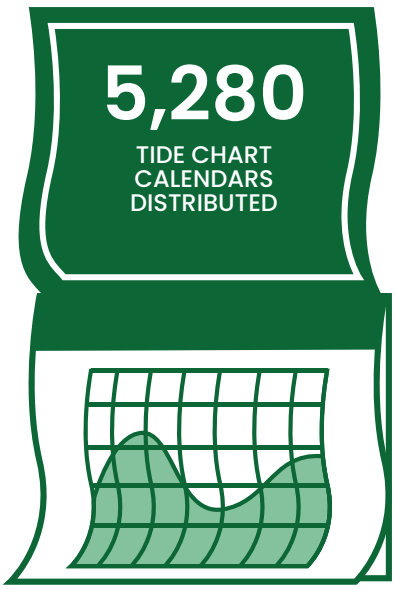
485 REGISTERED **127** PRESENTATIONS AND SPEAKERS

SACNAS 2023

NATIONAL DIVERSITY IN STEM CONFERENCE

34 UOG STUDENTS ATTENDED

3,000 VISITORS TO UOG BOOTH



GUAM GREEN GROWTH CONSERVATION CORPS

2023 **IMPACTS FOR OUR SUSTAINABLE FUTURE**

20,212
CANS COLLECTED & RECYCLED

294
TREES PLANTED

1,755
TREES PRUNED

307.5
X-LARGE BAGS OF TRASH PICKED UP

30
FEET OF EROSION CONTROL DEVICES BUILT

200
TREES PLOTTED FOR CITIZEN FORESTER PROGRAM

200
WHITE GOODS & BULKY WASTE REMOVED

UNIVERSITY OF GUAM
UNIBETSEDÅT GUAHAN

70

TRUCK LOADS OF LARGE WASTE REMOVED (MAWAR RECOVERY)

66,000

LBS OF FOOD COMMODITIES PACKED AND DISTRIBUTED (MAWAR RECOVERY)

11

BROWN TREE SNAKES REMOVED

10

ROADSIDE CLEANUPS

5

ISLAND BEAUTIFICATION PAINTING PROJECTS

6

BEACH CLEANUPS

Typhoon recovery efforts, building community resilience

After typhoon Mawar left a path of destruction across the island, the UOG Center for Island Sustainability and Sea Grant team swiftly went to work to aid in recovery efforts.

Together with Guam NSF EPSCoR and the NSF INCLUDES Seas Alliance, the team gathered at the Guam Department of Education's Commodity Distribution Warehouse in Piti to provide assistance to the Emergency Food Assistant Program.

The team joined volunteers from the government and private sector in packing and distributing around 7500 bags of food commodities to the different villages.

Also, a day after the storm, all 12 members of the third cohort of the Guam Green Growth Conservation Corps (G3CC) assisted with cleanup operations on campus --- from clearing debris to reopening access to essential areas used by both vehicles and pedestrians.

Usually engaged in village beautification activities, the G3 Conservation Corps recognized the urgent need to redirect their efforts towards supporting the island's recovery in the wake of the typhoon.

Meanwhile, the UOG Sea Grant aquaculture program, established to enhance food security on the island, swiftly adapted its focus to address the immediate needs of the community.

The aquaculture team donated fresh tilapia to the Mangilao Mayor's Office, providing much-needed sustenance to those impacted by the disaster.

UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, expressed the program's commitment to support the community during times of crisis. "In the aftermath of a super typhoon, ensuring food security becomes paramount," he said.

UOG Sea Grant Aquaculture Specialist Dave Crisostomo, said, "It's about providing nourishment and hope to our community when they need it the most."

Before the typhoon, the UOG Center for Island Sustainability biologists also worked tirelessly to secure native plants in their nursery to safe locations.

Vince Fabian, a UOG Center for Island Sustainability biologist, spearheaded the relocation efforts, with the assistance of the other biologists and G3 Conservation Corps members.

"It took all of us two days to move all the plants, and without the help of the G3 Conservation Corps it would have taken much longer," said Fabian.

There were several bright spots after the typhoon. Plants that weathered the storm in areas around the island began to develop new leaves, flowers, and fruits as a response to the stress, according to Fabian.

Another bright spot after the storm: biologists found, collected, and planted several native orchids.

Disaster preparedness

The UOG Center for Island Sustainability and Sea Grant team also took proactive measures several months after typhoon Mawar, as Guam braced for tropical storm Bolaven.

Contributing to building community resilience, the team distributed the "Mariana Islands Homeowner's Handbook to Prepare for Natural Hazards" at strategic locations.

"As we brace ourselves for the incoming storm, it is crucial that the community has access to reliable information to secure their homes and ensure the safety of their loved ones," said Kyle Mandapat, MBA, UOG Center for Island Sustainability and Sea Grant associate director for communications and community engagement.

The handbook is a result of the collaborative efforts between UOG Sea Grant, the University of Hawai'i Sea Grant College Program, UOG Cooperative Extension and Outreach, CNMI (Commonwealth of the Northern Mariana Islands) Coastal Resource Management and other partners.

The UOG Sea Grant team gathered resources from organizations like the National Weather Service – Forecast Office Guam, Guam Building Code Council, Guam Homeland Security, and the NOAA (National Oceanic and Atmospheric Administration) Coastal Storms Program for the manual.

LEFT PHOTO: *Gov. Lou Leon Guerrero, Piti Mayor Jesse Alig and Guam State Clearinghouse Administrator Stephanie Flores pose with the UOG Center for Island Sustainability and Sea Grant and EPSCoR team who assisted in packing food commodities at the Guam Department of Education Food Distribution warehouse in Piti.* **BOTTOM PHOTO:** *Residents from different villages receive tilapia from the Mangilao Mayor's Office. UOG Sea Grant donated fish from its own aquaculture system as part of its post-typhoon outreach.*

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

Guam & Hawai'i Sea Grant support Green Growth expansion

A $1.4 million grant from the U.S. Department of State through the National Oceanic and Atmospheric Administration (NOAA) National Sea Grant College Program has enabled the UOG Center for Island Sustainability and Sea Grant and the University of Hawai'i Sea Grant College Program to expand the Green Growth Initiative across the Western Pacific.

Program representatives made the announcement at the National Sea Grant Association meeting in September, saying that the grant supports efforts to extend the reach of the Local2030 Islands Network and the G3 Initiative to include the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, the Republic of Palau, and the Republic of the Marshall Islands.

The National Sea Grant Association meeting marked Guam's inaugural hosting of the biannual event. Over 70 directors and representatives from nearly all the 34 Sea Grant programs nationwide attended the meeting.

The new grant underpins efforts to extend the reach of the Local2030 Islands Network and the G3 Initiative to include the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, the Republic of Palau, and the Republic of the Marshall Islands.

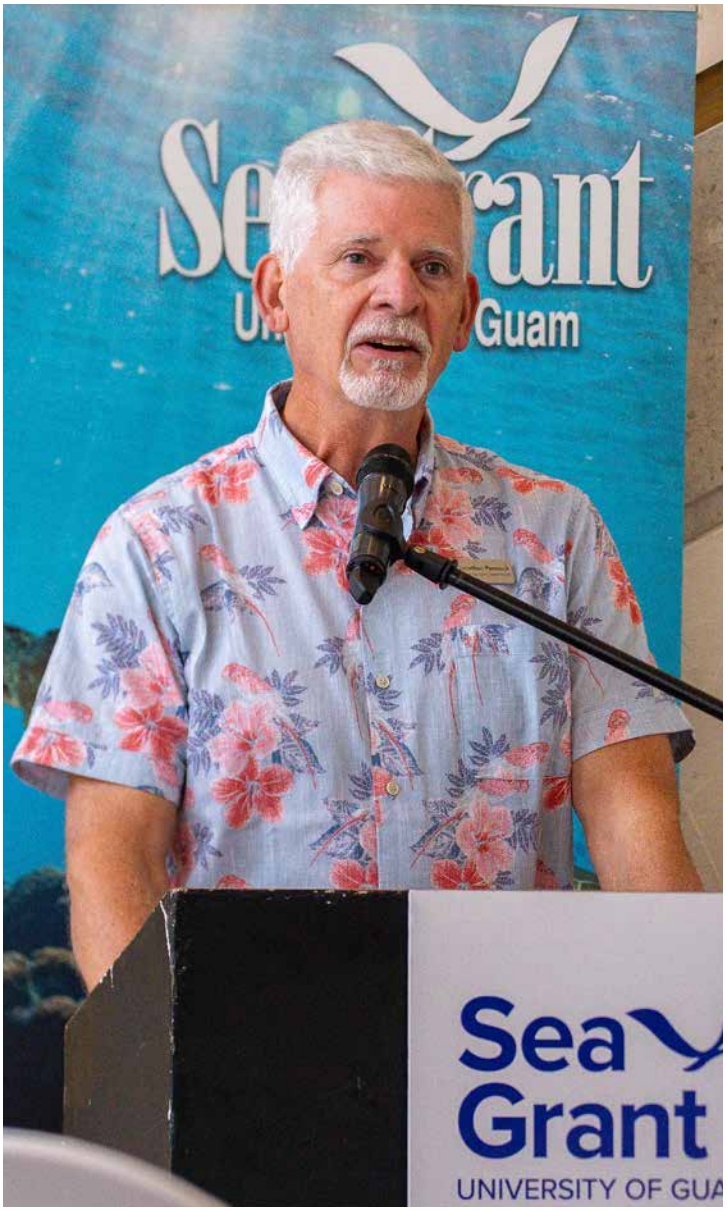
UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, said the seed funding will enable Guam's island neighbors to start their own Green Growth programs and hire coordinators. "We aspire to collectively strengthen our capacity across Micronesia and the Pacific to advance sustainable development," Shelton added.

Meanwhile, Sea Grant Association President and Director of the UH Sea Grant College Program Dr. Darren Lerner, PhD, commended the long-standing partnership between the two universities. He praised UOG for its commitment to excellence, emphasizing the strength derived from the dedication of every program to this shared goal.

National Sea Grant College Program Director Dr. Jonathan Pennock, PhD, also recognized the impressive growth of the UOG Center for Island Sustainability and Sea Grant program in a relatively short period of time. He emphasized its strong connection to the community and praised the program for effectively carrying forward the mission of Sea Grant.

In 2022, UOG achieved Sea Grant Institutional Status following a unanimous recommendation from the National Sea Grant Advisory Board and official designation from NOAA senior leadership.
The National Sea Grant College Program is a collaborative effort between universities and NOAA, dedicated to enhancing the practical utilization and conservation of coastal and marine resources, with a vision of fostering a sustainable economy and environment. The Sea Grant network comprises more than 3,000 scientists, engineers, public outreach experts, educators, and students.

LEFT PHOTO: *Representatives from the UOG Center for Island Sustainability and Sea Grant, University of Hawai'i Sea Grant College Program and the National Sea Grant College Program gather for a photo after a press conference announcing a $1.4 million grant from the U.S. Department of State through the National Sea Grant College Program.*
BOTTOM-LEFT PHOTO: *National Sea Grant College Program Director Dr. Jonathan Pennock, PhD, speaks at the press conference announcing the Green Growth expansion.*
BOTTOM-RIGHT PHOTO: *UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, presents at the Micronesian Islands Forum. Leaders from the different island nations and jurisdictions in Micronesia attended the forum.*



Sustainability conference 2023: UOG, GovGuam align with Blue Planet Alliance

On the fourth day of the 2023 UOG Conference on Island Sustainability, government officials signed a landmark agreement with nonprofit Blue Planet Alliance to solidify the island's commitment to fully transition to renewable energy by 2045.

Blue Planet Alliance's mission is to encourage islands and countries worldwide to legislatively mandate their commitment and to provide support in the process.

Governor Lou Leon Guerrero and Blue Planet Alliance founder Henk Rogers signed the landmark agreement. Guam follows the Kingdom of Tonga, and the Government of Tuvalu as the third Blue Planet Climate Agreement signee.

This historic event marks a significant step forward in the fight against climate change and the promotion of sustainable energy practices, according to the officials at the event.

Rogers, a Hawai'i and New York-based entrepreneur, served as the keynote speaker at the conference.

He is known for his environmental advocacy work and success in pushing for the adoption of Hawai'i's mandate for 100 percent renewable energy by 2045. As the founder of Blue Planet Alliance, Rogers inspires the rest of the world to do the same.

According to Rogers, codifying renewable energy goals through legislation is part of alliance-building and ensures continuity of the commitment. He advocates for starting initiatives from the islands and then expanding toward the nation and internationally.

Guam has legislation in place that sets a renewable energy goal of 100 percent by 2045. Senator Amanda Shelton and then-Senator Clynt Ridgell drafted the bill that became public law.

"Thank you so much for already doing this for Guam," Rogers said.

For UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, the signing of the agreement marks the start of an important

LEFT PHOTO: *Henk Rogers, the founder of Blue Planet Alliance, signs an agreement with Governor Lou Leon Guerrero and former UOG President Thomas Krise. The agreement firms up the island's commitment to fully transition to renewable energy by 2045.*
RIGHT PHOTO: *Representatives from the Kingdom of Tonga, the Government of Tuvalu, Guam, Pohnpei State (Federated States of Micronesia), the Republic of Palau, the Cayman Islands, the Commonwealth of Northern Mariana Islands, and American Samoa attend the first Blue Planet Fellowship Program in Honolulu, Hawai'i.*

partnership to fortify the island against the devastating impacts of climate change.

"This agreement not only highlights the importance of collaboration between sectors but also emphasizes our responsibility to preserve the beauty and resilience of our island. Let us continue to work together in implementing sustainable solutions and championing climate action for Guam and our region," he said.

Former UOG President Dr. Thomas Krise, PhD, also signed a Memorandum of Understanding with the nonprofit, officially making UOG a member of the Blue Planet Alliance.

Krise, in a discussion during the conference, said universities play an essential role in facilitating dialogue and partnerships with organizations and alliances outside the island.

Krise hosted the Presidential Summit on Island Sustainability at the conference, a landmark event that brought together leaders from universities and colleges in Guam, Palau, American Samoa, the Commonwealth of the Northern Mariana Islands, and Jeju Island.

"With the increasing urgency of climate change and other global challenges, university leaders play a crucial role in shaping policy and implementing practical solutions," Krise said.

In October 2023, Sen. Amanda Shelton, Guam Power Authority Assistant General Manager John Cruz, NSF INCLUDES SEAS Fellow Morgan Leon Guerrero, and Guam Youth Congress representative Julie Ann Laxamana represented the island in the first Blue Planet Fellowship Program in Honolulu, Hawai'i. Blue Planet Alliance and other partners brought multi-sectoral stakeholders from island countries and territories together to learn how Hawai'i passed a law mandating a transition to 100 percent renewable energy by 2045.

Research


Sea Grant

Leilani Sablan
Fishery Biologist and Research Associate
University of Guam Sea Grant

Guihan for Guåhan: Fish data-gathering promotes citizen science

UOG Sea Grant started Guihan for Guahan (Fish for Guam), a data-gathering project that engages local fishers on Guam.

The primary objective of Guihan for Guahan is to increase its fishery data set by identifying various fish species through photo submissions and collecting catch measurements directly from the local fishers. The project has a long-term vision of studying and analyzing reef stock trends over the years, which would provide valuable insight into marine conservation efforts.

Leilani Sablan, a fishery biologist and research associate with UOG Sea Grant, said, "The team continually build and foster connections with the fishing community to gather vital catch-and-effort data.

Sablan added, "Our approach emphasizes collaboration, enabling fishing community members to play the role of citizen scientists. They seamlessly incorporate measuring habits into their fishing routines, contributing these essential snapshots to us for comprehensive and long-term monitoring."

This data collection endeavor aligns seamlessly with the Healthy Coastal Ecosystem strategic focus area of the UOG Sea Grant Omnibus. This overarching focus supports community engagement initiatives that promote preserving and safeguarding coastal ecosystems.

Within this framework, UOG Sea Grant provides funding and guidance for applied research projects to tackle challenges related to the conservation and management of local natural resources.

Sablan said, "Recognizing the inadequacy of current fisheries outreach and educational materials on the island, we are in the process of crafting innovative and informative resources that encompass the latest in fisheries information for Guam. Once these materials are printed, we will embark on a distribution drive to ensure their widespread accessibility."

Guihan for Guahan extends its reach by collaborating with Dr. Brett Taylor, PhD, of UOG Sea Grant in his rabbitfish sampling and processing efforts. The data collected from these endeavors contribute substantially to a life history study that Dr. Taylor is conducting. According to Sablan, this information holds significant value for effective fisheries management strategies.

Looking ahead, Guihan for Guahan plans to open fish measuring stations around the island and host workshops on fisheries-related themes.

RIGHT PHOTO: *UOG Sea Grant Guihan for Guahan project lead Leilani Sablan encourages fishers from all around the island to share photos of their catch as part of the data collection project.*
LEFT AND BOTTOM PHOTOS: *Some of the local catch submitted by local fishers for measurement.*

Dr. Brett Taylor
Assistant Professor of Fisheries Ecology
Sea Grant Researcher,
University of Guam

Study on Guam parrotfish population

Parrotfish numbers in Guam have decreased by 30 percent over the past decade, according to a UOG Sea Grant-funded study conducted by researchers from the UOG Marine Laboratory.

During the study, "Decadal changes in parrotfish assemblages around reefs of Guam, Micronesia," researchers used video cameras to survey parrotfish numbers in 2012 and then again in identical locations in 2021.

The cameras allowed researchers to record the survey of approximately 15,000 parrotfishes. The survey included measuring the length of the parrotfishes.

According to the study, 63 percent of the surveyed sites with increased numbers of parrotfish stocks were within Marine Protected Areas.

Meanwhile, 70 percent of the surveyed sites that showed a decline were in unprotected areas.

The study found that overfishing played a role but isn't the only cause of the decline. According to the study, "a complex mixture of exploitation, habitat change from multiple stressors, and responses to management measures" contributed to the change.

The study offers caution that "the potential future decline in fishery production and ecological function is substantial and merits continuous monitoring and proactive management."

According to the study, Guam's coral reefs have faced stress over the past decade. Several major coral bleaching events in Guam have killed large sections of coral communities, previous UOG studies found.

Parrotfishes – known locally as laggua for some of the large varieties, and palakse' for some of the smaller ones – are brightly colored, common inhabitants of Guam's coral reefs.

They feed daily on reef microalgae and therefore a decline in parrotfish stocks also impacts grazing rates on local reefs.

"This is not the story I was hoping to tell with our research," said Dr. Brett Taylor, PhD, the study's lead author, assistant professor of fisheries ecology, and UOG Sea Grant researcher. "But fortunately, there has already been positive management action that will hopefully turn this trend around," he added.

According to Taylor, an example of this positive action is Public Law 35-78, which prohibits fishing with a spear or other devices while SCUBA diving. It was enacted into law in March 2020. With the passage of the legislation, Guam joined more than 60 countries, states, and territories that banned the practice.

"This legislation represents the most effective management action for ensuring sustainable reef fisheries. Thus, we hope to see a rebound in fish numbers over the next decade," Taylor said.

The study is published in the journal Coral Reefs.

LEFT PHOTO: *Dr. Brett Taylor, PhD, surveys reef fish populations as part of a study funded by UOG Sea Grant.*
BOTTOM PHOTO: *A pair of parrotfish graze on reef substrate.*

Dr. Else Demeulenaere
Associate Director for Natural Resources,
UOG Center for Island Sustainability

Dr. Stefanie Ickert-Bond
Professor of Botany and Herbarium Curator
University of Alaska Fairbanks

Researchers ask scientific community to join call for environmental justice in Guam's *Serianthes* case

A paper by Dr. Else Demeulenaere, PhD, associate director of the UOG Center for Island Sustainability and Sea Grant, and Dr. Stefanie Ickert-Bond, PhD, Professor of Botany and at the University of Alaska Fairbanks, highlighted one symbol of Guåhan's (Guam) biocultural heritage: håyun lågu or *Serianthes nelsonii*. This tree is amongst the tallest tree species in the Mariana Islands.

Biocultural heritage for Guåhan means preserving its natural and cultural diversity holistically. The concept of biocultural heritage connects biological, cultural, and linguistic elements of Guåhan's natural and cultural way of life, as they intertwine with society.

Serianthes nelsonii only occurs on Guåhan and Luta (Rota), and nowhere else in the world. The tree is called håyun lågu on Guåhan and tronkon guåfi on Luta. The federal and local endangered species act lists this species as endangered.

There is only one adult tree on Guåhan, which is now heavily damaged after the typhoon, and less than 60 remaining on Luta. The last wild population at Tailalo' became threatened by military expansion when the firing range complex was planned close to the last adult tree.

In their paper a Demeulenaere and Ickert-Bond integrated scientific and traditional knowledge, proving the infringement upon environmental justice and biocultural rights.

According to the paper, the CHamoru belief system emphasizes a close relationship with the natural world and is grounded in core values of respect for

trees and all life on land and the ocean. Protecting this unique tree, which has a unique genotype, when comparing it with the Luta populations, is protecting its unique Guåhan heritage.

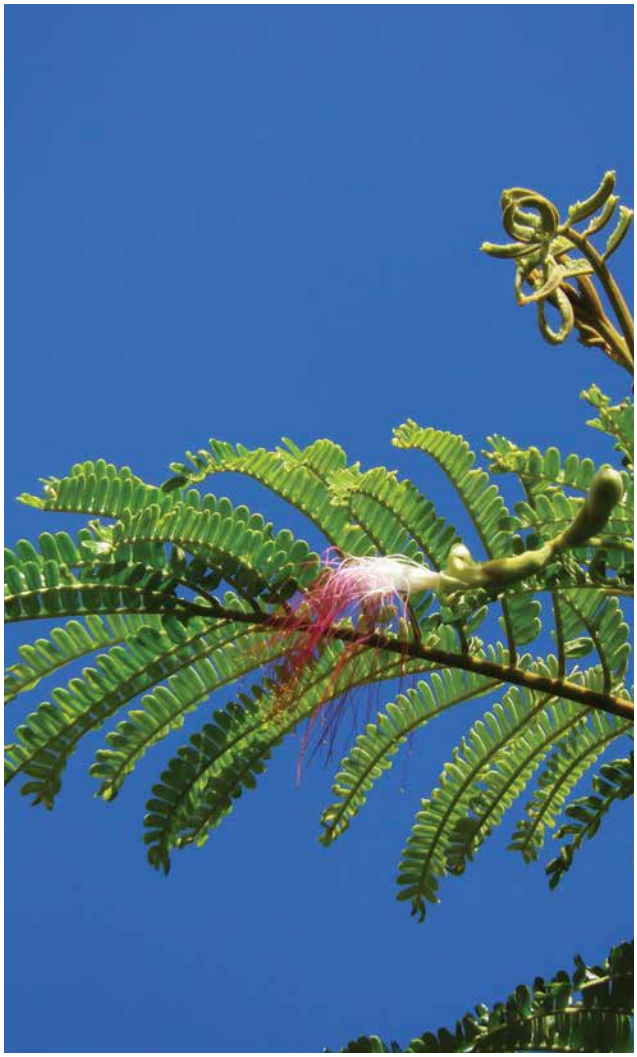
The opinion piece was published in 'Conservation Science and Practice', a journal of The Society for Conservation and Practice.

"We called upon the scientific community to voice our concerns regarding the incongruities between the National Environmental Policy Act and the Endangered Species Act and Indigenous social and cultural systems" said Demeulenaere. These regulations neglect to incorporate Indigenous and scientific viewpoints critical for safeguarding Indigenous biocultural heritage and the last håyun lågu.

Ickert-Bond who works closely with the Indigenous peoples in Alaska said, "Our findings emphasize the importance of managing competing demands and respecting the rights of Indigenous communities to the preservation of the environmental and cultural integrity of their natural resources".

The authors hope that their work can advance biocultural rights for Guåhan and can be a model for decolonizing environmental laws and making them fit for Indigenous cultures.

LEFT PHOTO: *Dr. Else Demeulenaere, PhD, associate director of the UOG Center for Island Sustainability and Sea Grant, and Dr. Stefanie Ickert-Bond, PhD, Professor of Botany at the University of Alaska Fairbanks, are co-authors of a paper on the håyun lågu, a symbol of Guåhan's biocultural heritage.* **BELOW LEFT:** *The field crew shown here on Luta is composed of Indigenous knowledge holders and scientists.* **BELOW RIGHT:** *Serianthes nelsonii flower (håyun lågu on Guåhan and tronkon guåf on Luta). Photos courtesy of Else Demeunelare and Matthew Putnam*



Dr. Brett Taylor
Assistant Professor of Fisheries Ecology
Sea Grant Researcher, University of Guam

Study reveals complex life histories of surgeonfishes in the Mariana Islands

Researchers from UOG Sea Grant and UOG Marine Laboratory published a paper titled "Comparative demography of surgeonfishes from the tropical Western Pacific," which provides new insights into the life of surgeonfishes.

Scientifically known as *Acanthuridae*, surgeonfishes are essential components of coral reef communities and serve as valuable coastal fisheries resources in tropical regions.

While, surgeonfishes have been harvested in the Mariana Islands for thousands of years, many aspects of their biology remain enigmatic, particularly in the unique environmental context of the tropical Western Pacific.

The study compiled age-based life-history information for 13 species of surgeonfish, accounting for over 99 percent of the surgeonfish fishery in the Mariana Islands.

For each species, the paper uncovers a suite of life-history traits such as the rate of growth, mean adult body size, life span, and mortality, which are useful for fishery managers to understand stock status.

One of the most intriguing findings was the discovery that different modes of reproduction across surgeonfish species might influence the vulnerability of some species to overexploitation

Another finding was that surgeonfishes exhibit a "two-phase" rate of mortality, or simply-put, natural death of portions of the population occur at very weird rates.

According to the study, while surgeonfishes can live long lives, most will die in the first few years of life, but then some members of the population (although less than we would expect) will live for multiple decades. This is an extremely rare trait in coastal fishes, and likely contributes to a higher sustainability of surgeonfish fisheries in the Mariana Islands and elsewhere.

Dr. Brett Taylor, PhD, lead author and assistant professor of fisheries ecology, expressed the significance of the findings: "Our study uncovers previously hidden complexities in the life histories of surgeonfishes, with potential consequences for fisheries management and our understanding of how these species respond to environmental changes."

Also, by comparing surgeonfish life-history data from Micronesia with the Great Barrier Reef and the Hawaiian Islands—highly seasonal tropical regions of higher latitude—the research demonstrated that life spans vary with temperature, whereby species from high-latitude regions can live up to three times longer. This sheds light on the substantial role of environmental factors in shaping surgeonfish biology.

As tropical coral reefs face the challenges of a changing climate, these findings highlight the importance of the effects of climate change on these species.

TOP PHOTO: *Dr. Brett Taylor, Ph.D., lead author of the study, highlights the hidden complexities in surgeonfish life histories with potential implications for fisheries management and species adaptation to environmental changes.*

Biologist makes strides on native butterfly species research

Matthew Putnam, a graduate student and research biologist at the UOG Center for Island Sustainability (CIS), made a breakthrough in the captive rearing of the Mariana eight-spot butterfly, an endangered and listed species.

UOG CIS Associate Director for Natural Resources Dr. Else Demeulenaere, PhD, has mentored Putnam in conservation biology for several years, and his thesis supervisor is Dr. G. Curt Fiedler, PhD, a biology professor at UOG College for Natural Appliance Sciences (CNAS).

Putnam's research on *Hypolimnas octocula marianensis* is an important contribution to the scant knowledge about this species endemic to the Marianas and the subject of his master's thesis.

Little is known about this butterfly's basic biology, so Putnam worked with Fiedler and Dr. Aubrey Moore, PhD, a UOG CNAS research and extension entomologist who holds the permit to collect and raise this species via a grant from the Guam Department of Agriculture (DoAg).

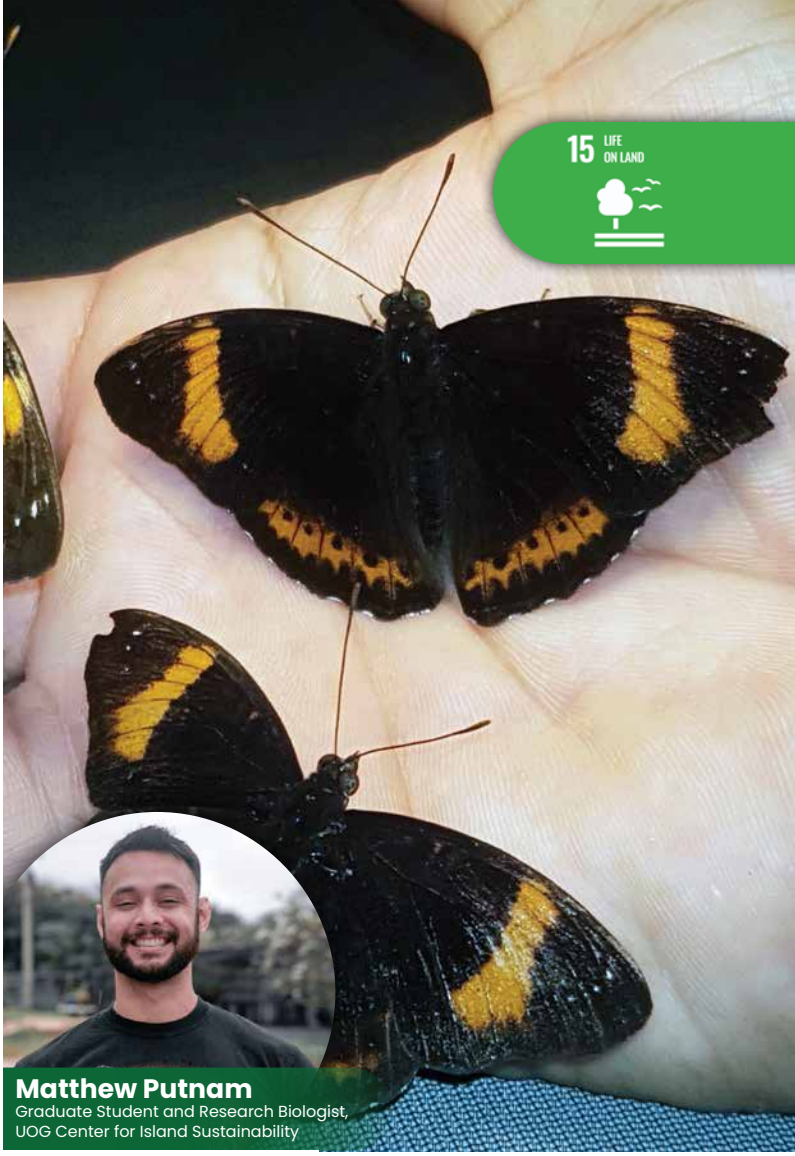
Before raising captive butterflies, Putnam spent a year monitoring butterfly sites in the wild at Andersen Air Force Base as part of Fiedler's endangered species monitoring project, which was funded by NAVFAC Marianas.

In preparation, Putnam built a rearing tent in the CIS compound and furnished it with cages according to Moore's recommendations. He also cultivated host plants in the CIS nursery for the hungry caterpillars. These insects depend on two host plant species for their life cycle: *Procris pedunculata* and *Elatostema calcareum* (tupon ayuyu).

When the system was ready, Putnam and Fiedler collected eggs and caterpillars from a site near the campus.

Putnam said, "We reared 38 adults out of 333 eggs with a 90 percent survival rate from eggs, but a high number of losses with the larvae."

Before this study, it was unknown how long these butterflies lived. So, Putnam monitored



TOP PHOTO: *Matthew Putnam, a UOG graduate student and research biologist at the UOG Center for Island Sustainability (CIS), research on Hypolimnas octocula marianensis is an important contribution to the scant knowledge about the species. Photo Credit: Matthew Putnam*

and recorded the life span of five captive-reared butterflies.

Three individuals lived for 18 days, 14 days, and 25 days each. Two individuals lived longer; one survived for 46 days and the other for 74 days, which surprised everyone with its longevity.

This research has resulted in important information about the Marianas eight-spot butterfly for future scientists to draw from. Putnam, Fiedler, and Demeulenaere have submitted a grant proposal to the Department of Agriculture for additional State Wildlife Conservation funds from the US Fish and Wildlife Service.

In the meantime, NAVFAC Marianas has funded Fiedler to support Putnam's rearing efforts in the short term.

After Typhoon Mawar: Natural resource team rescues native orchids, plants and restores forest biodiversity

The core of the UOG Center for Island Sustainability's forest management strategies is restoring Guam's unique forest biodiversity by prioritizing the removal of invasive species and the replanting of native species.

According to UOG Center for Island Sustainability Associate Director Dr. Else Demeulenaere, Ph.D., and biologist Vince Fabian, the natural resources team grows over 50 species, each with a unique ecosystem function.

A forest typically comprises different layers; therefore, the team ensures they grow species that occur in all these layers.

During the dry season, the team typically removes invasive species, while the rainy season is for planting trees and scrubs.

When the National Weather Service announced the approach of typhoon Mawar, the native plant nursery was almost bursting out of its seams.

Once Mawar became an actual threat to the island, the natural resources team took immediate action.

At the time, the team had about 2000 plants growing in the native plant nursery, ready for outplanting during the upcoming rainy season. Propagation typically takes six months and includes

collecting seeds, propagating seedlings, and maintaining them in the nursery.

The team, wanted to ensure their hard work was well-spent. They moved all 2000 plants, from the tiniest seedling to a 2—to 3-foot tall seedling, inside containers and offices to protect them from high winds and heavy rain.

The natural resources crew was among the first teams to assess the impacts of Mawar in the forest. After the typhoon, the damaging effects were noticeable in the areas dominated by invasive species.

During the first weeks, the team rescued over 120 endangered orchids from the forest floor, many of which were *Tuberolabium guamense* but also included some clusters of *Bulbophyllum guamense* or siboyas hålom tåno in CHamoru.

Mawar's high winds broke off branches and ripped off the bark of the trees along with the epiphytic orchids.

The native plant nurseries have two orchid benches used to safeguard the orchids and help them recover. Because the high typhoon wind damaged the forest canopy severely, leaving only a little shade, the team waited six months to bring the orchids back into the forest.

Of the 2000 plants grown in the UOG Center for Island Sustainability native nursery, over 1000 were outplanted in the forest, according to the report by the team.

LEFT PHOTO: *The UOG Center for Island Sustainability natural resources team secures native plants before typhoon Mawar.*
BELOW: *Bulbophyllum guamense or siboyas hålom tåno is shown on the top left. Tuberolabium guamense is shown flowering in the top right photo. When these orchid flowers, they only last for two days. Jacob Concepcion, a UOG Center for Island Sustainability research assistant, poses next to the orchids saved by the team.*

Plans for ocean-energy aquaculture center

Exciting developments are on the horizon for Guam's aquaculture industry with a groundbreaking project exploring ocean energy.

David Crisostomo, UOG Sea Grant aquaculture specialist, said a U.S. Department of Energy grant is paving the way for exploring ocean energy and other renewable systems to power the future Guam Aquaculture Innovation Center, a facility that aims to revolutionize the region's approach to aquaculture.

The grant sets the stage for a two-year exploratory planning phase, during which experts from the Pacific Northwest National Laboratory (PNNL) and SANDIA National Laboratories will join forces with UOG Sea Grant and other local stakeholders.

According to Crisostomo, with a budget of $400 thousand, this initial phase aims to identify and assess potential marine energy systems, focusing on ocean thermal energy conversion and wave energy.

"The project has already started. We have already reviewed the top sites identified for the feasibility study, which are the possible locations for the innovation center. Both have pros and cons. It's just a matter of proceeding what the marine energy options are for each of those areas," he said.

The Guam Aquaculture Innovation Center, currently in its conceptualization stage, was highlighted and prioritized in the 2022 aquaculture study completed by the Guam Economic Development Authority.

According to Crisostomo, this facility will resemble the Fadian Hatchery, incorporating a dedicated section for reproducing species, which will benefit the region once it is realized.

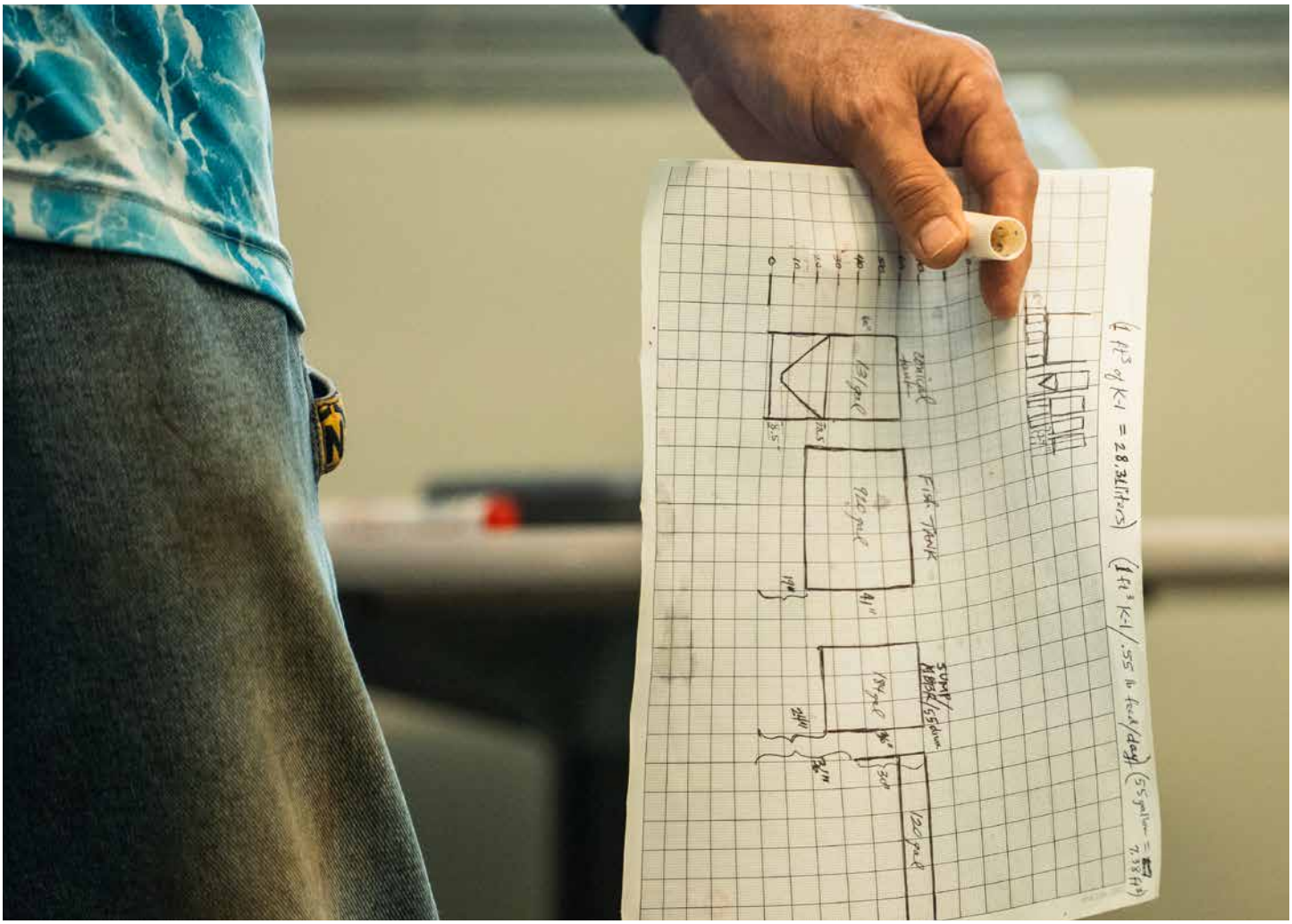
Among the proposed center's primary functions is conducting research on cultivating local species and enhancing the understanding of their biological requirements and growth conditions.

"The focus (of the facility) is to look at eliminating the importation of seed stock so we can cut off or eliminate the possibility of introducing diseases," Crisostomo said.

Additionally, he said the facility will offer an incubator-type setup, allowing individuals and businesses to lease tank space without the burden of navigating complex permitting processes. This streamlined approach seeks to stimulate the commercial side of aquaculture, with a strong emphasis on promoting and sustaining local species.

Crisostomo emphasized the significance of the planned innovation center as a potential game-changer for Guam's aquaculture industry. By harnessing ocean energy, the center will operate sustainably, showcasing the island's commitment to green and innovative practices.

PHOTOS: *UOG Sea Grant aquaculture specialist David Crisostomo says a U.S. Department of Energy grant-supported project aims to harness ocean energy to power the proposed Guam Aquaculture Innovation Center. The center is a high priority in a 2022 aquaculture study commissioned by the Guam Economic Development Authority.*



Outreach

New kid's magazine celebrates island wisdom, art, and science

Emphasizing the significance of traditional knowledge in science, the UOG Center for Island Sustainability and Sea Grant unveiled the inaugural issue of CHalan Deskubre magazine on December 9 at the Micronesia Mall, with this theme at its core.

CHalan Deskubre isn't your typical magazine—it is a place-based STEAM (Science, Technology, Engineering, Arts, and Mathematics) publication designed specifically for kids on Guam and the region. It encourages them to adopt a scientific mindset and explore the world beyond their classrooms.

Additionally, the magazine incorporates art to creatively show scientific concepts and foster a visually engaging learning experience for young readers, intertwining imagination with exploring STEAM subjects.

The first issue focuses on science and traditional wisdom, highlighting how the knowledge from our island communities contributes to scientific advancements and innovative practices.

Subsequent issues will revolve around themes that spotlight the resources unique to Guam and other islands in the region, aligning with the 17 UN Sustainable Development Goals.

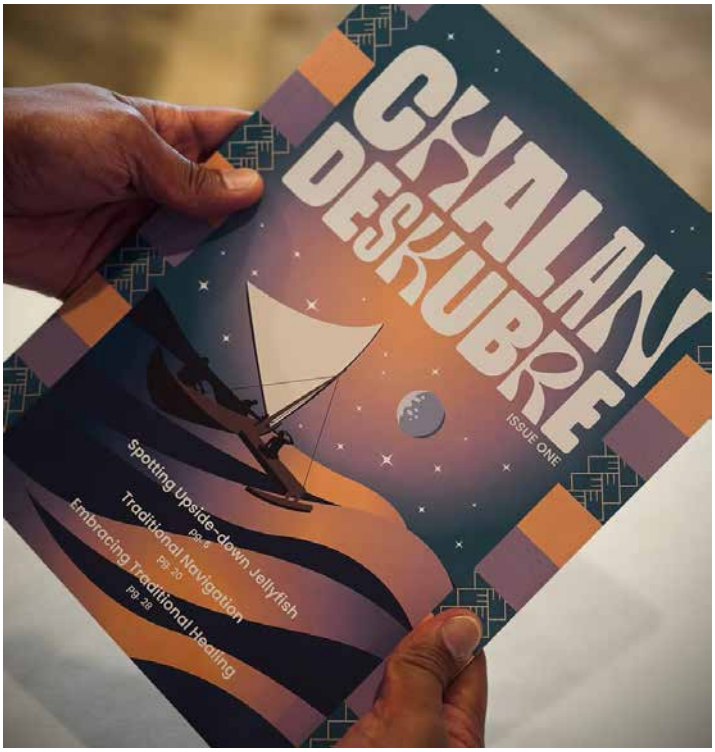
"This magazine (CHalan Deskubre) was designed specifically for you. I hope you take the opportunity to explore the magazine," said Dr. Sharleen Santos–Bamba, PhD, UOG Senior Vice President and Provost.

Santos-Bamba added, "Great partnerships like these allow us to provide services, information, and scholarship to our Guam community and region."

According to Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, CHalan Deskubre embodies UOG's commitment to scientific and place-based learning.

He said, "Our team crafted CHalan Deskubre to ignite curiosity and discovery, guiding children onto a path of scientific inquiry." Shelton added, "This is the first time that we are going to have a science magazine that teaches you about the islands around you."

For the magazine's publication, the UOG Center for Island Sustainability and Sea Grant received funding from the Education Stabilization Funds (ESF) for the "Innovating Through Pandemic Challenges to Deliver Place-Based Education in Marine Environmental and Sustainability Sciences" program. The ESF funding is a component of the Governor of Guam's Education Assistance and Youth Empowerment Grant Program.



LEFT & TOP PHOTO: *CHalan Deskubre is a place-based STEAM (Science, Technology, Engineering, Arts and Mathematics) magazine that encourages kids on Guam to explore the world beyond their classrooms.* **BOTTOM PHOTO:** *Members of the UOG Center for Island Sustainability and Sea Grant team, UOG Press, and government representatives pose with students from the WAVE Club at the launching of CHalan Deskubre.*

Townhall explores ocean and wave energy

Islands like Guam face the challenge of developing resilient electricity infrastructure and energy systems --- often relying on expensive and unreliable systems vulnerable to natural disasters and rising energy costs.

UOG Sea Grant hosted a town hall meeting in November to address this challenge and to gather stakeholder input on the viability of using ocean and wave energy systems.

Over 50 representatives from various sectors attended the meeting. The first part featured presentations on ocean and wave energy systems, while the second facilitated a focus group discussion with key stakeholders.

UOG Sea Grant utilized the input from the discussions to inform two projects.

The first project—supported by the National Oceanic and Atmospheric Administration (NOAA) Sea Grant College Program and the US Department of Energy's Water Power Technologies Office—seeks to assess public perceptions of ocean energy.

Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, emphasized the importance of diversifying the island's energy source.

"We have an abundant set of renewable energy resources around us. We are very familiar with the sun and solar panels. Still, now it is time to move to other areas of sustainability and renewable energy," said Shelton, one of the project's principal investigators.

Dr. Francis Dalisay, PhD, UOG associate professor of communication and media and co-principal investigator, said the town hall offered a valuable

opportunity for stakeholder engagement, "It's clear that there is a strong interest in developing ocean energy on Guam."

The second project explores the feasibility of using ocean energy technology to power the Guam Aquaculture Innovation Center. UOG is collaborating with Pacific Northwest National Laboratory (PNNL) and SANDIA National Laboratories to study the potential of utilizing ocean thermal electric conversion (OTEC) and wave-energy converter (WEC) systems to generate electricity for the facility.

Fleur de Peralta, the project's principal investigator, said they conducted focus groups with diverse participants, including representatives from the fishing community.

According to Dr. Bastian Benlage, PhD, an associate professor of bioinformatics at UOG, the stakeholders involved in aquaculture and fisheries have a positive perception of the potential of using technology to lower energy bills for the equipment used in aquaculture facilities.
Meanwhile, David Crisostomo, a UOG aquaculture specialist, highlighted the Guam Aquaculture Innovation Center's significance. He said the center could transform Guam's aquaculture industry by providing a centralized research, education, and commercial production location.

LEFT PHOTO: *Around 50 people from the public and private sector, and the academe, share their perception on developing ocean and wave energy systems for aquaculture and other industries at a townhall meeting organized by UOG Sea Grant.*
BOTTOM LEFT PHOTO: *Fleur de Peralta, Senior Advisor in the Risk and Decision Sciences Group at PNNL, is a principal investigator in a project assessing the feasibility of using ocean energy technology.* **BOTTOM RIGHT PHOTO:** *Dr. Francis Dalisay, PhD, UOG associate professor of communication and media and co-principal investigator, talks about community engagement at the townhall meeting.*

Countdown to 2030: UOG and partners celebrate Sustainable September

During Sustainable September, the UOG Center for Island Sustainability and Sea Grant and its partners raised awareness for the United Nations' 17 Sustainable Development Goals (SDGs) by bringing them to the forefront as the world approaches 2030.

The UN marked 2030 as the target year for its call to action to achieve the SDGs.

Guam and several other countries are participating in this global initiative to increase awareness about collaborative efforts to achieve the 2030 goals.

"This month-long commemoration is a testament to the university's unwavering dedication to the United Nations' Sustainable Development Goals," said UOG President Dr. Anita Borja Enriquez, DBA.

"Through meaningful events and conversations, we illuminate the path to a greener, more harmonious future – where awareness, collaboration, and commitment converge."

Guam's Sustainable September activities included a proclamation signing by Governor Lou Leon Guerrero, the launch of the Guam Green Growth (G3) Local2030 Islands Network Conservation Corps, a National Sea Grant Association Meeting, the International Coastal Clean-up, and Community Planting at the GROW Site in Malojloj.

G3 also unveiled an exhibit in Tumon, in partnership with DFS Galleria.

The G3 exhibit showcased sustainable fashion and art, emphasizing their core objective of diverting waste from the landfill.

G3 recognizes that, as an island, Guam's resources are finite, intensifying the need for conservation and sustainable practices.

Abby Crain, G3 Circular Economy coordinator and the creative mind behind local brand Blue Latitude designed the sustainable creations.

Crain crafted fashion pieces from food packaging and bubble wrap. She also made a manta ray and surfboard display from marine debris. A display showcased a large guasåli with hand-folded butterflies made from 300 aluminum cans.

The slow fashion movement inspired her designs, which promote sustainable and ethical production methods and encourage consumers to invest in durable, long-lasting clothing. Crain used vintage fabrics and remnants of vegetable-tanned leather in her designs.

Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, emphasized the significance of Sustainable September.

"We are truly excited to sustain the momentum in forging a better future for our island. The United Nations underscores the critical urgency of achieving the 17 UN (Sustainable Development Goals), emphasizing that the world stands within a pivotal window to tackle humanity's most pressing sustainability issues before the clock strikes 2030," Shelton said.

PHOTOS: *The UOG Center for Island Sustainability and Sea Grant and its partners raise-awareness for the United Nations 17 Sustainable Development during Sustainable September. Guam's Sustainable September activities include an exhibit in Tumon, in partnership with DFS Galleria. The Guam Green Growth (G3) exhibit showcased sustainable fashion and art.*

G3 community garden in Hagåtña recognized as the island's first "People's Garden"

The U.S. Department of Agriculture recognized the Guam Green Growth (G3) Community Garden in Hagåtña as the island's first "People's Garden" in early 2023.

G3 partnered with Guåhan Sustainable Culture (GSC) to start the Hagåtña garden in 2021. GSC designed the 1,400-square-foot garden while the G3 Conservation Corps, AmeriCorps GSC members, and Pacific Federal Management Inc. built the raised garden beds.

GSC manages and continues to develop the garden with its AmeriCorps GSC team. They host garden volunteer days and provide educational opportunities for food security and healthier lifestyles.

"We are thrilled to join gardens nationwide in the People's Garden effort and what it represents," said Michelle Crisostomo, president and founder of GSC.

"This garden is here to inspire and empower our community to come together around expanding access to healthy food, addressing food insecurity, practicing sustainability, and advancing our efforts towards food sovereignty," Crisostomo added.

"A lot of the conversations during the pandemic revolved around food security and the vulnerability in having to import over 90 percent of all the foods and goods we consume," said Dr. Austin Shelton, PhD, co-chair of the G3 Steering Committee and director of the UOG Center for Island Sustainability and Sea Grant. "This is not just going to be a place to grow food, but it also will be a beacon of hope and a demonstration to all the other villages that they can do something similar."

To be recognized as a People's Garden," it must fulfill a set of criteria. A garden must:

- Benefit the community.
- Be a collaborative effort.
- Incorporate conservation management

LEFT PHOTO: *Partners and volunteers celebrate the opening of the first G3 Community Garden in Hagatna. The garden was recognized as a "People's Garden" by the US Department of Agriculture.* **ABOVE:** *Americorps Guahan Sustainable Culture members and Guam Green Growth Conservation Corps members helped to keep the garden moving following the initial ground-raising.* **BELOW:** *The garden features above ground garden beds with native and introduced food crops and classes for the community.*

practices and educate the public about sustainable gardening practices and the importance of local, diverse, healthy food sources.

In 2009, the USDA launched the People's Garden Initiative, taking inspiration from former President Abraham Lincoln's reference to the USDA as the "People's Department." Lincoln had established the USDA during his presidency in 1862.

According to USDA, the People's Garden community connects gardens across the country that produce local food, practice sustainability, and bring people together. People's Gardens can take many different forms, including food-producing gardens, wildlife habitats, conservation or beautification projects, and education and training spaces.

GROW reports increased volunteer numbers, trees planted

In 2023, the Guam Restoration of Watersheds (GROW) Initiative continued to make significant progress in restoring the island's watersheds despite facing several challenges.

In May, super typhoon Mawar arrived and caused widespread devastation on the island.

Despite the setback caused by the typhoon, the GROW Initiative remained determined to achieve its goals. By the end of the year, they had made significant strides in restoring the natural state of the island's watersheds.

GROW organized seventeen tree-planting events in 2023. The number of volunteers who participated and the total number of trees planted have surpassed all previous records.

In 2023, the GROW Initiative worked with 486 volunteers, surpassing the previous year's count of 450. Together, these volunteers successfully planted a total of 4,836 trees, which is higher than the previous year's count of 4,718.

It is important to remember that each tree planted has the potential to offset the community's carbon footprint.

According to Ecotree, one tree can absorb 25 kg of carbon dioxide emissions annually. Therefore, as the 4,836 trees planted by GROW in 2023 begin to mature, they can absorb approximately 120,900 kilograms (about 266,539 lbs.) of carbon dioxide emissions annually.

GROW strengthened its efforts to mitigate the effects of erosion by planting many acacia trees. The initiative is helping keep sediments out of Guam's freshwater systems and ocean, thus ensuring that the island's drinking water remains clean and protecting ocean reefs from sediment runoff.

Although acacia trees are not native to Guam, they are necessary to revitalize barren soil. They can reintroduce nitrogen to badlands, thus enriching the soil in preparation for the next phase of planting native plants.

As 2023 ends and a new year begins, the GROW Initiative remains rooted in its commitment to protecting and preserving Guam's freshwater resources and ocean.

PHOTO: *Volunteers plant trees at the GROW project site in Ugum.*

Guam Habitat Conservation Plan team initiates community discussion

With a forward-thinking goal to safeguard Guam's biological and cultural heritage, the UOG Center for Island Sustainability, the Guam Department of Agriculture (DoAG), and consulting firm ICF held a public meeting to prepare for community discussions on the development of the Guam Habitat Conservation Plan (HCP).

The Guam HCP is a 30-year plan to protect endangered species and their habitats, preserve the island's distinct biodiversity, and promote sustainable economic development. The HCP is also crucial to streamlining Guam's development permitting process.

Almost 70 people attended the meeting, where community engagement was encouraged through various means --- including detailed presentations about the Guam HCP and opportunities to interact with the team to discuss various aspects of the plan.

Also, the UOG Center for Island Sustainability natural resources team displayed two species listed under the Endangered Species Act (ESA) --- the fadang (*Cycas micronesica*) and a native orchid, the *Tuberolabium guamense*. The DoAG -DAWR team also discussed the ko'ko' and other endangered animal species with the public.

In 2015, the United States Fish and Wildlife Services (USFWS) listed 23 endangered and threatened plant and animal species, of which 20 were found in Guam under the ESA.

The ESA does not allow harming endangered species, but non-federal agencies and developers can receive an exception for their land use activities by obtaining an Incidental Take Permit (ITP). An HCP is required for an ITP. The HCP demonstrates that the impacts of the proposed activities will be fully offset.

HCPs are designed to provide a structured approach to minimizing and mitigating impacts on the listed species that may be affected by land use activities. By allowing careful consideration of applications for local projects, HCPs offer a streamlined and efficient method for environmental protection.

According to Dr. Else Demeulenaere, PhD, associate director at the UOG Center for Island Sustainability, the HCP balances human development and endangered species conservation, ensuring the preservation of endangered species while facilitating sustainable development projects.

"Guam HCP is the plan that can meet that middle ground, protecting our species and their habitats while streamlining the permitting process for sustainable economic development," Demeulenaere said.

The HCP Development Team, comprising the DoAG, UOG/CIS, and ICF, received funding from the U.S. Fish and Wildlife Service to develop this plan for Guam.

PHOTO: *UOG Center for Island Sustainability Natural Resources team showcase some of the endangered plant species they grow at their rare plant nursery.*

45th Science Fair recognizes budding STEM researchers

The UOG Center for Island Sustainability and Sea Grant, the Guam Science and Discovery Society, and its partners recognized upcoming talents in STEM (Science, Technology, Engineering, and Mathematics) at the 45th Guam Annual Island Wide Science Fair.

More than 300 students from Guam and the Commonwealth of the Northern Mariana Islands submitted entries to the competition. Out of the entries, the judging panel selected the following overall and division winners:

Andrew Kang from John F. Kennedy High School (1st Place Overall, High School Division Winner), PROJECT: "Invisible Groundwater Discharge Patterns Across Tumon Bay, Guam: Discovery of Vital Habitats Sustained by Tumon Bay Karst Watershed Discharges from an Uplifted Carbonate Aquifer."

Angel Payumo from George Washington High School (2nd Place Overall, NSF INCLUDES SEAS Islands Alliance Winner), PROJECT: "Understanding the Role of Coral Pigmentation in Response to Coral Bleaching."

Kailee Wong from St John's School (1st Place, Middle School Division), PROJECT: "Artocarpus Atilis Hydrogel: The making of a Super absorbent polymer with Carboxymethylcellulose (CMC), Aluminum Sulfate, and Dehydrated Breadfruit."

Inina Harrison from St. Anthony Catholic School (1st Place, Upper Elementary Division), PROJECT: "Bees on Guam."

Riley Zephyr Mortera from Wettengel Elementary School (1st Place, Primary Grades Division). PROJECT: "Mag Lev Train: Magnetic Poles."

Overall winners, Kang and Payumo represented Guam at the 2023 International Science and Engineering Fair in Dallas, Texas.

The international fair included several days of activities for student entrants including static display judging, in-person presentations of projects to colleges and sponsors, and official judging. The final days of the event featured special awards and overall Finalist Award Ceremonies.

For his project, Kang conducted surveys on groundwater patterns and coral growth in Tumon Bay, noting that salinity values and PH levels of the freshwater discharges from the bay impact staghorn coral growth.

Kang received mentorship from UOG Marine Lab Associate Professor/Sea Grant researcher Dr. Peter Houk, PhD.

Meanwhile, Payumo's project looked at heat stress on coral reefs and its implications for reef restoration.

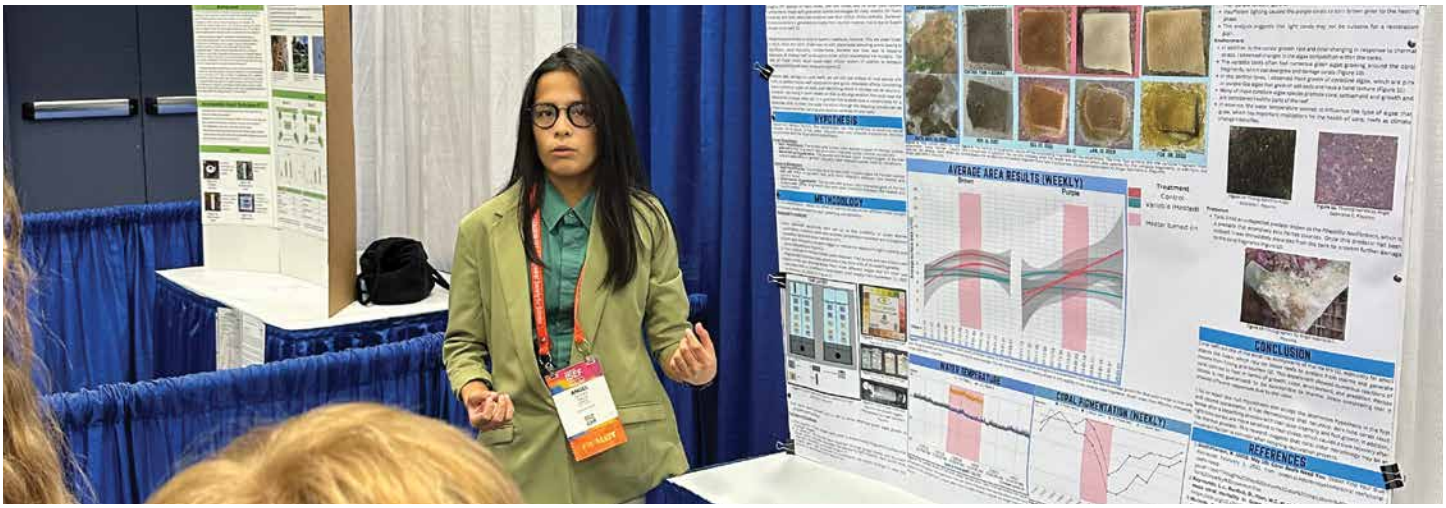
"For my experiment, I focused on the color of the corals and how they react to warm water temperature, also known as coral bleaching and how it connects to climate change," she said.

Payumo completed the NSF INCLUDES SEAS Islands Alliance Guam Hub's High School Summer Internship program in 2022.

UOG Associate Professor of Bioinformatics Dr. Bastian Bentlage, PhD and EPSCoR Research Associate Colin Lock mentored Payumo.

Guam Established Programs to Stimulate Competitive Research (EPSCoR), and the NSF-INCLUDES programs also helped organize the event.

LEFT PHOTO: *The winners of the 45th Guam Annual Island Wide Science Fair pose with organizers, representatives from the University of Guam, government, at the awarding ceremony in April.* **BELOW:** *Andrew Kang from John F. Kennedy High School and Angel Payumo from George Washington High School are the top winners at the 5th Guam Annual Island Wide Science Fair, placing 1st and 2nd, respectively. They represented Guam at the 2023 International Science and Engineering Fair in Dallas, Texas.*



New G3 Art Corps features emerging and seasoned artists

To promote island sustainability using art as a platform, The Guam Green Growth (G3) initiative and the University of Guam launched the first-ever Art Corps program at the G3 Makerspace and Innovation Hub.

For the program's first cohort, G3 selected eight artists to collectively design, plan, and execute public murals on Guam. These murals highlighted the island's journey towards achieving sustainability by 2030, as outlined by the G3 Action Framework and the 17 United Nations Sustainable Development Goals.

G3 chose the following artists for its inaugural cohort: Ariel Dimalanta, Kamaka Aquino, Frank "Kie" Susuico, Corina Benavente, Baptist Bell, Ha'ani Bettis, Geraldine Datuin, and Lucille Ronquillo.

Dimalanta had decades of experience as an artist, sculptor, and publisher. While semi-retired, he decided to join the Art Corps to make a difference. "It is time to give back to the community," he said.

Each artist received a stipend in exchange for participating in capacity-building activities and collaborating with the team to create the murals.

For two years, two cohorts will paint 17 murals to disseminate the message of sustainability and sustainable development to a broader audience.

According to UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, art is crucial for community engagement.

"We are bringing something new to the table; we have previously talked about Science, Technology, Engineering, and Math before. That was about figuring out the science of our natural resources. But now we add an A in between. Art is important because this is how we can connect with our community."

Several UN Sustainable Development Goals guided the process of developing the G3 Art Corps --- including Goal 4, which seeks to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all and Goal 11, which focuses on making cities and human settlements inclusive, safe, resilient, and sustainable.

The Education Stabilization Fund under the Office of the Governor provided funding support to start the G3 Art Corps program.

PHOTOS: *Guam Green Growth (G3) and university and government leaders pose with the first members of the Art Corps. The program promotes the 17 United Nations Sustainable Development Goals through art.*

UOG Sea Grant Environmental Justice Legal Fellowship Program expands opportunities

The UOG Sea Grant Legal Research Fellowship program had expanded its partnership in 2023, opening more opportunities for law students and recent law school graduates interested in local environmental and human rights issues.

That year, Camacho Taitano Law Firm joined UOG Sea Grant and Blue Ocean Law as a new partner in the program.

"One of our goals is to form partnerships that create opportunities for our students to gain valuable experience in environmental law here in Micronesia," said Attorney Leevin Camacho, co-founder of the Camacho Taitano Law Firm.

"The long-term hope is that these fellows will use the experience and take advantage of opportunities right here at home to be advocates for our communities by helping to ensure meaningful participation in the legal process and identify resources, such as government funding, to address environmental impacts," he added.

Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant also emphasized the importance of increasing program reach on Guam and the region.

"Through partnerships like these, we intend to keep growing capacity in the islands to protect and manage our natural resources and support the communities who depend on them," said Shelton.

Attorney Julian Aguon, a Pulitzer Prize-nominated author and the founder of Blue Ocean Law, concurred with Shelton.

"Initiatives like these are a great way to encourage students to contribute to their communities," Aguon said. "Additionally, it is a way for them to start engaging with novel areas of law. For instance, climate change is a threat multiplier — it is increasingly acting as an accelerant for human rights violations. So it is exciting for them to examine the ways in which the law can meet one of the greatest challenges of our time."

Blue Ocean Law is an international firm based on Guam that specializes in human and indigenous rights, self-determination, and environmental justice in the Pacific.

In 2021, the firm had its first UOG Sea Grant Legal Research Fellow, Cheerful Catunao, who completed the fellowship and entered Guam's legal workforce full-time.

Lillian Gill from Harvard Law and Kyra Blas from Yale Law School also worked in environmental law and climate justice at Blue Ocean Law.

UOG Sea Grant has opened another program cycle for individuals interested in applying. Fellows are assigned to one of the partner law firms and receive a $5,000 stipend for the duration of the program.

LEFT PHOTO: *The UOG Center for Island Sustainability and Sea Grant expands its environmental and legal fellowship program in partnership with Blue Ocean Law and the Camacho and Taitano Law Group. UOG Center for Island Sustainability and Sea Grant leadership pose with representatives from the two firms.* **BELOW:** *Pulitzer Prize-nominated author and the founder of Blue Ocean Law, attorney Julian Aguon says the fellowship program will build levels of expertise in environmental law in the region.*

Second cohort completes traditional healing course

At the close of 2023, the Guam Green Growth (G3) Yo'åmte Project marked the culmination of its second traditional healing and medicine class with an awarding of certificates and åmot (traditional medicine) presentations centered on the coconut.

The G3 Yo'åmte Project worked in collaboration with the UOG Center for Island Sustainability and Sea Grant and the UOG College of Liberal Arts and Social Sciences to develop the initiative.

Launched in 2022, the project promotes using åmot and traditional healing practices through apprenticeship, training, and outreach.

"This milestone not only signifies academic achievement but also a commitment to preserving island wisdom and traditional knowledge and healing practices," said UOG President Dr. Anita Borja Enriquez, DBA.

Lourdes 'Mama Lou' Manglona, master Yo'åmte and project lead, facilitated the course CM394: Traditional Healing Practices on Guam. The course --- a component of the G3 Yo'åmte Project --- focused on native plant species and their medicinal applications, spotlighting the art of åmot through presentations and sampling.

At the event, fifteen participants received certificates. As part of the process, they created table-top exhibits on the diverse uses of the coconut, a tree central to CHamoru culture for its versatility in sustaining communities.

"We use the coconut for food, medicine, clothing, arts, and everything; that's why we used the coconut tree to highlight its significance," Manglona explained.

Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, expressed the uniqueness of concluding the semester with a class driven by the Yo'åmte. He commended Manglona and her apprentices for playing a vital role in promoting traditional knowledge and island wisdom.

Shelton also acknowledged UOG's leadership in incorporating the framework into the university's strategic goals.

He emphasized that the UOG Center for Island Sustainability and Sea Grant works with university units to recognize and elevate traditional knowledge and island wisdom, perpetuating the understanding that it has always existed on Guam.

"Our people arrived here 3500 to 4000 years ago, long before Western Science approached the islands," Shelton said.

At the event, Manglona also shared her passion for teaching traditional medicine and healing, "I hope that they (students) will carry this knowledge forward to teach and help other people. This is one way to protect our indigenous heritage."

Before CM394, an inaugural class, CM294: Introduction to CHamoru Indigenous Health and Healing, was offered in 2022. The two courses received support from the UOG CHamoru studies program, UOG Island Wisdom, G3, and the UOG Center for Island Sustainability and Sea Grant.

LEFT PHOTO: *The Guam Green Growth (G3) Yo'åmte Project, led by Lourdes 'Mama Lou' Manglona, recognize the participants who completed the second traditional healing and medicine class for Fanuchånan 2023.* **BELOW:** *Local leaders from the academe and the community awarded fifteen participants their certificates of completion for CM394: Traditional Healing Practices on Guam. The event featured table-top exhibits on the diverse uses of the coconut.*

Sustainable Alliances


GUAM

UOG President marks investiture with tree-planting ceremony

The UOG Center for Island Sustainability and Sea Grant teams witnessed a historical moment when Dr. Anita Borja Enriquez, DBA, planted an ifit sapling during a pre-investiture ceremony marking the start of her service as the 12th President of UOG.

The ceremony was held at the President's Grove in November.

The ifit tree holds deep cultural significance on Guam and the Marianas, symbolizing resilience and connection to heritage.

Reflecting on her tree of choice, Borja Enriquez said, "I chose the ifit (tree) because it represents amazing resiliency. I think about our 70-plus-year history as an institution of higher education and what it represents for the over 20,000 alumni, not just here on Guam, not just across the region but across the globe."

As Borja Enriquez envisioned the tree's roots growing throughout the decades, she envisioned the University's growth, encapsulating the values of resilience, care, and progress. She hoped future generations passing by the tree would remember its representation of fortitude, unity, and love.

"I am honored to be part of the legacy of presidents who have come before me," Borja Enriquez said before planting the ifit sapling.

The ceremony symbolized the fusion of tradition and progress for UOG Senior Vice President and Provost Dr. Sharleen Santos-Bamba, PhD.

"The ifit tree that we are about to plant symbolizes her (Anita Borja Enriquez's) leadership and the roots that will grow underground for years to come."

Roland Quitugua, UOG CNAS invasive species specialist, emphasized the historical and practical

value of the ifit tree, being native to the r egion and renowned for its resilience against natural adversities.

"Let us plant this correctly, just as we hope our president will guide us...moving forward," said Quitugua.

The CNAS team, led by Quitugua, prepped the tree planting site and the sapling to ensure its proper growth and survival.

Aside from the UOG Center for Island Sustainability and Sea Grant, the event saw contributions from various UOG entities, including the College of Natural and Applied Sciences, Endowment Foundation, and Alumni Relations.

LEFT PHOTO: *UOG President Dr. Anita Borja Enriquez, DBA, plants an ifit tree with the assistance of UOG CNAS Invasive Species Specialist Roland Quitugua.* **BELOW:** *Dignitaries and special guests attend the tree-planting event commemorating the investiture of UOG President Dr. Anita Borja Enriquez, DBA.*

Addressing brain drain at the core of Navigating Home program

Highly skilled and educated individuals sought better opportunities elsewhere due to economic challenges and limited professional growth prospects in their home state or territory, causing brain drain.

The 2020 U.S. Census identified brain drain and climate change as contributing to population decline in U.S. territories like Guam, the U.S. Virgin Islands (USVI), and Puerto Rico.

In response to this pressing challenge, the UOG Center for Island Sustainability and Sea Grant and partners in USVI and Puerto Rico launched the 2023 National Science Foundation (NSF) Navigating Home Early-Career Fellowship Program.

The program was designed to create a pipeline for training and recruiting individuals with advanced degrees in marine, environmental, or sustainability sciences who may have left for educational or work opportunities.

The primary aim was to entice them back to Guam, where they could contribute their expertise to the local workforce.

As part of the program, participants collaborated with universities, non-profits, government agencies, and community organizations within their territorial program hub

“We empowered our future, one homecoming at a time,” said Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant at the launch event.

Thanks to NSF’s $7.5 million funding, the five-year program provided opportunities to 68 fellows and 68 professionals from Guam, Puerto Rico, and the USVI. $2.17 million of the funding came directly to UOG.

The first person chosen for 2023 was Katelyn Renee Anderson. She completed her undergraduate

degree in environmental studies from Chaminade University of Honolulu in 2020 and earned a master's degree in environmental stewardship from Colorado State University in Fort Collins.

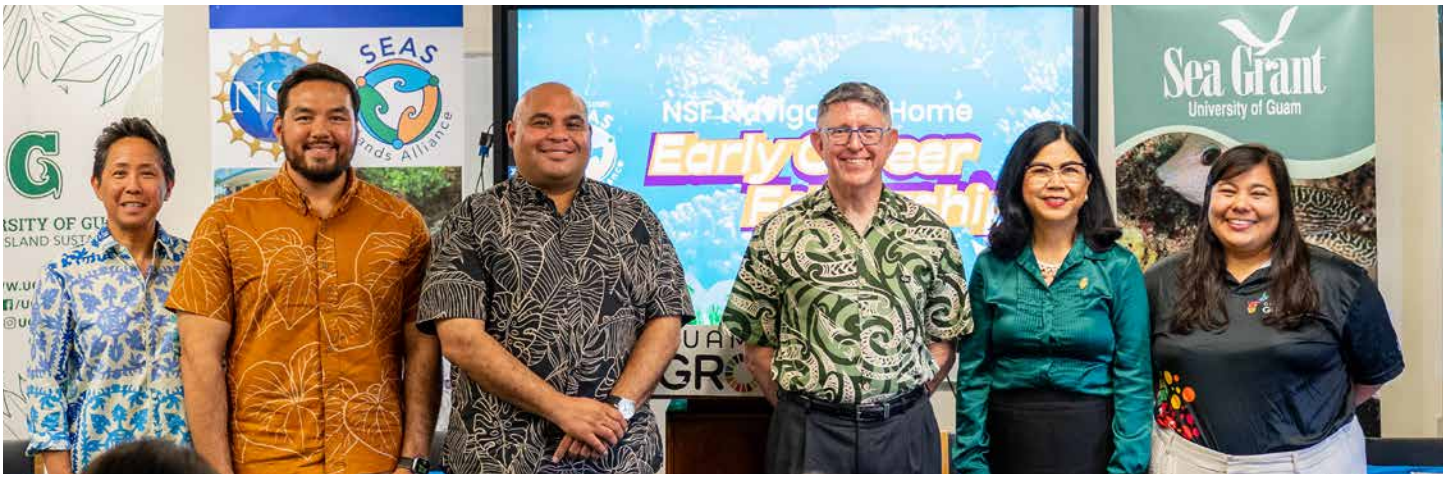
Anderson was assigned to work with the Guam Department of Agriculture and the Guam Restoration of Watersheds (GROW) Initiative.

At the launch event, UOG President Dr. Anita Borja Enriquez, DBA, highlighted the significant outflow of talent as many UOG graduates sought education and career opportunities abroad.

She said that forming partnerships with key stakeholders in the private and public sector played a crucial role in maintaining essential capacity on the island and fostering social responsibility and progress.

The Guam Energy Office, the Guam Environmental Protection Agency, the Bureau of Statistics and Plans, the Guam Coastal Management Program, the Guam Department of Agriculture, and the Guam Department of Administration are just some of the partners involved in the program.

LEFT PHOTO: *Katelyn Renee Anderson, a Navigating Home program fellow for 2023, is working with the Guam Department of Agriculture and the Guam Restoration of Watersheds (GROW) Initiative as part of her fellowship.*
BELOW: *UOG and government officials attend the launch of the 2023 National Science Foundation Navigating Home Early-Career Fellowship Program. Dr. Cheryl Sangueza, Ph.D., representing the NSF INCLUDES SEAS Islands Alliance Guam, talks about the opportunities available through the Navigating Home program. Morgan Leon Guerrero participated in the pilot Navigating Home program in 2022. She was assigned to work with the Guam Energy Office on energy transition grants.*



UOG and San Diego State University partner in new environmental justice center

The University of Guam, in a partnership led by San Diego State University, was awarded a $10 million grant from the U.S. Environmental Protection Agency to create one of 17 centers nationwide to connect underserved communities with resources for energy and environmental justice.

Out of the total funding, $526,000 is directed to the UOG Center for Island Sustainability and Sea Grant to lead outreach, engagement, and service delivery for Guam and the regional community through its coordination of Guam Green Growth (G3) and renewable energy and energy efficiency activities working with the Guam Energy Office.

“Guam and the rest of Micronesia are no strangers to environmental justice issues. We are on the frontlines of climate change impacts despite contributing the least to its causes. This significant grant will build local capacity to address some of these justice issues and expand our center’s ability to support sustainable development in Guam and our region,” stated Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant.

The SDSU Center for Community Energy and Environmental Justice will provide critical services to rural, remote, tribal, and Indigenous communities to access federal resources for environmental and energy justice projects.

Over the next five years, the center and its partners will co-create accessible, multilingual, in-person, and virtual services to help communities often most affected by environmental challenges like drought, flooding, and pollution apply for government funding.

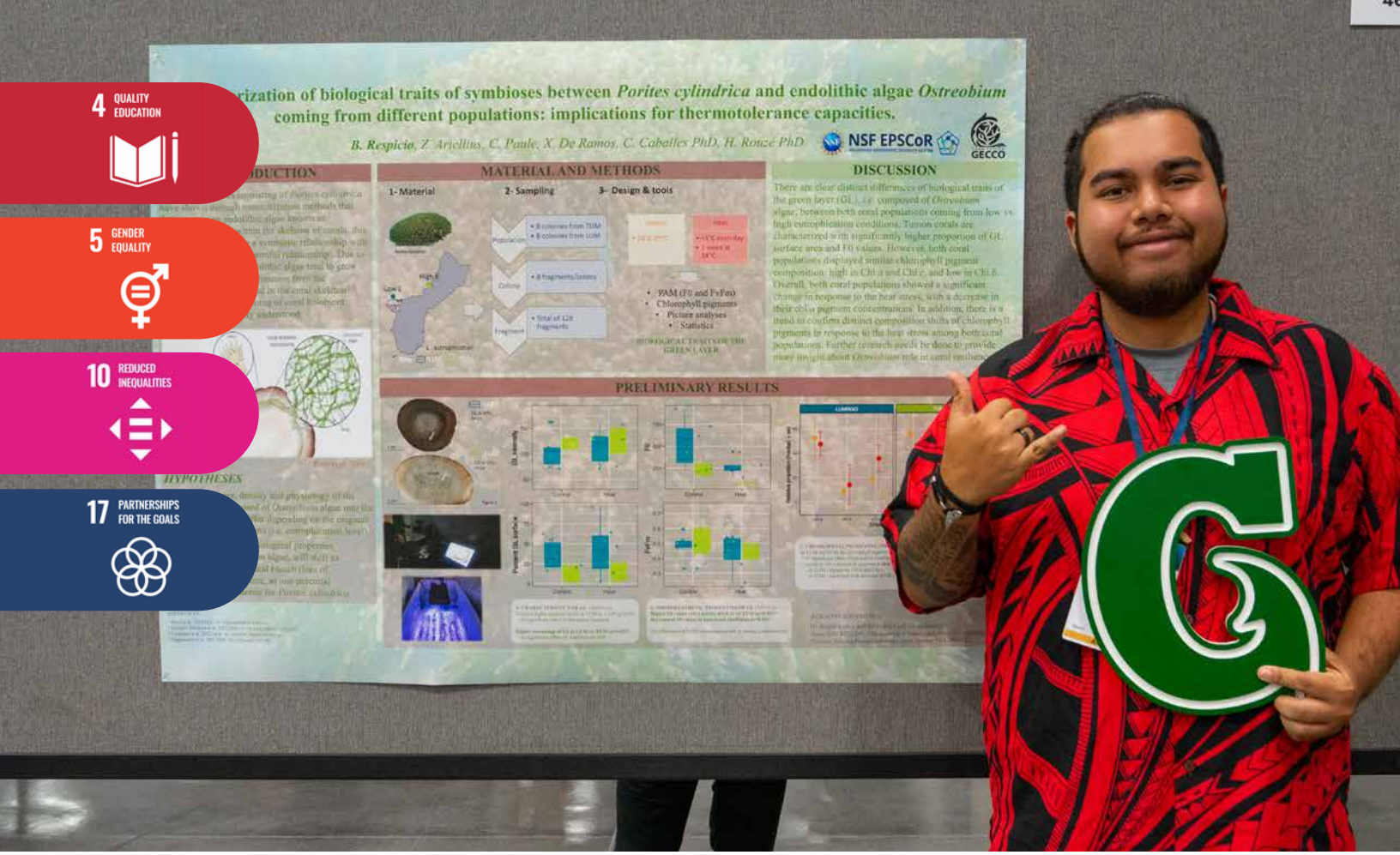
“UOG continues to serve our students, our island, and our region through our faculty and research expertise and meaningful partnerships we are building across the globe. We are pleased to partner with the prestigious San Diego State University under the leadership of their President, Dr. Adela Dela Torre, to deliver new resources and

networks for the benefit of our island communities," said UOG President Dr. Anita Borja Enriquez, DBA.

Other academic institutions participating in the initiative include Arizona State University, and the University of San Diego's Energy Policy Initiatives Center. Partner organizations span industry and non-profit sectors, including the Environmental Protection Network, Center for Creative Land Recycling, Institute for Tribal Environmental Professionals, Desert Research Institute, Pacific RISA, and the Public Health Alliance.

The new center will assist community organizations in environmental and energy justice needs, grant identification and administration, navigating government systems, decision-making participation, and advancing community champions.

PHOTOS: *Representatives from the U.S. Environmental Protection Agency's Region 9, including Regional Administrator Martha Guzman meet with Dr. Austin Shelton, Ph.D., director of the UOG Center for Island Sustainability and Sea Grant and staff at the G3 Circular Economy Makerspace and Innovation Hub at the Chamorro Village.*



UOG SACNAS chapter wins top award at largest STEM diversity conference

The UOG SACNAS Student Chapter received the 2023 Undergraduate Chapter of the Year award at the 2023 SACNAS National Diversity in STEM (NDiSTEM) Conference.

The NDiSTEM conference, a cornerstone in fostering diversity in Science, Technology, Engineering, and Mathematics (STEM), took place in October in Portland, Oregon.

More than 40 attendees from UOG participated in the 2023 NDiSTEM, which stood as the largest multidisciplinary and multicultural STEM diversity event in the United States.

UOG President Dr. Anita Borja Enriquez, DBA, who was a member of the conference delegation, said, "UOG takes immense pride in our presence at the SACNAS NDiSTEM Conference. This gathering not only strengthened our commitment to fostering inclusivity but also emphasized the vital role of diverse perspectives in shaping the future of science and innovation."

Throughout the conference, participants actively attended workshops, showcased their research, and established connections with officials from academia and industry nationwide, creating valuable research and career opportunities.

Another significant achievement was the number of student presenters from the UOG delegation. Eighteen student attendees from Guam, representing nearly half of the total UOG delegation, delivered presentations at the conference.

"Our presence echoed our university's dedication to shaping a world where opportunities in STEM are accessible to everyone," said UOG Center for Island Sustainability and Sea Grant Director, Dr. Austin Shelton, PhD, an elected member of the SACNAS National Board of Directors,

Shelton also serves as the faculty co-advisor of the UOG SACNAS Student Chapter, along with UOG Associate Professor Dr. Cheryl Sangueza, PhD.

Britney Sison, president of the UOG SACNAS Student Chapter, said, "This award meant a lot to us, and I hope it inspires future students to continue the mission of SACNAS – to support underrepresented groups in their pursuit of degrees and careers in STEM and to encourage others to bring their culture and whole selves into the process."

Meanwhile, Sabrina Zhi, vice president of the UOG SACNAS Student Chapter, said the award demonstrates collective support from many past and present UOG students to highlight their resilient attitude towards the advancement of representation for the Pacific Island community. Celebrating its 50th year, SACNAS fosters the success of underrepresented Americans – from college students to professionals – in attaining advanced degrees, careers, and leadership positions in STEM.

The attendees participated in the conference through support from NSF INCLUDES SEAS and Guam NSF EPSCoR grants and travel scholarships from SACNAS, Chapter Officer Leadership October Retreat (COLOR), and the Research Corporation of the University of Guam.

PHOTOS: *The UOG SACNAS student chapter and members of the UOG delegation pose for pictures after receiving the 2023 Undergraduate Chapter of the Year award at the 2023 SACNAS National Diversity in STEM (NDiSTEM) Conference.*

8 DECENT WORK AND ECONOMIC GROWTH

11 SUSTAINABLE CITIES AND COMMUNITIES

17 PARTNERSHIPS FOR THE GOALS

Regional-focused G3 Local2030 Islands Network Conservation Corps

The Guam Green Growth (G3) initiative and UOG Center for Island Sustainability and Sea Grant started the regional-focused G3 Local2030 Islands Network Conservation Corps for university dorm residents from the region, following three successful seasons of the G3 Conservation Corps.

The new G3 Local2030 Islands Network Conservation Corps was launched at the UOG Residence Halls and the members came from the Federated States of Micronesia, Palau, Marshall Islands, and the Commonwealth of the Northern Mariana Islands.

The ten new G3 Local2030 Conservation Corps were Sirena Braiel, Chuuk state, FSM; Don David, Pohnpei state, FSM; Joshlynn Eberdong, Palau; Josh Fanapngag, Yap state, FSM; Jesley Ferdinand, Pohnpei state; Toyolynn Hilton, Marshall Islands; Jon Arthur Kihleng, Pohnpei state; Mc Gee Mereb, Palau; Jonathan Mitsur, Yap state; and Aira May Ngalongalo, Saipan, CNMI.

The program provided all participants a $1,300 stipend per semester and 120 continuing education units (CEUs).

Dr. Anita Borja Enriquez, DBA, recognized this pioneering initiative as the next phase of the G3 Conservation Corps. “As we launched this new program, we weren’t just empowering dorm residents - we were nurturing a network of change-makers who will drive sustainable solutions for our evolving world,” said Dr. Enriquez.

According to UOG Center for Island Sustainability and Sea Grant Director Dr. Austin Shelton, PhD, the G3 Local2030 Islands Network Conservation Corps is vital in advancing the more significant movement toward achieving the 17 UN Sustainable Development Goals on Guam and the region.

Shelton emphasized that the initiative reflected their dedication to creating a sustainable future that balances economic growth, human well-being, and environmental health. He said the program will serve as a vital link between education and action.

The first 10 G3 Local2030 Islands Network Conservation Corps members represented a diverse group of students from Micronesia.

Participation in the Corps, said Ngalongalo, a business administration student and dorm resident assistant, provided an avenue to influence change. For Ferdinand, a civil engineering student, emphasized the importance of bringing the knowledge back to his community.

Like their counterparts at the G3 Conservation Corps, the new G3 Local2030 Islands Network Conservation Corps program included capacity-building and training activities to prepare them for the emerging green economy.

Activities covered agriculture, aquaculture, island beautification, invasive species mitigation, reforestation, circular economy practices, ocean conservation, and harnessing renewable energy. The inaugural cohort also participated in activities supporting civic engagement and leadership.

PHOTOS: *Following three successful Guam Green Growth (G3) Conservation Corps seasons, the UOG Center for Island Sustainability and Sea Grant launches the new regional-focused G3 Local2030 Islands Network Conservation Corps at the UOG Residence Halls.*

Shelton: Peace, sovereignty, island sustainability

Guam's path to sovereignty and peace includes producing more locally, trading better, and circularizing the economy, according to Dr. Austin Shelton, PhD, UOG Center for Island Sustainability and Sea Grant director.

Shelton mentioned these points in his keynote address at the "Fanhita: Security, Sovereignty, and the Path to Peace" conference recently organized by the Commission on Decolonization.

He highlighted the island's significant reliance on imported goods and the urgent need to transition towards a more sustainable and self-reliant future.

Guam currently imports over 90% of its food and goods, which poses immense challenges regarding food security, economic stability, and environmental sustainability.

Shelton emphasized that Typhoon Mawar served as a stark reminder of the island's vulnerability due to its overdependence on external resources.

He outlined a three-pronged approach to address these challenges and foster a more resilient and sustainable Guam: producing more locally, trading better, and circularizing.

Enhancing local food production is crucial for Guam's food security and economic independence. Shelton highlighted several initiatives the Guam Green Growth (G3) Initiative undertook to promote local agriculture and aquaculture, including the partnership with Guahan Sustainable Culture for the community gardens.

Shelton also mentioned promoting aquaculture and aquaponics systems to increase local seafood

production and supporting local farmers through education, technical assistance, and market access opportunities.

According to Shelton, Guam's strategic location can be leveraged to enhance trade partnerships and negotiate better trade deals. He cited Singapore as an example of an island nation that has successfully diversified its trade network, ensuring a stable supply of essential goods.

He also emphasized the importance of political cohesion and collective bargaining power to negotiate fairer trade agreements that benefit Guam's economy and food security. "We need solidarity and determination to fight for our collective best interests as an island," he said.

Adopting circular economy principles can significantly reduce Guam's reliance on imported goods and minimize waste generation. Shelton advocated for initiatives that promote recycling and waste reduction programs and encourage the reuse and repurposing of materials. He also supported the development of local industries that utilize recycled materials.

Shelton said the G3 Conservation Corps is pivotal in preparing the island's workforce for the emerging green economy. The program equips participants with the skills and knowledge to pursue careers in agriculture, aquaculture, recycling, and circular economy sectors through hands-on training and education.

LEFT PHOTO: *Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, delivers his insights on sustainability and peace as keynote speaker at the "Fanhita: Security, Sovereignty, and the Path to Peace" conference.*
BOTTOM PHOTO: *The Fanhita conference provides a forum for the community to share insights on self-determination and decolonization.*

Obama Foundation Fellow Kyle Mandapat

Kyle Mandapat, MBA, the associate director for communications and community engagement at UOG Sea Grant and Center for Island Sustainability, was selected for the Obama Foundation 2023 Leaders Asia-Pacific program.

Mandapat had joined 34 emerging changemakers from the Asia-Pacific region who participated in the leadership program from February to July 2023. The program offered virtual skill-building workshops, network-building opportunities, and a variety of conversations with issue-area experts while focusing on individual growth as a leader.

Mandapat has over 15 years of experience as an on-air personality for radio and television, a print and digital media writer, and a former vice president of operations at Sorensen Media Group.

At UOG, Mandapat's responsibilities include developing and implementing strategies for publicizing research and outreach activities to the science community and the public.

When asked what he wanted to achieve as part of the program, Mandapat had said, "I hope to be able to bring back everything that I have learned during this program and use it to benefit our people. I look forward to hearing about solutions from around the planet and how they can apply to our troubles and challenges here in Guam."

At the end of the program, participants became part of the Obama Foundation's leadership network.

Over 200 leaders from 36 nations and territories, across various sectors and issue areas, are now part of this global network of changemakers.

PHOTO: *Kyle Mandapat, associate director for communications and community engagement at the UOG Center for Island Sustainability and Sea Grant made it to the 2023 Leaders Asia-Pacific program, according to the Obama Foundation.*

SEAS Islands INCLUDES alumna and 2023 Student Athlete: "Science and sports go hand-in-hand"

The University of Guam recognized National Science Foundation (NSF) INCLUDES SEAS Islands Alliance Guam alumna Rebecca Salas as 'Student-Athlete of the Year.'

Salas received four awards in recognition of her athletic abilities.

UOG Athletics & Field House Director Doug Palmer said in a release that Salas was the Most Valuable Player in beach volleyball and the Best Offense for the indoor volleyball team.

No other athlete won two awards in two different sports during the 2022-23 academic year.

During her year as an intern with NSF INCLUDES, Salas worked under UOG Associate Professor of Bioinformatics Dr. Bastian Bentlage, PhD, at the Marine Laboratory, focusing on the upside-down jellyfish *Cassiopea*.

She also worked as a summer intern at the Environmental Division on Andersen Air Force Base where she assisted with fieldwork in native plant restoration.

The lab work she had done with NSF INCLUDES helped her secure the internship. Moreover, she said her experience in sports proved helpful in working in the field.

Salas had explained that "science and sports go hand in hand.

Salas planned to get a master's degree in environmental science and, in the future, work in compliance and regulations to guide companies toward sustainable practices and protect Guam's environment and cultural resources.

Salas credits the Near Peer seminars with broadening her interests and helping her consider the direction of her studies and future career.

The seminars support the research efforts of STEM (Science, Technology, Engineering, and Mathematics) students through peer mentorship, knowledge exchange, and shared experiences.

PHOTOS: *NSF INCLUDES alumna Rebecca Salas received the UOG Student-Athlete of the Year award in 2023.*

For the first time, Guam hosts National Sea Grant Association meeting

After achieving institutional status in 2022, UOG Sea Grant hosted its first association meeting the following year, bringing other Sea Grant programs to the island.

Over 70 directors and representatives from nearly all 34 Sea Grant programs nationwide attended the National Sea Grant Association biannual meeting at the Hyatt Regency Guam.

At the association meeting, the UOG Sea Grant team got the opportunity to network with colleagues from other states.

The meeting covered presentations and breakout sessions where representatives shared best management practices, program strategies, and challenges in their respective areas.

In 2022, UOG achieved Sea Grant Institutional Status following a unanimous recommendation from the National Sea Grant Advisory Board and official designation from the National Oceanic and Atmospheric Administration (NOAA) senior leadership.

That same year, UOG also marked its 70th founding anniversary and its 50th year as a land grant institution.

The UOG Sea Grant program was unanimously recommended by the National Sea Grant Advisory Board and the NOAA senior leadership for a change in status after passing through a rigorous two-week review in October.

In the announcement, National Sea Grant College Program Director Dr. Jonathan Pennock, PhD, said UOG Sea Grant demonstrated excellence in research, education, public service, and a dedication to the environmentally responsible management and development of Guam's marine and coastal resources.

The University received its first funding support from Sea Grant in the late 1970s. It transitioned into a pre-extension program in 2000 and to a project in 2004. UOG Sea Grant gained program status in August 2008 and Coherent Area Program status in February 2012.

Over the years, UOG Sea Grant's focus areas have expanded to STEM and ecosystem-based education, watershed management and conservation, sustainable fisheries, and climate change adaptation.

PHOTO: *The UOG Center for Island Sustainability and Sea Grant hosts the National Sea Grant Association biannual meeting, which brings together representatives from the Sea Grant College programs nationwide.*

Guam participates in NSF conference highlighting program, participant diversity

The University of Guam participated in the National Science Foundation (NSF) INCLUDES National Network Convening and Invitation to Co-Create --- an event that encouraged knowledge exchange and broadened participation among members.

The convening was held in Washington DC, in August.

At the event, the UOG delegation had a chance to meet up with alliance members from territories like the U.S. Virgin Islands and Puerto Rico.

As part of the NSF-funded alliance, the programs in the territories include fellowships and internships to build capacity and broaden diversity in STEM (Science, Technology, Engineering, Mathematics).

With only 200 people attending, the conference allowed for substantial talks regarding progress, limitations, and challenges and a chance for alliances to talk with NSF people about the programs.

Remedios Perez, MS, UOG Center for Island Sustainability and Sea Grant program leader, felt that getting to know the other alliances and how the programs differed was essential.

For Perez, the major highlight of the conference was a diverse panel of students discussing experiences as program participants.

At one of the panels, a student spoke about their physical and intellectual disabilities, another student talked about their experience of being incarcerated before becoming a student in STEM, and the fourth student shared their experience as an international student.

The panels gave the NSF attendees a glimpse of the students they served.

Anela Duenas, a UOG NSF INCLUDES alumna, was also part of the panel. “It was a really good experience and eye-opening to see how things were done behind the scenes. Being on the panel with three other students with very different perspectives was thought-provoking,” said Duenas.

She added: “The student panel was very useful for the conference’s intent. After the panel, many people thanked us for sharing our stories. They had no idea the hardships we had as Pacific Islanders, even just getting resources out here.”

PHOTOS: *At the National Science Foundation (NSF)INCLUDES National Network Convening and Invitation to Co-Create in Washington DC, the UOG delegation had a chance to meet up with alliance members from territories like the U.S. Virgin Islands and Puerto Rico.*

3rd G3 Conservation Corps graduation

The Guam Green Growth (G3) initiative reached another milestone with the graduation of its third conservation corps cohort in August at the Sinajana Community Arts Hall.

The innovative workforce development program prepares its program participants for the emerging green economy.

Launched in 2021 in collaboration with the UOG Center for Island Sustainability and UOG Global Learning and Engagement, the G3 Conservation Corps program offers a full-time training experience spanning five months each year.

Participants receive instruction on various sustainability topics, covering agriculture, aquaculture, island beautification, invasive species removal, reforestation, circular economy, ocean conservation, and renewable energy.

The third batch of G3 Conservation Corps graduates included Maria Balbin, Jace Blas, Zeriah Blas, Cassie Bordallo, Michael Herbert, Michael Jude Hernandez, Connor Law, Laura Layan, Javier Mercado, Ciara Taijeron, Michael Torres, and Elisa Rose Padilla.

“We’ve learned a lot here and from all of our partners,” said Balbin, who served as corps crew supervisor.

UOG President Dr. Anita Borja Enriquez, DBA, at the graduation, called the graduates conservation warriors.

“You are a special group of conservation leaders. Through your experiences, you represent us as ambassadors to our youth and members of our community,” Borja Enriquez said.

Governor Lou Leon Guerrero also commended the graduates. “The 12 of you are very significant to our island conservation. You have gone through an experience that we will probably never go through,” she said.

Meanwhile, Dr. Austin Shelton, PhD, director of the UOG Center for Island Sustainability and Sea Grant, highlighted the unique experience of the conservation corps graduates, which prepared them for regional and global environmental challenges.

“This season was a little bit different. We had an unexpected typhoon, and we had to do things differently. You got on-the-job training for what is becoming the new reality,” he said.

Shelton also mentioned the impactful multiplier effect generated by the G3 Conservation Corps program, especially in partnership development.

For example, he said the program facilitated the establishment of the G3 Art Corps and the newly formed G3 Kupu Corps collaboration with Kupu, a Hawai’i-based youth leadership development program.

He also underscored G3’s ongoing commitment to expanding the movement. He said the program’s current efforts have attracted new federal funding, enabling the future development of G3 partnerships across Micronesia and the Pacific.

PHOTO: *Members of the Guam Green Growth (G3) third cohort celebrate their graduation program in August at the Sinajana Community Arts Hall.*

Selected Publications

Anthony, C.J.; Lock, C.; **Taylor, B.M.**; Bentlage, B. (2023). Cellular plasticity facilitates phenotypic change in a dominant coral's Symbiodiniaceae assemblage. *Frontiers in Ecology and Evolution,11*. https://doi.org/10.3389/fevo.2023.1288596

Demeulenaere, E.; Ickert-Bond, S.M. (2023). Guam's last håyun lågu tree (*Serianthes nelsonii*) in peril. *Conservation Science and Practice, 5*(11). https://doi.org/10.1111/csp2.13019

Demeulenaere, E.; Sellmann, J. D. (2023). Reminiscence of CHamoru Cuisine: Bringing CHamoru Philosophical Values to the Foreground Related to Food and Environmental Sustainability. In K. Ota; N. Kanzaki, S. Zollet (Eds.). *5th Asia Pacific Society for Agricultural and Food Ethics Conference: Just Transition in Regenerative Food Systems Under Urbanization and Climate Crisis*, (pp. 33–42), Nagoya, Japan. https://www.apsafe.online/apsafe2023/

Harrison, H.B.; Drane, L.; Berumen, M.L.; Cresswell, B.J.; Evans, R.D.; Galbraith, G.F.; Srinivasan, M.; **Taylor, B.M.**; Williamson, D.H.; Jones, G.P. (2023). Ageing of juvenile coral grouper (*Plectropomus maculatus*) reveals year-round spawning and recruitment: implications for seasonal closures. *Proceedings of the Royal Society B*, 290: 20230584. https://doi.org/10.1098/rspb.2023.0584

Houk, P.; **Castro, F.**; McInnis, A.; **Rucinski, M.**; Starsinic, C.; **Concepcion, T.**; Manglona, S.; Salas, E. (2022). Nutrient thresholds to protect water quality, coral reefs, and nearshore fisheries. *Marine Pollution Bulletin, 184*, 114144. https://doi.org/10.1016/j.marpolbul.2022.114144

Patil, U.D.; Mabagos, D.; Yeo, M.H.; Congress, S.S.C.; **Shelton, A.; Demeulenaere, E.** (2023). Improvement in Stability of a Tropical Hillslope via Mechanical Root Reinforcement. In E. Rathje, B.M. Montoya, & M.H. Wayne (Eds.), *Geo-Congress 2023: Sustainable Infrastructure Solutions from the Ground Up,* (pp. 469–477), American Society of Civil Engineers. https://doi.org/10.1061/9780784484654.047

Patil, U.D.; Yeo, M.; Aquino, E.; Congress, S.S.C.; **Demeulenaere, E.** (2023). Role of *Acacia* Tree Root's Reinforcement in Hill Slope Stability. In T. Base, A. Farid, X. Fei, & D. Zekkos (Eds.). *9th International Congress on Environmental Geotechnics*, Chania, Crete, Greece. https://doi.org/10.53243/ICEG2023-258

Patil, U.D.; Yeo, M. H.; **Demeulenaere, E.;** Mabagos, D.; Congress, S.S.C. (2023). Contribution of Vetiver Grass Towards Slope Stability Via Mechanical Root Reinforcement. In H. Hazarika, S.K. Haigh, B. Chaudhary, M. Murai, S. Manandhar (Eds.). *2nd International Conference on Construction Resources For Environmentally Sustainable Technologies, CREST-2023*, Fukuoka, Japan. https://doi.org/10.1007/978-981-99-9215-7_2

Santos, C.,F.; Agardy, T.; Aheto, D.; Allison, E.H.; Bennett, N.J.; Blythe, J.L.; Calado, H.; Crowder, L.B.; Day, J.C.; de Vos, A.; Flannery, W.; Galparsoro, I.; Gissi, E.; Gjerde, K.M.; Gobin, J.F.; Green, S.; Isaacs, M.; Karuaihe, S.T.; Lombard, A.T.; Lopes, P.F.M.; Ojea, E.; Orbach, M.; Pecl, G.; Reid, A.; Scherer, M.; **Shelton, A.J**.; Sogbanmu, T.O.; Villasante, S.; Wedding, L.; Sumaila, U.R. (2023). Advancing interdisciplinary knowledge for ocean sustainability. npj Ocean Sustainability. 2(1):18. https://doi.org/10.1038/s44183-023-00026-6

Taylor, B.M.; McInnis, A.J.; Deinhart, M.; K. Kawahigashi; Gourley, J. (2023). Comparative demography of surgeonfishes from the tropical western Pacific. *Reviews in Fish Biology and Fisheries, 34*, 353–370, (2024). https://doi.org/10.1007/s11160-023-09816-0

Trianni, M.; DeMartini E.E.; **Taylor, B.M.** (2023). Life history characteristics and status of the Pacific yellowtail emperor, *Lethrinus atkinsoni* (Seale 1910), in the Commonwealth of the Northern Mariana Islands. *Aquaculture, Fish and Fisheries* 3, 165-174. https://doi.org/10.1002/aff2.100

Directory

Leadership

Austin J. Shelton III, PhD
Director
(671) 735-5631
shelton@uog.edu

Fran A. Castro, MS
Associate Director for Operations and Development
(671) 735-5633
francastro@uog.edu

Else Demeulenaere, PhD
Associate Director for Natural Resources
(671) 735-2918
else@uog.edu

Kyle Mandapat, MBA
Associate Director for Communications and Community Engagement
(671) 683-7716
mandapatk@triton.uog.edu

Remedios Perez, MS
Program Leader
perezr6060@triton.uog.edu

Administrative Support

Ci'Ana Cruz
Grant Assistant
(671) 735-5631
cruzcr@triton.uog.edu

Janelle Renee Flores
Program Associate
(671) 735-5631
floresj844@triton.uog.edu

Guam Green Growth Action Framework

Camarin Quitugua, MSW
Guam Green Growth
Action Framework Coordinator
(671) 735-2918
quituguac@triton.uog.edu

Sarah Taitano, MSW
Guam Green Growth
Action Framework
Associate Coordinator
(671) 735-2918
taitanos3391@triton.uog.edu

Sea Turtles and Fisheries Science

Addie Ferguson
Sea Turtle Biologist
fergusona@triton.uog.edu

Brett Taylor, PhD
Assistant Professor of Fisheries Ecology Research Coordinator
taylorb@triton.uog.edu

Leilani Sablan, MS
Fisheries Biologist
sablanl9009@triton.uog.edu

Traditional Knowledge

PWO H. Larry Raigetal, MA
Master Navigator
raigetalh@triton.uog.edu

Lourdes Manglona
Lead Yo'åmte
G3 Yo'åmte Project
manglonal15243@triton.uog.edu

Susan Aguon
Yo'åmte Apprentice
G3 Yo'åmte Project
aguons15240@triton.uog.edu

Outreach and Engagement

Phillip Cruz, PMBA
Outreach and Sustainability Coordinator
(671) 735-2918
philcruz@uog.edu

Annania Nauta Kemp, PMBA
Guam Green Growth and Kupu Corps Coordinator
(671) 735-2918
annania.nauta@triton.uog.edu

Joseph Certeza
Guam Green Growth Art Corps and Guam Green Growth Local2030 Conservation Corps Project Coordinator
certezaj@triton.uog.edu

Gabrielle Topasna
Outreach Assistant
topasnag15513@triton.uog.edu

Aquaculture & Aquaponics

David Crisostomo, MS
Aquaculture Specialist
crisostomo8562@triton.uog.edu

Johnny Borja
Aquaculture Associate
borjaj5756@triton.uog.edu

Joshua Muna
Aquaculture Associate
munaj7479@triton.uog.edu

Guam Restoration of Watersheds (GROW)

Daniel Stone, Jr.
GROW Project Lead
stoned@triton.uog.edu

Teddy Lee Concepcion
GROW Extension Assistant
tconcepcion@triton.uog.edu

Anthony Ritter
GROW Graduate Research Assistant
rittera@triton.uog.edu

Christopher Certeza
GROW Extension Assistant
certezac8658@triton.uog.edu

Laura Layan
GROW Research Associate
layanl@triton.uog.edu

Guam Green Growth Makerspace and Innovation Hub

Abby Crain
Guam Green Growth
Circular Economy Coordinator
(671) 475-0161
(671) 475-0162
(671) 475-0163
craina@triton.uog.edu

Regine Biscoe Lee
G3 Economic Valuation Project Coordinator
leer16164@triton.uog.edu

Guam Green Growth Makerspace and Innovation Hub

Christian Valencia
G3 Economic Valuation Project Research Associate
valenciac11235@triton.uog.edu

Franceska De Oro
Education Assistant
(671) 475-0161
deorof@triton.uog.edu

Shawn Garcia
Makerspace Attendant
garcias6899@triton.uog.edu

Center for Island Sustainability Natural Resources Research

Vince Fabian
Project Associate
(671) 735-2918
fabianv@triton.uog.edu

Matthew Putnam
Project Associate
(671) 735-2918
putnamm@triton.uog.edu

Jacob Concepcion
Research Assistant
(671) 735-2918
concepcionj15242@triton.uog.edu

Caley Jay Chargualaf
Research Associate/Apprentice
(671) 735-2918
chargualafc10679@triton.uog.edu

Damon Concepcion
Research Assistant
(671) 735-2918
concepciond15462@triton.uog.edu

Wade Kitalong
Research Assistant
(671) 735-2918
kitalongw@triton.uog.edu

Anna Aguirre
Research Associate
(671) 735-2918
aguirrea@triton.uog.edu

Savana Baza
Extension Assistant
(671)735-2918
bazas16272@triton.uog.edu

Zeriah Blas
Research Assistant
(671) 735-2918
blasz15489@triton.uog.edu

Regina-Mae Dominguez
Research Associate
Research Statistician
(671) 735-2918
dominguezr@triton.uog.edu

Joshua Fernandez
Research Associate
(671)735-2918
fernandezj4711@triton.uog.edu

Tristin Guile
Research Assistant
(671) 735-2918
guilet@triton.uog.edu

Juan-Carlos Mungaray
Extension Assistant
(671) 735-2918
mungarayj@triton.uog.edu

Xavier Reyes
Research Assistant
(671) 735-2918
reyesx@triton.uog.edu

Kara Schwarz
Research Associate
(671) 735-2918
schwarzk@triton.uog.edu

Aubrie Uson
Research Assistant
(671) 735-2918
usona@triton.uog.edu

Samantha Mower
Research Associate
(671) 735-2918
mowers@triton.uog.edu

Damien Camacho
Research Assistant
(671) 735-2918
camachod11125@triton.uog.edu

Capacity Building

Jessica Fernandez
NSF Navigating Home Program Associate
fernandezj9941@triton.uog.edu

Emily Wendte, MFA
Guam NSF EPSCoR Program Associate
wendtee@triton.uog.edu

Climate Resilience and Energy

Renee Crisostomo, MS
Climate Change Resillence Coordinator
crisostomor13516@triton.uog.edu

Clementine Schnabel
Micronesia Challenge Guam Coordinator
schnabelc@triton.uog.edu

Morgan Leon Guerrero, MS
NSF INCLUDES SEAS Fellow
leonguerrerom@
triton.uog.edu

Science Communication

Maria Louella Losinio
Production & Media Supervisor
(671) 735-5631
losiniom@triton.uog.edu

Maurice Jones
Production Coordinator
(671) 735-5631
jonesml@triton.uog.edu

Amanda Dedicatoria
Science Communicator
(671) 735-5631
dedicatoriaa@triton.uog.edu

April Colitoy-Gaerlan
Graphic Artist
(671) 735-5631
colitoya@triton.uog.edu

Clyde Grapa
Graphic Artist
(671) 735-5631
grapac@triton.uog.edu

Jeremie Charfauros
Assistant Science Communicator
(671) 735-5631
charfaurosj3148@triton.uog.edu

Reese Espinosa
Assistant Science Communicator
(671) 735-5631
espinosak16299@triton.uog.edu

Marissa Villaverde
Web Specialist
(671) 735-5631
villaverdem@triton.uog.edu

Gabriella Piper
Science Communicator Intern
(671) 735-5631
piperg@gotritons.uog.edu

Partners


UNIVERSITY OF GUAM
UNIBETSEDÅT GUAHAN
UNIVERSITY OF GUAM
CENTER FOR ISLAND SUSTAINABILITY
Sea Grant
UNIVERSITY OF GUAM
NOAA
NSF
GUAM EPSCoR
NSF INCLUDES
SEAS Islands Alliance
GUAM GREEN GROWTH
GPA
POWER TO SERVE
GUAM ECONOMIC DEVELOPMENT AUTHORITY
MARCH 3, 1849
Micronesia Challenge
UOG ENDOWMENT FOUNDATION
UNIVERSITY OF GUAM
SCHOOL OF BUSINESS & PUBLIC ADMINISTRATION
UNIVERSITY OF GUAM
SCHOOL OF EDUCATION
UNIVERSITY OF GUAM
COLLEGE OF NATURAL & APPLIED SCIENCES
UNIVERSITY OF GUAM
GLOBAL LEARNING AND ENGAGEMENT CENTER
UNIVERSITY OF GUAM
CENTER FOR ENTREPRENEURSHIP AND INNOVATION
CALVO'S insurance
Bank of Guam
gta
Matson
ADA'S TRUST & Investment, Inc.
PFM
Bank of Hawaii
Guahon Waste Control, Inc. aka Mr. Rubbishman
WERI
NMC
MICRONESIAN CONSERVATION COALITION
mina
Mariana Islands Nature Alliance
KUPU
CCEEJ
SDSU
Center for Community Energy and Environmental Justice
BLUE PLANET ALLIANCE
PACIFIC ISLANDS
Climate Adaptation Science Center
GUAM NASA EPSCoR
THE OCEAN FOUNDATION
GUMA
GUAM UNIQUE MERCHANDISE & ART
GSC
EDUCATE. CULTIVATE. NOURISH.
GUAM COUNCIL ON THE arts & humanities AGENCY
ISLANDWIDE Beautification TASK FORCE
SERVE GUAM COMMISSION
AmeriCorps
GUAM SOIL & WATER CONSERVATION DISTRICTS
i recycle
reduce. reuse. recycle.
FOREST SERVICE
USDA
PROFERRE
GCC
GUAM COMMUNITY COLLEGE
HAWAI'I GREEN GROWTH
LOCAL2030 HUB
GLOBAL ISLAND PARTNERSHIP
LOCAL2030 ISLANDS NETWORK
SAN DIEGO STATE UNIVERSITY
THE CLIMATE STRONG ISLANDS NETWORK
MCCA
Micronesia Climate Change Alliance
MICRONESIA CONSERVATION TRUST
ASU
Julie Ann Wrigley Global Futures Laboratory
Marine Laboratory
University of Guam
NFWF
CESU
HAWAI-PACIFIC ISLANDS
Sea Grant
UNIVERSITY OF HAWAI'I
EA
EA Engineering, Science, and Technology, Inc., PBC
KUAM
COMMUNICATIONS
LMSGU
SPF
SASAKAWA PEACE FOUNDATION
GUAM ENERGY OFFICE
Ufisinan Alentos Guahan
public works
DIPATTAMENTON CHEGUE' PUBLIKO
THE BUREAU OF STATISTICS AND PLANS
Government of Guam
AmeriCorps
Guåhan Sustainable Culture
DISTRICT OF TALOFOFO
GOD'S COUNTRY
AMERICA'S SBDC
PACIFIC ISLANDS NETWORK


Coral Reef


GREEN SEA TURTLE


TRAIN STATION


EPSCOR


Sea Grant


EPSCoR


GUAM GREEN
GROWTH


UNIVERSITY OF GUAM


Metgot Nalina'låta

cis.uog.edu
seagrant.uog.edu
@uogcis
@uogseagrant
@guamgreengrowth
@nsfincludesseasguam