

**WRITTEN TESTIMONY OF
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U.S DEPARTMENT OF COMMERCE**

**HEARING ON
IMPACTS OF CLIMATE CHANGE ON HAWAII AND THE PACIFIC ISLANDS**

**BEFORE THE
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE**

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Introduction

Good morning Senator Inouye and members of the Committee. I am Bill Thomas, Director of the National Oceanic and Atmospheric Administration (NOAA) Pacific Services Center. I thank you for the opportunity to testify on the impacts of climate change on Hawai'i and the Pacific Islands and NOAA's efforts to assist the region in managing their resources in the face of this challenge.

Over the last 50 years, researchers at NOAA's Mauna Loa Observatory (MLO) in Hawai'i have been measuring the increasing concentrations of carbon dioxide and other greenhouse gases in the Earth's atmosphere. This long-term carbon dioxide record has been instrumental in forming the basis for the theory of global atmospheric change as well as acting as a catalyst for international policies. It is now well-documented in scientific literature and publicized in the media that our changing climate will have impacts on a global scale. Today, we must now begin to understand and address the impacts of climate change in highly vulnerable locations.

Island communities, such as Hawai'i and other Pacific Islands, are particularly susceptible to climate change impacts. This was apparent to participants at a coastal zone visioning session held in Hawai'i in 2007, organized by NOAA and sponsored by its Pacific Region, where climate change was identified as the number one issue. In addition, at a recent meeting of island coastal managers, every jurisdiction cited climate change as their most important area of concern.

Changing Climate and its Impacts on Pacific Islands

The recently published Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC-AR4) has updated the projections of changing climate conditions (i.e. temperature, rainfall, sea level, and extreme events) and the consequences for Pacific Islands and other small island states. IPCC-AR4 confirms the vulnerabilities identified in the 2001 Pacific Islands regional assessment and provides insights into then less widely understood climate-related challenges such as ocean acidification.

The IPCC-AR4 and similar climate assessment reports identify small island communities like those in the Pacific as particularly vulnerable to climate variability and change. There are similar threads regarding small island impacts that run through such reports including:

- Deterioration of coastal conditions is expected to affect local resources and reduce their value as tourist destinations (e.g., the combined effect of increased ocean temperatures and ocean acidification on coral reef resources)
- Sea level rise is expected to exacerbate coastal hazards such as inundation, storm surge and erosion as well as reduction of freshwater availability due to saltwater intrusion, especially in low-lying islands
- Climate change is projected to reduce water resources in many small islands (Pacific and Caribbean) to the point where, by mid-century, resources may be insufficient to meet demand during low rainfall periods
- Invasion of non-native species is expected to occur with rising temperatures
- Climate change will exacerbate other existing human influences on fisheries and marine ecosystems such as over-fishing, habitat destruction, pollution, and excess nutrients.

NOAA in the Pacific Islands: Developing Capacity to Deal with Climate Change

NOAA's Pacific Region is a hallmark of an integrated approach to problem-solving.

The Pacific Risk Management 'Ohana (PRiMO)

The Pacific Risk Management 'Ohana (PRiMO) is a network of partners and stakeholders involved in the development and delivery of risk management-related information, products, and services in the Pacific and is led by the NOAA Pacific Services Center. Established in 2003, this multi-agency, multi-organizational, multi-national group brings together representatives from agencies, institutions, and organizations involved in Pacific risk management-related projects and activities with the overall goal of enhancing communication, coordination, and collaboration among the 'ohana of partners and stakeholders involved in this work. As a result of this collaboration, several ideas that emerged over the years have led to the development of decision-support and community planning tools that aid a cross section from managers to the general public in better understanding risks and in making the best possible socio-economic decisions. Examples of these collaborations include:

Decision Support Tools

- Hazard Assessment Tools (HATs) have been developed in partnership with NOAA's Pacific Region, local governments in American Samoa, Guam, and Hawai'i (County of Kaua'i). These tools use Geographic Information Systems (GIS) maps to integrate hazard risk information, such as sea level rise projections, along with local information on infrastructure, natural resources, and administrative boundaries to improve both short and long term decision making.
- The Hazard Education and Awareness Tool (HEAT) is a template which allows any organization the ability to create a simple website which provides public access to local hazard maps for their community. Additional information on appropriate response and preparedness actions are also included.

- Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT) is a decision support tool which allows coastal managers to compare potential water quality impacts of land cover change that may occur from changes in climate.

Data

- The Coastal Change Analysis Program (C-CAP) is a nationally standardized database of land cover and land change information, developed using remotely sensed imagery, for the coastal regions of the U.S. C-CAP products inventory coastal intertidal areas, wetlands, and adjacent uplands with the goal of monitoring these habitats by updating the land cover maps every five years. Its primary objective is to improve scientific understanding of the linkages between coastal wetland habitats, adjacent uplands, and living marine resources. Land cover data from C-CAP has been developed for Hawai‘i from satellite images acquired in both 2000 and 2005. High resolution elevation data for Hawai‘i was collected in 2005 using Interferometric Synthetic Aperture Radar (IFSAR). This elevation data provides resource managers with the highest resolution elevation data currently available for Hawai‘i. This data is invaluable for determining potential impacts of changes in climate, such as sea level rise, in areas where higher resolution data may not be available.

Community Planning Tools

- The Coastal Community Resilience (CCR) Guide presents a framework for assessing resilience of communities to coastal hazards. The work was the result of a partnership funded through the Indian Ocean Tsunami Warning System Program and is being piloted for application in Hawai‘i. The framework, developed in concert with over 140 international partners, encourages integration of coastal resource management, community development, and disaster management for enhancing resilience to hazards, including those that may occur as a result of climate change.

The Pacific Enso Application Center (PEAC)

Pacific Island communities continually deal with dramatic seasonal and year-to-year changes in rainfall, temperature, water levels and tropical cyclone patterns associated with the El Niño-Southern Oscillation (ENSO) cycle in the Pacific. This dynamic system involving the Pacific Ocean and the atmosphere above it can bring droughts, floods, landslides, and changes in exposure to tropical storms. Fourteen years ago, NOAA joined forces with the University of Hawai‘i, the University of Guam, and the Pacific Basin Development Council to begin a small research pilot project designed to develop, deliver, and use forecasts of El Niño-based changes in temperature, rainfall, and storms to support decision making in the American Flag and U.S.-Affiliated Pacific Islands. That pilot project – the Pacific ENSO Applications Center (PEAC) – continues its work today as part of the operational National Weather Service programs in the Pacific. The PEAC experience has demonstrated the practical value of climate information for water resource management, disaster management, coastal resource planning, agriculture, and public health.

The Pacific Climate Information System (PaCIS)

The experience gained from PEAC has helped inform the emergence of a comprehensive Pacific Climate Information System (PaCIS). As an integrated organization that brings together NOAA's regional assets as well as those of its partners, PaCIS provides, on a regional scale, a programmatic framework to integrate ongoing and future climate observations, operational forecasting services, and climate projections, research, assessment, data management, communication, outreach and education that will address the needs of American Flag and U.S.-Affiliated Pacific Islands. Within this structure, PaCIS will also serve as a United States' contribution to the World Meteorological Organization's Regional Climate Centre for Oceania and represents the first integrated, regional climate service in the context of emerging planning for a National Climate Service.

Scientists and decision-makers in Pacific Island communities are now engaged in individual and collaborative efforts to understand the nature of the climate change impacts described in IPCC-AR4 and explore our options for both mitigation and adaptation. This shared effort involves NOAA, other federal programs, state agencies, university scientists, community leaders and non-governmental organizations. Together they are bringing their unique insights and capabilities to bear on a number of critical climate programs and activities including: contributions to global and regional climate and ocean observing systems; operational forecasts of seasonal-to-inter-annual climate variability; development and analysis of improved models that provide long-term projections of climate change; multi-disciplinary assessments of climate vulnerability, climate data stewardship, the development of new products and services to support adaptation and mitigation in the Pacific, and education and outreach programs to increase the climate (and environmental literacy) of Pacific Island communities, governments, and businesses. One of the newest activities involves a summary of the most recently published work on climate change and vulnerability in key sectors such as agriculture, water resources, and coastal infrastructure in the context of a Pacific regional contribution to a new Unified Synthesis Report of the U.S. Climate Change Science Program. This work is being supported and led by NOAA through its Integrated Data and Environmental Applications (NOAA IDEA) Center in Honolulu. While led by the NOAA IDEA Center, the full range of regional assets of NOAA in the Pacific are being brought to bear on this critical issue.

Future planning for a number of climate programs in the Pacific will be organized in the context of PaCIS including building upon the PEAC, the Pacific Islands Regional Integrated Science and Assessment (Pacific RISA) program and other related climate activities in the region. In addition to meeting the specific needs of U.S. affiliated jurisdictions in the Pacific, PaCIS will also provide a venue in which to discuss the role of U.S. contributions to other climate-related activities in the Pacific including, for example, observing system programs in the region, such as the Pacific Islands Global Climate Observing System (PI-GCOS) and the Pacific Islands Global Ocean Observing System (PI-GOOS), as part of an integrated climate information system.

In order to further define the roles and capabilities of PaCIS, a steering committee has been selected incorporating PEAC, the Pacific RISA, PI-GCOS, U.S. National Weather Service Operations Service and Climate Services Division, and their partners, as well as experts and users of climate science and applications in the region. The PaCIS Steering Committee, made up of representatives of institutions and programs working in the fields of climate observations, science, assessment, and services in the Pacific, as well as selected individuals with expertise in

similar regional climate science and service programs in other regions, will provide a forum for sharing knowledge and experience and guide the development and implementation of this integrated, regional climate information program.

The Pacific Region Integrated Coastal Climatology Program (PRICIP)

Discussions with Pacific disaster management agencies and coastal managers over the past decade have highlighted concerns about sea level rise and coastal inundation as one of the most significant climate-related issues facing coastal communities in the Pacific. In light of this need, NOAA, through its IDEA Center with support from the Pacific Services Center and working with colleagues throughout NOAA, the U.S. Army Corps of Engineers, U.S. Geological Survey and university scientists in Hawaii, Guam, Alaska, and Oregon, initiated the Pacific Region Integrated Coastal Climatology Program (PRICIP). PRICIP recognizes that coastal storms and the strong winds, heavy rains, and high seas that accompany them pose a threat to the lives and livelihoods of the people of the Pacific. To reduce their vulnerability, decision-makers in Pacific Island governments, communities, and businesses need timely access to accurate information that affords them an opportunity to plan and respond accordingly. The PRICIP project is helping to improve our understanding of patterns and trends of storm frequency and intensity within the Pacific Region and develop a suite of integrated information products that can be used by emergency managers, mitigation planners, government agencies, and decision-makers in key sectors including water and natural resource management, agriculture, fisheries, transportation, communications, recreation, and tourism.

As part of the initial build-out, a PRICIP web portal is serving a set of historical storm “event anatomies.” These event anatomies include a summary of sector-specific socio-economic impacts associated with a particular extreme event as well as its historical context climatologically. The intent is to convey the impacts associated with extreme events and the causes of them in a way that enables users to easily understand them. The event anatomies are also intended to familiarize users with in situ and remotely-sensed products typically employed to track and forecast weather and climate.

Hawaiian Archipelagic Marine Ecosystem Research (HAMER)

The Hawaiian Archipelagic Marine Ecosystem Research Plan (HAMER) is a collaborative planning process to develop sustainable conservation and management throughout Hawai‘i’s marine ecosystem through improved understanding of the unique physical and biological attributes of the Hawaiian archipelagic marine ecosystem, their interconnected dynamics, and their interactions with human beings. By using Hawai‘i as a large-scale archipelagic laboratory for the investigation of biophysical processes, comparing the protected Northwestern Hawaiian Islands to the heavily used Main Hawaiian Islands and integrating socioeconomic information, Hawai‘i and comparable marine ecosystems worldwide should realize improvements in resource management and community response to changes in climate.

While this project is in its formative stages, the information generated by this projected 10-year multi-agency, collaborative program will:

- Fill critical and important research gaps in the underlying science of marine ecosystem dynamics

- Complement national, international, and state ecosystem research initiatives
- Improve understanding of the behavior of humans in a marine ecosystem approach to conservation and management
- Formulate predictive theory of ecosystem dynamics relative to physical and biological variables, and
- Generate useful information for conservation managers.

Conclusion

NOAA's Pacific Region is engaged in a number of ways to help the Pacific Islands plan for, mitigate against, and adapt to climate change. This is not an exhaustive list. I have highlighted efforts that are most prominent at this time. The development of NOAA's products and services as they relate to climate change is as dynamic as the issue itself.

NOAA's Pacific Region will continue to work with our island communities to develop tools, products, and services to move towards realizing NOAA's vision of, "An informed society that uses a comprehensive understanding of the role of the oceans, coasts and atmosphere in the global ecosystem to make the best social and economic decisions."

Thank you for the opportunity to appear before you today.