

Pacific Research on Island Solutions for Adaptation

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LEAD INVESTIGATORS

Victoria Keener, PhD, Research Professor, Arizona State University (ASU) Global Institute of Sustainability and Innovation (GIOSI); Senior Research Fellow, East-West Center (EWC); keener@eastwestcenter.org

Laura Brewington, PhD, Research Professor, ASU GIOSI; Research Fellow, EWC; brewingl@eastwestcenter.org

CORE TEAM

Chelsey Bryson, Project Specialist, Pacific RISA Program, EWC; brysonc@eastwestcenter.org

Mari Ching, Program Coordinator, Pacific RISA Program, ASU GIOSI; mari.ching@asu.edu

Krista Jaspers, Communications Manager, Pacific RISA Program, ASU GIOSI; krista.jaspers@asu.edu

Paula Moehlenkamp, Project Specialist, Pacific RISA in cooperation with Local2030 Islands Network, EWC; moehlenp@eastwestcenter.org

CO-INVESTIGATORS

Abby Frazier, PhD, Assistant Professor, Geography, Clark University; Adjunct Fellow, EWC; afrazier@clarku.edu

Tom Giambelluca, PhD, Director, Water Resources Research Center; Professor, Geography; University of Hawai'i at Mānoa; thomas@hawaii.edu

Zena Grecni, MEM, Sustained Climate Assessment Strategic Lead, ASU GIOSI; zgrecni@asu.edu

John Marra, PhD, Regional Climate Services Director, Pacific Region, NOAA National Centers for Environmental Information (NCEI), Center for Weather and Climate (CWC); Senior Adjunct Fellow, EWC; john.marra@noaa.gov

Kirsten Oleson, PhD, Professor, Natural Resources and Environmental Management; University of Hawai'i at Mānoa; koleson@hawaii.edu

Austin Shelton, PhD, Associate Professor, Extension & Outreach; Director, Center for Island Sustainability and University of Guam Sea Grant; shelton@triton.uog.edu

Christopher Shuler, PhD, Assistant Hydrologist, Water Resources Research Center, University of Hawai'i at Mānoa; cshuler@hawaii.edu

Matthew Widlansky, PhD, Associate Director, Sea Level Center; University of Hawai'i at Mānoa; mwidlans@hawaii.edu

PACIFIC RISA ADVISORY COMMITTEE

Kelley Anderson-Tagarino, Extension Agent, University of Hawai'i Sea Grant College Program American Sāmoa, American Sāmoa Community College

Amanda Ellis, Executive Director, Asia-Pacific, ASU GIOSI; Senior Director, Global Partnerships and Networks, ASU

Julie Ann Wrigley, Global Futures Laboratory

Kealoha Fox, President and Senior Advisor, Institute for Climate and Peace; Native Hawaiian Liaison, AlohaCare

Matt Gonser, Chief Resilience Officer and Executive Director, Office of Climate Change, Sustainability and Resiliency, City and County of Honolulu

Ka'āina Hull, Director, Kaua'i County Planning Department

Trina Leberer, Director, Pacific Regional Partnerships, The Nature Conservancy

Malia Nobrega-Olivera, Director of Strategic Partnerships and Community Engagement, Hawai'i inuiākea School of Hawaiian Knowledge

Ruby Pap, Coastal Land Use Extension Agent, Hawai'i Sea Grant Program, Kaua'i County Planning Department

(Ex Officio) **Dave White**, Director, ASU GIOSI

RESEARCH PARTNERS, POST-DOCTORAL RESEARCHERS, STUDENTS, AND INTERNS

(*new team member)

***Katherine Anarde** (Carolinas Collaborative on Climate, Health, and Equity and NC State University)

Kelley Anderson-Tagarino (American Sāmoa Community College and University of Hawai'i Sea Grant Program)

Lucille Apis-Overhoff (Climate Change Division, FSM Department of Environment, Climate Change, and Emergency Management)

Chelsea Arnott (Hawai'i Department of Land and Natural Resources)

Perry Arrasmith (University of Hawai'i at Mānoa)

Kaimana Bingham (Local2030 Islands Network)

***Régine Biscoe Lee** (RBL & Associates and the University of Guam)

***Andrea Blas** (University of Guam and Micronesia Conservation Trust)

Jeff Burgett (US Fish and Wildlife Service)

Elaine Chugen (College of Social Sciences, University of Hawai'i at Mānoa)

Celeste Connors (Local2030 Islands Network)

***Lilia Davis** (Natural Resources and Environmental Management, University of Hawai'i at Mānoa)

Glenn Dulla (University of Guam)

Bradley Eichelberger (Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife)

***Annette Evans** (University of Massachusetts Amherst)

***Bryan Falk** (National Invasive Species Council)

Katrina Fandrich (University at Albany, SUNY)

Xue Feng (University of Hawai'i at Mānoa)

Brian Gorberg (University of Hawai'i at Mānoa)

Tamara Greenstone-Alefaio (Micronesia Conservation Trust)

***Leigh Greenwood** (The Nature Conservancy)

Samatha Happ (Local2030 Islands Network)

***Miyuki Hino** (Carolinas Collaborative on Climate, Health, and Equity; UNC at Chapel Hill)

Chris Hobbs (Local2030 Islands Network)

Jacques Idechong (Palau Community College)

Gerson Jackson (Micronesia Regional Invasive Species Council)

***Olivia Jarvis** (University of Hawai'i at Hilo)

Kennedy Kaneko (Secretariat of the Pacific Regional Environment Programme)

Heather Kerkering (Pacific Islands Climate Adaptation Science Center)

***Lysbeth Koster** (University of Hawai'i at Mānoa and Wageningen University and Research)

***Ketty Loeb** (Institute for Sustainability and Resilience, University of Hawai'i at Mānoa)

Katrina Mariner (American Sāmoa Power Authority)

Christy Martin (Hawai'i Coordinating Group on Alien Pest Species)

Xavier Matsutaro (Palau Climate Change Office)

***MJ Mazurek** (US Fish and Wildlife Service)

Susanne Moser (Susanne Moser Consulting)

Ann Nyambega (University of Hawai'i at Mānoa)

Elliott Parsons (University of Hawai'i at Mānoa)

Roland Quitugua (University of Guam)

Nicole Read (Duke University)

***LeRoy Rodgers** (South Florida Water Management District)

Kristen Sanfilippo (University of Hawai'i at Mānoa)

Denis Sene Jr. (American Sāmoa Community College)

Casey Tebeest (University of Hawai'i at Mānoa and American Sāmoa Power Authority)

Oliver Timm (University at Albany)

***Reginald White** (NOAA NWS Weather Service Office, Majuro)

Keoni Williams (Richardson School of Law, University of Hawai'i at Mānoa)

***Wallon Young** (American Sāmoa Power Authority)

***Thomas Zackious** ((NOAA NWS Weather Service Office, Majuro)

***Paul Zajicek** (National Aquaculture Association)

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Introduction

ABOUT PACIFIC RISA

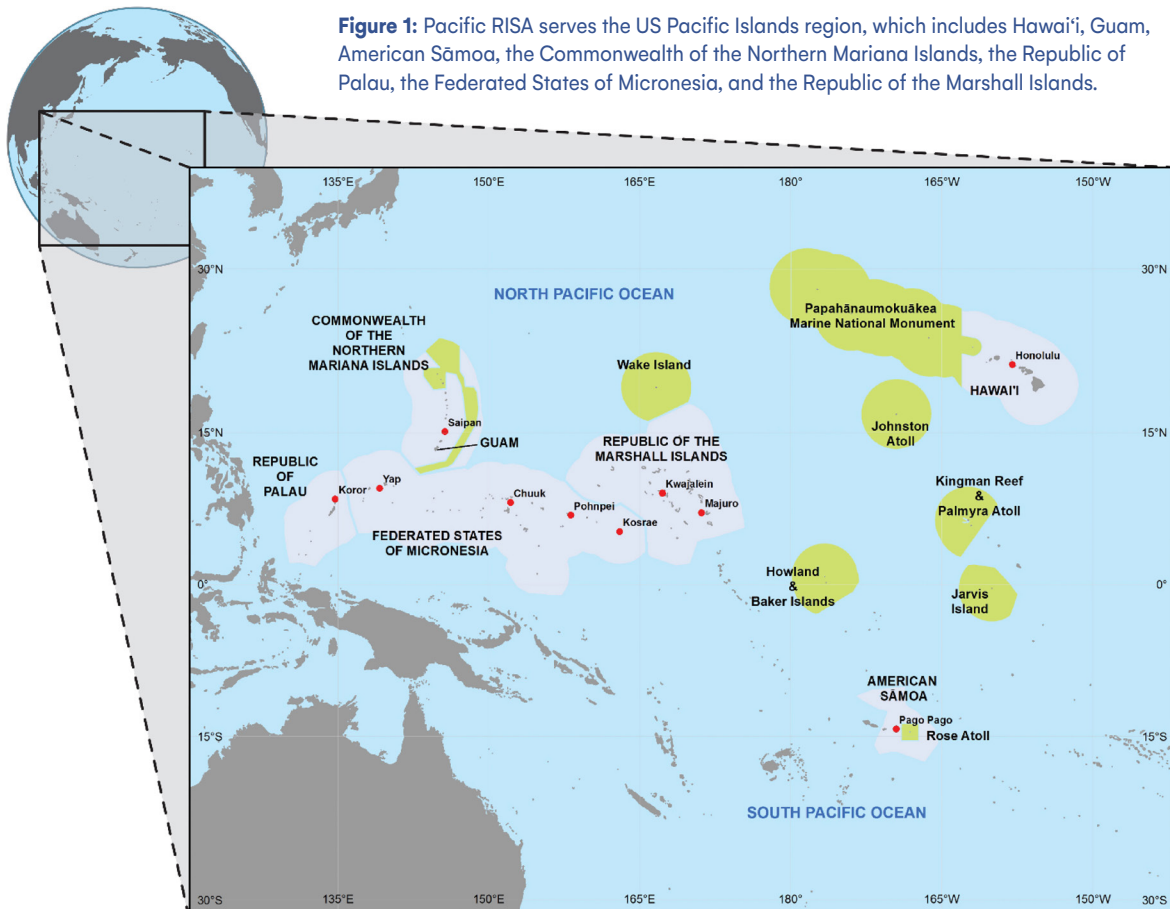
The Pacific Research on Island Solutions for Adaptation (Pacific RISA) program supports Pacific Island and coastal communities in adapting to the impacts of climate variability and change. As part of a national network of Climate Adaptation Partnership programs, Pacific RISA emphasizes the engagement of communities, governments, and businesses in developing effective strategies to build resilience in key sectors such as water resource management, coastal and marine resources, fisheries, agriculture, tourism, disaster management, and public health.

The Core Office of the Pacific RISA program is led by the Arizona State University (ASU) Global Institute of Sustainability and Innovation (GIOSI), in partnership with and located at the East-West Center (EWC). Principal research faculty are from ASU, the Universi-

ty of Hawai'i (UH) Water Resources Research Center, Department of Natural Resources and Environmental Management, Richardson School of Law, and Sea Level Center, the University of Guam (UoG), and Clark University Department of Geography. Collaborators are at the USGS-Pacific Islands Water Science Center, and the Micronesia Conservation Trust.

During this third year of our Phase IV funding, Pacific RISA has accelerated research, outreach, and policy implementation with outcomes across all aspects of the program: engaging with Native Hawaiian and frontline or underserved communities; advancing modeling and visualization tools focused on the Island of Kaua'i as a research hub; leading authorship of the Hawai'i and Pacific Islands chapter of the Fifth National Climate Assessment; mapping compound flooding impacts; informing US federal agencies about the dual threat of invasive species and climate change, and initiating the next-generation of Pacific Islands Regional Climate Assessment (PIRCA) reports.

Figure 1: Pacific RISA serves the US Pacific Islands region, which includes Hawai'i, Guam, American Sāmoa, the Commonwealth of the Northern Mariana Islands, the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.



Accomplishments

FEATURED ACCOMPLISHMENT: NATURAL CAPITAL-INFORMED DECISION MAKING TO GUIDE CLIMATE ADAPTATION

In April 2018, the Island of Kaua'i experienced a record-breaking rainfall event that caused flash floods, landslides and millions of dollars in damage and destruction to private and public structures and homes. It also washed out critical bridges connecting communities on the island's North Shore. Despite being marketed as an elite resort and remote-work destination, Kaua'i as a whole is also often overlooked for community investment, and rural areas are disproportionately affected. Pacific RISA is working with the County of Kaua'i and several community organizations within disadvantaged areas to co-produce information needed for a natural capital approach to climate resilience. By compiling coastal ecosystem accounts and providing spatial information about the extent, condition, and use of coastal ecosystems, we are assessing how these tools benefit marginalized groups. The development of these tools is deeply integrated with community groups, ensuring the research is relevant and directly beneficial to the communities involved. Thus far, Pacific RISA PI Oleson and team have partnered with three Native-Hawaiian led community groups on Kaua'i: Kaua'i Sea Farm and Malama Hulē'ia, featured here, and the Waipā Foundation (see [Impacts](#)).

Kaua'i Sea Farm: Water Quality Data Collection and Staff Training

Nomilo Fishpond, located on the southwest shore of Kaua'i, is one of the oldest fishponds in the State of Hawai'i. [Kaua'i Sea Farm \(KSF\)](#) is a Hawaiian family-owned and operated business whose mission is "to preserve the integrity, health and well-being of Nomilo fishpond and surrounding coastline while developing sustainable production of shellfish and seafood products." In response to the need for information on fishpond dynamics under a changing climate, the team worked closely with KSF to implement a comprehensive water quality monitoring program. They trained staff on proper



Image 1: PI Oleson checking water quality monitoring samples at Kaua'i Sea Farm. Credit: Kirsten Oleson.

sampling techniques, data recording, and initial data analysis. Regular sampling and data collection sessions were held to ensure staff proficiency in sampling techniques and data handling, contributing to improved water quality management practices at the farm. This collaboration has empowered the community with the knowledge to monitor their water resources effectively. The ability to visualize water quality data will enhance their capacity to make informed decisions about aquaculture practices and environmental stewardship, and succeed in food and native species production goals.

Malama Hulē'ia: Linking Restoration Activities to Resilience through Evaluation

[Malama Hulē'ia](#) is a Native Hawaiian-led organization focused on the environmental restoration of the Alakoko fishpond, located near the Hulē'ia National Wildlife Refuge, about a half-mile inland from Nāwiliwili Harbor. Pacific RISA collaborated with Malama Hulē'ia to evaluate and connect fishpond restoration activities to broader climate resilience outcomes and to assist with the development of a comprehensive master plan for future restoration efforts. Over the past year, the team has participated in Malama Hulē'ia

workdays, engaging directly in restoration activities and immersing themselves in the fishpond environment, which helped them to gather valuable insights and to strengthen engagement with the community. As part of this ongoing collaboration, the team has contributed to Malama Hulē'ia's master plan by authoring a section on climate change and resilience.

The evaluation, led by graduate student Nyambega, aims to underscore the significant contributions of Malama Hulē'ia restoration efforts to the resilience of communities and ecosystems. This encompasses the restoration of traditional fishponds through mangrove removal, the revitalization of native species, and the enhancement of ecosystem services. This evaluation will serve as a baseline for future assessments to measure impact and success.

NEW FOCUS AREAS/PARTNERSHIPS

Cross-CAP Projects

Pacific RISA is a partner in two new cross-CAP projects funded by special Bipartisan Infrastructure Law awards. The first, "Enabling equitable adaptation to changing coastal flood risks through community-engaged modeling in the Carolinas and Pacific Islands regions," is in partnership with the Carolinas Collaborative on Climate, Health, and Equity (C3HE). It aims to conduct community-engaged research to support equitable flood resilience in Hawai'i and North Carolina. On O'ahu, Pacific RISA will work with community-based partner organization Kualoa-He'eia Ecumenical Youth (KEY) Project to develop local flood risk maps and engage community members to prioritize potential adaptation solutions for coastal communities on the island (focused on the North Shore, Northern Ko'olaupoko and southern Ko'olauloa). PIs Grecni and Shuler and graduate students Gorberg and Davis have started engaging with community partners, land stewards, and groups with an interest in managing resources and conducting 'āina (land stewardship) education. They hosted a booth at KEY Project Kalo Fest in March 2024, introducing the flood modeling project and leading educational and outreach activities on participatory flood mapping, sea level rise, and webcam siting. They successfully engaged many members of the community and did an educational demo of their new participatory flood mapping application.

The second project, "Stories as science: Integrating lived experience and community knowledge into actionable adaptation science," is in partnership with and led by the Northwest Climate Resilience Collaborative (NCRC). The NCRC is piloting a groundbreaking method for elevating first-hand experiences and visions of climate resilience and solutions, with the goal of incorporating community knowledge into efforts to prepare for climate impacts. In collaboration with the documentary storytelling organization Tikkun Olam Productions, NCRC and Pacific RISA will record the oral histories of frontline communities, the Shoalwater Bay Indian Tribe in the Pacific Northwest and Waimanalo on the Island of O'ahu, which face flooding and other climate change impacts. PI Keener has partnered with the UH Center for Oral Histories and introduced them to the NCRC team to share methods and workshops across the regions.



Image 2: Graduate student Davis (right) shares a sea level rise demonstration with community members at Kalo Fest. Credit: Zena Grecni.

UH Climate Resilience Collaborative/NOAA AdSci Digital Elevation Modeling

Resulting from prioritized research needs identified by the Federated States of Micronesia (FSM) PIRCA report (see Impacts), PI Keener is working with the UH Climate Resilience Collaborative on a NOAA AdSci-funded project to provide Digital Elevation Models (DEMs) of areas impacted by sea level rise and flooding on the islands of Pohnpei and Yap. PI Keener is coordinating survey plans and creating data-sharing agreements with the US Indo-Pacific Command (INDOPACOM), which is generating high resolution remotely-sensed imagery of key military resources in FSM. This could provide an opportunity for the AdSci team to focus DEM coverage on impacted community resources by leveraging INDOPACOM data products, and the project team is planning field visits to map communities via drone in Fall 2024.

Economic Valuation of the Guam Green Growth Initiative

This January, Pacific RISA was excited to welcome a new research project and PI to the team; Dr. Austin Shelton, Associate Professor and Director, UoG Center for Island Sustainability & Sea Grant, and Researcher Regine Biscoe Lee. The project will assess and quantify the economic impact of the Guam Green Growth (G3) Conservation Corps workforce development program and provide insight into the financial benefits and return on investment for these initiatives. Guam Green Growth is a public-private partnership created to achieve a sustainable future for Guam by developing tangible solutions to sustainability challenges and contributing to a green economy. In the first months of the project, UoG team members worked with PI Oleson to select and customize economic valuation methodologies from available literature, and collaborated with stakeholders and experts in environmental economics to refine valuation models and develop a standardized framework.

Figure 2: Example of indicators developed with stakeholders in Guam for evaluating the G3 goal of fostering healthy and prosperous communities, as well as the data that is required.

G3 FRAMEWORK	IMPACT INDICATOR	DATA NEEDED
Healthy and Prosperous Communities	Post-typhoon recovery hours	Specific tasks performed during post Typhoon Mawar recovery
	Island-wide beautification projects	Determination of which activities (e.g., picking up trash, painting murals, cleaning schools) are to be quantified for valuation
	Food crops planted	Clarification on whether volunteer hours for garden maintenance are already accounted for in other indicators Types and quantities of crops planted at the G3 Community Garden.
	Food commodities distributed	Types and quantities of food items distributed Number of recipients

RESEARCH HIGHLIGHTS

The Hawai'i and Pacific Islands Chapter of the 5th National Climate Assessment (NCA5)

The White House released the Fifth National Climate Assessment (NCA5) in November 2023. NCA5 “Chapter 30: Hawai'i and US-Affiliated Pacific Islands” was written by 16 authors, including five Pacific RISA PIs (Frazier, Keener, Grecni, Oleson, and Shuler) and Advisory Committee member Malia Nobrega-Oliveira. The assessment concluded that climate change in

Hawai'i and the Pacific Islands worsens inequities and threatens ecosystems, cultural resources, human health, livelihoods, the built environment, clean water, and healthy food. The chapter had 41 technical contributors, was backed by nearly 500 citations from published literature, and emphasized historic climate data inequities across the region that continue to impact community resilience and adaptive capacity. Pacific RISA authors engaged in multiple outreach activities to publicize findings from the chapter (see Outreach and Engagement).

O'ahu Community Heat Assessment (August 31, 2019)

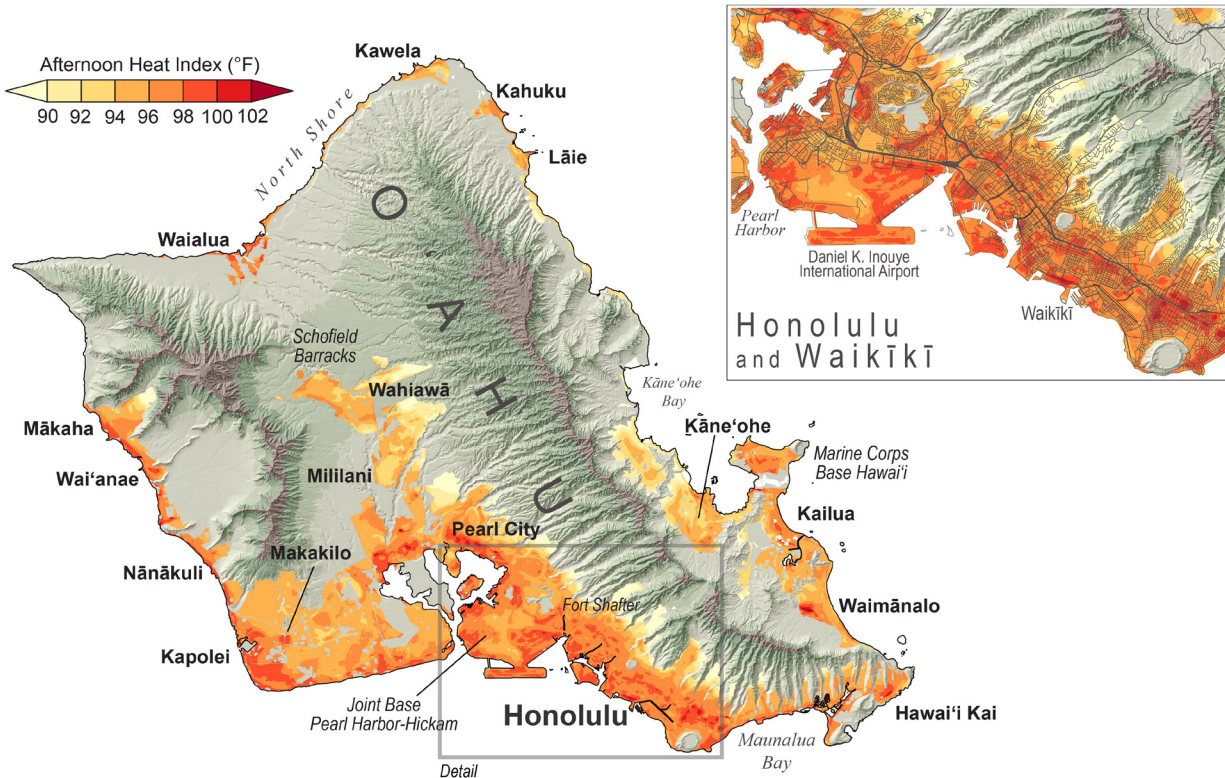


Figure 3: This community heat assessment map featured in Chapter 30 shows the afternoon heat index and “hotspots” for the Island of O’ahu, Hawai’i on August 31, 2019. On this day, the high temperature tied the hottest-ever recorded for Honolulu. Multiple neighborhoods on O’ahu experienced afternoon heat indices above 100°F, with a maximum recorded heat index of 107.3°F. *Figure credit: Arizona State University, University of Hawai’i at Mānoa, NOAA NCEI, and CISS NC, based on City and County of Honolulu data.*

Cross-Regional Challenges and Priorities for Climate-informed Invasive Species Management

In recent decades, substantial evidence has accumulated regarding the effects of climate change on the establishment, spread, and impact of invasive species. While the importance of incorporating climate change into invasive species management and policy is increasingly recognized, practitioner experiences and perspectives are often overlooked. PI Brewington collaborated with an interdisciplinary and multi-regional team of researchers from the national Regional Invasive Species and Climate Change (RISCC) Management Network to compare survey responses from natural resource managers across four regions of the United

States, including the Pacific Islands. The team identified common priorities and challenges in managing invasive species in a changing climate. Understanding how climate change may impact control strategies was consistently identified as a high priority for invasive species management, followed by identifying resilient ecosystems and range-shifting taxa. On the other hand, common barriers to climate-informed invasive species management include limited time, funding, and personnel. These results demonstrated the critical need for stronger researcher-practitioner networks, like the regional RISCC teams, and greater investment in research and policy topics that more closely align with management needs to address the interacting stressors of invasive species and climate change.

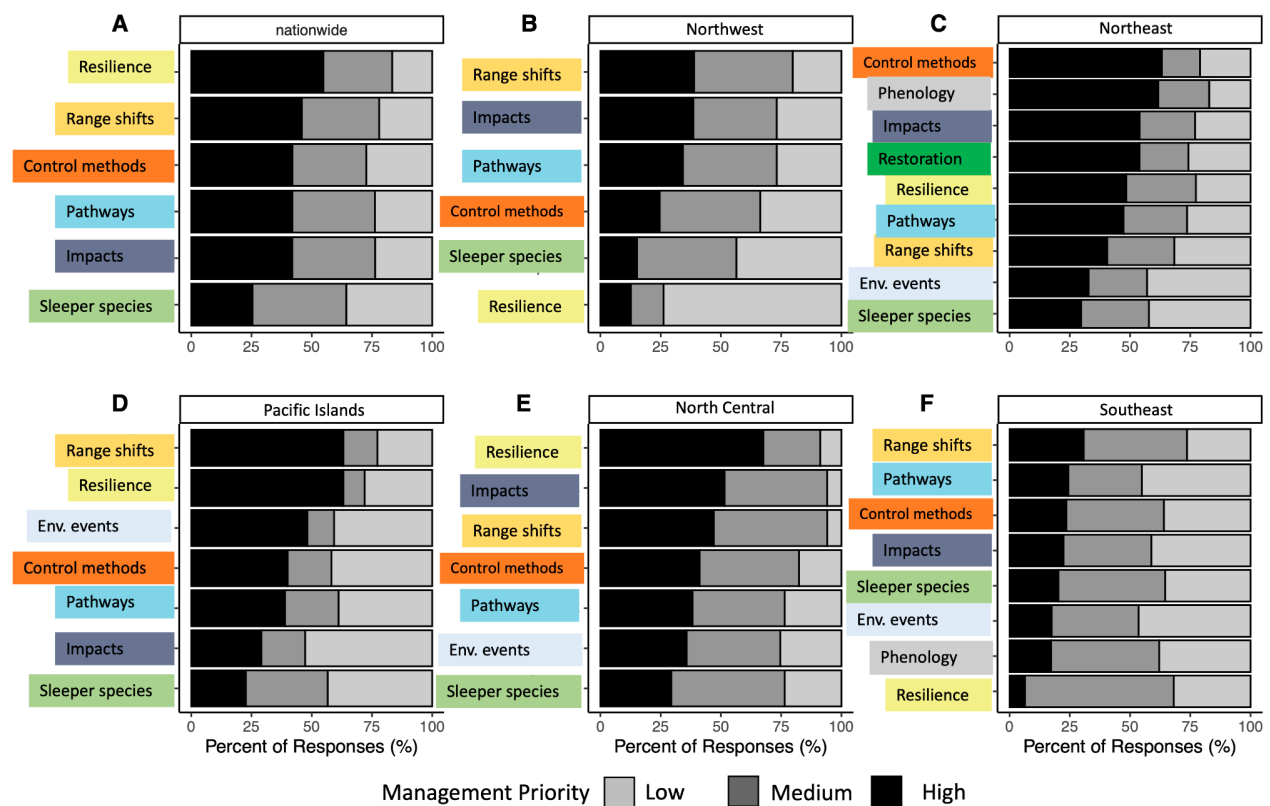


Figure 4: Percent of responses by survey participants across the United States (nationwide) and within each RISCC region when asked to rank each invasive species research topic in terms of "low", "medium", or "high" priority for informing management. Percentages are relative to the sample size for each individual research topic that was offered as a response option in each RISCC survey. *Figure credit: Evans et al. In Review.*

Peer-to-Peer Knowledge Exchanges on Island Resilience Planning

Since 2021, Pacific RISA has engaged in applied adaptation research with county-level partners from the Island of Kauaʻi. Based on four knowledge exchange activities held with the Kauaʻi Resilience Team, county departments within the State of Hawaiʻi, the City of Boston, and others, PIs Keener and Brewington have assessed the goals, activities, and outcomes of each exchange, and identified the factors or best practices that contributed to the success of the exchanges on information sharing and climate resilience planning. This assessment has provided strategic insights into how a peer-to-peer exchange approach can help foster transformational adaptation to meet the rapidly growing needs of commu-

nities that are experiencing the impacts of climate change. Exchange outcomes have been conceptual, instrumental, and symbolic, including: new Sea Level Rise Constraint District legislation that made Kauaʻi County one of the first municipalities in the United States to regulate construction based on the future sea level rise impacts; a deeper understanding of state-wide frameworks related to adaptation and managed retreat; and the use of peer exchanges as a model for transparent and inclusive community engagement and communication. This ongoing Pacific RISA project demonstrates how knowledge exchanges can help inform and accelerate strategic guidance that is assisting government officials in identifying strategies, gaps, and methods for inclusive and effective adaptation planning.

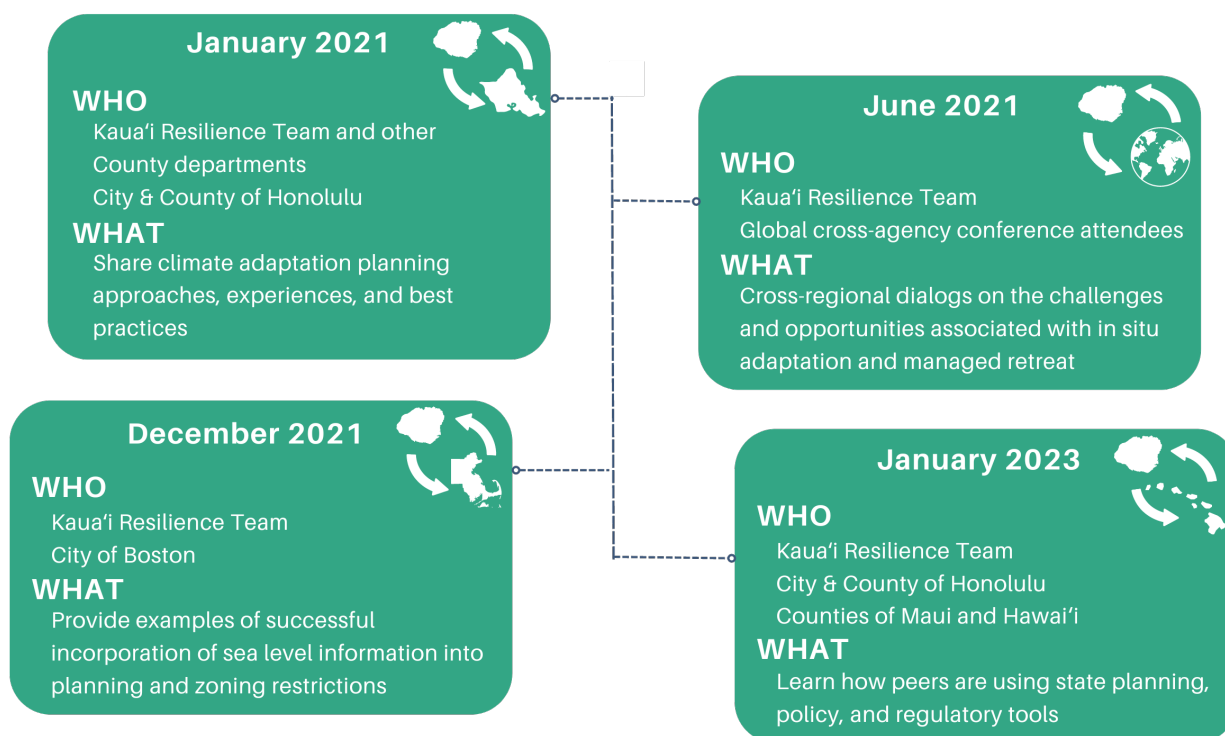


Figure 5: Timeline and goals of the four exchange activities that Pacific RISA has led between the County of Kauaʻi and peer cities and counties. A publication on the exchange process and outcomes is forthcoming. *Figure credit: Brewington et al. In Review.*¹

Invasive Species Reduce US Resilience to Climate Change

As a member of the US Invasive Species Advisory Committee (ISAC), PI Brewington co-chaired a subcommittee focused on the intersection between climate change and invasive species, specifically the implications for US federal climate adaptation planning and policy. The subcommittee reviewed 26 Climate Change Adaptation Plans from US federal agencies, identifying gaps and opportunities in integrating invasive species considerations. Based on this gap analysis and engagement with federal government

representatives and partners, they developed five recommendations that emphasize the need to explicitly incorporate invasive species into national climate adaptation guidance, increase support for relevant research networks and programs, integrate invasive species science into international treaties, ensure climate-informed early detection and rapid response, and invest in long-term management strategies. After being formalized into a [white paper](#) and adopted by the full ISAC, many of these recommendations are already being incorporated in federal updates to existing Climate Change Adaptation Plans.



Figure 6: Although developed based on US federal plans, the ISAC recommendations can be used by state and local, as well as international, jurisdictions who are tasked with implementing climate-adaptive policies to build resilience across multiple sectors. *Figure credit: ISAC 2023.*



Image 3: Rain bands surrounding Hanalei Bay near the mouth of the Hanalei River. *Credit: Nadine/Adobe Stock.*

Flood Inundation Mapping for Kaua'i's North Shore

PI Shuler and graduate student Gorberg have continued to calibrate the Gridded Surface Subsurface Hydrologic Analysis (GSSHA) model they are developing to model compound flood impacts due to extreme rainfall in Kaua'i's North Shore area. A physics-based, hydrologic, sediment transport model, GSSHA integrates hydrologic model statistical techniques with various observed extreme rainfall events in Hanalei. The team has met with NOAA and other stakeholders on Kaua'i to develop a prototype of stream gage height interval flood maps and has also collaborated closely with Advisory Committee members Ka'aina Hull and Ruby Pap

at the County of Kaua'i to discuss the model and the compound flooding scenarios. In the process, they have calculated the maximum discharge for various return periods (20, 50, 100 years) using the distribution of peak flows at the Hanalei stream gage, which were used to create flood maps for various stream gage heights in Hanalei (6, 10, 14, and 18 feet). They then applied three sea level scenarios to each gage height flood map (0 feet = sea level, 4.0 feet = sea level rise, 8.2 feet = sea level rise plus maximum tide level) to simulate compound impacts. NOAA's National Weather Service Office in Hawai'i has added these maps to their flooding viewer, and the maps could also be used by stakeholders in proposals to mitigate flooding on the Hanalei River.

Flood Inundation Depth Maps Using Various Gage Height and Sea Level Scenarios

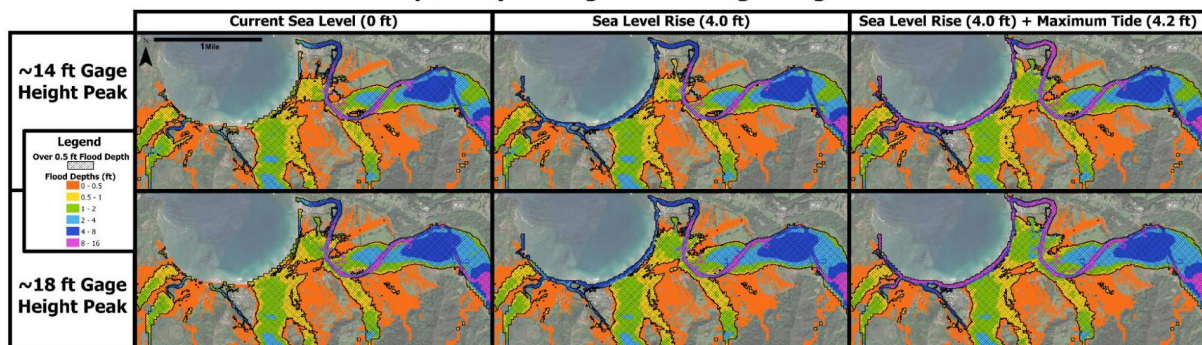


Figure 7: Hanalei River surface water flood maps generated using the GSSHA model. These maps show the maximum flood depths under different scenarios, including various river gage heights and sea level rise conditions. The comparison illustrates how flood risks change with different water levels, helping to identify areas most vulnerable to flooding along the Hanalei River. *Figure credit: Chris Shuler.*

The Hidden Consequences of Sea Level Rise: Groundwater Inundation

In the Pacific Islands region, sea level rise could be greater than 7 feet by the end of the 21st century. On the Island of Tutuila, American Sāmoa, apparent sea level rise is five times the global average, making adaptation planning critically important. PI Shuler led a Pacific RISA project to investigate the threat that groundwater inundation, a lesser-known impact of sea level rise, poses to buried infrastructure in Tutuila. In the first study of its kind in the South Pacific, the team found that with ~7 feet of sea level rise, American Sāmoa will face significant groundwater inundation of nearly half (45%) of its buried and over a quarter (28%) of its surface infrastructure. By combining a numerical groundwater model with buried and surface utility data, they were able to map where adaptation efforts should be prioritized and address a serious climate impact knowledge gap regarding American Sāmoa’s infrastructure. These effects are often overlooked by or unknown to policy and decision makers, so raising awareness of groundwater-based inundation can help managers in American Sāmoa and other island communities prioritize holistic adaptation actions.

Integrating Science and Policy to Support Flood Management in Palau

Sea level rise in Palau is driving increased concerns among its inhabitants about the impacts of flooding on infrastructure such as low-lying roads and causeways, the vulnerability of the national hospital and its surrounding facilities, saltwater intrusion into agricultural areas, and the inundation of low-lying communities, housing, schools, and cultural landmarks. With support for international work from the US State Department, Pacific RISA is using social and physical research to bridge the gap between science and policy to help enable Palau to assess and address these evolving challenges. The team is collaborating with NOAA, the UH Sea Level Center (UHSLC), and the Local2030 Islands Network to develop a set of flooding impact indicators designed to provide information to support flood risk management and adaptation planning in Palau.

In 2024, Project Specialist Moehlenkamp conducted 15 interviews with key stakeholders in Palau to better understand historic flooding impacts, locations of high concern, and identify data gaps and information needs. This engagement will frame a quantitative data analysis focused on developing threshold toler-

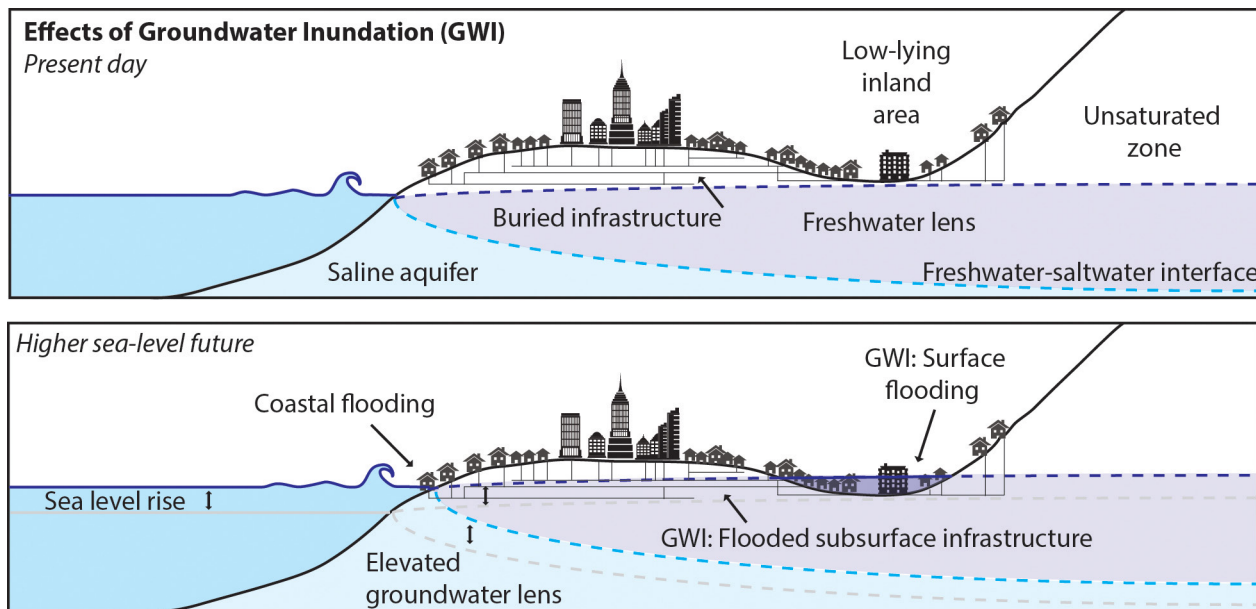


Figure 8: Conceptual diagram of groundwater inundation due to sea level rise. Figure credit: Shuler 2023.

ances (or indicators) for multiple flood-prone areas in Palau—a critical step in linking sea level rise data to on-the-ground impacts. Through continued close collaboration with partners in Palau, this research will help support Palau’s sustainability goals and inform national adaptation plans and climate policies. Moreover, this information can be seamlessly integrated into Palau’s recently launched [Sustainable Development Goal Dashboard](#), ensuring ongoing monitoring and evaluation of flood-related impacts as well as action and response initiatives. Results from interviews are currently being analyzed.

Improving Rainfall Projections for Hawai‘i

Graduate student Sanfilippo is leading Pacific RISA’s work to test predictors in a downscaling model to project future rainfall in Hawai‘i. With thousands of

predictor sets proving similarly skilled in representing rainfall in the historical time period, a range—or ensemble—of predictor sets may be better able to account for the variance that could result from predictor selection in future projections. This approach shows improvements when applied to the most recent statistical downscaling model for Hawai‘i. Sanfilippo conducted validation by projecting future rainfall for 17 General Circulation Models (GCMs) for CMIP5 scenario RCP 4.5 using both a well-supported and poorly-supported predictor set ensemble. Her results demonstrated that using a statistically-supported ensemble of predictor variable sets leads to lower variance and higher sign agreement within the ensemble compared to an ensemble with low statistical support. New rainfall projection datasets will be made available on the Hawai‘i Climate Data Portal in the near future.

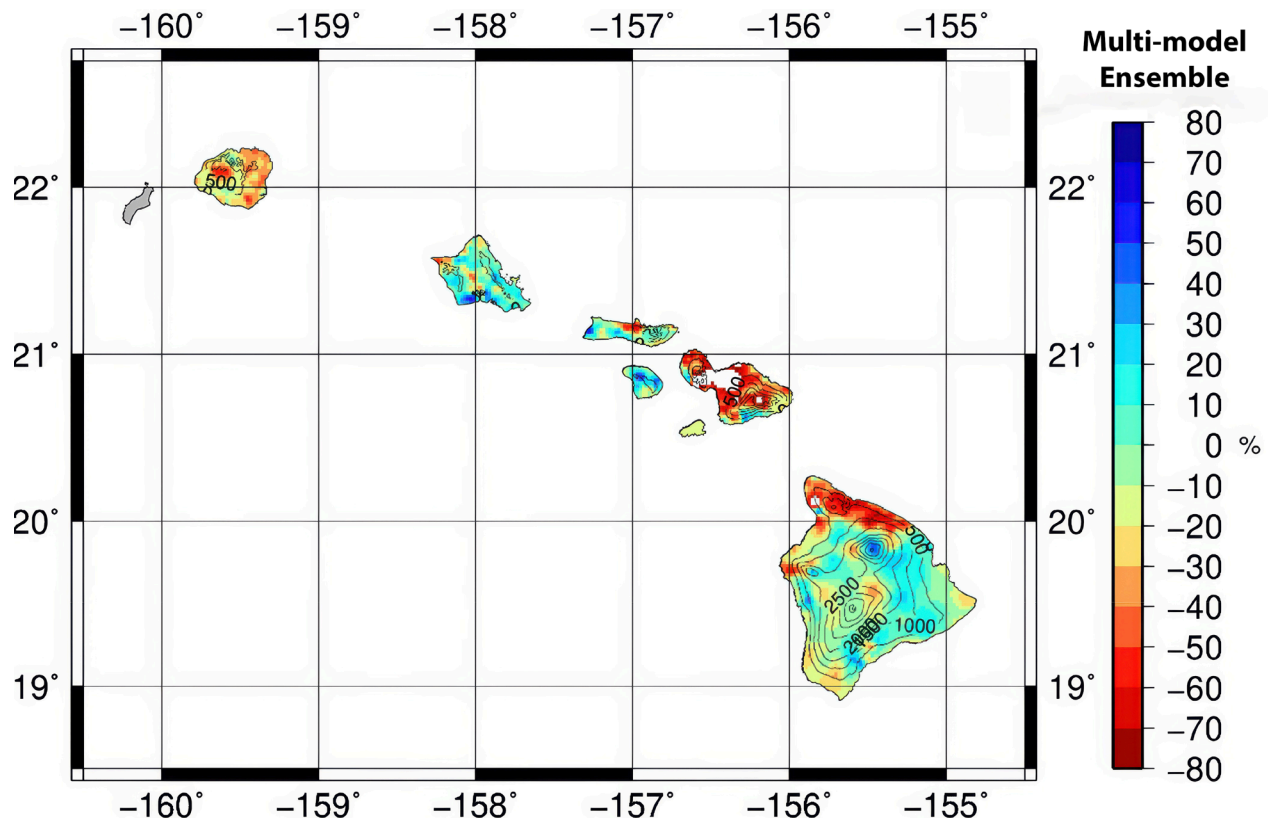


Figure 9: The multi-model mean wet season rainfall percentage change for the end of the century for CMIP5 scenario RCP 4.5 over the Hawaiian Islands using the highly ranked 100-predictor ensemble. Figure credit: Sanfilippo et al. 2023.

OUTREACH AND ENGAGEMENT

International

- **Local2030 Islands Network Data for Climate Resilience:** Pacific RISA Project Specialists Moehlenkamp and Bryson attended the Local2030 Islands Network convening of the [Data for Climate Resilience Community of Practice](#) and [Sustainable and Regenerative Tourism Community of Practice](#), in partnership with NOAA, in April 2024 in Honolulu. They facilitated a session for the Data for Climate Resilience Community of Practice titled, “Climate Services Engagement,” in collaboration with NOAA Climate Services Director Dr. John Marra and the Data and Reporting Officer for the Palau Office of Climate Change, Mikayla Etpison. The session provided the outcomes of the 2024 Climate Services and Coordination Workshop held in Palau, an overview on the Climate Action Pathway—a framework developed to connect in-country high level adaptation goals to actionable data and indicators—and explored how to engage the right stakeholders for the successful implementation of climate services to support decision-making in participants’ home islands.
- **INDOPACOM 2023 Invasive Species Forum:** PI Brewington delivered a keynote address at the July 2023 Invasive Species Forum (ISF) held by US INDOPACOM in Guam. The ISF, which was a result of INDOPACOM’s participation in the [2022 Pacific Ecological Security Conference](#) led by Pacific RISA, solicited input from Pacific Island countries and territories that is driving Department of Defense funding competitions around next-generation technologies, research, and development for dealing with invasive species threats. As at the PESC, building climate resilience, food security, and island sustainability were key themes at the ISF. Attended by the Governor of Guam and Rear Admiral Greg Huffman from Joint Region Marianas, as well as federal partners from the United States, Australia, and New Zealand, the ISF elevated the issue of Pacific Island invasive species to high-level audiences, and working groups delivered a set of proposal items and actions needed to tackle these big-picture threats to island economies, ecosystems, and cultures.

Regional

- **Palau Sector-based Climate Services and Coordination Workshop:** The Pacific RISA team traveled to Koror, Palau in February 2024 to facilitate the [Sector-based Climate Services and Coordination Workshop](#). The workshop was funded by the Green Climate Fund and organized by Project Specialist Bryson in collaboration with NOAA, UH, the Palau Ministry of Finance Bureau of Budget and Planning, Palau Office of Climate Change, and the Palau Weather Service Office. The goals of the workshop were two-fold: 1) facilitate



Image 4: Participants map climate events and impacts during the 2024 Palau Climate Services Workshop. Credit: Krista Jaspers.

the development and delivery of locally relevant and impact-driven climate products to support sector-based decision-making in Palau; and 2) foster increased alignment and coordination of climate projects in Palau. To this aim, technical and regional partners were invited to attend to support this objective and help to reduce redundancy and stakeholder fatigue by using this gathering as an opportunity to help align the many different climate initiatives. The more than 100 participants included representatives and decision makers in Palau from sectors impacted by a rapidly changing climate, as well as other representatives from local, national, and regional agencies, institutions, and non-governmental organizations with an interest in understanding and predicting climate change, its impacts, and adapting to them.



Image 5: PI Widlansky and participants from the sea level training workshop visit a tide gauge at Malakal Harbor, Palau. Credit: Matthew Widlansky.

- **Palau Sea Level Workshop:** PI Widlansky facilitated a sea level training workshop in Palau in coordination with the Palau Climate Services Workshop. The Republic of Palau is using the UHSLC Station Explorer tool to better understand sea level variability, and during the workshop PI Widlansky provided technical assistance to users and boosted learning outcomes related to understanding tidal datums, water level predictions, sea level rise, and flooding impacts. Feedback from workshop participants was positive and they were especially appreciative of the hands-on learning activities, which included educational game play (Sea Level BINGO), exercises (build a Datum Stick), and a field trip to visit the tide gauge. Based on feedback from the workshop, PI Widlansky plans to build capacity for sea level monitoring by installing three additional tide gauges. Equipment funds will be leveraged from other projects, and research is planned to investigate using large-language model

technology to improve communication about sea level data.

- **Pacific Invasive Species and Climate Change:** The many webinars, workshops, and presentations held by the Pacific Regional Invasive Species and Climate Change (Pacific RISCC) Management Network over the past year were selected in response to the diverse interests and concerns of network members. The Pacific RISCC Core Team regularly asks members to submit priority topics to be covered and identifies appropriate speakers or forums to meet that need. In the aftermath of the Maui wildfires, the Pacific RISCC team was inundated with requests for information and a safe space to talk about the role that invasive species played in the disaster. These forums also provide a way to exchange information between islands or jurisdictions, or to identify new collaborators that can be called on for technical assistance.

- Enhancing Pacific Ecological Security through Research, Outreach, and Exchange:** PI Brewington briefed agency representatives from the National Invasive Species Council (NISC), NOAA, USDA, and DOI on the [ISAC white papers](#) produced in 2023, which contain key recommendations for the federal government around integrating invasive species into policies addressing climate change and underserved communities. She has also given multiple presentations to stakeholders and decision makers in Hawai'i and Guam about the content of the papers and how they can be used by local governments. These papers and subsequent outreach activities emphasize how the impacts of climate change and invasive species are inextricably linked in the Pacific Islands region, and how the Pacific RISCC management network is working at the intersection of these threats to build resilience. At the federal level, the white papers are now being used to update federal agency

Climate Change Adaptation Plans and inform new opportunities for cross-agency programs to build resilience across the nation.

- University of Guam Conference on Island Sustainability:** PIs Brewington, Oleson, and Shuler attended the 15th annual [University of Guam Conference on Island Sustainability](#) in Guam in April 2024. Under this year's conference theme, "Sustainability Endures," PI Brewington presented on the US Invasive Species Advisory Committee's recent [white paper](#) recommending federal action on invasive species and climate change, PIs Oleson and Shuler represented the NCA5 Hawai'i and Pacific Islands chapter team at a Guam-focused workshop session, PI Oleson participated in a high level panel about policy and economics, and PI Shuler joined a session on climate adaptation and shared insights from the [American Sāmoa Climate Data Portal](#).



Image 6: UOGCIS panel discussion with Chris Avery, Chief of Staff, National Climate Assessment at the US Global Change Research Program, PI Shuler, PI Oleson, and Romina King, PI-CASC at UOG lead. Credit: Laura Brewington.



Image 7: Lāhainā Town in the immediate aftermath of the fire. *Credit: Elyse Butler.*

State

- **Maui Wildfires:** In August 2023, a fast-moving wildfire devastated the town of Lāhainā, Maui, and ultimately became one of the deadliest wildfires in United States history. High winds with gusts up to 80 miles per hour were recorded on the dry, leeward slopes of the Hawaiian Islands due to Hurricane Dora, which passed 550 miles to the south of the archipelago. With dry conditions resulting from a summer of extreme drought, the risk of fire in Hawai‘i was already high when the gusting winds likely caused the start of the fire and then accelerated it while also grounding the firefighting helicopters. Invasive grasses, a consequence of Hawai‘i’s plantation history, cover over a quarter of the land in the state and burned quickly in the fire that was responsible for billions of dollars in damages and the displacement of thousands of residents. These devastating fires in Lāhainā and elsewhere in Hawai‘i and the Pacific Islands are clear examples of the synergistic effects of invasive species and a changing climate, and an area of focus for PI Brewington through the Pacific RISCC

management network. The 2023 ISAC [white paper on climate change and invasive species](#) references this intersection (see Publications). In response to the fire, Pacific RISA developed a [web page](#) with resources for understanding the context and science of wildfire in Hawai‘i and the Pacific Islands. As the devastating impacts of the fire continued to unfold, the team also responded to [numerous media interviews](#) and requests for information.

- **Hawai‘i Climate Week Conference:** In March 2024, for the sixth year, Pacific RISA co-hosted the [Hawai‘i Climate Conference](#) as a collaboration with the US Global Change Research Program, the [Hawai‘i Climate Change Mitigation and Adaptation Commission \(CCMAC\)](#), UH Sea Grant, Pacific Island Climate Adaptation Science Center (PI-CASC), UH Mānoa, and the USDA Southwest Climate Hub. The event featured the rollout of the NCA5 regional chapter and the official launch of the [CCMAC Comprehensive Climate Action Plan](#). Staff from the US Global Change Research Program, along with authors of the Hawai‘i and US-Affiliated Pacific Islands (USAPI) chapter, hosted the



Image 8: NCA5 panel at the Hawai'i Climate Conference. From L to R: Phoebe Woodworth-Jefcoats, Richard Wallsgrove, PI Oleson, Malia Nobrega-Olivera, Allyza Lustig, PI Grecni, Christian Giardina, and PI Keener. Credit: Krista Jaspers.

NCA release event with overview presentations and a panel discussion and Q&A, followed by small group breakout discussions led by authors and organized around key sectors highlighted in the chapter. Discussions identified partners and projects to help implement adaptation actions and gaps that could be addressed in NCA6.

- Maui Mayor Sustainability Series:** PIs Frazier, Oleson, Shuler, Grecni, and Keener were invited to Maui by the Mayor's Sustainability Office to speak about NCA5 chapter findings and implications. During two trips in February and March 2024, authors presented key findings and impacts for Mayor Richard Bissen's Sustainability series, hosted by his Office of Innovation and Sustainability. Presentations consisted of a public presentation at the University of Hawai'i Maui College and a presentation at the County executive building to Executive Branch staff and contractors. Giv-

en the devastation of the Maui wildfires, special consideration and discussion was given to chapter findings around the relationship between climate and wildfire, and discussions focused on policies and management to help understand and mitigate future wildfire risk. PI Keener was also invited to summarize climate impacts from NCA5 and related policy implications at the [State of Hawai'i Joint Senate-House Climate Change Informational Briefing](#) in January 2024, sponsored by State Senator Gabbard and the Senate Committee on Agriculture and Environment.

- Honolulu City Council:** In September 2023, PI Keener, Vice-Chair of the Honolulu Climate Change Commission, was invited to present to the Honolulu City Council committee on Housing, Sustainability, and Health on the Commission's updated [Climate Change Brief \(2023\)](#). Watch Vice-Chair Keener's testimony [here](#) (starting at

Image 9: Joshua Cooper and PIs Oleson, Frazier, and Shuler on Maui. Credit: Abby Frazier.



1:32:46). Chief Resilience Officer Matt Gonser followed with a presentation on the forthcoming island-wide adaptation plan, [Climate Ready O‘ahu](#).

- **Climate Roundtable:** In January 2024, PI Giambelluca convened a climate roundtable meeting between Pacific RISA members, the Honolulu Board of Water Supply, the Commission on Water Resource Management, Hawai‘i Mesonet, Hawai‘i Climate Data Portal, and Hawai‘i Established Program to Stimulate Competitive Research (EPSCoR) to promote communication of climate science to end users in Hawai‘i. The meeting included an overview of potential global climate change effects in the Hawai‘i region as well as more specialized presentations including Hawai‘i climate trends, detection and attribution of human-caused climate change in Hawai‘i, new downscaling approaches, climate monitoring and data visualization, and the [Hawai‘i Climate Data Portal](#). Structured discussion and Q&A was built into the meeting schedule to gather information on gaps and needs from end users and stakeholders as well as to address questions about the content of the presentation. An entrance and exit survey was administered to gather information about user needs, knowledge gaps, and the effectiveness of the meeting. The meeting was a success in spurring conversation between producers and users and it paved the way for additional meetings and discussions to be held.

NEXT STEPS

Pacific RISCC Strategic Planning and Updated Network Survey

The Pacific RISCC Core Team and newly-established Science Advisory Team met in person in August 2024 to develop a five-year Strategic Plan and research agenda. The Pacific RISA-supported Regional Research Coordinator, Dr. Andrea Blas, will finalize a survey that will be distributed to the full Pacific RISCC network to better understand the priorities and challenges of invasive species managers in the context of climate change. As an update to the Pacific RISCC 2019 survey of Hawai‘i-based managers, this survey aims to facilitate and improve communication between scientists and natural resource managers on invasive species and climate change, and update

management priorities for the expanded region that now includes the entire USAPI. Because climate change is likely to cause invasive species management priorities and approaches to shift, new information from the network will help the Pacific RISCC better understand current needs and gaps so that we can continue to develop and disseminate relevant research and management tools/resources.

The Pacific Islands Center of Excellence for Climate and Invasive Species Resilience

In early 2024, PI Brewington collaborated with the UoG on a \$40mn proposal to the NOAA Climate Resilience Regional Challenge. If funded, the project team will create a Pacific Islands Center of Excellence for Climate and Invasive Species Resilience (PCCISR), which envisions building regional resilience in Micronesia by reducing risks and damage from the compounding impacts of climate change and invasive species. The proposed activities will align with existing initiatives, networks, and plans in the Micronesia region and the broader Pacific Islands, including those of Pacific RISA and other regional partners. Leveraging partnerships and collaborations with federal, regional, and international entities, including the US Departments of Agriculture, Commerce, Interior, and Defense, the USGS Pacific Islands Climate Adaptation Science Center, and various organizations such as Micronesia Conservation Trust, The Nature Conservancy, and Island Conservation, the PCCISR aims to advance resilience-building actions outlined in climate plans, biosecurity plans, and regional strategies—such as those developed during the 2022 Pacific Ecological Security Conference that was funded in part by NOAA.

American Sāmoa Basin Study

PI Shuler has been working with the American Sāmoa Power Authority (ASPA) to successfully apply to the Bureau of Reclamation Basin Study Program to obtain an ~\$1.8mn grant to conduct an American Sāmoa Basin Study. These funds will be portioned between ASPA, Bureau of Reclamation, and UH, with PI Shuler responsible for ~\$700k to develop future climate informed salt-water intrusion models that will assess the viability of freshwater resources throughout the entire island of Tutuila.

Impacts

ADVANCING PACIFIC RISA'S INTERNAL AND EXTERNAL EVALUATION

Pacific RISA's evaluation encompasses both internal and external projects that iteratively learn from the program's role in advancing adaptation planning in the region and thus contribute to assessing the value of the overall program. In this project year, Pacific RISA researchers worked with External Evaluator Dr. Susi Moser to develop appropriate frameworks to integrate equity and justice metrics and indicators into both program and project specific evaluations. At the start of Year 3, Dr. Moser led a thought exercise on four types of equity: procedural, related to processes that are inclusive and allow people to be heard; distributional, related to the fair and equal distribution of risks and outcomes; structural, related to institutional arrangements, norms, and power; and epistemic, related to ways of knowing and types of knowledge that are valued. The team then discussed how equity measures could better be integrated into each project's activities, objectives, and outcomes. Researchers reflected on ways to track equity-focused indicators through the Pacific RISA Action Logic Model (ALM) and how they

could be utilized to drive and improve project-based equity for different audiences and purposes.

All PIs and their project staff then had individual meetings with Dr. Moser to discuss how metrics and indicators of equity and justice could be considered and incorporated into each project, and independently did an exercise to conceptualize and define elements of equity and justice in both their individual projects and the program as a whole. Teams brainstormed indicators relevant to different types of equity within their projects, metrics by which they would track equity, and examples of current project metrics. The Pacific RISA Core Team reviewed all project indicators and identified program-relevant variables that could be applicable to annual reporting, which Dr. Moser synthesized. She is currently working with the Core Team to finalize recommendations for formally integrating equity and justice into evaluation² and the Pacific RISA ALM, which is already well suited to include these new considerations. She noted that the thought exercise researchers completed through this process is already being incorporated into projects and making them more inclusive and more user-targeted, iteratively improving program outcomes. These recommendations will be implemented in the next program year.

	Indicator	#		Indicator	#
PROCEDURAL	Participation by underserved groups	9	DISTRIBUTIONAL	High geographic coverage and access to info	4
	Diversity of participants in projects (women, youth, elders, Indigenous, sectors)	9		Reach and benefit to underserved or vulnerable communities	4
	Increased usefulness and use of products due to stakeholder input	7		Distribution of impacts and benefits of adaptation	3
	Trust and transparency in the research process	5		Equitable improvements in resilience	3
STRUCTURAL	Adaptive capacity and knowledge are improved	6	EPISTEMIC	Traditional/Indigenous knowledge is respected and incorporated	6
	Impact on policies that aim for more equitable outcomes	5		Project and participant teams are diverse and include Indigenous, frontline, women, youth	3
	Funding is increased and equitably distributed	2		Diversity of disciplinary and expert knowledges are equally heard, respected, and visible	10
	Insights are transferred	1			

Figure 10: Number of Pacific RISA projects tracking specific evaluation indicators for advancing procedural, distributional, structural, and epistemic equity across projects and at the program level. *Figure credit: Moser 2024.*

² Moser, S.M. (2024). Measuring & Tracking Equity in the Work of the Pacific RISA: A Working Equity Framework for Evaluation. Susanne Moser Research & Consulting, Hadley MA.



Image 10: The 2022–2024 ISAC cohort at the November 2023 meeting in Washington, DC. Credit: Laura Brewington.

SOCIETAL IMPACT

Frontline Communities and the Impacts of Climate Change and Invasive Species

The majority of the USAPI region is home to many underserved and historically marginalized communities. The region is also on the frontlines of the climate crisis, and invasive species only further undermine the resilience of ecosystems, livelihoods, and cultural traditions. The loss of endemic and vital plants and trees, such as the coconut tree, has deep cultural significance to the people of the Pacific Islands, whose identities and livelihoods are often tied closely to their land and seas. The Pacific RISCC Core Team and broader Listserv membership are representative of underserved and frontline communities that are engaged with on a regular basis, with over half of members of the Pacific RISCC Core Team being from the USAPI; about a third of Listserv members from underrepresented jurisdictions (i.e., outside Hawai‘i but in the USAPI); 17% of Listserv members representing communities or community-based organizations; and over half of Listserv members being women.

As a member of the ISAC, PI Brewington also contributed to a [white paper](#) that was focused on how invasive species impact underserved communities within the United States. The paper identified key ways that invasive species impact underserved communities, sometimes disproportionately, and how there are both individual and compounded or synergistic impacts with climate change. The authors offered a set of best practices and recommendations that can help guide agencies in meeting the needs of underserved communities regarding invasive species. Because many underserved communities are not mappable, especially those within the USAPI, some are not reflected or identified in federal tools for equity and environmental justice, such as the Climate and Economic Justice Screening Tool (CEJST). Furthermore, CEJST was not built to include invasive species, their impacts, or how they may intersect with or be exacerbated by climate change. The paper therefore maintains that CEJST should not necessarily determine how to provide support concerning invasive species projects, while simultaneously calling for national initiatives to work with underserved communities to collect invasive species data in both spatial and temporal formats.



Image 11: By participating in fishpond restoration with Malama Hulē'ia, Pacific RISA is directly supporting a growing movement to restore Native Hawaiian fishponds. *Credit: Kirsten Oleson.*

Community Engagement with the Climate Data Portal in American Sāmoa

PI Shuler hosted an in-person workshop in collaboration with the Pacific Drought Knowledge Exchange covering the American Sāmoa Climate Data Portal (ASCDP). This was the first event to formally introduce local stakeholders to the ASCDP, and the event was held in American Sāmoa at the AS-EPA headquarters in February 2024. The ASCDP is intended to bolster the territory's climate adaptation success and resilience. The workshop fostered community engagement for improved climate resilience. Participants discussed the portal's development, engaged in a feedback session using Jamboard, and explored potential internship opportunities, with a commitment to incorporate the feedback for better portal functionality and community impact.

Ecosystem-based Adaptation for Vulnerable Communities in Hawai'i

The activities led by PI Oleson on the Island of Kaua'i are collectively enhancing the resilience and sustainability of local ecosystems and communities. By building strong relationships, providing training, and engaging in hands-on restoration and planning, we are supporting the long-term health and vitality of Kaua'i's natural and cultural resources. The next step will be to empirically investigate the causal pathways linking natural resource management and ecosystem services to social and biophysical resilience to inform the design of ecosystem-based adaptation, again with a focus on vulnerable groups dependent on nature for their wellbeing.

NARRATIVE CASE STUDIES

Advancing Community Resilience Solutions through the Waipā Foundation

Located along Hanalei Bay on Kaua'i's North Shore, the Waipā ahupua'a (watershed) is part of a rural area that has been disproportionately impacted by extreme rainfall and flooding in recent years. The [Waipā Foundation](#), a Native Hawaiian-led organization focused on environmental restoration, has been implementing multiple projects in Waipā, most notably stream restoration and coastal erosion projects. Pacific RISA is working with them to evaluate the



Images 12–13: Pacific RISA team members hosted a table at the Waipā Āina Festival on Kaua'i's North Shore in May 2024, where they surveyed the community (and some tourists) about their connections to Waipā, the challenges that they have experienced/anticipate, gathered suggestions for solutions to these challenges, and collected feedback on plans that have already been implemented. *Credit: Kirsten Oleson.*

outcomes of these projects and connect their restoration activities to broader resilience outcomes.

The first product developed through this partnership is a “ridge-to-reef” systems map showing the interconnections between different parts of the ecosystem and the impacts of human activities and climate change on them. Community members were able to add their input to the map at the May 2024 Waipā Festival, ensuring that stakeholder priorities and insight were also incorporated. Analyzing the before-and-after status of these projects will allow the team to determine how efficient they have been by highlighting areas where the projects have been effective and where they are still lacking. Efforts will then be modified in accordance with these results in order to best restore Waipā’s environment and preserve and perpetuate Hawaiian culture.

Policy Implementation in the County of Kauaʻi

Pacific RISA’s knowledge exchange program between peer stakeholder groups in Hawaiʻi has improved and accelerated climate resilience on Kauaʻi, with conceptual, instrumental, or symbolic physical and policy outcomes that are fostering transformative adaptation in public and private sectors. One of the four exchanges that Pacific RISA facilitated as part of the “Peer-to-Peer Knowledge Exchange” project (see Research Highlights) was between the County of Kauaʻi and the City of Boston. This facilitated discussion in 2021 was highly technical and is an example of how deep exchange between cities led to the implementation of new climate adaptation legislation, the Kauaʻi Sea Level Rise Constraint District. Kauaʻi’s coastal communities are highly vulnerable to both sea level-induced flooding and inundation from heavy rainfall events, and the catastrophic 2018 flooding on Kauaʻi’s North Shore has made policy interventions to reduce or prevent flood impacts all the more urgent. Combined with technical flood modeling results from partners at the Climate Resilience Collaborative that were integrated into the online Sea Level Rise Constraint District Viewer, the county was able to utilize information from the exchange and the Boston Sea Level Rise Zoning Ordinance to craft a similar policy for Kauaʻi.

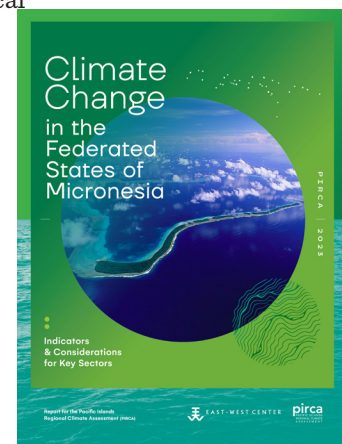
In October 2022, Mayor Derek Kawakami signed Sea Level Rise Constraint District legislation that made Kauaʻi one of the first municipalities in the United States to regulate construction based on the future sea level rise impacts of passive flooding and annual high-wave run up. The ordinance, which is now being implemented, requires the lowest floor of all new or substantially improved residential construction to be elevated two feet above the highest projected sea level rise flood elevation, and all new non-residential construction and substantial improvements to be elevated at least one foot above the highest sea level rise flood elevation. This policy outcome is indicative of the power of peer exchanges as a method that facilitates open and transparent communication, leading to accelerated replication and adaptation of methods and policy strategies across seemingly disparate regions.

SUSTAINED ASSESSMENT SPECIALIST

In July 2023, the Pacific Islands Regional Climate Assessment (PIRCA) released its latest jurisdictional climate assessment report for the FSM, *Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors*. PI Grecni, Project Specialist Bryson, and Pacific RISA intern Elaine Chugen co-authored the report, with 30 technical

contributors from local government, NGOs, and research. The report is a concise summary of the changes the country is already experiencing, through several key climate indicators and future climate projections.

It consolidates knowledge about the status of adaptation in key sectors and evidence of which strategies are effective. The FSM Department of Environment, Climate Change, and Emergency Management (DECHEM) co-released the report, with particular support from FSM Assistant Secretary of Climate Change Lucille Apis-Overhoff. In the days following



the report’s release, partners and contributors sent messages confirming the utility and timeliness of the assessment:

- *“Thank you so much for your hard work and this a beautiful report and I need this for my grant proposals and management plan and planning” – official in Yap State Government*
- *“Thank you for your hard work. This is a practical report and will assist us in making informed decisions.” – Lucille Apis-Overhoff, DECEM, FSM National Government*
- *“The analysis equips decision-makers with the knowledge and insights necessary to develop effective and targeted action plans, ensuring a more resilient and sustainable future for the Federated States of Micronesia.” – Dr. Murukesan Krishnapillai, a research scientist at the College of Micronesia–FSM*

Other PIRCA work included further development of the Republic of the Marshall Islands (RMI) jurisdictional PIRCA report. PI Grecni and Project Specialist Bryson co-hosted a workshop with the NWS Majuro Weather Service Office in December 2023 to gather input and technical expertise for the report. The RMI Climate Change Directorate agreed to be a co-author on the PIRCA report and to submit it to the Tile Til

Eo (Marshall Islands 2050 climate strategy) Advisory Board for official endorsement as a reference to inform government operations and adaptation planning. PI Grecni and Project Specialist Bryson held additional meetings in Majuro with prospective partners, including the U.S. Embassy, the Marine Resources Authority, the RMI EPA, and the Majuro Water and Sewer Authority, among others, both to gather additional feedback for the PIRCA and to introduce and inform CIS-Pac5 activities.

Work has started on planning the next generation of the [Palau PIRCA report](#) with the convening of approximately 100 in-country stakeholders and partners in Palau in February 2024. The update to the national Palau Climate Change Policy (PCCP) is nearing completion, with the Palau PIRCA report serving as a key evidence base. At this critical stage for the Palau government and stakeholders, discussions with the national Climate Change Coordinator focused on how the PIRCA process and outputs could support the next phases in the government’s action on climate change adaptation. A main outcome of the meeting was to explore ways to create a position dedicated to state-level outreach and decision-support tool development. The Palau International Coral Reef Center (PICRC) was identified as a potential partner in developing a state-level PIRCA product.



Image 14: Participants gathered for the December 2023 Pacific Islands Regional Climate Assessment Workshop in Majuro, co-hosted by Pacific RISA and the Majuro Weather Service Office. Credit: Pacific RISA.

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