

Pacific Islands- Climate Adaptation Science Center

Supporting Climate Resiliency

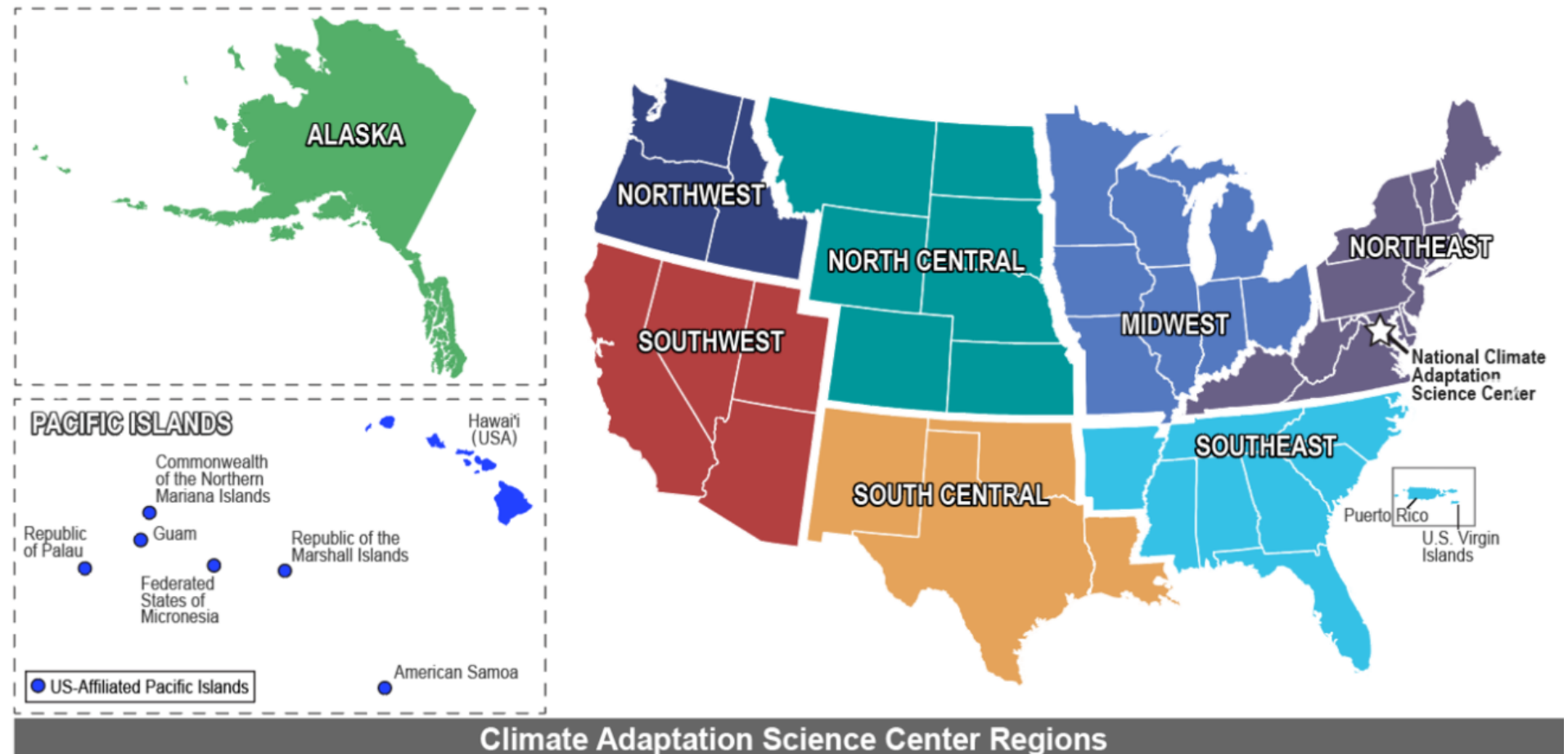
Heather Kerkering
Assistant Regional Administrator



PACIFIC ISLANDS
CLIMATE ADAPTATION SCIENCE CENTER



The Climate Adaptation Science Centers (CASCs) are a partnership-driven program that teams scientists with natural and cultural resource managers and local communities to help wildlife, water, land, and people adapt to a changing climate.



Northern
Mariana Islands



Republic of the
Marshall Islands



Hawai'i



Guam



Palau



Federated States
of Micronesia



American Samoa





PACIFIC ISLANDS CLIMATE ADAPTATION SCIENCE CENTER





PACIFIC ISLANDS

CLIMATE ADAPTATION SCIENCE CENTER

- Sea Level and Coastal Flooding Research and Tools
- Coral Reef Resilience
- Climate Data Portal
- Invasive Species and Climate
- Education Resources
- Funding Opportunities

THE NEED FOR SEA LEVEL RISE PROJECTIONS IN AMERIKA SAMOA

Subsidence

= 16 mm/yr or

0.6 in/yr

Historical rate

= 2.2 mm/yr or

0.08 in/yr –

current rate

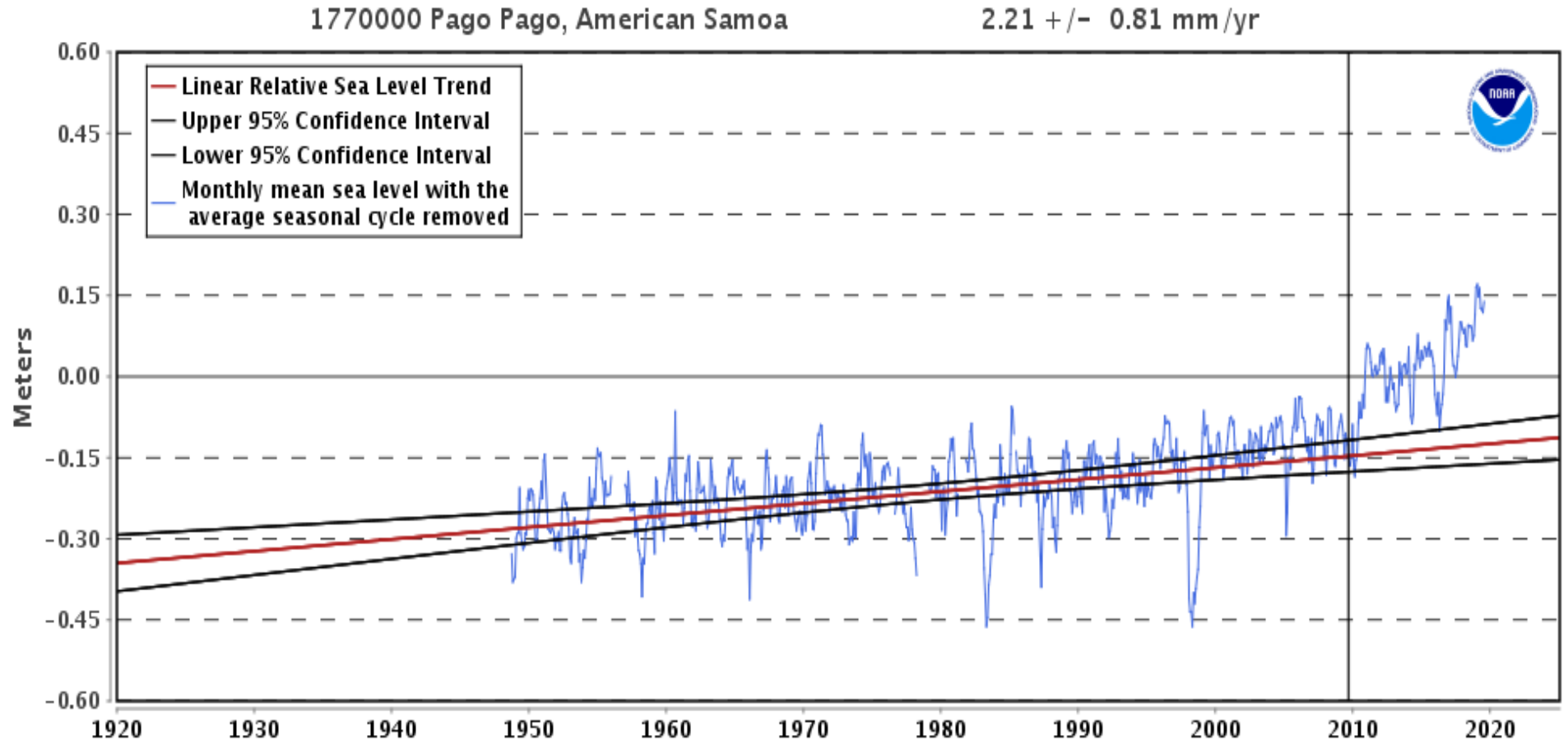
= 3.2mm/yr or

0.13 in/yr

Modern rate

= 19.2 mm/yr or

0.76 in/yr

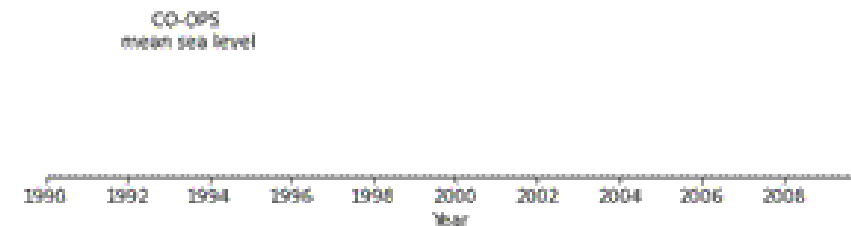
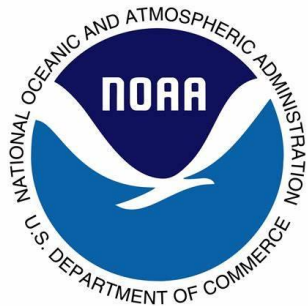


AS RSLR in last 11 years > previous 100 years

- “Following the earthquake, relative sea levels on Tutuila Island rose 250 millimeters (9.8 inches) in just 11 years. The increase was captured by NOAA’s water level station between September 2009 and January 2020.”

Mean Sea Level Rise vs. Land Elevation
at Pago Pago, American Samoa

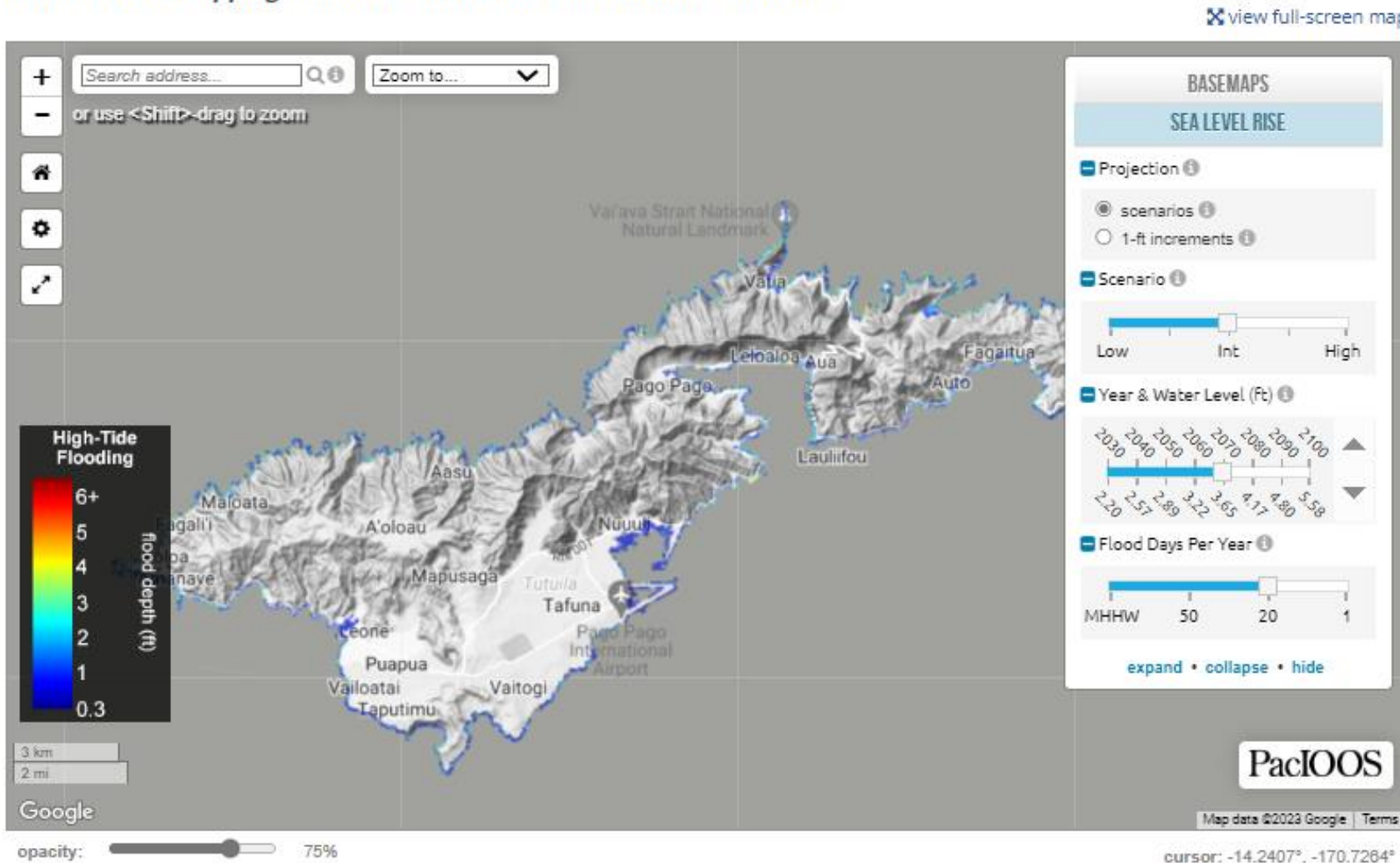
- Before 2009 our RSLR was 9.5 inches per 100 years!



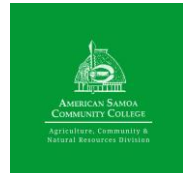
Sea Level Rise : American Samoa Sea Level Rise Viewer

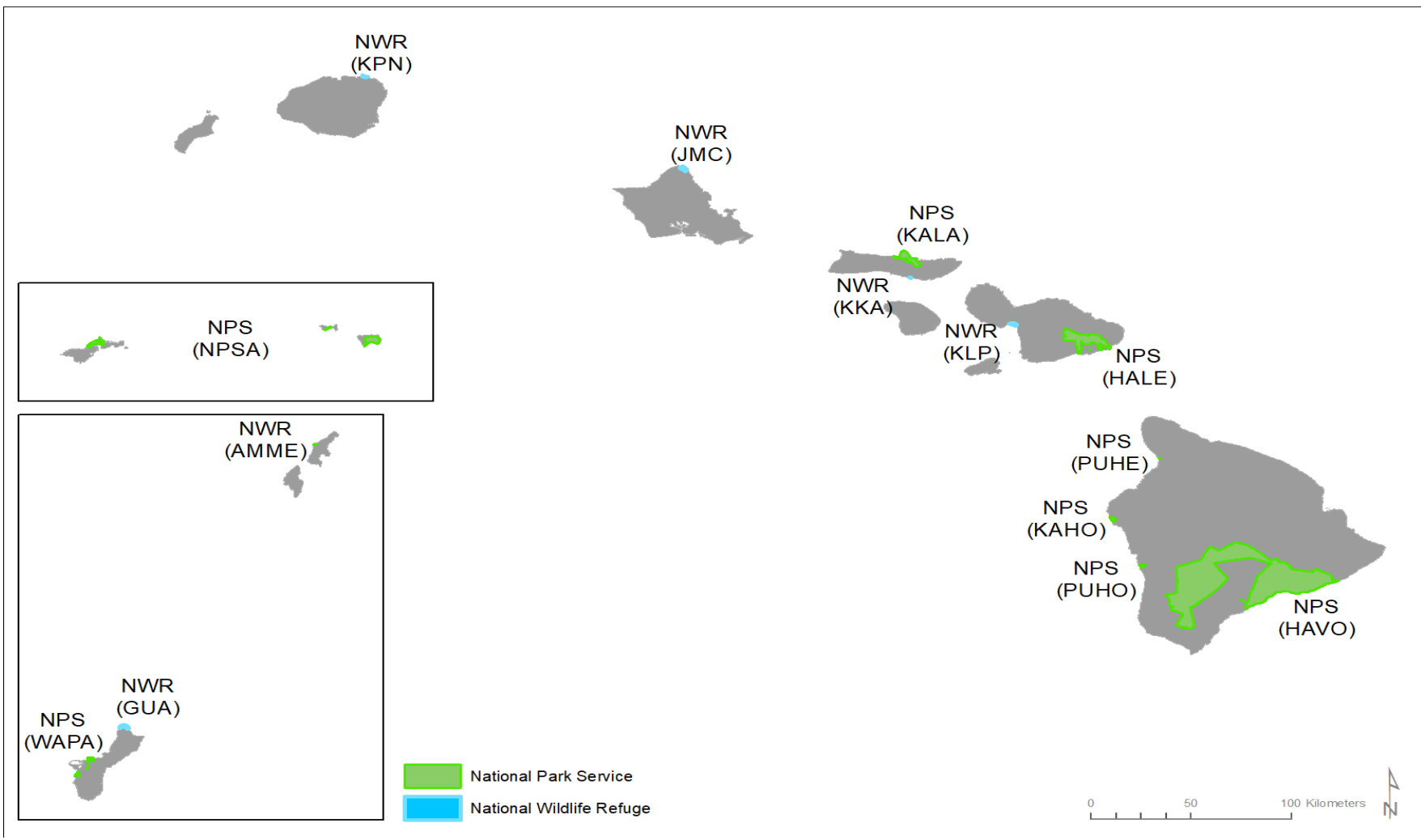
<https://www.pacioos.hawaii.edu/shoreline/slr-amsam/>

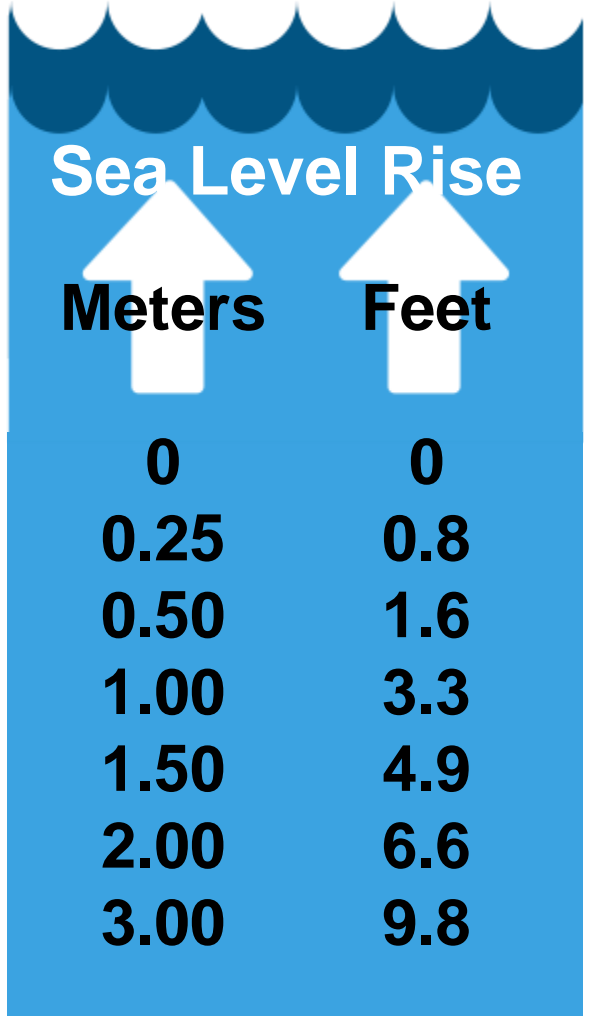
An Interactive Mapping Tool to Assess Future Sea Level Rise Scenarios



- Can apply various combinations of scenarios to assess vulnerability
- Passive flooding model used in the Viewer does *not* include the effects of waves on flooding (future)







at 10-m² res

X Storm Frequency

Annual (1-yr)

20-year

100-year

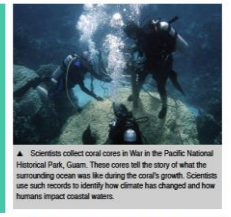


20-year storm +1.00 m SLR



Climate Change and Reef History

The make-up of coral skeletons tells the story of how corals developed over decades to centuries. Like tree rings, coral growth rings reveal the coral's age. Cores, or plugs, taken from corals also indicate whether corals grew differently in the past, and whether water temperature, salinity, nutrients, sediment, or contaminants differed. If growth today is unlike the past, is it due to a change in environmental conditions caused by human activities or by climate change?



Pacific Coral Reefs Project

The Health and Fate of Pacific Coral Reefs

Most of the world's coral reefs are in the Pacific Ocean, and they are central to the lives of many Pacific island residents and visitors. Reefs provide nursery grounds and shelter for commercially and culturally important fish and invertebrates, they protect harbors, beaches, and coastal communities from erosion and storm wave damage, and they are vital to the marine tourism industry. Most Pacific coral reefs appear to be relatively healthy, but some areas have died or are heavily damaged. Numerous studies predict climate change will further degrade reefs. Understanding why coral health has declined and how better to protect and preserve corals is a central mission of the U.S. Geological Survey (USGS) Pacific Coral Reefs Project. USGS efforts in coral reef research have become internationally recognized—bolstered by strong relationships with the U.S. Coral Reef Task Force, the National Park Service, NOAA, EPA, state and local governments, and other academic and non-governmental institutions.



Research Focus

To complement studies of coral reef ecology and biology, the USGS Pacific Coral Reefs Project focuses on geology and oceanography. How much sediment runs off the land to smother corals and cloud the surrounding water? How do ocean currents move sediment or coral larvae during spawning? What's in the freshwater that flows from the land into the ocean? The project addresses these questions and many others when examining how natural and human influences combine with climate change to stress corals. The branches of this research interlink; coral decline can occur for many reasons. Not only will this project foster more partnerships in coral reef research and monitoring, but the information it gathers will also help forecast how corals could change in a shifting environment.

Circulation and Reef Sediment

Corals typically grow in clear waters; however, rocks and storms can deliver sediment and contaminants from land that smother these delicate ecosystems. So, the USGS aims to understand the ocean circulation patterns that affect how much sediment might be around to smother corals, or how long corals might be exposed to contaminants in the water. These oceanographic patterns also give USGS insight into how corals erode and eventually become part of the island's protective, sandy beaches—important knowledge, particularly in the face of sea-level rise and climate change.

Future Planning and Reef Value

Documenting the quality of our reefs, their features, and their distribution is fundamental to protecting them. Only three of the eight U.S. National Parks in the Pacific with corals have reef maps detailed enough for management, and none of the U.S. Wildlife Refuges in the Pacific with corals have such maps. To help agencies manage their reefs, USGS leads efforts to quantify and describe these natural resources. Part of this work will assess the number of people and the economic value of infrastructure protected by reefs.

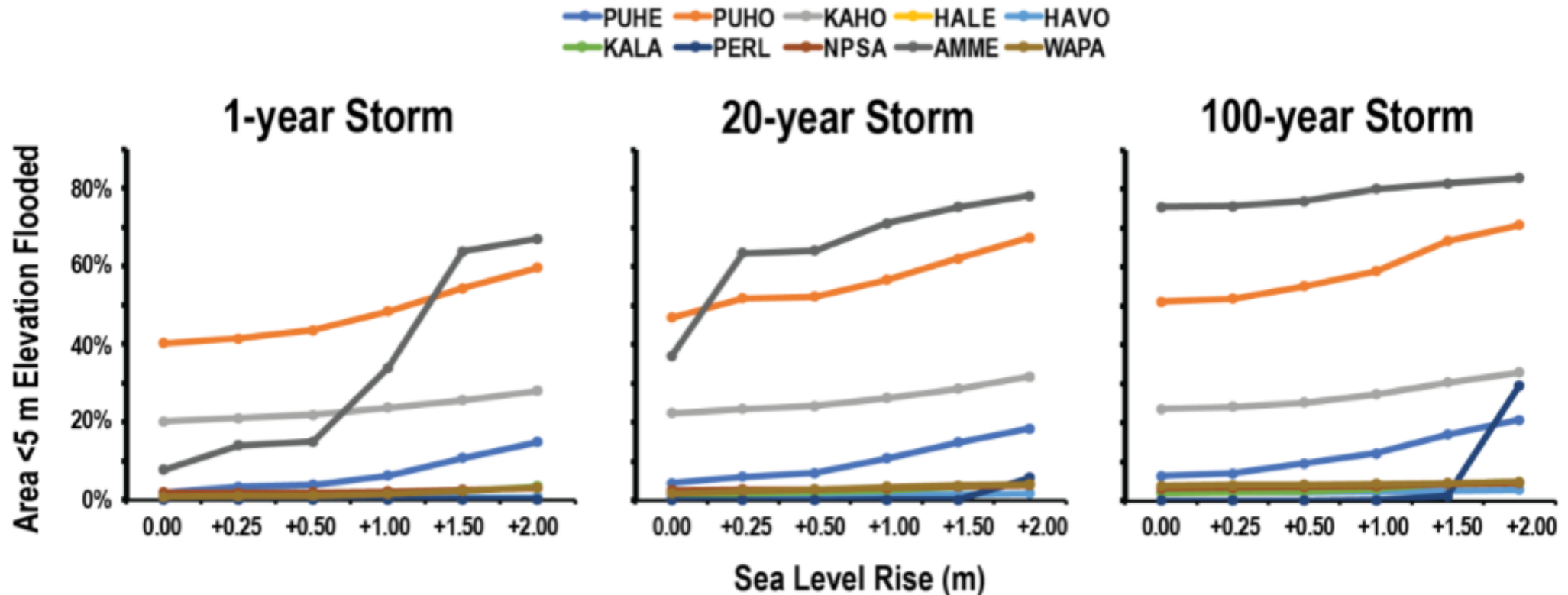
Health

How does the health of a coral reef change over time? Does the influx of freshwater affect the effects of a coral reef? How do contaminants, such as pesticides and herbicides, affect coral reef health? The USGS also evaluates proposed marine protected areas (MPAs) on their ability to aid in coral reef resiliency. For instance, are circulation patterns sufficient to carry coral larvae from the MPA to degraded reefs outside the MPA? If MPAs are to be effective lifelines for the future and help balance the stress of climate change, then understanding the local oceanography, such as waves and freshwater input, will help managers choose suitable areas for prospective MPAs.

FOR MORE INFORMATION CONTACT
 Curt Storlazzi, Project Chief
 (831) 460-7321, csstorlazzi@usgs.gov
<http://coralreefs.usgs.gov/>

Deliverables

Flooding of U.S. coastal parks in the Pacific Islands could **double to increase tenfold** due to climate change and sea-level rise in the 21st century.



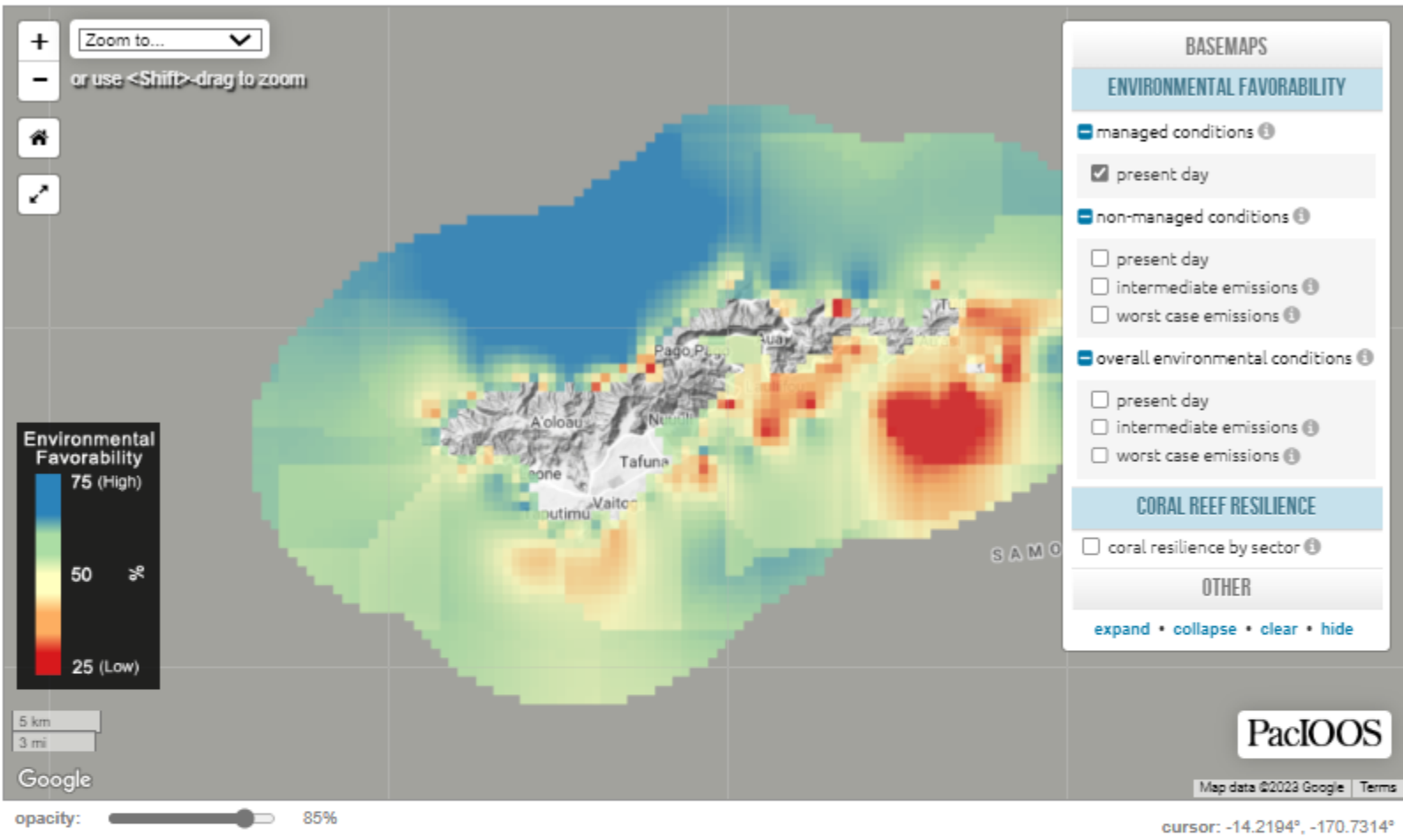
Project: Coral Reef Resilience in American Samoa

“Where can Resilience-Based Management strategies be appropriate for coral reefs?”



The objective of this project is to identify areas of reefs with the most favorable environmental conditions for coral growth and survival under multiple climate scenarios American Samoa.





This project developed GIS layers to show the spatial patterns in environmental favorability and resilient coral reefs

<http://www.pacioos.hawaii.edu/projects/coral-resilience-guam-amsam/#data>

Environmental Favorability

- ▶ Managed Conditions
- ▶ Non-Managed Conditions
- ▶ Overall Environmental Conditions

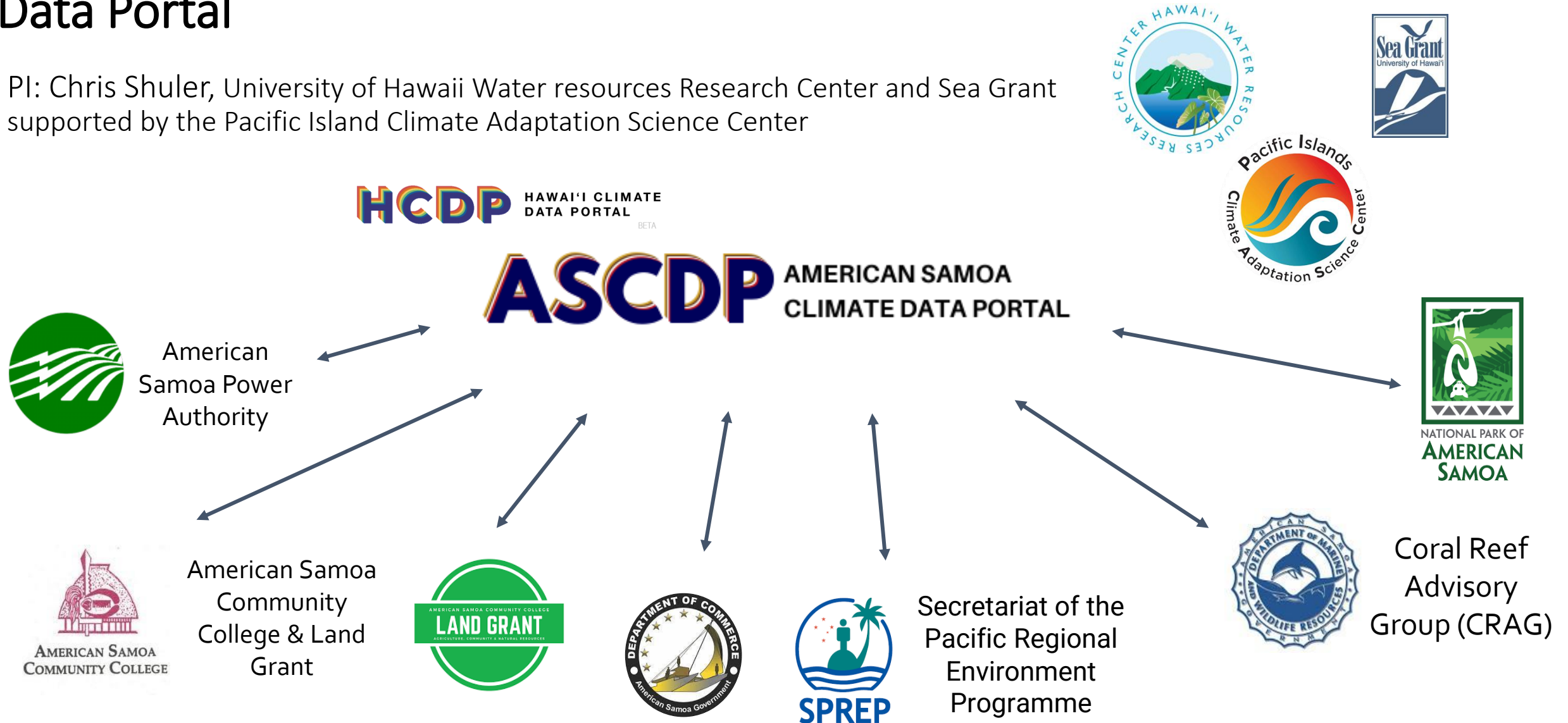
Coral Reef Resilience

- ▶ Coral Monitoring Sectors

Results can guide managers on what locations may be ecologically suitable for resilience-based management strategies for coral reefs

A Collaborative Approach to Enhancing Data Availability and Adaptation Capacity: Developing the American Samoa Climate Data Portal

PI: Chris Shuler, University of Hawaii Water resources Research Center and Sea Grant supported by the Pacific Island Climate Adaptation Science Center



Building the American Samoa Climate Data Portal: **Goals**

Effective and Successful Climate Adaptation

GIS layers

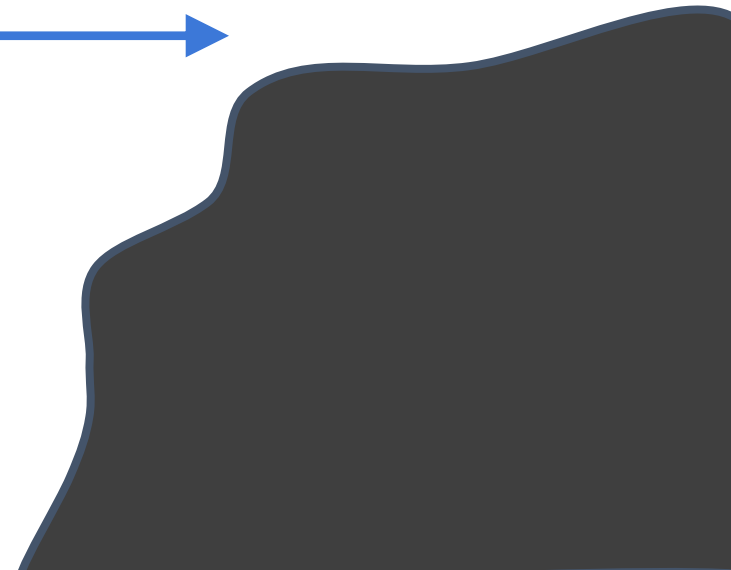
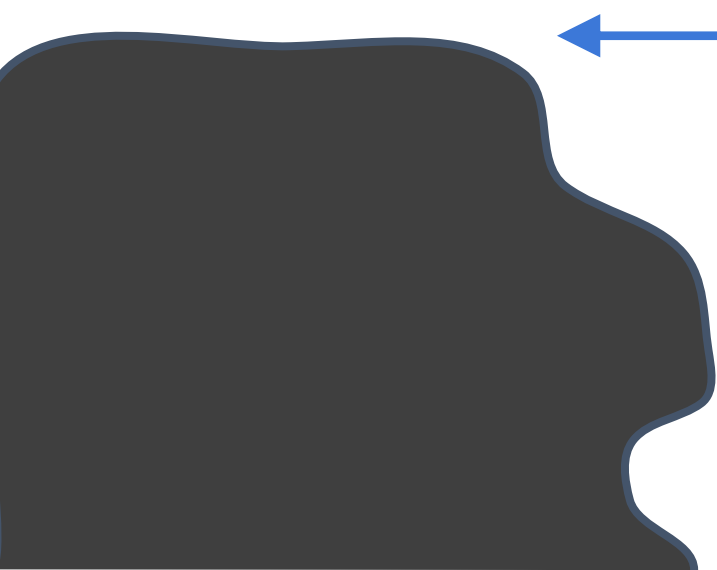
Climatological data

Future climate projections

Climate adaptation literature



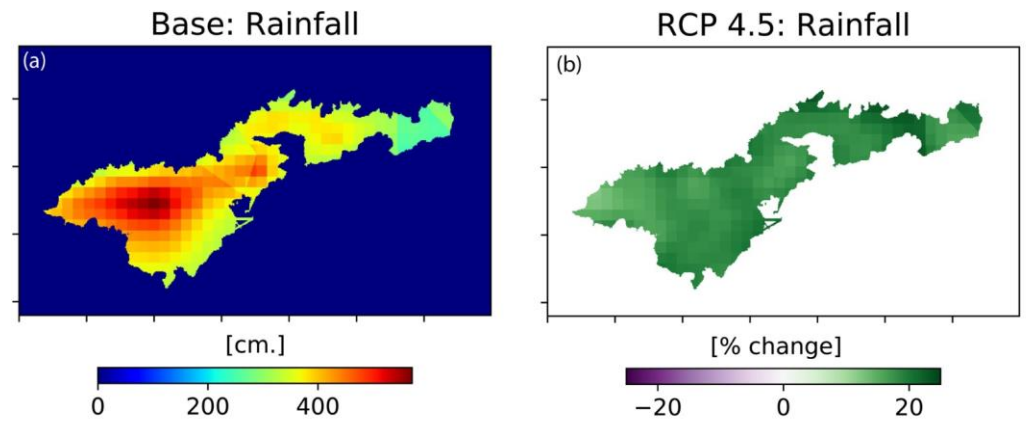
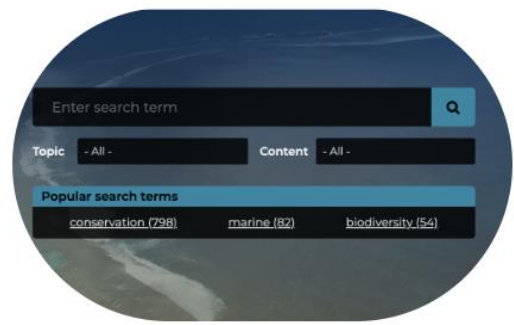
“Bridging the Gap” through:
Data accessibility
Collaboration
Communication
Student training



Building the American Samoa Climate Data Portal: Objectives

Specific objectives :

- Support revitalization of AS-DOC GIS data portal
- Support upgrades to SPREP Environment Data Portal (DKAN)
- Increase availability of key climate-relevant datasets
- Build local capacity through student internships

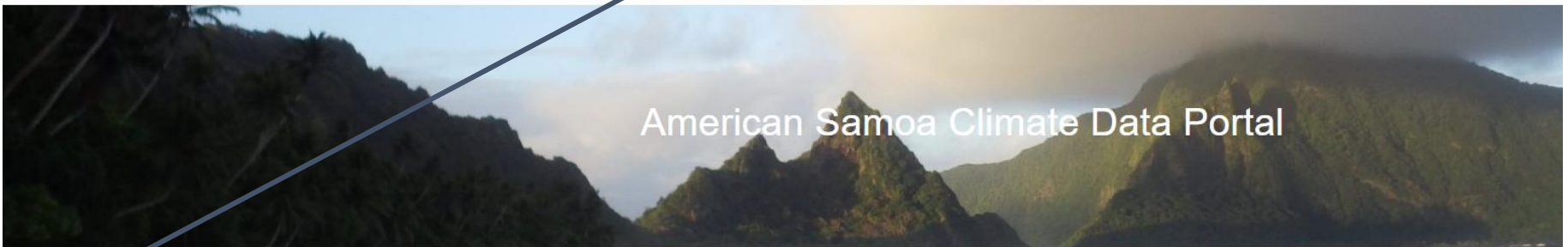


Draft Portal

<https://www.hawaii.edu/climate-data-portal/americansamoaportal/>

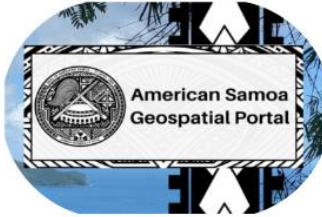


Built as a part of the Hawaii Climate Data Portal. Hosted on UH servers



The American Samoa Data Portal's goal is to assist climate adaptation and natural resource managers in American Samoa by providing access to new and existing web-based tools that provide open access to GIS and climate-related data. These tools can enable managers and community members to collect, download, and view relevant data, facilitating a wide range of adaptation and management activities.

Curates and presents other climate tools, important datasets, and future projections



AMERICAN SAMOA GEOSPATIAL PORTAL
Explore American Samoa's geospatial data including shapefiles and rasters of biological, geological, political, and climate related data

Provides geospatial data through the AS-DOC ESRI portal



SPREP ENVIRONMENT DATA PORTAL
Publications, tabular data, and climate related resources for American Samoa

Provides literature and raw data through SPREP DKAN portal



CLIMATE AND WATER MONITORING DATA PORTAL
Real time weather station and stream gauge data for American Samoa

Home for real-time climate and hydrological monitoring data

Seeking Your Feedback!

The ASCDP is still in the design phase. If interested please visit the portal, then share your thoughts and help us improve!



<https://forms.gle/aSgAkrZtZCh8tNii8>

Fa'afetai Lava



Invasive Species & Climate Change

Growing the Pacific RISCC
Management Network



WHEN CLIMATE CHANGE & INVASIVE SPECIES INTERSECT

1

Climate changes how species are transported

2

Climate changes where species are distributed

3

Climate makes management efforts less effective

4

Invasives reduce resilience or ability to adapt to climate change



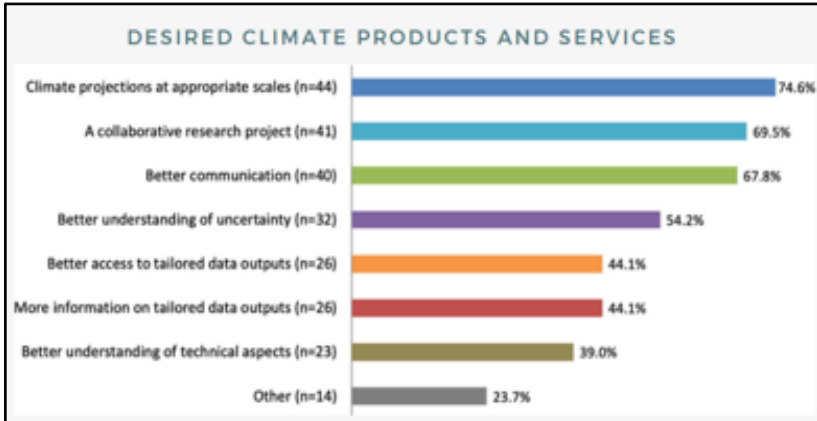
PACIFIC RISCC

Our Vision

Support transformative adaptation that builds Pacific Island resilience to climate change by helping communities and decision makers plan for and prevent invasive species impacts



Products & Initiatives



Needs Assessment

Pacific RISCC June 2023 Webinar:
Hawaiian Anchialine Ecosystem and Fishpond Conservation in the face of Climate Change

Climate change, including sea level rise, and invasive species threaten anchialine ecosystems and Hawaiian fishponds. What is happening and how can managers adapt to these changes?

Webinar Series

Chapter 5
Pacific Island Perspectives on Invasive Species and Climate Change

Laura Brewington, Bradley Eichelberger, Nicole Read, Elliott Parsons, Heather Kerkering, Christy Martin, Wendy Miles, Jacques Idechong, and Jeff Burget*

Syntheses & Publications

Increasing the Resilience of Ecological Restoration to Extreme Climatic Events, Zabin, Jurgens, and Bible et. al. 2022

Management Considerations:

- Plan for Extreme Climatic Events (ECEs) by considering the potential impacts of extreme events most likely to impact your area, possibly exceeding historical events.

Take Home Points:

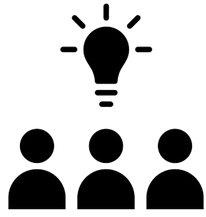
Research Summaries for Managers



Knowledge Exchange



Interactive Workshops



GROWING THE PACIFIC RISCC



Phase 3
Partnerships
Research
Capacity



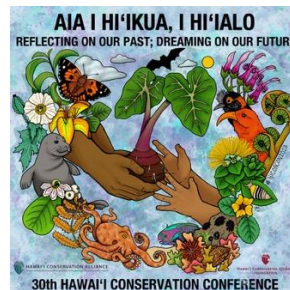
Recognize the critical importance of invasive species work...to climate resilience



>400
members

Phase 1
Survey and report
Webinar series
Listserv

Phase 2
Convening
Communications
Science priorities



How Invasive Plants Caused the Maui Fires to Rage

A sweeping series of plantation closures in Hawaii allowed highly flammable nonnative grasses to spread on idled lands, providing the fuel for huge blazes.

How Swaths of Invasive Grass Made Maui's Fires So Devastating

Scientists have long warned that Hawaii's cover of nonnative shrubs is kindling waiting to burn

Maui's neglected grasslands caused Lahaina fire to grow with deadly speed

Visual analysis retraces how the grasslands blazed. Landowners and the government have done little to address the well-known problem.

Fast forward to 2023, and Mr. Trauernicht, a specialist in wildland fire science and management at the University of Hawaii at Manoa, said the deadly Maui blaze has shown clearly how **nonnative grasses** — many of them on former plantation lands that have been left substantially unmanaged by large corporate landowners — can cause what might be an otherwise manageable fire to balloon in size.



Pacific Drought Knowledge Exchange





Welcome to the Education Hub of the Pacific Islands Climate Adaptation Science Center. Explore place-based lesson plans, dive into engaging relevant data and tools, and access additional resources for students, teachers, and researchers on all things education.



Lesson Plans

Explore activities inspired by the science and research happening at PICASC.



Data and Tools

The Data and Tools page provides a landing site to be directed to topic specific applications as well as a resourc...



Resources

Opportunities, articles, and more for students, teachers, and researchers.

For Teachers

Explore this curated list to help direct you to useful resources. If you would like to add a resource you have found useful, please [contact us](#) and we will work with you to add your recommendations.

Aloha Teachers - PI-CASC welcomes your thoughts, insights, and climate concerns around adaptation science. Please feel free to reach out to PI-CASC Federal Director Mari-Vaughn Johnson (mvjohnson@usgs.gov) to share your ideas around ongoing gaps, challenges, and projects, and to inquire about opportunities related to the information and materials on this site.

Curricular Materials For Hawai'i and the Pacific Islands

Grades K-8: NGSS Connection Kits Windward Academy for Career and Technical Education (CTE)	▼
Grades K-8: Partnerships for Reform through Investigative Science and Math (PRISM) University of Hawai'i Hilo	▼
Grade 3-5: Sea, Earth, Atmosphere (SEA) University of Hawai'i Sea Grant	▼
Grade 3-7: Aloha 'Aina Curriculum The Pacific American Foundation	▼
Grades 4-12: Project Kahea Loko, The Call of the Pond The Pacific American Foundation	▼
Grade 5-12: Place-based Science curriculum Healthy Climate Communities	▼
Grade 6-12: Exploring our Fluid Earth University of Hawai'i Sea Grant	▼
Grades 7-12: Mālama Kaho'olawe Pacific American Foundation	▼
Grade K-12: Hawai'i DOE Educator Resources Hawai'i State Department of Education	▼
Grade K-12: Teaching Resources Symphony of the Hawai'i Forests	▼

Data and Tools

Want to create your own investigation or lesson for your classroom? Browse our curated datasets, visualizations, or additional tools in climate science topics.

Data Resources by Topic

Each topic explored in our lesson plans will have additional data resources and tools. Some of these tools may already be built in to student activities but can also stand alone to be explored by anyone. Check out our topic on Drought and stay tuned for additional resources on Sea Level Rise.

Continue scrolling this page to learn more about some of our data sources or to explore additional datasets yourself.



Drought

Explore data and tools related to drought.



Sea Level Rise

Find relevant applications and data about sea level rise.



Coral Reefs

Browse existing data and tools regarding coral reefs in the Pacific Islands



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Lesson Plans

Explore activities inspired by the science and research happening at PICASC.



Data and Tools

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Resources

Opportunities, articles, and more for students, teachers, and researchers.

Lesson Plans

Lessons found on this page have been developed through various partnerships, programs, and PI-CASC funded projects. Explore products that stem from teacher workshops (EARTH), collaborations in Guam, and in connection with the USGS Youth and Education in Science office.



In July 2023, PI-CASC teamed up with the Monterey Bay Aquarium Research Institute (MBARI) to co-host the annual EARTH Teacher Workshop. Throughout the week, educators and researchers connected to explore the world of data, climate science, and a sense of place to frame new lesson plans. The six activities below are the result of that week of learning and collaboration.



Why are coral reefs so stressed out?

Coral reefs are bleaching due to climate change. Students investigate why the coral is bleaching & how to differentiate between healthy and bleached

Explore the lesson



Hurricane Hunters

Students will collect and evaluate hurricane information from multiple sources, then communicate their learning through student created videos.

Explore the lesson plan



A Big Wave Surf Mystery

Students look at maps and make predictions for a mystery event. They then compare and contrast data from the event to the current date.

Explore the lesson plan



Mālama 'Āina: Land and Water Usage on O'ahu

Students will investigate the human impact of land usage using water recharge data on O'ahu.

Explore the lesson plan



Taking a Dip in the Ocean Data Pool

An introduction to the importance of float data.

Explore the lesson plan



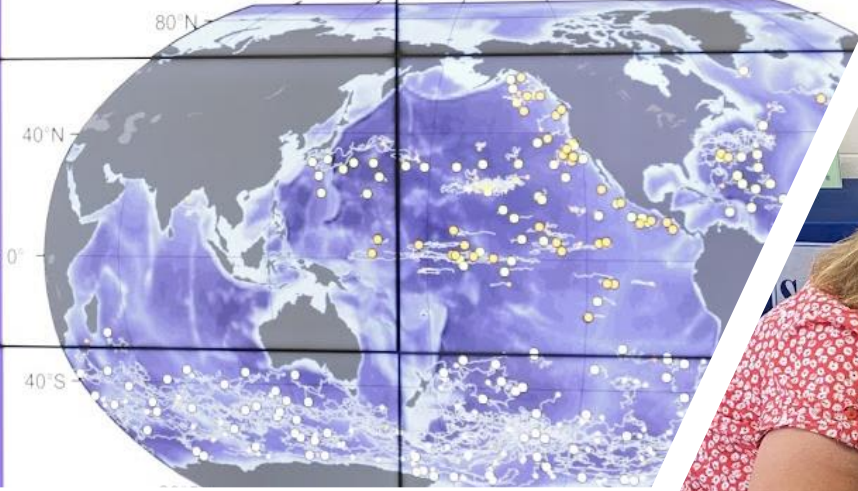
Water cycle changes impact on water sources

Hawaii is feeling the effects of climate change as added stress in the water cycle such as floods and droughts.

Explore the lesson plan



○ GO-BGC floats ○ SOCCOM floats ● UW/MBARI Partner floats





PI-CASC K-12 Education Hub

A growing platform to share educational resources and tools as well as provide space to build connections with the broader educational community through workshops and partnerships.

What's on the Hub



Lesson Plans
Activities aligned to teaching standards exploring climate change impacts and adaptation relevant to the Pacific Islands.



Data & Tools
Topical pages to share existing data tools and apps in the context of teaching and with how-to guides.



Resources
For students, teachers, and researchers - a library of existing materials and opportunities relevant to climate and education.

K-12 Programing includes:



Co-hosting EARTH (Education and Research Hypotheses) teacher workshop, connecting science and education through data.



Summer Undergraduate Research Fellowship (SURF)

Providing promising undergraduates a valuable research experience to improve their skills in climate science and expand their knowledge of Pacific environmental issues.

A Glimpse of SURF

Details

- Open to any undergrad enrolled at a US college, UOC, or another college but attended US in Hawaii for Guam
- Fellowship lasts for 10 weeks
- Stipend is provided
- Multi-disciplinary nature: biology, engineering, geography, earth sciences, botany, natural resource management, oceanography

Opportunities

- Dissertation program
- Pre-arranged development workshop
- Present at PI-CASC symposium
- Present at other symposiums
- Present at the National Forum & Summit of U.S.A.I.
- PI-CASC has been a productive working with mentors from 1-4 Pacific Islands

Example SURF Project:



Natural gas regeneration of Acahualoa in a non-native forest.



PI-CASC Graduate Scholars Program

An opportunity for graduate students across the PI-CASC network to gain invaluable experience in preparation for future careers in research, resource management, and policy.

Opportunities for our Scholars

Professional Development

- Science to Management and Policy Issues
- Early Career Panel
- Networking

Service & Community Engagement

- Kilauea Non-Community Workshop
- SOEST Open House
- Community Engagement Activities

Science Communication

- Student Symposium
- Research Story Map
- Impacts Workshop
- Blog Writing
- Science by the Sea
- Next-Gen Humboldt
- Site of PI-CASC

Example Grad Scholar Project:



Unlocking Resilience Drivers to Inform Pacific Coral Reef Management.



Manager Climate Corps (MCC)

A practitioner-driven research program for graduates in Hawaii that engages diverse knowledge forms and unites worldviews by collaborative research.

How MCC Works



MCC programming prioritizes direct experience of place (human and more-than-human community) and roots research in relational knowledge forms to produce research that can be readily utilized by practitioners on the ground.

Example MCC Project:



He ala 'ae kai - The path near the sea: Climate inflections upon intertidal.



Climate Adaptation for Resource Management (CARM)

A fellowship and continuing education opportunity for natural resource managers and professionals in Guam and Micronesia to bolster professional capacity through higher learning.

A Unique Take on Fellowships

While a traditional graduate fellowship bridges a student's education from the undergraduate level to the graduate level, or graduate level to doctoral level, the CARM program works with natural resource agencies to seek out individuals with substantial field experience who can benefit from receiving advanced education and further build technical capacity of the agency they serve.

Example CARM Project:



Perceptions of wildfire and wildfire management on Guam.

For more info on the Education Hub, scan this QR code or contact Emily Seino at eseino@usgs.gov



For more info on SURF, scan this QR code or contact Rachel Lentz at rlentz@hawaii.edu



For more info on the Graduate Scholar, scan this QR code or contact Beth Lemz at lelemz@hawaii.edu



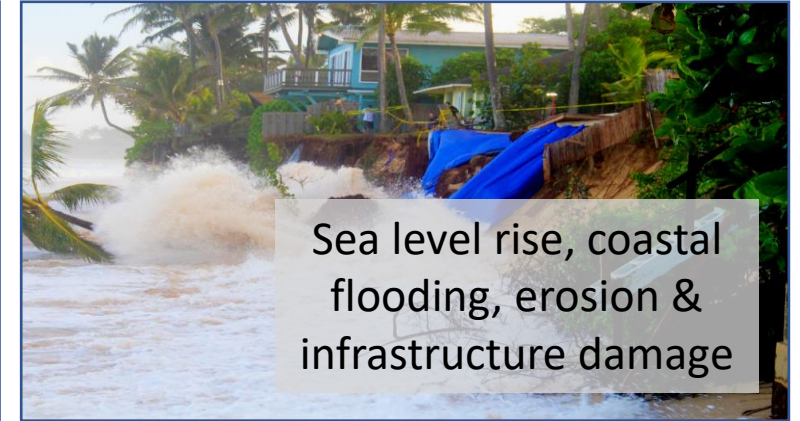
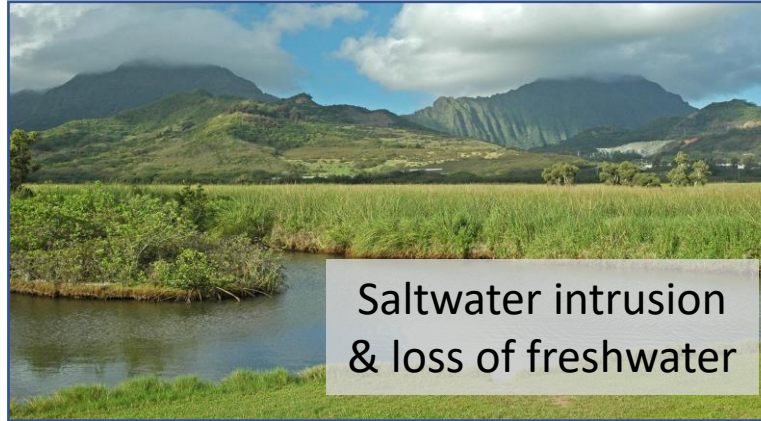
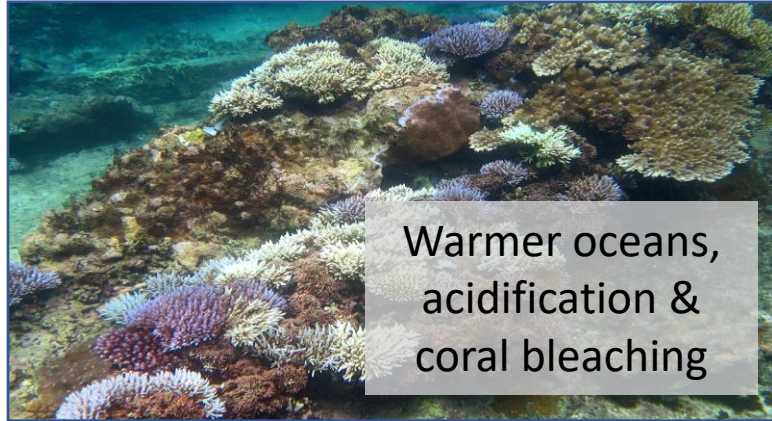
For more info on MCC, scan this QR code or contact Scott Laursen at slaursen@hawaii.edu



For more info on CARM, scan this QR code or contact John Borja at borja@619@triton.uog.edu



Climate change poses serious problems for the Pacific Islands region...



etc....

Actionable Climate Adaptation Science

By integrating with local networks, researchers work with managers to create actionable science designed to support sustainability and climate adaptation for communities across the Pacific Islands.



Spectrum of Partner Engagement



Science for Climate Adaptation

2018-2023 Science
Agenda Management
Priorities



Drought, Fire, Landscape Change



Imperiled and Invasive Species



Agroforestry



Coastal Adaptation and Management



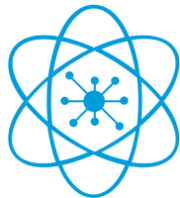
Risk and Vulnerability Assessments



Freshwater Security Solutions



Forest Conservation



Build a Stronger Scientific Base



Biosecurity



Adaptation and Survival in Low Atolls and Islands



Managing Novel Ecosystems



Island to Island Tech Transfer



Core Questions for Resource Managers

ENGAGE
SOLICIT PROPOSALS
FUND PROJECTS

Fa'afetai

Thank You!

Heather Kerkering
Assistant Regional Administrator
hkerkering@usgs.gov



PACIFIC ISLANDS
CLIMATE ADAPTATION SCIENCE CENTER

