

2013 – 2014 ANNUAL REPORT: PACIFIC RISA

- 1. Award Title: Climate Adaptation Partnership for the Pacific (CAPP): Pacific Regional Integrated Sciences and Assessments (RISA) Phase II**
- 2. Performance Period: June 1, 2013 to May 31, 2014**
- 3. Who are your team members? Please include graduate students and post-doctoral researchers in this list.**

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4. What are your **new areas of focus or partnerships** that have begun this past year? Please provide some context for why you are expanding into this area or partnership.
- ***American Samoa Groundwater Sustainability Study.*** The University of Hawai‘i (UH) Water Resources Center (WRC) is evaluating the future sustainability of groundwater resources in American Samoa, led by Pacific RISA PI Dr. Aly El-Kadi, UH graduate student Christopher Schuler, and American Samoa Community College (ASCC) faculty member Randy DeWees. Planning and project development has occurred throughout the reporting period with input from partner agencies, including the American Samoa Power Authority (ASPA), American Samoa Environmental Protection Agency (ASEPA), and the ASCC. To date, the study team has 1) reviewed hydrologically and geologically relevant literature for the region; 2) compiled a GIS database of the historical water quality record; and 3) completed water quality analysis for all samples collected in 2013. More samples are being collected during summer of 2014. Strong relationships with local partners have been formed, and the team has developed a preliminary understanding of the correlation between anthropogenic activities and nutrient contamination of groundwater. The research team continues to 1) identify potential contaminant sources in well capture zones; 2) assess each well under the direct influence of surface water to evaluate potential freshwater contribution; and 3) identify potential land use impacts to the wells, including inputs from soils, fertilizers, cesspools, septic tanks, and piggeries. Development of a conceptual hydrological model (MODFLOW) for the island of Tutuila, American Samoa, is underway, with continued data acquisition for calibration and recharge. The model will estimate sustainable aquifer yields under current and future water uses, including a limited number of scenarios of drought and land use changes, and incorporating climate effects where climate data is available.
 - ***American Samoa Water Policy Analysis.*** Following the successful reception by Hawai‘i water policy decision makers of Pacific RISA and the Center for Island Climate Adaptation and Policy’s (ICAP) white paper, *Water Resources and Climate Change Adaptation in Hawai‘i: Adaptive Tools in the Current Law and Policy Framework* (Wallsgrove and Penn 2012), East-West Center Project Specialist Richard Wallsgrove and Pacific RISA Project Assistant Duncan McIntosh are undertaking an analysis of American Samoa’s water management scheme, with a special focus on adaptation. The need for adaptive tools is especially sharp in the context of managing vital water resources. The assessment describes American Samoa’s water resources, and then identifies patterns of climate change including 1) changes in rainfall; 2) changes in stream flow; 3) increasing temperature; and 4) changes in sea level. Stakeholder insights into water quality issues in American Samoa will be combined with results from existing studies on

groundwater and surface water to better understand the context for decision making, and preliminary results indicate there is a need for expanded water quality monitoring and further assessment of potential alternative sources of clean drinking water. Although American Samoa enjoys relatively abundant resources, developing and maintaining sustainable water sources is a clear priority for government, business, and water users at the village level. Overall, the lack of high quality, consistent data makes it difficult to determine trends in water quality and anticipate possible future problems associated with climate variability and change.

- ***Republic of the Marshall Islands Drought/Freshwater Resources Dashboard.*** In collaboration with partners from the Pacific Regional Climate Information System (PaCIS), Pacific RISA PIs Drs. Melissa Finucane and Victoria Keener, with Project Assistant Duncan McIntosh, supported the development of a Drought Dashboard for the Republic of the Marshall Islands (RMI) by identifying key characteristics of 1) regional stakeholders; 2) climate-sensitive decisions and information needs; and 3) the broader contextual factors that influence drought management decisions. Interviews were conducted with decision makers from a range of organizations, including the College of the Marshall Islands, the International Federation of the Red Cross, the Micronesia Conservation Trust, NOAA National Weather Service and Weather Service Office, and the US Department of Agriculture Forest Service. Information from the final stakeholder report was instrumental in the development of the Drought Dashboard for the RMI, and Mr. McIntosh delivered a talk on preliminary findings at the project workshop, “Pacific Islands Climate Services Dialog: Preserving Freshwater Resources and Minimizing the Impacts of Drought,” in Majuro, RMI, April 2014.
- ***Disasters and Climate Change Risk Perception and Preparedness.*** Pacific RISA Research Fellow Dr. Kati Corlew launched a pilot project to explore the influence of context on psychological disaster recovery, and perceived risk of future disasters due to climate change on Maui Island, Hawai‘i and American Samoa. The project also explores the benefits to psychological disaster recovery in addressing individual agency and capacity in the context of perceived risk. On Maui, an online survey, qualitative interviews, community presentations, and stakeholder-guided discussions have been completed during the reporting period. In July 2014, the final data collection will be completed in American Samoa, followed by community presentations and guided discussions. Following data analysis and reporting, Dr. Corlew will use the results from preliminary work to pilot an iterative model for culturally and community responsive climate service development in two unique settings, and evaluate the model for future use in large-scale implementation across the Pacific Islands region.
- ***Water Resources on Guam.*** Drs. Finucane and Keener are PIs on a Strategic Environmental Research and Development Program (SERDP) funded project in Guam focusing on the potential impacts and adaptive responses of water resources on Department of Defense (DoD) Installations to climate change. As part of this interdisciplinary project, they are working to understand the context in which DoD natural resource managers and stakeholders in the Government of Guam make decisions about how to manage and allocate future freshwater resources, and how a changing climate may affect these decisions. In conjunction with a diverse set of stakeholders, they will research the most effective and helpful ways to translate the hydroclimatological projections generated by the research team into actionable and understandable management information. Due to Drs. Finucane and Keener’s involvement with Pacific RISA, stakeholders from Guam will become more integrated into the larger circle of freshwater and climate stakeholders that the Pacific RISA works with.

- ***Ecosystem Services and Climate Change.*** The Pacific RISA has started to collaborate with Dr. Kirsten Oleson, a natural resources economist in the Department of Natural Resources and Environmental Management at UH who is working at the watershed scale in east Maui. Dr. Oleson's lab will utilize the island-wide future climate scenarios that the Pacific RISA is developing to run her ridge-to-reef INVEST model that values ecosystem services in the face of a changing climate.
5. Please provide a list of up to 5 **research findings** – Please try to include examples that span disciplinary and interdisciplinary work. Examples might be: a) dust-on-snow reduces Colorado River runoff by 5%, or b) analysis revealing the presence or absence of adaptive capacity in legal and policy frameworks for managing resources.

- ***Climate Projections for Hawai'i and other Pacific Islands.*** The International Pacific Research Center (IPRC) evaluated the CMIP5 global models for their ability to simulate climate fields around major Pacific Island groups, performing and evaluating extensive high resolution (3 km and 1 km) Hawai'i regional climate model (HRCM) simulations for Hawai'i and compared to late 20th century observations (1990 to 2009). Conditions for late 21st century (2091 to 2100) were simulated at the 1 km grid scale for Maui, and efforts were begun to extend those simulations to other Pacific Islands. This research is being used as an input to efforts conducted by Pacific RISA and the USGS to assess the effects of projected climate changes on aspects of the natural and manmade environments of interest to Hawai'i. Specific outcomes during the reporting period include:
 - “Present day” (1990 to 2009) simulations with the 3 km HRCM capture the overall observed pattern of rainfall within the state of Hawai'i
 - Major interannual fluctuations of rainfall are well represented by the model, including the complicated structure of the diurnal rain cycle
 - “Future” (2091 to 2100) projection results for Hawai'i indicate a warming of the long-term mean surface air temperature, with the largest warming expected at higher elevations
 - Mean rainfall patterns are also projected to change significantly (up to 30%), with increased rainfall over areas that currently have high mean rainfall, and decreasing rainfall over currently dry areas (i.e. wet areas get wetter, and dry areas get drier)

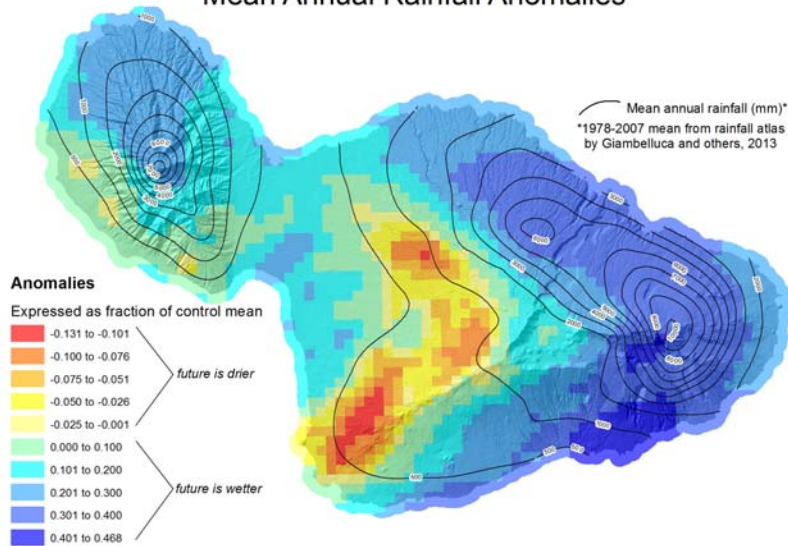
A 20-year time series, triply-nested version of the IPRC model with a single outer domain and two sets of inner domains for Guam and American Samoa at the 0.8 km grid scale has been configured and successfully run. Initial efforts have focused on further tuning of the model to be appropriate for these new focus areas, which feature more convective rainfall than in the Hawai'i region and are also more affected by hurricanes.

- ***Estimating Changes in Groundwater Recharge under Future Climate Conditions.*** Pacific RISA and the United States Geological Survey (USGS) Pacific Islands Water Science Center (PI-WSC) are estimating changes in groundwater recharge under future climate conditions on the island of Maui, Hawai'i. Previous streamflow research by the USGS found significantly decreasing trends in the dry season months (May – August) across the state of Hawai'i, with significant dry season decreases since 1990 at half of the sites on Maui. During the reporting period, a water budget model has been developed for the island of Maui to derive preliminary estimates of groundwater recharge using dynamically downscaled climate input datasets from the IPRC, preparing projections of rainfall, direct runoff, evapotranspiration, and groundwater recharge by aquifer system. A modified 2010 land cover surface for Maui Island was developed based on recent aerial photography, satellite imagery, and ground truth data to serve as the baseline input for the water budget model. Other climate input datasets of rainfall and reference evapotranspiration were developed, and 20-year IPRC climate simulations from 1990 to 2009, and projections from 2090

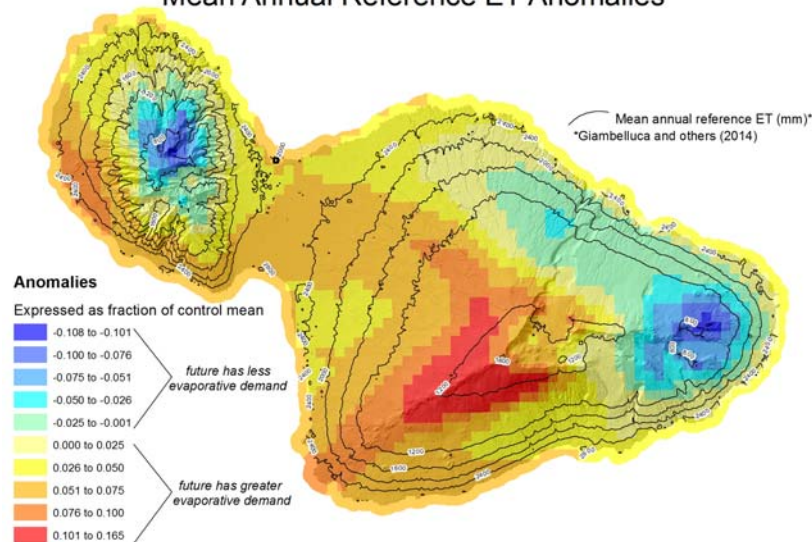
to 2109, have been run to evaluate hydrological processes under the current land cover scenario. Key findings comparing water budget output using future and control climate scenarios for a 2010 land cover condition indicate:

- Mean annual rainfall increases by 29%
- Mean annual evapotranspiration increases by 7%
- Mean annual direct runoff increases by 54%
- Mean annual recharge increases by 26%
- Wet regions of Maui get wetter, while some dry regions get wetter and others get drier
- Little change in cloud base elevation and trade wind inversion height

Mean Annual Rainfall Anomalies



Mean Annual Reference ET Anomalies



Rainfall (top) and reference evapotranspiration (bottom) anomalies for Maui Island, HI, calculated by the IPRC using dynamically downscaled climate models at the 1 km grid scale. Anomalies are expressed as a fraction of the control mean, derived by subtracting simulated current 20-year rainfall and ET (1990 to 2009) from projected future 20-year rainfall and ET (2091 to 2100). Rainfall and ET are projected to increase in already-wet areas of East and West Maui, while drier areas leeward of Maui’s mountain ranges are projected to receive less rainfall and experience higher ET.

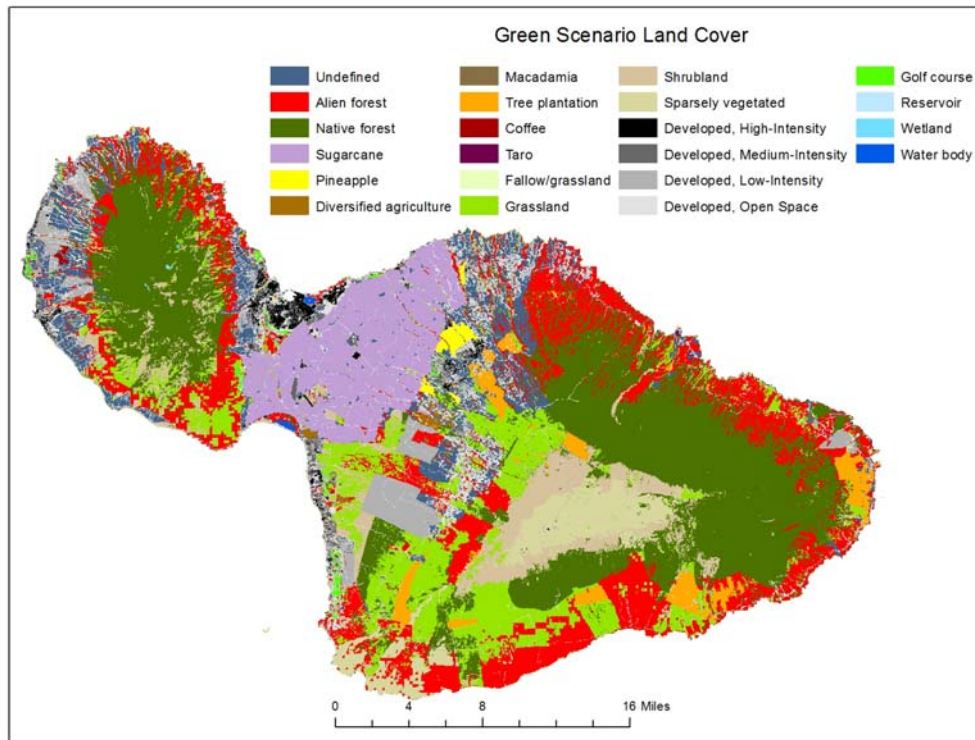
Feedback following presentations that described these preliminary findings raised questions about apparent inconsistencies between 1) previously observed downward trends and projected future increases in rainfall; and 2) climate projections derived from statistical downscaling and those derived from dynamically downscaling. Collectively, the feedback identified the need for developing a credible explanation for these differences. Ongoing USGS activities use the water budget model to simulate future groundwater recharge for three additional land cover scenarios being developed by Pacific RISA using future climate projections from the IPRC. Manuscripts and white papers describing the methods and results are anticipated in early 2015, and Pacific RISA and the USGS continue to present results at regional and national conference proceedings.

- ***Maui Groundwater Recharge Future Scenario Development.*** East-West Center Pacific RISA PIs Dr. Victoria Keener and Dr. Melissa Finucane, and Research Fellow Dr. Laura Brewington, are working with Maui Island stakeholders to refine inputs to future climate and land cover scenarios, to inform groundwater modeling being conducted by the USGS WSC. To date, there have been 24 meetings held with stakeholders on Maui and Oahu, which have been instrumental in the development of land cover maps to serve as inputs into the USGS water budget model.

Stakeholders include:

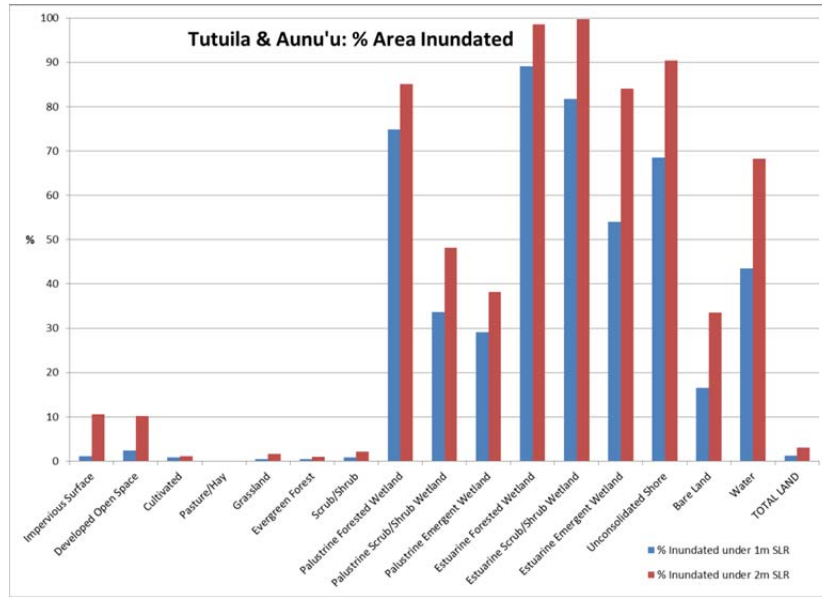
- Hawai'i Commission on Water Resource Management
- County of Maui Department of Water Supply
- County of Maui Planning Department
- Hawai'i Department of Agriculture
- Hawai'i Department of Land and Natural Resources
- Hawai'i Commercial and Sugar Company
- Haleakala Ranch
- Haleakala National Park Service
- Maui County Council
- Department of Hawaiian Homelands
- Maui Watershed Partnerships
- Maui Invasive Species Council
- The Nature Conservancy
- Kamehameha Schools

To determine how different management scenarios might impact Maui's groundwater supplies under projected climate change, the RISA team has developed three future land cover maps to represent "green," "growth," and "managed growth" on Maui, with land cover classes corresponding to management decisions related to 1) native and alien forest; 2) agriculture and ranching; 3) urban development and expansion; 4) streamflow restoration; and 5) new recharge sources. The USGS model will be used to identify hotspots of future groundwater stress and climate by comparing scenario output with the baseline of current climate and current land cover on Maui, and results will assist in translation to stakeholders for direct incorporation into the Hawai'i Water Resources Protection Plan and the Maui Water Use Development Plan.



Green Scenario future land cover map for Maui, developed by Pacific RISA using stakeholder input

Sea-Level Rise Projections for American Samoa. To meet the science needs of the National Marine Sanctuary of American Samoa, Pacific RISA Project Assistant Duncan McIntosh completed an analysis of sea-level rise (SLR) vulnerability and associated visualization tools for the Tutuila region. Like global mean sea level (GMSL), empirical evidence indicates that the local sea level in American Samoa has been rising, and though the instrumental record is limited in the Pacific Island region, the rate of rise, like that of GMSL, also appears to be accelerating. As a result of the steep topography of the main American Samoan islands, the majority of the territory's population, infrastructure, and arable land are found on low-lying coastal plains, leaving them vulnerable to inundation and increased erosion. Mr. McIntosh generated a series of passive-inundation maps depicting incrementally elevated sea levels for 22 selected coastal areas of Tutuila and Aunu'u islands highlighting areas, populations, and infrastructure vulnerable to inundation. The data were then spatially analyzed to quantify land area and land cover types likely to be affected under different inundation scenarios. Of the land cover types represented on Tutuila and Aunu'u, wetlands are clearly the most vulnerable, with virtually 100% of estuarine forested and estuarine scrub/shrub wetlands (in their current locations) inundated under a 2 meter rise in sea level. Impervious surface and developed open space land types represent a good indication of where development is concentrated on the islands, and these two land classes both show significant inundation percentages (>10%) under 2 m SLR.



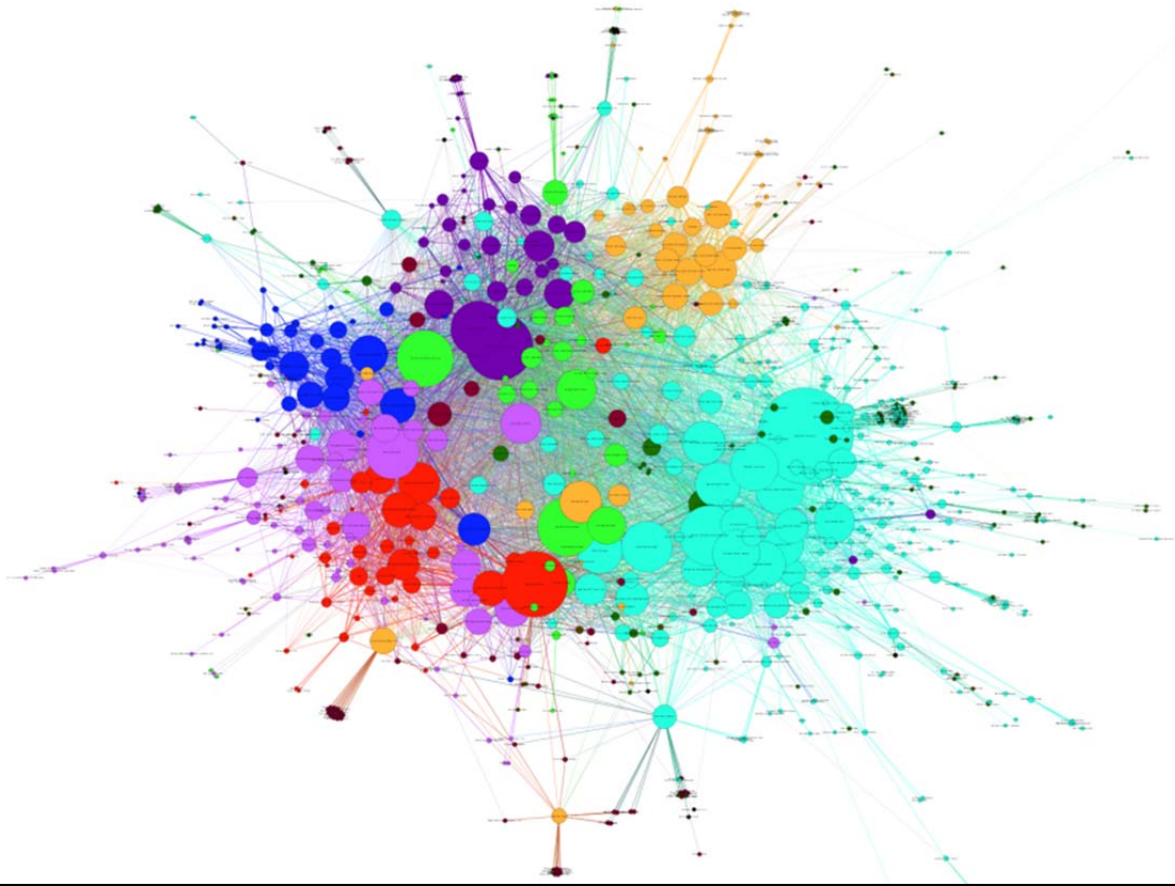
Percent of land area inundated under a 2 m rise in sea level for Tutuila and Aunu’u Islands in American Samoa, by land cover type

The Tutuila airport region and nearby urban infrastructure shows significant inundation at either 1 m or 2 m of SLR. Aunu’u Island may also experience significant change as the high proportion of wetland land cover on the island of Aunu’u signifies substantial inundation vulnerability with SLR. With 2 meter rise, Aunu’u is likely to experience the inundation of approximately 38% of its current land area.



Passive inundation maps depicting 2 m rise in sea level in the region surrounding Tutuila Island’s Tufuna Airport (top), and the small neighboring island of Aunu’u under a 2 m rise (bottom)

- **Social Network Analysis.** Pacific RISA PI Dr. Victoria Keener and Research Fellow Dr. Kati Corlew carried out a network analysis survey among climate change professionals in the Pacific Islands between December 2012 and March 2013, collecting information on professional and personal demographics, network connectedness, climate change risk perception and resiliency, and sense of community from over 300 participants. The study sought to identify both spatial and knowledge-related climate information gaps and utilize successful networks to link isolated sectors, groups, and islands into established networks. Prior to the study there were no formal analyses that quantified and tracked the flow, sources, and quality of climate knowledge and risk perception in the region, where geographic isolation and large distances between information hubs makes collaboration and communication about climate knowledge essential. Findings on network connectedness include:
 - The more strongly participants are connected to the network, the more strongly they *feel* connected to the network.
 - This is true for sense of connection to local networks as well as to a large Pacific-wide community of climate change professionals
 - The effect is nearly twice as strong for sense of community with local communities



Pacific Islands Region full map from Pacific RISA Social Network Analysis. Palau – dark blue, Hawai'i – light blue, Guam – light green, FSM – light purple, NMI – dark purple, RMI – red, Other Pacific Islands – dark red

Additionally, significant differences in sense of responsibility and control were found between regional networks, with Guam, for example, exhibiting moderate sense of responsibility for addressing climate change but no corresponding sense of control. In early 2014, the full network maps were published on the Pacific RISA website and disseminated through the project mailing list to regional collaborators, where users can explore the dense international and interdisciplinary communication networks within the region, and identify current or potential collaborators whose professions or regions of focus overlap. To evaluate the functionality and uses of the network maps across the region, a very short survey was launched in May 2014 to measure 1) how useful stakeholders found the maps; 2) what kinds of activities were being supported with the information; and 3) ways to improve the reach and functionality of the products.

Sense of Responsibility	American Samoa	FSM	Guam	Hawai'i	RMI	NMI	Palau
To what extent do you feel personally responsible to act to address climate change <u>on the island where you live?</u>	52.7	62.9	31.8	44.0	55.6	43.8	64.3
To what extent do you feel personally responsible to act to address climate change <u>on Pacific Islands generally?</u>	21.1	54.3	22.7	36.0	33.3	43.8	35.7
Sense of Control	American Samoa	FSM	Guam	Hawai'i	RMI	NMI	Palau
To what extent do you feel able to control the climate change impacts <u>on the island where you live?</u>	0.0	21.2	0.0	0.8	22.3	18.8	7.1
To what extent do you feel able to control the climate change impacts <u>on Pacific Islands generally?</u>	5.3	37.2	0.0	1.8	27.8	0.0	7.7

6. Please provide a list of up to 5 **outreach activities** that you have undertaken in the past year. OPTIONAL: If applicable, please share the outcomes of these activities.
- **National Climate Assessment Release.** On May 6, 2014 the East-West Center and Pacific RISA hosted a briefing for the Pacific Islands Region of the Third National Climate Assessment. Moderated by Pacific RISA PI Dr. Victoria Keener, the event featured an introduction by William Aila, Director and Chair of the Hawai'i Department of Land and Natural Resources, as well as a panel of authors from the Pacific chapter of the report. The briefing was well attended by local media, including three local TV stations that featured the event on the evening news. More than 80 people were in attendance, including Rep. Chris Lee, Chairman of the House Environment committee, Bill Tam, Deputy Director of the Department of Land and Natural Resources, other state and federal employees working on climate change, staff members from Rep. Hanabusa and Rep. Gabbard's offices, UH faculty, East-West Center staff, and students. Local news stations, Hawai'i Public Radio, and print media conducted interviews with Pacific RISA team members Drs. Keener and John Marra, with the following media reports:
 - May 8, 2014 - [FIJI Times](#) article, "Warming to affect fresh water," about the 3rd NCA release with quotes from Dr. Victoria Keener
 - May 7, 2014 - [Radio New Zealand](#) - Climate report appeals for US congress action
 - May 7, 2014 - [Huffington Post](#) - "Coral Loss, Water Supplies, Increased Temperatures Top Hawai'i and Pacific Region in 3rd U.S. NCA"
 - May 7, 2014 - Interview with Chris Lee on [HPR2](#), (Hawai'i Conversation)
 - May 7, 2014 - [Honolulu Star Advertiser](#) front page story "Isles are gradually drying up, a new assessment warns"
 - May 6, 2014 - [KHON 2](#) coverage of the 3rd NCA, "Key climate report findings for Hawai'i, Pacific" (interview with William Aila)
 - May 6, 2014 - [Hawai'i News Now](#) report on the the 3rd NCA, "Major Concerns Over Hawai'i's Climate Change"
 - May 6, 2014 - [KITV 4 New report](#) on the 3rd National Climate Assessment briefing, "Scientists say Hawai'i's climate getting warmer" (Dr. Keener quoted/video interview)
 - May 6, 2014 - [HPR2 Interview with Jeff Polovina](#) (Hawai'i Conversation)
 - May 6, 2014 - [SCIENCE](#) magazine article about the 3rd NCA (Dr. Keener quoted)

- **Media Events.** The Pacific RISA team has been involved in numerous outreach and media events during the reporting period. Some of these events are listed below:
 - Hawai'i Water Forum, hosted by Senator Brian Schatz, HI State Capitol (Aug, 2013)
 - Pacific Climate Science Workshop, University of the South Pacific, Suva, Fiji (Sep, 2013)
 - Pacific Islands Leadership Program, East-West Center (Oct, 2013)
 - Women in Climate Change Event, University of Hawai'i (Feb, 2014)
 - National Climate Assessment Engagement Workshop, USGCRP, D.C. (Feb, 2014)
 - Pacific Risk Management 'Ohana (PRiMO) Conference (Mar, 2014)
 - Earth Day Celebrations, University of Hawai'i (Apr, 2014)
 - National Climate Assessment Release Event, East-West Center (May, 2014)



Top Row (L to R): Hawai'i Water Forum and Pacific Islands Leadership Program presentations
Bottom Row (L to R): Women in Climate Change event and Earth Day celebrations

- **PIRCA Evaluation.** Dr. Susi Moser completed an external evaluation of the Pacific RISA program's success in reaching and influencing different audiences in Hawai'i and the Pacific region. Dr. Moser conducted key informant interviews, deployed an online survey, and analyzed event, website, and media data to 1) ascertain the perceptions of interest in and usefulness of the Pacific RISA-led 2012 Pacific Islands Regional Climate Assessment (PIRCA; Keener et al. 2012); 2) determine the geographic spread and reach of different types of stakeholders and capture interest in PIRCA information; 3) identify indicators of how the PIRCA was received; and 4) identify future information needs and ways to improve future assessments. The evaluation revealed that the PIRCA has done extraordinarily well in its outreach and influence, with several indicators illustrating that the Pacific RISA has been instrumental in achieving the following results:
 - The Pacific RISA provided timely input to the National Climate Assessment
 - They were principally responsible for ensuring that the PIRCA was publicized through highly visible media
 - The Pacific RISA conducted inclusive, informative, and impactful outreach

- The PIRCA is widely perceived as a high-quality, useful document that stakeholders view as salient, legitimate, and extremely credible
- The PIRCA has had a traceable impact on planning and policy-making at state and federal levels. To date it has served as a reference document, a source of information for speeches by political leaders, backing for policy initiatives, and motivation to rethink management approaches. Access summary as of 12/31/2013:
 - Full report: 1,347 visits
 - Case studies: 316 visits
 - Project overview: 263 visits
 - Executive summary: 256 visits

Of the 40 write-in answers Dr. Moser received from the survey, the following phrases appeared repeatedly, and they are grouped into a number of categories suggesting what "useful" means to these stakeholders:

- *One-stop-shop*: "Excellent summary", "very good compilation of information", "synthesized the most relevant and recent information", "comprehensive oversight", "all this info for the Pacific region in one place", "good starting place", "quick overview"
- *Staying current*: "Getting a grasp on the latest science", "to keep up with what's going on", "understanding status of climate and projected changes", "updated reviews"
- *Credible source*: "Essential reference", "the go to reference", "vitaly important to know"
- *Regional differentiation and specificity*: "Regional descriptions are useful", "clear understanding of regional distinguishing characteristics", "all this info for the Pacific region in one place", "summarized information and provided details", "case studies bring the messages alive"
- *Critical knowledge assessment*: "Summarized the scientific consensus", "getting a grasp on the latest science and its implications"
- *Research agenda-setting*: "Relevant to current research and course development"; "helped identify where information was lacking and what types of studies were needed", "set a baseline of knowledge ... to build on"
- *Informing planning and action*: "Provided a framework for possible management responses", "use results ... to plan and execute my responsibilities", "helps to justify programs and initiatives"
- *Accessibility to non-experts*: "Distilled for quick understanding", "language that can be used by decision-makers", "case studies provide useful examples of successes", "pretty", "colorful", "useful communication tools"

Dr. Moser's final report was delivered in December 2013 and shared with Pacific RISA partners, the RISA program office, and NCA/USGCRP partners (Moser 2013). Recommendations from the evaluation suggest opportunities for future directions of PIRCA and NCA outreach and sustaining regional assessment efforts.

- **Communication Platforms.** Social media and the Pacific RISA [website](#) have been main components in reaching regional and international audiences and organizations for Pacific RISA this past year. A [Facebook](#) account has previously existed for Pacific RISA and, within the last year, the number of people / organizations following us using this platform has almost tripled. A [Twitter](#) account was opened within the last year and, as of 06/13/2014, the number of followers (119) exceeds the number of following (108). With both communication platforms, Pacific RISA has made efforts to re-share/retweet information from other RISA projects.

Examples of followers with similar interests to Pacific RISA:

- *US Agencies & Individuals* – USGCRP, Al Gore

- *Partner & Affiliated Organizations* – East-West Center, University of Hawai‘i, other RISAs Regional agencies:
 - [Secretariat of the Pacific Regional Environment Programme \(SPREP\)](#)
 - [The University of the South Pacific \(USP\)](#)
 - [Secretariat of the Pacific Community \(SPC\)](#)
 - [NZ Met Service](#)
 - [Pacific-Australia Climate Change Science and Adaptation Planning Program \(PACCSAP\), Australian Bureau of Meteorology \(BoM\)](#)

The Pacific RISA [website](#) has been continually updated and upgraded over the last year with new features such as the [Maui Groundwater Project](#), listed under the main Projects Menu as Climate Scenarios, the availability of country-specific maps and tools under the [Social Network Analysis project](#), updated [videos](#) and presentations to [media](#), and the [blog/news page](#).

- **Regional Collaborations.** The level of understanding of the mission and values of the Pacific RISA project have increased as a result of the above outreach and strategic partnerships. Major regional organizations have valued scientific reports and contact with the Pacific RISA team and their collaborators.
 - *PIRCA report visibility* – Following on the evaluation done by Dr. Susi Moser, Pacific RISA has taken active steps to address the gap in PIRCA report visibility on the websites of regional organizations. The PIRCA report can now be accessed on the [Pacific Climate Change Portal](#), [Pacific Disaster Net](#) (part of SPC), and [Pacific Centre for Environment and Sustainable Development Knowledge Centre](#) (part of USP) websites. PIRCA visibility has made Pacific RISA the go-to institution for climate change information in the region, proving important and useful to researchers and practitioners as a comprehensive information source, as a consensus document in political/policy contexts where action needs scientific backing or justification, as a communication and education tool, and as a research agenda-setting document.
 - *Strategic partnerships* – Strategic partnerships have been strengthened with SPREP (based in Western Samoa) and USP through its 12 member countries, climate change projects, and in-country specialists.
7. Please provide a list of **key publications** from the past year - We are seeking ~ 5 publications, give or take a few, to be highlighted on the CPO webpage. These can be either non-peer reviewed or peer-reviewed. For peer-reviewed publications, please list either **published** or in **press**, but **not** “in review”. For non peer-reviewed publications, please provide a hyperlink or webpage wherever possible. (You may include a more comprehensive list of publications as an appendix.)

Hamilton, K. (2014). Projecting climate change in Hawai‘i. *IPRC Climate*, 14(1), 3-11.

Lauer, A., Zhang, C., Elison-Timm, O., Wang, Y., & Hamilton, K. (2013). Downscaling of climate change in the Hawai‘i region using CMIP5 results: On the choice of the forcing fields. *Journal of Climate*, 26, 10,006-10,030, doi:10.1175/JCLI-D-13-00126.1.

Leong, J.-A., Marra, J. J., Finucane, M. L., Giambelluca, T., Merrifield, M., Miller, S. E., Polovina, J., Shea, E., Burkett, M., Campbell, J., Lefale, P., Lipschultz, F., Loope, L., Spooner, D., & Wang, B. (2014). Ch. 23: Hawai‘i and U.S. Affiliated Pacific Islands. In *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 537-556. doi:10.7930/JOW66HPM.

Moser, S.C. (2013). PIRCA Evaluation: Development, Delivery, and Traceable Impacts – With Particular Emphasis on the Contributions of the Pacific RISA.

Wang, Y., Zhang, C., & Lauer, A. (2013). Dynamical downscaling of regional climate for the Hawaiian islands: An overview. In *Climate Change Perspectives from the Atlantic: Past, Present and Future*, J.M. Fernandez-Palacios et al. (Eds), pp. 563-597. Universidad de La Laguna.

8. Please provide up to 3 narrative **examples** from the past year of plans, policies, strategies, tools, agreements, etc. that were proposed, adopted, and/or implemented as a result of RISA work.
- After a conference in August of 2013 on freshwater sustainability needs in Hawai‘i convened by U.S. Senator Brian Schatz (D-Hawai‘i), Chairman of the Energy and Natural Resources Subcommittee on Water and Power, at which Dr. Victoria Keener spoke about Pacific RISA projects and climate and freshwater needs and gaps, Senator Schatz announced the SECURE Water Amendments Act of February 2014 (S.2019), legislation to conserve water resources and promote sustainability. The SECURE Water Amendments Act of 2014 will expand grants and increase funding for water conservation and drought projects, provide resources for better data collection and analysis of water supply and use, and finally make Hawai‘i water conservation projects eligible for grants, all ideas put forward during the August 2013 meeting to increase Hawai‘i’s freshwater security in the face of climate change. The Senate bill is co-sponsored by Senators Martin Heinrich (D-N.M.), Mazie Hirono (D-Hawai‘i), Mark Udall (D-Colo.), Tom Udall (D-N.M.), and Ron Wyden (D-Ore.).
 - Governor Neil Abercrombie of Hawai‘i was appointed as a member of President Obama’s Climate Change Task Force, and created a document titled “Navigating Change: Hawai‘i’s approach to adaptation - Report for the First Meeting of State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience” in December of 2013. The draft of this document was revised by several Pacific RISA and PIRCA members, and recommends actions in language taken directly from the NOAA RISA program, (see recommendation #1: . Provide actionable information for local decision-making and the island context. First Step: Support Task Force members’ engagement of local stakeholders to develop specific recommendations and expedite the development and delivery of priority technical assistance). Figures co-created by Pacific RISA and PIRCA are also featured in the report. Download the Navigating Change document at: <http://governor.Hawai‘i.gov/wp-content/uploads/2014/01/Navigating-Change-12914.pdf>
 - The Pacific RISA document *Water Resources and Climate Change Adaptation in Hawai‘i: Adaptive Tools in the Current Law and Policy Framework* was published in 2012, and author Richard Wallsgrove spent the next 12-months traveling across Hawai‘i to hold workshops introducing decision makers and resource managers to the toolkit’s suggestions and gathering feedback. As part of the outreach, Mr. Wallsgrove held a special session with the Hawai‘i Commission on Water Resource Management (CWRM), in which many of the suggestions were met with enthusiasm. The next year, CWRM approached Pacific RISA about incorporating climate change projections and planning into their revision of the Hawai‘i State Water Resources Protection Plan (WRPP), one of the toolkit’s recommendations. Since then, Pacific RISA has been working on future climate scenario development including CWRM as stakeholders. Ideally, finished scenarios of groundwater recharge and land use under future climate on Maui will be integrated into the revision of the WRPP later this year.

9. **OPTIONAL:** How do you measure success? Please provide information on 1-3 metrics or indicators that you use to evaluate your projects and/or program. These will be compiled into a RISA-wide resource to enable sharing among RISAs.
- ***Formal Program-Evaluation Theory.*** As part of the Pacific RISA core program, we developed a formal Action-Logic Model (ALM) to frame our ultimate research aims and education and outreach goals in terms of short, medium, and long-term changes in policy, management, and knowledge. As part of the program theory, we track both internal and external factors that impact our research, the context in which our research is done, and the policy environment in which we operate. Framing and monitoring these factors via the ALM and an associated internal website allows us to constantly re-evaluate our progress and make adjustments to our research so we can best integrate it into the most helpful and current decision making needs in the region.
 - ***Independent External Evaluation.*** We have hired an independent evaluator to research and quantify our impact on different components of the Pacific RISA program in each year. Her reports have thus far focused on internal evaluations of the program and research, perceptions by our collaborators, and our impact on the regional and national chapters of the National Climate Assessment process and report. The reports have been extremely helpful in allowing us to course-correct our program as we work, get a better idea of where we are succeeding and where we could improve, and how we are perceived by our partner organizations in a crowded climate research landscape.
10. Please fill out the attached project database template for projects that meet all of the following criteria (NOTE: These criteria are generally a judgment call on the part of the Principal Investigator(s) and/or the Program Managers and do not require extensive analysis. Criteria should NOT be listed in database.):
- a. Core RISA projects – Determined by one or more of the following:
 - i. RISA investigator is leading the effort
 - ii. RISA is primary source of funding
 - iii. RISA capacity is critical to the project (e.g. Regional Chapters/Technical Inputs of the NCA)
 - b. Current projects – Determined by one or more of the following:
 - i. Recently completed (i.e. finished within the last six months)
 - ii. Ongoing (i.e. initiated, but not completed)
 - iii. Planned (i.e. funded but not started)

APPENDIX: Presentations relevant to the Pacific Islands Regional Climate Assessment (PIRCA) and Pacific RISA research, June 2013 – May 2014

Date	Name	Title of Talk	Conference or Event	Location
7/10/2013	Victoria Keener	Impacts and Indicators of Climate Change in the Pacific Islands	East-West Center seminar	East-West Center, Honolulu, HI
7/11/2013	Victoria Keener, John Marra, Deanna Spooner	Pacific Islands Regional Climate Assessment	Pacific Islands Climate Change Cooperative webinar	online
7/15/2013	Kati Corlew	Human Dimensions of Climate Change in the Pacific	2013 Environmental Education Symposium (Environmental Literacy In and Out of the Classroom)	Hawai'i Convention Center, Honolulu, HI
9/17/2013	Victoria Keener, Melissa Finucane	Climate Change Impacts in the Pacific: Implications for US Environmental and Human Security	United States Congressional Briefing, co-sponsored by Sen Brian Schatz	Dirksen Senate Office, Washington, DC
9/18/2013	Victoria Keener	Climate Change in the Pacific Islands	Smithsonian, National Museum of Natural History, "Scientist Is In" lecture	NMNH, Ocean Hall, Washington, DC
9/20/2013	Victoria Keener	Climate Change Impacts in the Pacific: Implications for US Environmental and Human Security	Science Policy guest lecture	Potomac Institute for Policy Studies, Arlington, VA
10/16/2013	Victoria Keener, Rachel Nunn, Kati Corlew	Climate Change in the Pacific Islands	Guest Speakers - Pacific Islands Leadership Program (PILP)	East-West Center, Honolulu, HI
10/24/2013	Victoria Keener	Impacts of Climate Change on Water Resources in Maui	Hawai'i Water Works Association Meeting	Kihei, Maui, HI
11/19/2013	Kevin Hamilton	Regional Climate Change Projections for Hawai'i	2 nd JIMAR/PIFSC Symposium: Climate and Change	East-West Center, Honolulu, HI
1/28-30/2014	Melissa Finucane	Presented a paper - PIRCA: US Environmental and Human Security	Climate Change and Security Risks and Opportunities Symposium	Washington, DC
1/28-30/2014	Melissa Finucane	PIRCA Perspectives on Lessons Learned	National Climate Assessment's Scientific and Engagement Innovations Workshop	Washington, DC
3/12/2014	Victoria Keener	Developing a Drought Dashboard for the Republic of the Marshall Islands	Pacific Risk Management 'Ohana Conference	Hawai'i Convention Center, Honolulu, HI
3/13/2014	Rachel Nunn	Media Messaging in Disasters	Pacific Risk Management 'Ohana Conference	Hawai'i Convention Center, Honolulu, HI
4/3/2014	Victoria Keener	Participatory Scenario Planning for Climate Change Adaptation: The Maui Groundwater Project	Geography Seminar on Climate Change	UH Manoa, Honolulu, HI
4/9/2014	Laura Brewington	Participatory Scenario Planning for Climate Change Adaptation: The	Association of American Geographers Annual Meeting	Tampa, FL

		Maui Groundwater Project		
4/11/2014	Victoria Keener	Network Connectedness and Risk Perception of Climate Change Professionals in the Pacific Islands	Association of American Geographers Annual Meeting	Tampa, FL
4/24/2014	Duncan McIntosh	Developing a Drought Dashboard for the Republic of the Marshall Islands	Pacific Islands Climate Services Dialog - Preserving Freshwater Resources and Minimizing the Impacts of Drought	International Conference Center Majuro, Republic of the Marshall Islands
4/25/2014	Laura Brewington	Climate change Impacts in the Pacific: The Maui Groundwater Project	Department of Hawaiian Studies Seminar on Climate Change in Oceania	UH Manoa, Honolulu, HI
4/29/2014	Alan Mair	Groundwater Recharge on Maui: Assessing the Effects of Climate, Land-use, and Land-cover Change	State of Hawai'i, Commission on Water Resource Management	Department of Land and Natural Resources, Honolulu, HI
4/30/2014	Alan Mair	Groundwater Recharge on Maui: Assessing the Effects of Climate, Land-use, and Land-cover Change	County of Maui Department of Water Supply	Wailuku, Maui, HI
5/6/2014	Victoria Keener, John Marra	Hawai'i-Pacific Highlights Briefing of the 3 rd US National Climate Assessment	National Climate Assessment Release Event	East-West Center, Honolulu, HI
5/8/2014	Alan Mair	Groundwater Recharge on Maui: Assessing the Effects of Climate, Land-use, and Land-cover Change	Hawai'i Water Conference	Honolulu, HI
5/22/2014	Kati Corlew	Disaster Preparedness in Maui	Community open discussion forum	Wailuku Public Library, Maui, HI
6/17/2014	Kevin Hamilton	Regional Climate Change Projections for Hawai'i	State of Hawai'i, Commission on Water Resource Management	Department of Land and Natural Resources, Honolulu, HI