

## PACIFIC ISLANDS

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### Pacific Islands Regional Integrated Science and Assessment (Pacific RISA) Program

Input to

#### SPARC Reconciling Supply and Demand Workshop: Climate Science Policy Lessons from the RISAs

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### Pacific Islands RISA – An Introduction

The Pacific Islands Regional Integrated Assessment (Pacific RISA) program began in fall 2003 with a small, initial three-year grant from the NOAA Office of Global Programs. As described in the initial proposal to NOAA/OGP, the Pacific RISA program continues

**“an ongoing commitment to the emergence of a Pacific climate information system that supports the development and use of climate information to support decisionmaking”**

in the American Flag and U.S.-Affiliated Pacific Islands.<sup>1</sup> The Pacific RISA program emphasizes understanding and reducing Pacific Islands’ vulnerability to climate-related extreme events such as droughts, floods and tropical cyclones. In other words, the Pacific RISA program has been organized to *support and enhance the climate risk management activities of Pacific Island governments, communities, resource managers and businesses.*

In the context of a climate information and risk management system, the Pacific RISA focuses these and related ongoing climate activities in the region on the following objectives:

- Sustain and expand a *focused, interactive dialogue* with decision makers in climate-sensitive sectors to enhance understanding of regional vulnerability, explore potential response options and identify critical information needs;
- Enhance regional efforts to *develop and apply climate forecasts and information products* to meet the information needs of decision makers in climate-sensitive sectors including disaster management, water resources and public health;
- Develop *enhanced data and information products* that better address the nature and consequences of current and future patterns of climate-related extreme events and the patterns of climate variability that set them in motion; and
- Adapt and apply existing *model-based decision support tools* with an initial focus on climate-related extreme events and further develop these same tools in the context of integrated climate assessment methodologies.

The Pacific RISA program is built on the foundation of a number of past climate forecasting applications, climate research and climate assessment activities in the Pacific, including: the Pacific ENSO Applications Center<sup>2</sup>; the Pacific Assessment of the Consequences of Climate Variability and Change conducted as part of the first U.S. National Assessment of the Consequences of Climate Variability and Change; and an East-West Center-University of Hawaii joint research project on climate and health. These earlier programs are described in more detail in Appendix 1. In

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<sup>1</sup> The American Flag Pacific Islands include Hawaii, Guam, American Samoa and the Commonwealth of the Northern Mariana Islands; the U.S.-Affiliated Pacific Islands include the Federated States of Micronesia (Yap, Chuuk, Kosrae and Pohnpei), the Republic of the Marshall Islands and the Republic of Palau.

<sup>2</sup> The Pacific ENSO Applications Center (PEAC) represents a working partnership among the University of Hawaii (Social Science Research Institute and School of Ocean and Earth Science and Technology); the University of Guam; the Pacific Basin Development

addition, the Pacific RISA program builds on a long history of disaster management, risk management and climate research at the East-West Center and the University of Hawaii's Social Science Research Institute.

### **Dialogue with Users (Demand Side Assessment)**

#### *Who are the stakeholders for the Pacific RISA Program?*

The early foundations for a Pacific RISA program were laid with the initiation of the work of the Pacific ENSO Applications Center (PEAC) in 1994. NOAA's Office of Global Programs initiated PEAC as a research pilot project following a 1992 workshop at the University of Hawaii that brought together ENSO scientists and representatives of key climate-sensitive sectors throughout the American Flag and U.S.-affiliated Pacific Islands. The idea for the 1992 workshop, and the Pacific ENSO Applications Center that would later emerge, began in the context of early presentations by NOAA/OGP<sup>3</sup> on emerging seasonal climate forecasting capabilities associated with the El Niño-Southern Oscillation with Pacific Island coastal zone managers during the preceding two years.

The 1992 workshop was explicitly designed to engage representatives of key sectors affected by climate variability and change in the development of a climate forecasting and applications program. The users represented at the 1992 workshop included representatives of:

- Disaster/emergency management offices/agencies;
- Coastal zone management offices/agencies;
- Fishery management agencies and regional organizations;
- Water resource management agencies and electric utilities companies or agencies;
- The Pacific Basin Development Council comprising the Governors of the four American Flag Pacific Islands;
- The National Weather Service offices in the Pacific; and
- Academic and scientific institutions engaged in climate research in the region.

As part of the initial Assessment of the Consequences of Climate Variability and Change (2000-2003), this initial group of current and potential climate information – Pacific RISA -- users was expanded to include:

- Agriculture ministries and businesses, including small-scale farmers;
- Agencies and businesses engaged in supporting tourism including tourism authorities, risk managers and community liaison officers from the Outrigger hotel chain, faculty from the Travel and Tourism Management at the University of Hawaii;
- Land and resource management agencies in the AFPI and USAPI jurisdictions (the Department of Land and Natural Resources in Hawaii);
- Representatives of marine sanctuaries and other protected areas in Hawaii and American Samoa;
- Non-governmental organizations addressing environmental and resource conservation issues;
- Representatives of health ministries including public health officials in the region;
- The national climate change country teams emerging in the independent nations of the Pacific with U.S. affiliations (Federated States of Micronesia, Republic of Palau and Republic of the Marshall Islands); and
- Regional organizations supporting Pacific Island programs in weather, climate, disaster management, water resource management and community development, most notably the South Pacific Regional Environment Programme (SPREP) and the South Pacific Applied Geosciences Program (SOPAC).

These individuals and colleagues in their home institutions form the user base for the Pacific RISA program. More recently, this user group has been expanded to include groups like the Pacific Risk Management Ohana (PRiMO) representing the key Federal, state and regional agencies and scientific and technical institutions engaged in disaster

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Council (PBDC) and NOAA (the National Weather Service and the Office of Global Programs). Operational responsibility for PEAC resides with the National Weather Service, Pacific Region.

<sup>3</sup> NOAA/OGP was represented at these meetings by Eileen Shea who was then Deputy Director of OGP.

management in the Pacific. PRiMO is becoming a primary source of input on the programs and plans for the Pacific RISA program as they relate to disaster/risk management. PRiMO has embraced managing climate-related risks as one of the three risk areas used to guide PRiMO's activities and the Pacific RISA program is identified as the/a primary source of guidance on the climate-related programs and activities of PRiMO and its participating agencies.

What processes are used to include stakeholders in research planning, implementation and reporting processes?

As will be described in more detail in the following section, a majority of the activities in the initial Pacific RISA program are focused on stakeholder interaction and partnerships in the emergence of a Pacific climate information and risk management system. Figure 1 provides a conceptual framework of such a system and emerged from the initial Pacific Assessment of the consequences of climate variability and change. The conceptual design of a Pacific climate information system reflected in Figure 1 emerged in response to the overarching recommendation from the initial Pacific climate assessment:

**The shared exploration of climate vulnerability and resilience that began with the initial Pacific Assessment should be maintained as a continuing process with a goal of nurturing critical partnerships to develop, share and use climate information to support decisionmaking.**

The Pacific RISA program is a direct response to that recommendation.

Pacific RISA stakeholders are included on the Pacific RISA steering committee and are, similarly, engaged on the steering committees for the current suite of program elements including the PEAC review, the NOAA/CSC-funded Pacific Assessment follow-on education project, and the Pacific Islands Training Institute on Climate and Extreme Events. In addition, representatives of key stakeholder groups are actively recruited to serve on the organizing committees for and participate in climate-related workshops, briefings and roundtable discussions. During such meetings, we strive to ensure that breakout sessions are co-chaired by a scientist and a user and that breakout groups reflect as broad a cross-section of climate information users and providers as possible. To the maximum extent possible, reports from such RISA-related workshops, meetings and discussions are co-authored whenever possible.

The PEAC review project included several elements designed to elicit input from the users of PEAC products and services including: written surveys, in-person interviews and a June 2004 regional workshop during which PEAC users and scientists explored the first ten years of PEAC operations, identified information gaps and research needs and developed recommendations for future PEAC and RISA programs in the context of a Pacific climate information and risk management system. These findings and recommendations are being integrated into planning for PEAC and related NWS climate services in the Pacific region and will be used to help guide the development of the next Pacific RISA proposal.

During its first decade, PEAC has employed a number of activities to disseminate climate information and seek input and guidance from the users of PEAC products (stakeholders). In 1994 PEAC began issuing a quarterly newsletter describing ENSO-relevant ocean-atmosphere conditions and providing Pacific Island jurisdictions with information regarding the implications of those conditions for rainfall and other key factors. PEAC established a website early and, as a result of the PEAC review workshop in June 2004, is improving web-based opportunities for user input on PEAC products and services.

PEAC also initiated an active program of education, outreach and dialogue with users to clarify information needs and make PEAC products more useful and usable. In addition to reports, brochures and other written products, this education program included regular visits to Pacific Island jurisdictions served by PEAC to discuss current and projected ENSO conditions and facilitate discussion of adaptation measures with affected communities, agencies and businesses in those jurisdictions. One of the interesting findings of the PEAC review involves the importance of maintaining the human resources needed to sustain the science-user dialogue. When PEAC was created, a NOAA Corps Officer was identified to serve as an education/outreach focal point for PEAC. Unfortunately, after the first three years of PEAC operations, the Corps Officer was re-assigned and the NOAA Corps was not able to provide an officer to maintain the PEAC billet until approximately three years ago when a permanent billet was established at the Pacific Region National Weather Service for PEAC and related climate services education and outreach activities. As a result, for a period of about three years, PEAC operated without a designated education/outreach officer. Survey and interview responses during the PEAC

review suggest that those user groups who first became aware of PEAC products during that three-year period were less satisfied with their opportunities for input to PEAC product design and implementation than those who were either among the first PEAC users or joined the extended PEAC family of users since the re-instatement of the education/outreach officer. *These results seem to confirm the concept that sustained communication and user engagement is critical to the co-evolution of climate science, information services and climate risk management policies.*

The NOAA/CSC-funded Pacific Assessment education workshops in Pacific RISA jurisdictions are being used to explore local vulnerability, identify information gaps and elicit recommendations for future climate observations, research, forecasting and assessment activities.

The Prescott College project involving the development of a model-based decision support tool for county planning officials in Hawaii was initially designed in consultation with county planning officials and that dialogue continues as the Digital Comprehensive Planning (DCP©) model has evolved. The initial idea for this element of the Pacific RISA program emerged during the initial Pacific Islands climate assessment when the team from Prescott College was invited by county representatives to explore the applications of their model in Hawaii. From the beginning, the development of this decision support tool included an explicit element of stakeholder engagement and, during a recent conversation with the Pacific RISA Director, the project lead (Wil Orr) noted that *the successful development and demonstration of a prototype for Maui County was “one-third (1/3) technical (technology development) and the two-thirds (2/3) a process of shared learning through interaction and dialogue with the intended users of the tool.*

*How are stakeholder interactions evaluated?*

We have not conducted any formal evaluation of the stakeholder interactions in the Pacific RISA program to date although we anticipate doing so in the future. Members of the Pacific RISA team do query users informally on a periodic basis and exploration of the process of science-user dialogue and interaction is routinely an explicit element of RISA-supported workshops, briefings and training programs.

The PEAC review, however, did include explorations of the effectiveness of PEAC in communicating with users as well as understanding and responding to their needs. As noted, earlier, one lesson learned from the surveys, interviews and workshop discussions conducted as part of the PEAC review is that websites, newsletters, brochures and reports are not sufficient. For PEAC – and the Pacific RISA more generally – sustained interaction with a trusted individual (or group of individuals) is essential. As you will see in the following section, building trust and credibility is essential and that takes, as one member of the extended Team Pacific says, “eyeball-to-eyeball” contact.

*What has your RISA learned from the process of stakeholder interaction, and how have its decision processes changed as a result?*

Answering the second part of the question first, I’d say that our thinking about the next phase of the Pacific RISA program continues to evolve as a result of our continuous interaction with the users of climate information in the Pacific. For example, discussions during the PEAC review workshop in June 2004 have lead the Pacific RISA team and the National Weather Service Pacific Region to begin development of an integrated Pacific Islands climate information and risk management system in which operational forecasting and other climate services, climate research, assessment programs like RISA and climate-related observing programs are integrated into a single, interactive and mutually-supportive system focused on the needs of Pacific Islands governments, communities and businesses. The Pacific RISA of the future will be shaped by its role in this broader system and that will undoubtedly produce a RISA that is different than one that might have evolved independently as a science program.

Much of what we have learned from the stakeholder interactions in the Pacific region were most clearly articulated in the context of the PEAC review. As described at the AMS 2005 Annual Meeting, some of these key “lessons learned” from the Pacific experience include:

- **Early and continuous partnership and collaboration with users is essential -- shared learning & shared responsibilities:**
  - Among partners in climate information system
  - Across local, national, regional and international

- Between/among providers and users
- Among user communities
- Dynamic nature of climate and policy
- Continuous evaluation and revision—FEEDBACK essential
- **Education, outreach and dialogue activities play a critical role:**
  - Raising awareness and understanding
  - Identifying impacts and exploring solutions
  - Building trust and credibility
- **Building trust and credibility is a long-term endeavor:**
  - Establishing and sustaining “eyeball-to-eyeball” contact
  - Build on existing institutions and trusted information brokers
  - **Maintaining awareness between events – i.e., focus on establishing a sustained, climate information system not just an event-based early warning system**
  - Accommodating relative successes and failures (e.g., 1997-1998 vs. 2001-2002)
- **Forecasts or projections of future conditions must be set in an appropriate context:**
  - Problem to be addressed
  - Historical events, patterns and trends
  - Traditional knowledge and practice
  - Useful and usable information appropriate to the intended application and decision-making community
- **Decision makers in many sectors are interested in climate information on a continuum of timescales from extreme events through seasonal and interannual timescales to projections of changing conditions on timescales of decades and longer:**
  - Exploring linkages across timescales important
  - Extreme events can be a galvanizing focus for planning, response and capacity-building
- **Early experience points to a number of scientific, technical and institutional constraints in specific places/sectors, including:**
  - Communications – systems and language
  - Difference in forecast skill with season, place and parameter
  - Political and institutional boundaries – for both users and providers of climate information
  - Forecasts remain limited by observations, data and computational constraints
  - Understanding of consequences, vulnerabilities and options for risk management still fairly limited.

While some of these lessons are explicitly focused on ENSO-based seasonal forecasting and applications, experience during the Pacific Assessment, the Pacific Islands Training Institute on Climate and Extreme Events and related RISA activities confirm these lessons as important for climate science and services more generally.

*How did you develop your process for eliciting stakeholder needs/wants?*

As described earlier, the Pacific RISA has evolved from a number of previous activities, programs and institutional experience with climate and risk management in the Pacific. The processes for eliciting stakeholder needs and wants utilized in the Pacific RISA program today are based on approaches used successfully in these earlier programs (e.g., PEAC). An incident during the 1992 workshop that recommended the creation of PEAC has helped shape the Pacific Assessment approach. Following a presentation on then current capabilities in ENSO-based seasonal forecasting, one of

the scientists suggested that “these forecasts are not yet good enough for you to use.” The public utilities manager for American Samoa raised his hand with the following question “Professor, do you respect me?” After a brief exchange focused on the difference between forecast skill and forecast usefulness and usability, both scientist and user arrived at the same place – mutual respect and shared understanding of the capabilities and problems on both the supply and demand side of the science-policy equation is essential for success.

### **Defining the Science Program (Supply Side Assessment)**

*Briefly describe the research agenda for the Pacific RISA and How does the Pacific RISA set its own research priorities?*

**T**he Pacific RISA Program reflects the experience acquired during the first eight years of operation of the Pacific ENSO Applications Center and specifically responds to some of the critical research and information needs identified during the initial Pacific Assessment including:

- Enhancing efforts to monitor, *document, understand and model climate processes and consequences* at local, island, national and regional levels;
- Improving *information on the nature and consequences of patterns of natural variability* including current ENSO and how those patterns might change in the future;
- Improving *understanding of climate-related extreme events* such as droughts, floods and tropical cyclone patterns;
- Enhancing efforts to *identify and evaluate adaptation measures*; and
- Improving *access to useful and usable climate information* to support decision-making related to water resource management, public health and safety, agriculture, tourism, fisheries and coastal resource management.

The research priorities for the first three years of the Pacific RISA were identified in the context of these information needs. The Pacific RISA team will review experience, consult with key partners, and discuss future priorities with the Pacific RISA steering during the coming year in preparation for the submission of a proposal for the second multi-year phase of the Pacific RISA program.

As noted previously, the Pacific RISA program has been organized to *support and enhance the climate risk management activities of Pacific Island governments, communities, resource managers and businesses*. Currently, Pacific RISA provides a programmatic framework for integrating the work of a small suite of climate research, assessment and services activities being supported by NOAA and other sponsors including:

- A review of the first ten years of operation of the Pacific ENSO Applications Center (funded by NOAA’s Office of Global Programs);
- A NOAA Coastal Services Center-supported climate assessment and outreach project designed as a direct follow-on to the initial Pacific Islands Assessment of the Consequences of Climate Variability and Change<sup>4</sup>;
- A three-year Pacific Islands Training Institute on Climate and Extreme Events being conducted jointly by the East-West Center, the University of the South Pacific and the New Zealand National Institute for Water and Atmospheric Research (NIWA) with support from NOAA and the Asia-Pacific Network for Global Change Research (APN);
- A subcontracted project with colleagues at Prescott College to explore the potential to include consideration of climate variability and change in a model-based, Digital Comprehensive Planning (DCP©) decision-support tool being developed for county officials in Hawaii; and
- An emerging partnership with the National Center for Atmospheric Research (NCAR) as part of NCAR’s Extreme Weather and Climate Extremes initiative<sup>5</sup>.

*How has this agenda evolved over the duration of the RISA? What projects have been started that were not anticipated at the*

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<sup>4</sup> The NOAA-CSC project is entitled “Addressing the Challenges and Opportunities of Climate Variability and Change for Pacific Island Coastal Communities” and provides resources to hold local workshops and briefings on the results of the initial Pacific Islands climate assessment produced as part of the first U.S. National Assessment of the Consequences of Climate Variability and Change.

*beginning of the RISA? What projects have been terminated and why?*

The Pacific RISA is only two years old so there have not yet been any major changes in the research agenda. Ongoing research and stakeholder interactions during this initial phase, however, have helped identify potential areas of new or enhanced interest including, for example:

- expansion of PEAC forecast products to include projections of sea level variability;
- development of an experiential data base that not only includes information on ENSO impacts but also on the adaptive measures undertaken in Pacific Island jurisdictions during and following the 1997-1998 ENSO event;
- greater integration with climate-related observing systems and programs;
- inclusion of capacity-building program elements including professional internships/fellowships as well as formal and informal education and training programs; and
- enhanced efforts to explore, anticipate and mitigate the consequences of climate variability and change on marine and coastal ecosystems and the sectors that depend upon them (e.g., tourism and fisheries).

No elements of the Pacific RISA program have been terminated during the first two years of the RISA existence. Most of the science programs encompassed by the Pacific RISA program are actually supported with resources from other sources and most will come to an end during the coming year. As a result, the second Pacific RISA program will provide the first opportunity to develop a scientific agenda specifically in the context of the RISA program itself and the Pacific climate information and risk management program to which the RISA program will contribute.

*In the Pacific RISA, what is the balance between research on new subjects and assessment/compilation of existing knowledge? How is this balance determined?*

Currently, most of the direct Pacific RISA funding and, in fact, funding for the broader suite of Pacific RISA activities is focused on the *assessment process* of shared learning and joint problem-solving with users. In a practical sense, this balance was determined on the basis of limited new funding for the Pacific RISA (\$130K in year one and \$170K in years two and three) and the need to leverage other, related projects. On the other hand, this balance also reflects the Pacific RISA team's recognition that facilitating a process of dialogue with users was identified as the overarching recommendation from the initial Pacific Islands climate assessment. As noted above, the development of a proposal for a second phase of Pacific RISA funding will provide an opportunity to develop a science, assessment and education agenda specifically for RISA in the context of an evolving Pacific climate information system.

*Please describe the specific ways that knowledge is disseminated from the Pacific RISA. How would you assess the relative importance of various dissemination mechanisms, such as peer-reviewed publications, other types of publications, web-based presentations, public for a, etc.?*

Much of the dissemination of knowledge conducted in the context of the Pacific RISA is done through public presentations at workshops, briefings and small group meetings and the dissemination of reports, brochures, newsletters, PowerPoint slides in both hard-copy and electronic forms. The rationale for this approach is partly related to funding limitations and the fact that the Pacific RISA program is, currently, comprised of suite of activities originally developed prior to the initiation of the Pacific RISA and focused on outreach, education and dialogue with governments, businesses and communities affected by climate variability and change. It's important to recognize, however, that, based on the past decade of experience in climate forecasting, applications and assessment programs, the Pacific RISA program will probably always include a focus on face-to-face ("eyeball-to-eyeball") interaction as a critical element of the Program's approach to information dissemination. The PEAC review suggests, for example, that an initial commitment to in-country education and outreach activities in the early years of PEAC was one of the keys to the successful adaptation measures taken by Pacific Islands in response to the PEAC forecast of the 1997-1998 event.

The Pacific RISA program does have a website from which formal presentations and reports can be disseminated and through which users can learn more about individual RISA projects and the people involved in them. Past experience, however, points to the significant limitations associated with web access and electronic data and information transmission in the region. As a result, for example, participants in the PEAC review have reinforced the importance of hard-copy versions of the PEAC newsletter and related Pacific RISA materials.

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<sup>5</sup> This emerging Pacific RISA-NCAR partnership is focused on the work of Drs. Jerry Meehl and Linda Mearns.

Peer-reviewed publications will also play a role in the Pacific RISA program but we believe they will be most important to ensuring the scientific quality and integrity of the Pacific RISA program. In the context of supporting climate risk management, the suite of dissemination avenues for the Pacific RISA information will continue to emphasize individual presentations, participation in risk management meetings, committees and task forces, education and training programs, brochures, and written materials tailored for specific sectors/user groups.

## **Reconciliation/Managing Ecology of Supply and Demand**

*In what ways have considerations of supply for research shaped the evolution of your research agenda?*

**T**he foundations of the Pacific RISA program reflect considerations of both supply – i.e., the emergence of ENSO-based seasonal climate forecasting capabilities – and demand – i.e., recognition of information needs as expressed by user communities through PEAC and the continuing Pacific Assessment process. Certainly, the availability (supply) of a new suite of scientific products precipitated the convening of the 1992 PEAC workshop and set the stage for the creation of PEAC and the emergence of the Pacific RISA program. Similarly, the desire to use new scientific insights to assess the climate-related vulnerability of Pacific Island jurisdictions helped facilitate the initial Pacific Assessment. On the other hand, the programmatic and institutional approaches now represented in Pacific RISA-related projects reflects a growing recognition of the importance of engaging scientists and users as true **PARTNERS** in the endeavor.

Initially, my Pacific RISA colleagues and I found it a bit difficult to respond to this question. The use of “supply and demand” seems to imply a one-way flow of information and actions in the sort of information pipeline often used to environmental forecasting services or the use of scientific information to support decisionmaking. The concept of “*managing the ecology*” of supply and demand and the organizers own research, however, reflect the important recognition that what we’re striving for is the co-evolution of knowledge and action (science and policy) and that this kind of shared learning and joint problem-solving requires a continuous process of interaction and exploration. In a way, it’s a bit like the emergence of a definition of assessment that reflects both products and process and recognizes that the process itself is as important to the usefulness and usability of assessment reports and other information products as the quality and scientific integrity of the products themselves. I commend the organizers for tackling this important challenge and look forward to the results of our deliberations in Honolulu.

*What tensions have arisen between stakeholder needs, demands and expectations, and the scientific capabilities and priorities of the Pacific RISA? How have those tensions been addressed or resolved?*

I’m not sure that I’d characterize any of our discussions of user needs and scientific capabilities in the Pacific RISA context as representing “tensions.” In part, this may be due to the relative young age of the Pacific RISA. On the other hand, the foundation programs – like PEAC – have amassed a decade of experience. Beginning with the 1992 PEAC workshop, there have been continuous discussions of user needs for information that cannot yet be provided by the climate science community (e.g., timing of the cessation of rainfall associated with an ENSO warm event in individual jurisdictions or higher-resolution projections of the impacts of climate change on rainfall that better incorporates island topography) but the continuous, interactive nature of the dialogue between PEAC scientists and users has tended to maintain a constructive discussion of what can be provided now, how current information is being/can be used and an exploration of what might (or might not) be possible in the future given additional research or new modeling capabilities. The contributions of NCAR to the Pacific RISA program, for example, are a direct result of the desire to explore the potential for more regionally-specific, realistic projections of the effect of climate change on extreme events – a specific area of interest identified by PEAC and the Pacific Assessment process.

In a strange (and perverse) way, I think that the somewhat limited funds available for the initial Pacific RISA may have also helped preclude the emergence of “tensions” between what the Pacific climate science community might like to pursue intellectually and targeted efforts focused on stated user needs. The Pacific RISA has evolved to date as an integrating effort rather than a stand-alone science program so the Pacific RISA team primarily serves as an information broker – facilitating the dissemination of scientific information developed by the broader scientific community and supporting the user interactions that will help guide future climate research and services in the Pacific and the science-user dialogue that, we hope, will enhance resilience in the face of climate variability and change.



*How does the Pacific RISA evaluate the appropriateness of stakeholder needs (e.g., from the standpoint of public/private sector roles and responsibilities)?*

Since, as described above, the Pacific RISA *currently* serves as more of an information broker than direct provider, I can't say that we've ever had to formally evaluate the effectiveness of stakeholder needs directly during our first two years of existence. Discussions of public versus private roles/responsibilities have emerged as PEAC has evolved from research pilot project to operational element of the NWS Pacific region climate services but not in any dramatic way. I expect that we will face such issues in the future, however, as the Pacific RISA moves into its second stage and I look forward to the lessons being learned by our RISA colleagues in other regions. I also expect that the issue of public versus private roles and responsibilities will be explicitly addressed as we plan for the future of RISA in the context of an overall Pacific climate information and risk management system.

*How are stakeholders identified? What stakeholder groups are most important in influencing your RISA research agenda? Why? Which stakeholder groups are least important? Why?*

As discussed previously, Pacific RISA stakeholder groups evolved in the context of earlier programs and activities such as PEAC and the Pacific climate assessment process. In the case of both of these foundation programs, the most *active* stakeholders tended to come from the National Weather Service offices in Pacific Island jurisdictions, the scientific community engaged in climate research and assessment and the disaster management, water resource management and utilities sectors – user communities that were already utilizing weather and climate information to some extent in their work and were somewhat familiar with climate system processes or at least the general impacts of weather and climate on their sectors. In other words, these communities represented the early adapters of new climate capabilities such as ENSO-based seasonal climate forecasts. For those independent Pacific Island jurisdictions served by the Pacific RISA program, their national climate change country teams developed in the context of the UNFCCC have also become an important and continuous user community.

Subsequently, the agricultural, public health and natural resource management sectors became increasingly engaged in Pacific RISA discussions and activities. More recently, representatives of the tourism sector, land use/community planning ministries/offices and economic development ministries have become more active partners in the climate risk management dialogue supported in the context of Pacific RISA. Although I hadn't thought of it in these terms before, I suspect that the difficulties are, in part, related to the nature of the supply of climate information available. For example, ENSO-based forecasts and climate change projections tended to focus on changes in rainfall, temperature so the user communities (stakeholders) most active in the early years were those for whom changes in those parameters were most directly relevant.

I also believe that a decision to focus Pacific RISA programs on enhancing resilience to climate-related extreme events has helped engage user communities that were not easily drawn to discussions of long-term climate change (e.g., the tourism sector in the Pacific region). As discussed during a number of Pacific climate discussions, extreme events provide an opportunity to explore climate-related vulnerability in an historical context that most communities and sectors find familiar (most will have recent experience to bring to the table) and can provide an opportunity to develop recommendations for enhancing resilience that can help meet today's problems today while planning for the future.

Finally, discussions of climate vulnerability and adaptation in the Pacific region – including those facilitated by the Pacific RISA program – are highlighting the link between mainstreaming climate information and sustainable development planning. This linkage is helping to bring a broader array of ministries and sectors to the table.

Note that in these discussions, I have avoided the use of the word "important" since I do not believe that the level of engagement by a user group is, necessarily, a reflection of "importance" either in the near or short term. In the sense that active engagement implies influence on program direction, however, there is no doubt that some user communities have been more influential than others in the early evolution of the Pacific RISA program.

*How does your RISA evaluate its research planning process?*

Two years in, we have not formally evaluated our research planning process although we will be reviewing our scientific agenda in the coming year in the context of developing a proposal for the second phase of Pacific RISA.

Pacific RISA workshops and small-group discussions with stakeholders (user communities) usually include an explicit discussion of information gaps and research needs so the Pacific RISA team is constantly receiving input on the extent to which currently available climate information is meeting user needs and providing input on priorities that can be used in planning future RISA programs. Development of a more formal process for planning and evaluating Pacific RISA programs and activities will be incorporated into the development of the proposal for the next phase of the Program. The Pacific RISA Steering Committee – which includes scientists and users – will play a key role in this process.

*What lessons in the process of reconciliation of supply of and demand for science are relevant to the broader implementation of the CCSP?*

The PEAC review and continuing discussions of lessons learned from Pacific climate assessment work in the context of the Pacific RISA, has helped identify a set of what I call ‘guiding principles’ for the emergence of a Pacific climate information and risk management system<sup>6</sup>. In the assumption that these concepts may also be helpful in planning for future programs under the CCSP (particularly in the decision support program element), I’m including them here, in shorthand, as a response to this question:

- ▲ Focus on the **integrated climate-society system**<sup>7</sup>
- ▲ **Utilize a collaborative, participatory process with involving both users and providers of climate information**
  - ▲ Science-applications partnerships
  - ▲ Continuous, interactive dialogue
  - ▲ Co-production of knowledge
  - ▲ Public education campaign an essential component
- ▲ **Use a problem-focused (vs. forecast-focused) approach:**
  - ▲ Understand place, context, history and decision making process;
  - ▲ Responsive to user needs
  - ▲ Understand vulnerability and focus on building resilience
- ▲ **Produce, communicate and apply useful and usable information**
  - ▲ Scale, timing, format, language and content appropriate to a particular application community
  - ▲ Products and dialogue processes appropriate to user needs
  - ▲ Near-term decisions and long-term planning
  - ▲ Tools and technologies (e.g., analytical products and discussion/decision support tools) that are appropriate to the user community and application
- ▲ **Recognize the importance of climate information on a continuum of timescales**
- ▲ **Address both process and products** in the design of climate information systems
- ▲ Recognize the need for an **integrated program of observations, monitoring, forecasting, assessment, education and applications** – *with continuous evaluation and adjustment*

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<sup>6</sup> An early version of these guiding principles were first developed in the context of the synthesis of a March 2003 Symposium on Climate and Extreme Events in the Asia-Pacific: Enhancing Resilience and Improving Decision-Making. Subsequently, during a September 2004 Galapagos Workshop on El Niño Early Warning for Sustainable Development in Pacific Rim Countries organized by the National Center for Atmospheric Research ([http://www.exploratorium.edu/el\\_nino](http://www.exploratorium.edu/el_nino)), this author suggested that lessons learned in the Pacific region may be pointing toward a set of guiding principles that might be considered in thinking about climate science, services and information systems more generally.

<sup>7</sup> Credit for the phrase ‘climate-society system’ belongs to Mickey Glantz who used the phrase as part of an opening keynote address at a March 2003 Symposium on Climate and Extreme Events in the Asia-Pacific: Enhancing Resilience and Improving Decision-Making.

- ▲ **Build on existing systems, institutions, programs, relationships & networks**
  - ▲ Recognize the vital role of trusted information brokers
- ▲ **Facilitate proactive decision making and iterative, reflective, flexible and adaptive approaches**
- ▲ **Climate risk management – and the information systems that support it – should be set in a sustainable development context**
  - ▲ Responding to today’s variability
  - ▲ Adaptation to long-term change
  - ▲ Economic planning & community development
  - ▲ Mainstreaming climate information & adaptation

These guiding principles are still very much a work in progress and they are offered here to help support continued discussion of our shared journey toward sustained climate information systems and the mainstreaming of climate information to support adaptation in the face of climate variability and change.

In closing, however, I’d like to offer one more important lesson from the Pacific. It has to do with the meaning of the Hawaiian word ALOHA. The most important element of this word is HA – meaning breath or spirit of life. Hawaiians greeted each other by touching foreheads and breathing deeply – in other words, recognizing and sharing the life spirit, insights, experience and expertise that each brought with them. Scientists, engineers, government officials, businessmen and businesswomen, educators, the media, NGOs, community leaders and individual citizens each bring something important to our understanding of what Mickey Glantz calls the climate-society system and each will play an important role in responding to the challenges and opportunities presented by climate variability and change. If we do nothing else, we must ensure that the CCSP respects *and supports* efforts to establish and strengthen science-decisionmaking partnerships like those emerging in the context of the RISA programs.

## Appendix 1 Pacific RISA Foundation Programs

### **Pacific Islands Regional Assessment of the Consequences of Climate Variability and Change**

This activity, led by the PI, provided much of the conceptual, scientific and technical underpinning for this proposal. In October 2001, the East-West Center published *Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change for Pacific Islands* (Shea et al., 2001). This report synthesized the findings and recommendations of a two-year project to assess the consequences of climate variability and change for American Flag and U.S.-affiliated Pacific Islands<sup>8</sup>. The Pacific Assessment was conducted as a regional contribution to the first U.S. National Assessment of the Consequences of Climate Variability and Change. Based on extensive involvement of experts and stakeholders from diverse knowledge groups, the Pacific Assessment combined research and analysis of historical patterns and projected trends in climate with an organized program of outreach and dialogue that included two large workshops and small-group discussions with government officials, resource managers, businesses community leaders and scientists throughout the region.

By focusing on vulnerability (sensitivity, exposure and resilience/adaptive capacity), Pacific Assessment participants were able to develop specific recommendations for actions designed to enhance resilience in six key areas: ensuring public safety in extreme events and protecting community infrastructure; protecting public health; providing access to fresh water; sustaining agriculture; sustaining tourism; and promoting the wise use of marine and coastal resources. In the context of these recommendations, participants in the Pacific Assessment encouraged the establishment of a sustained scientific and decision support system designed to promote the development and application of climate information to support decision-making in the region (see Figure 1). The East-West Center is working with other members of the Pacific Assessment core scientific team<sup>9</sup> to build such a Pacific Island climate information system. The final report and additional information on the Pacific Assessment can be found at (<http://www2.EastWestCenter.org/climate/assessment>).

### **Pacific ENSO Applications Center (PEAC)**

Pacific Assessment participants specifically encouraged strengthening and sustaining ongoing institutions and programs like the Pacific ENSO Applications Center (PEAC) that support decision-making by providing and applying climate information. The concept for a Pacific ENSO Applications Center emerged during a 1992 workshop on ENSO forecast applications in the Pacific organized jointly by the University of Hawaii and NOAA's Office of Global Programs. PEAC began operations as a research pilot project in 1994; beginning in fiscal year 2002, the National Weather Service Pacific Region has assumed operational responsibility for PEAC with resources made available through NOAA's Climate Observations and Services initiative. PEAC is a partnership of the University of Hawaii, the University of Guam, NOAA and the Pacific Basin Development Council, with each partner contributing their special expertise to support the development, dissemination and application of ENSO forecast information to support decision making in critical sectors including disaster management, health, water resource management, agriculture and coastal management. During the 1997-1998 El Niño, Pacific Island governments responded to PEAC forecasts and public education programs by establishing government-wide task forces to prepare for anticipated drought conditions. While those drought conditions were extensive enough to require water rationing in most jurisdictions, the availability and application of advanced forecast information significantly mitigated the negative impacts the 1997-1998 event (See Appendix A for further details). Additional information can be found on the PEAC website (<http://lumahi.soest.hawaii.edu/Enso/>).

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<sup>8</sup> The American Flag Pacific Islands include Hawaii, Guam, American Samoa and the Commonwealth of the Northern Mariana Islands; the U.S.-affiliated Pacific Islands include the Federated States of Micronesia (Yap, Chuuk, Pohnpei, and Kosrae), the Republic of the Marshall Islands and the Republic of Palau.

<sup>9</sup> The Pacific Assessment core scientific team included: Dr. Michael P. Hamnett (University of Hawaii and co-PI for PEAC), Cheryl Anderson (UH Social Sciences Research Institute) and Dr. Nancy Lewis (East-West Center Director of Studies), all of whom will be actively involved in the work proposed here.

### **Climate and Health in Pacific Islands**

During the past six years, the East-West Center and the University of Hawaii have been involved in a series of related efforts aimed at improving the use of seasonal to inter-annual climate forecasting to reduce the negative impacts of climate variability on people in the Pacific region. The first was a research project that investigated the relationship between El Niño-Southern Oscillation (ENSO) events and water-borne and water-related disease in the Pacific Islands funded by the NOAA Office of Global Programs (NA67J0154). Multiple methods were used in analyzing the relationship between monthly, national-level, epidemiological data (1973-1994) for dengue, diarrheal disease, cholera and ciguatera fish poisoning and ENSO indices. These included Southern Oscillation Index (SOI), Sea Surface Temperature (SST) in the Niño 3-4 region, and rainfall and temperature for 66 locations in the Pacific Islands. A second component of the initial project was added with the onset of the 1997-1998 El Niño. This focused on dengue fever in the Pacific Islands region prior to and during the 1997-1998 ENSO warm event. This was based largely on review and analysis of epidemiological and climate data, and information gathered from PACNET and media reports.

Finally, a two-country study of the impact of climate variability on health in Cook Islands and Fiji has recently begun and is being funded by NOAA's Office of Global Programs and the Asia-Pacific Network for Global Change Research (APN). This new study, which is a collaborative effort involving the East-West Center, the University of Hawaii, the Fiji School of Medicine, the Cook Islands Meteorological Service and Ministry of Health, and the Fiji Meteorological Service and Ministry of Health, will compile and analyze sub-national climate and health data to further assess the feasibility of using climate forecasts to anticipate and respond to increases in the risk of dengue fever, diarrheal disease, cholera, leptospirosis, acute respiratory infections, influenza and ciguatera. An initial project meeting was held in Fiji in July 2001 with support from APN. A workshop to disseminate the results is tentatively scheduled for June 2003 with support from APN.