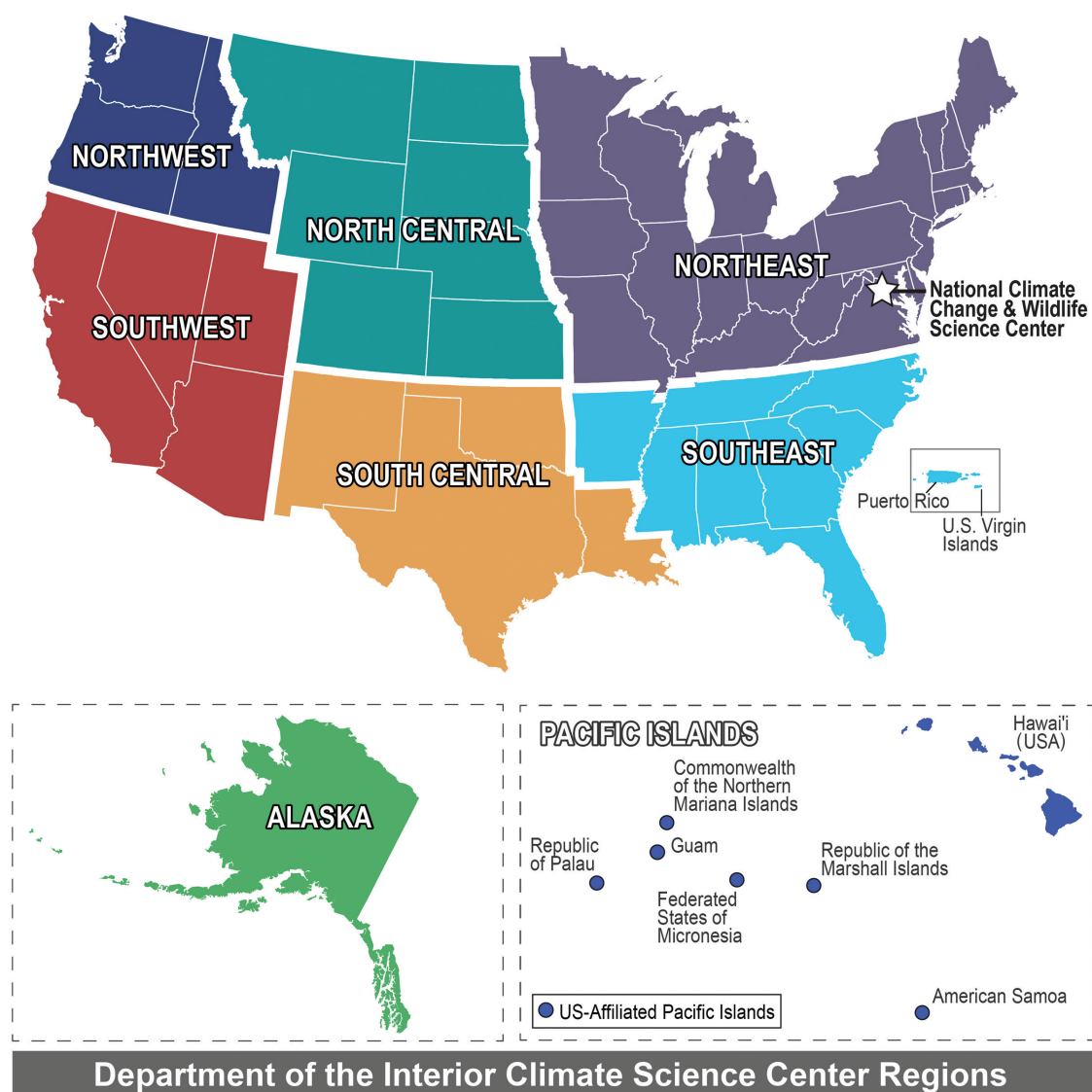


# Five-Year External Reviews of the Eight Department of Interior Climate Science Centers

## Pacific Islands Climate Science Center



June 2018

American Fisheries Society  
Cornell University Human Dimensions Research Unit

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Cover image: 2016 map of the Climate Science Center regions and consortia. U.S. Geological Survey, [www.sciencebase.gov](http://www.sciencebase.gov).

# Five-Year External Reviews of the Eight Department of Interior Climate Science Centers

## Pacific Islands Climate Science Center\*

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## Acknowledgments

This review involved substantial effort and time commitments from numerous individuals, particularly members of the Science Review Team (SRT) who took time away from their jobs and professional commitments to prepare for the review, conduct a 5-day site visit (including extended overnight travel to Majuro and back), and assemble their findings into this report. Pacific Islands Climate Science Center (PI CSC) staff devoted significant time to compile and provide necessary background material, hosted the week-long on-site review, answered follow-up questions, and provided substantive feedback to help improve the final report. In particular, we appreciate the contributions from the staff of the U.S. Department of the Interior Pacific Islands Climate Science Center: David Helweg, director, and Bonnie Myers, acting science manager; the staff of the University of Hawaii Pacific Islands Climate Science Center: Darren Lerner, university director/University of Hawaii, Sharon Ziegler-Chong, consortium coordinator, Rachel Lentz, science writer/communications specialist, and John Peterson, consortium coordinator, and all of the PI CSC staff and consortium university partners who participated. We extend special thanks to our hosts and guides on Majuro, Republic of the Marshall Islands for including the SRT in their stakeholder meeting and providing us with insight into the unique climate adaptation challenges that Pacific atolls face on a daily basis. We greatly appreciate the assistance of the numerous science user stakeholders and science producers who participated in the survey and focus panels to share their experiences and opinions, and in particular those who traveled thousands of miles and time zones to share their perspectives in person. Collectively, the information provided about the PI CSC throughout the review afforded a comprehensive overview of the center's first 5 years of operation. While the information provided to the SRT was extensive, we recognize the challenge of fully appreciating many years of accomplishments and challenges. We are, however, hopeful that the observations and recommendations of the SRT represented in this report are helpful to the PI CSC in continuing to realize its vision for collaborative climate science. This review was conducted under the guidance of Janet Cushing, acting chief, National Climate Adaptation Science Center (formerly National Climate Change and Wildlife Science Center).



## Executive Summary

In 2008, the U.S. Congress authorized the establishment of the National Climate Change and Wildlife Science Center (NCCWSC; renamed Pacific Islands Climate Adaptation Science Center as of April 2018) within the U.S. Geological Survey (USGS), with further direction set forth in Secretarial Order 3289 (Salazar 2009). The mission of NCCWSC is to provide natural resource managers with the tools and information they need to develop and execute management strategies that address the impacts of climate change on fish, wildlife, and their habitats. Eight regional Climate Science Centers (CSCs), each a collaborative arrangement between the USGS and a regional host university, form the core mechanism through which this mission is carried out.

The National Climate Change and Wildlife Science Center, with the engagement of the American Fisheries Society and Cornell University, began working with independent Science Review Teams (SRTs) to conduct reviews of individual CSCs in 2016. These reviews evaluate operational and programmatic aspects of each CSC, including the host-university relationship, to ensure that established goals and obligations are being met, as well as to identify obstacles and areas of improvement for future agreements.

The Pacific Islands CSC (PI CSC), established in 2012, is based in Honolulu, Hawaii, with the University of Hawaii at Mānoa (UH–Mānoa) serving as host university, coordinating a consortium composed of the University of Hawaii at Hilo and the University of Guam as consortium partners. The SRT was impressed by the high quality of capabilities represented in this relatively small consortium.

The PI CSC faces logistical challenges not experienced by any of the other seven CSCs in the network. While the majority of the other CSCs embrace the involvement of independent nations (federally recognized sovereign tribes) and cultures as does the PI CSC, no others face the expansive distances, time zones (including the international date line) and technological differences that challenge the operations of the PI CSC. This region encompasses a large geographic area spanning the Pacific Basin from the Hawaiian Archipelago to the U.S.-affiliated Pacific Islands (USAPI) across the western Pacific. This large region encompasses a wide diversity of ecological, climatic, and cultural landscapes, posing many unique challenges to the PI CSC. The SRT recognizes the institutional challenges created by working in this diverse region, including the turnover of personnel within potential partner organizations, logistical costs associated with travel, and other cultural and logistical factors inherent to this region.

In general, the projects presented during the on-site review demonstrated high-quality methodology; researchers were engaged and enthusiastic about their work and stakeholders were generally supportive and appreciative of the science products being produced. The SRT is impressed by the focus on actionable science within unique cultural contexts and on addressing climate science as it is relevant to people who live on the islands. In so doing, traditional knowledge of climate and the environment is highly respected and desired, although prioritizing coproduction in projects should be emphasized even more. The Manager Climate Corps appears to be an effort appreciated by stakeholders to involve them in identifying science needs. Stakeholders clearly valued in-person stakeholder meetings, which the PI CSC facilitates for coordination of overall climate science research in the region.

Unlike other CSCs, the PI CSC has had to develop a great deal of the basic science (e.g. downscaling) research that already existed for most of the continental United States. However, it is unclear to some stakeholders how all projects funded fit into the themes of the original science agenda, and in a few cases, the motivation for funding projects appears to have been to address non-CSC priorities of the partners rather than on the NCCWSC mission areas. There is a need to balance the pressure to fund such projects with the need to fulfill the NCCWSC mission. Clearly, projects are leveraging the funding provided by PI CSC, but the extent of internal or external funding that may come in as a result of CSC investment was not quantified during this review. The PI CSC could improve the understanding by stakeholders and partners of the USGS funding process to ensure that all key players in the PI CSC are cognizant of the process and

priorities before a request for proposal or funding opportunity is issued. Furthermore, the SRT recommends that the PI CSC develop improved mechanisms to ensure that partners and stakeholders are aware of projects that are funded through this process. Additionally, the PI CSC may want to consider ways to support projects that have applications across all or most of the region, especially the USAPI, as a way to extend the value of their science projects across such a far-flung region. A coordinator focused specifically on all of the regions other than Hawaii and Guam (where consortium universities are located) may be one way in which to increase this focus.

Administratively, the PI CSC has distinct periods of development. The early years were characterized by high turnover at the university (and to some extent USGS), which slowed the rate of implementation and has hindered development of the PI CSC. The *current* leadership team seems to have addressed many issues of the past. However, the SRT feels that this relationship can be further strengthened through increased communication and personal interaction between the leadership team of the USGS and consortium partners. Additionally, the location of the USGS PI CSC director's office away from any consortium university is not conducive to cohesive CSC program mission goals and objectives; the co-location of federal and university staff would benefit both parties (e.g., students get the benefit of experiencing federal employees/culture, etc. and USGS gets improved understanding of and communication with university partners). Compounding this, the minimal depth of USGS staff (one person) limits options for partners to obtain clarification and/or discuss issues and in some cases has led to confused expectations. The SRT feels that this is a serious issue that needs to be addressed. Additionally, the uneven and erratic funding flow to the PI CSC (often caused by the delays of the federal budgeting process in Washington) and a flat budget for 5 years have provided numerous challenges, including hindering the ability to recruit and retain researchers and students.

The administration of UH-Mānoa recognizes the importance of the role of the PI CSC in the university and for the state (e.g., developing the Institute for Sustainability and Resilience), as well as integration into other university programs. The current PI CSC host university director should be commended for taking on this role, particularly in light of his other responsibilities. The university's decision to align the PI CSC with the long-standing Sea Grant program at UH-Mānoa provides a well-established management infrastructure for the CSC and is a substantial asset for the program. Additionally, the strong accomplishments of the PI CSC consortium university directors and staff for helping to keep the CSC enterprise on track during the earlier period of instability (and continuing into the current stable period) are recognized. However, compared to other CSCs, there appears to be less financial support from the universities for hosting the PI CSC (as conveyed to the SRT); the thin employee staffing for PI CSC-related work and lack of a singular *physical* focal point for the PI CSC on the university side are concerning.

In terms of training the next generation of climate-adaptation scientists, the PI CSC has developed some substantial and unique programs for this capacity building. Some researchers have developed a progressive focus on developing skills within individuals who will stay and apply climate science in the Pacific Islands, thereby retaining those knowledge and skills to benefit the region rather than exporting it. The SRT was impressed by the diversity of presenters during the on-site portion of the review; the PI CSC has clearly engaged indigenous peoples across the region in the production of science.

The SRT saw many examples of excellent communication products developed by the PI CSC, particularly due to an increased focus and time in recent months to reach a diversity of audiences. To fully realize the impact of these tools as well as to provide guidance to identify priority audiences and messages, the PI CSC should develop a strategic plan for the implementing a communications strategy, particularly considering the limited communications staff. A need for greater outreach and engagement within the university consortium itself is apparent, with several comments expressed reflecting a lack of awareness of what projects were being conducted/funded by the PI CSC and how to engage with the PI CSC and its funding streams.

These and other observations and recommendations are detailed further in the report and should be viewed as constructive input to help build an even more vibrant and robust PI CSC program in the future.

## Abbreviations and Acronyms

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| ACCCNRS        | Advisory Committee on Climate Change and Natural Resource Science |
| AFS            | American Fisheries Society                                        |
| CIS            | Center for Island Sustainability                                  |
| CNMI           | Commonwealth of the Northern Mariana Islands                      |
| CSC            | Climate Science Center                                            |
| CSC-Federal    | Federal USGS-staffed component of the CSC                         |
| CSC-University | Host-university component of the CSC                              |
| DOI            | U.S. Department of the Interior                                   |
| FACA           | Federal Advisory Committee Act                                    |
| FG             | focus group                                                       |
| FTE            | full-time equivalent (employee)                                   |
| FY             | fiscal year                                                       |
| GIS            | geographic information system                                     |
| Hale           | Haleakalā Climate Network                                         |
| HAVO           | Hawaii Volcanoes National Park                                    |
| HDRU           | Cornell University Human Dimensions Research Unit                 |
| LCC            | Landscape Conservation Cooperative                                |
| MCC            | Manager Climate Corps                                             |
| NCCWSC         | National Climate Change and Wildlife Science Center*              |
| NGO            | nongovernmental organization                                      |
| PI             | principal investigator                                            |
| PI CSC         | Pacific Islands Climate Science Center†                           |
| PICCC          | Pacific Islands Climate Change Cooperative                        |
| PNNL           | Pacific Northwest National Laboratory                             |
| Q&A            | questions and answers                                             |
| RFP            | request for proposal                                              |
| RMI            | Republic of the Marshall Islands                                  |
| SAC            | Stakeholder Advisory Committee                                    |
| SAP            | Science Advisory Panel                                            |
| SRT            | Science Review Team                                               |
| SSA            | Strategic Science Agenda                                          |
| TOR            | Terms of Reference                                                |
| UoG            | University of Guam                                                |
| UCSB           | University of California, Santa Barbara                           |
| UH–Hilo        | University of Hawaii at Hilo                                      |
| UH–Mānoa       | University of Hawaii at Mānoa                                     |
| USAPI          | U.S.-Affiliated Pacific Islands                                   |
| USDA           | U.S. Department of Agriculture                                    |
| USFS           | U.S. Forest Service                                               |
| USGS           | U.S. Geological Survey                                            |
| WERI           | Water and Environmental Research Institute of the Western Pacific |

\* As of April 2018, renamed National Climate Adaptation Science Center.

† As of April 2018, renamed Pacific Islands Climate Adaptation Science Center.



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# Introduction

## *Review Purpose*

In 2008, the U.S. Congress authorized the establishment of the National Climate Change and Wildlife Science Center (NCCWSC)<sup>1</sup> within the U.S Department of the Interior (DOI).<sup>2</sup> Housed administratively within the U.S. Geological Survey (USGS), NCCWSC is part of the DOI's ongoing mission to meet the challenges of climate change and its effects on wildlife and aquatic resources (TWS and ESA 2009). Further direction for NCCWSC was set forth in Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources," on September 14, 2009 (amended February 22, 2010; Salazar 2009). Through this order, the original concept of eight "climate hubs" was redefined into the DOI Climate Science Centers (CSCs) and their mission was slightly expanded to "synthesize and integrate climate change impact data and develop tools that the Department's managers and partners can use when managing the Department's land, water, fish and wildlife, and cultural heritage resources" (Salazar 2009). As a result, NCCWSC established eight regional DOI CSCs from 2010 through 2012 (Figure 1) and has responsibility for their management. For the structure of the CSCs, NCCWSC developed a dual-approach model that employs a federal USGS-staffed component (CSC-Federal) and a parallel host-university component (CSC-University), established competitively through a 5-year cooperative agreement with NCCWSC.

The Pacific Islands Climate Science Center<sup>3</sup> (PI CSC) was established in 2012, has completed its initial 5-year project cycle, and is into its sixth year through a 1-year funding extension. As such, the university hosting agreement for this CSC region is subject to a recompetition process by USGS for the host university. As part of the recompetition process, NCCWSC, with the engagement of the American Fisheries Society (AFS) and the Cornell University Human Dimensions Research Unit (HDRU), coordinated an operational and programmatic review and evaluation of the CSCs to ensure that established goals and obligations under the hosting agreements were being met, as well as to identify obstacles and areas of improvement for the CSC as a whole.

This report covers only the findings from the programmatic evaluation of the PI CSC conducted by AFS and the HDRU and does not include any findings or discussions from the operational review conducted by NCCWSC. This report also does not discuss the goal of developing recompetition recommendations, which were submitted to NCCWSC in a separate report.

## *NCCWSC and CSC Missions and Guiding Principles*

In developing a review for the CSCs, it is important to understand their fundamental roles and audiences, as well as the services that they are expected to provide. The most basic documents for understanding this are the mission statements that NCCWSC and the CSCs have developed, based, in large part, on the directive provided in Secretarial Order 3289 (Salazar 2009). The mission statements of the NCCWSC and each CSC vary only slightly, with the CSCs including cultural resources in addition to the fish and wildlife emphasis of NCCWSC.

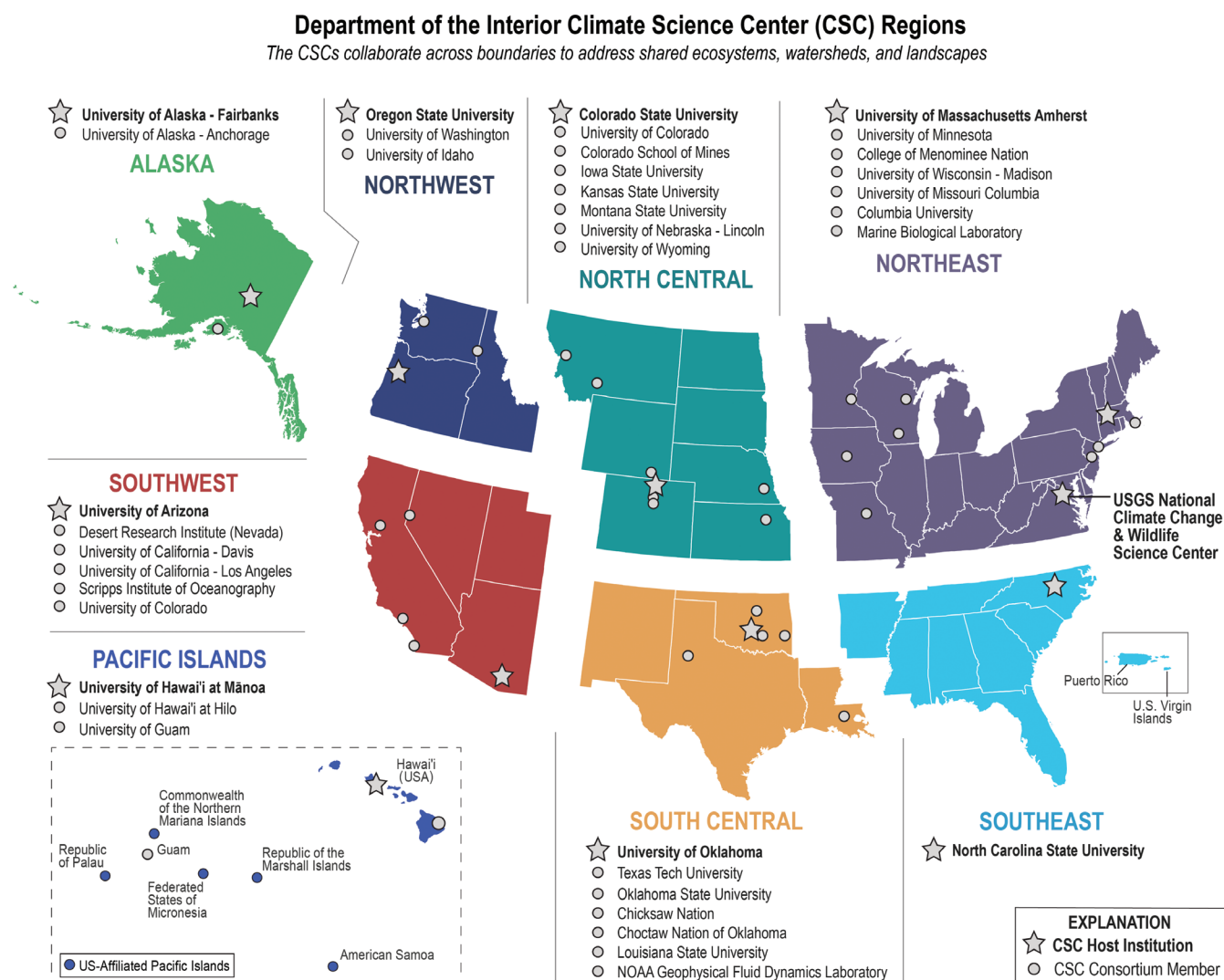
The mission of NCCWSC is to provide natural resource managers with the tools and information they need to develop and execute management strategies that address the impacts of climate change on fish, wildlife and their habitats. [USGS 2013.]

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<sup>1</sup> NCCWSC was renamed National Climate Adaptation Science Center in April 2018. However, for purposes of this report, the former name will be used since it was in place at the time of the review and provides consistency with other reports in this series.

<sup>2</sup> Consolidated Appropriations Act of 2008, Public Law 110-161, 110th Congress (26 December 2007). In this bill, NCCWSC was referred to as the National Global Warming and Wildlife Science Center.

<sup>3</sup> The Pacific Islands Climate Science Center was renamed Pacific Islands Climate Adaptation Science Center in April 2018, but for purposes of this review the former name is used since it was in place at the time of the review.



**Figure 1.** Map of the eight Climate Science Centers and consortia as constituted during the period under review (2012–2017).

The mission of the individual DOI CSCs is to provide natural and cultural resource managers with the tools and information they need to develop and execute management strategies that address the impacts of climate change on a broad range of natural and cultural resources. [USGS 2013.]

The NCCWSC 5-year strategy (2009–2014; NCCWSC 2009) was developed to guide the efforts of the NCCWSC–CSC network (USGS 2009). The plan states three basic goals:

- Work in close partnership with the natural resource management communities to understand their highest priority science needs regarding climate change impacts, and determine what is needed to fill those knowledge gaps.
- Work with the scientific community to develop the science information and tools in such a way that they can be readily used to generate management strategies for responding to climate change.
- Deliver these relevant tools and information in a timely and useful way directly to resource managers.

The NCCWSC strategic plan (2009–2014) also identifies priority scientific activities to help meet its mission and goals:

- Use and create high-resolution climate modeling information and derivative products in order to pro-

duce key information that is needed to forecast ecological and population response at national, regional, and local levels.

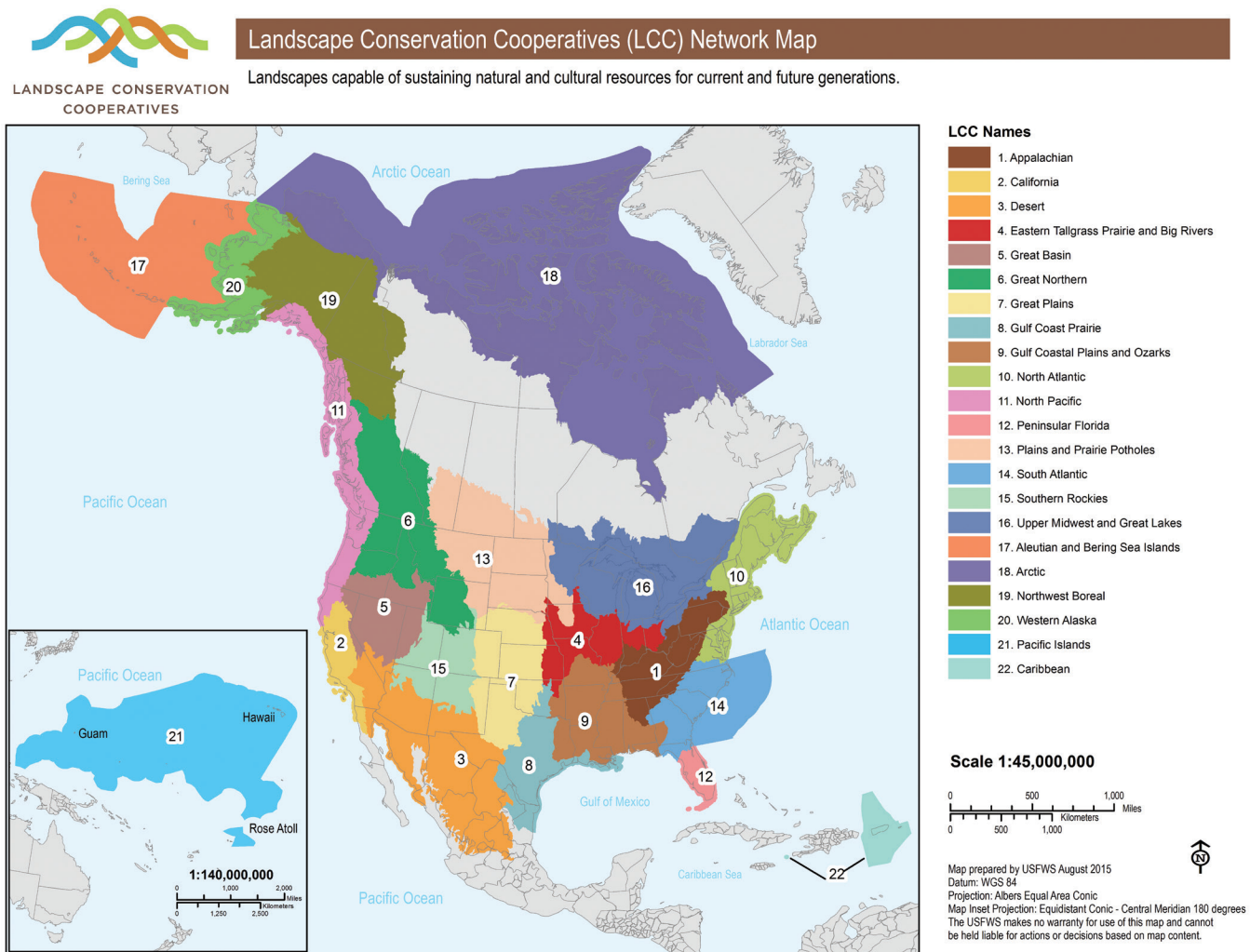
- Integrate physical climate models with ecological, habitat, and population response models.
- Forecast fish and wildlife population and habitat changes in response to climate change.
- Assess the vulnerability and risk of species and habitats to climate change.
- Develop standardized approaches to modeling and monitoring techniques in order to facilitate the linkage of existing monitoring efforts to climate models and ecological/biological response models.

The NCCWSC 5-year strategy states that a key component of the NCCWSC–CSC network is to work with partners. Two major groupings of partners include (1) science partners (e.g., federal agencies, universities, scientific societies, and other nongovernmental organizations [NGOs]); and (2) conservation partners, which cover a broad category of those working to apply conservation (e.g., state and federal natural resources agencies, conservation NGOs). It is important to note that these two primary partner groups are not discrete and sometimes have overlapping membership. For example, many conservation partners are also science producers (e.g., Ph.D.-level U.S. Fish and Wildlife Service [USFWS] biologists). A major indicator of success of the NCCWSC–CSC network is, therefore, the degree to which partners are effectively engaged and benefit from the work of the NCCWSC–CSC network.

Recognizing that no single agency or organization has the capacity to effectively address the challenges of climate change, the DOI, through Secretarial Order 3289 (Salazar 2009), launched a network of Landscape Conservation Cooperatives (LCCs) around the same time period as the establishment of NCCWSC and then the CSCs. The LCCs were developed to organize and coordinate large-scale conservation efforts through a partnership approach. The LCCs are primary CSC partners and consist of natural and cultural resource managers from federal, state, tribal, and other entities whose mandate is to work collectively to identify key resource issues and provide information and other support for integrated, landscape-scale conservation planning. The LCC network currently includes 22 geographic units across North America, the Caribbean, and U.S.-Affiliated Pacific Islands (USAPI), delivering unprecedented collaboration across jurisdictional boundaries (Figure 2).

The process of identifying the CSCs began in fiscal year 2010 with the identification of the University of Alaska as the location of the first CSC, after which the USGS initiated a competitive selection of host institutions for the additional centers (NCCWSC 2011). The Alaska, Northwest, and Southeast CSCs were formally established in September 2010, with fiscal year 2010 funds (NCCWSC 2011). Implementation of the Southwest and North Central CSCs was delayed by the late passage of appropriations legislation for fiscal year 2011, and these centers were established in June 2011 (NCCWSC 2011). The final three CSCs were established formally in March 2012 (Northeast, South Central, and Pacific Islands), completing the planned suite of eight regional CSCs (Varela-Acevedo and O'Malley 2013).

The NCCWSC–CSC network is committed to a partnership-driven model (NCCWSC 2011). As such, the CSC scientific agenda is not driven by an *a priori* national science agenda, but rather through the identified needs of the LCCs, as well as other land, water, wildlife, and other natural and cultural resource managers (NCCWSC 2011). All of the CSCs employ some form of a Stakeholder Advisory Committee (SAC) as a means of formally engaging partners in the strategic direction of the CSC. The SAC is intended to provide a vehicle for building collaborative partnerships, identifying key regional science priorities, and communicating and coordinating results and objectives across regional stakeholder agencies and organizations. NCCWSC established a set of guidelines in the CSC SAC Terms of Reference (TOR), which defines membership, primary purpose, and other operating guidance (NCCWSC 2014). The SACs are compliant with the operating principles of the Federal Advisory Committee Act (FACA) but are not officially chartered under the provisions of that act. As outlined, the CSC federal director, with input and guidance from its SAC, is to develop a 5-year strategic plan, as well as annual work plans that drive science priorities and requests for proposals (RFPs; Jones and Dalton



**Figure 2.** Map of the 22 Landscape Conservation Cooperatives.

2012). Regional priorities should be reconciled with input from NCCWSC, advisory committees, and other CSCs to build a higher-level national-scale agenda. This supports the identification of multi-CSC needs and ideas in addition to the opportunity to more effectively leverage resources. Together, the NCCWSC–CSC network forms the cornerstones of DOI’s integrated approach to climate change science and adaptation and assesses climate impacts that typically extend beyond the borders of any single land-management agency unit.

## Review Process

### *Roles of AFS, the HDRU, and NCCWSC*

The CSC evaluation consisted of two parts: an external programmatic review led by AFS and the HDRU and an internal operational review led by NCCWSC, which is not addressed in this report. To evaluate the performance of the host university, AFS and the HDRU established a Science Review Team (SRT) for each CSC. An SRT consisted of a team of up to five non-CSC-affiliated experts selected through a national solicitation and review of credentials, as well as a nonvoting USGS science center director who served as chair and a CSC federal director from outside the reviewed CSC (both selected by the NCCWSC deputy chief; Appendix A). The American Fisheries Society was tasked with assembling the SRTs, developing review metrics, managing the on-site review process (data collection, interviews, and

discussions), and developing review reports from evaluation findings, as well as logistical planning (travel, lodging, and food).

The HDRU investigators focused on the evaluation of CSC partnerships. During on-site reviews, the HDRU interviewed stakeholders and partners to assess the quality and extent of partnership involvement with the respective CSC. Using the interview data, the HDRU constructed a standardized survey that was sent out to all current and past CSC partners in each region to identify patterns of engagement with the CSCs, as well as barriers to engagement.

The PI CSC on-site review was conducted over a period of 5 days (January 22–26, 2018) in Honolulu, Hawaii, on the campus of the University of Hawaii at Mānoa (UH–Mānoa) and Majuro, Republic of the Marshall Islands (RMI; Appendix B). The review process was designed to develop a full understanding of the PI CSC. The review included the administrative structure, foundational documents and processes (e.g., strategic and science planning), research projects, communications of results, and engagement of stakeholders and others in an actionable science pathway approach that includes assessment of the utility of the science products. Due to an unexpected lack of a federal budget and thus authorization to travel by two team members (Drs. Debra Willard and Kimberly Yates), they were unable to physically participate in the on-site components of the review. However, they were able to join some on-site discussion via remote connections, although they experienced multiple technical difficulties. They also participated in the preparatory webinars and document review. As a result, their involvement is being described as consulting members of the SRT.

### *Program Evaluation Measures for CSCs*

Currently, no standard systemwide CSC performance measures (e.g., specific deliverables or activities completed by given dates) exist. Each CSC was established within the general frameworks of both the NCCWSC and CSC missions and in response to the needs of their region. As described in the review findings, the PI CSC developed a region-specific strategic science and operational plan and annual work plans. These plans establish objectives within the seven strategic science plan themes. While these science themes could provide a basis for assessment, they are not consistent across the CSCs and are more reflective of activities than measures of impact. As a result, the CSC review process sought other models upon which to construct the review process.

The Advisory Committee on Climate Change and Natural Resource Science (ACCCNRS) was a multi-stakeholder federal advisory committee established by the DOI in 2012, chartered under FACA, to provide guidance and input on the overall NCCWSC–CSC network (USGS 2012). The committee had 25 members from the DOI, other federal agencies, state and local governments, tribal nations and partners, NGOs, academia, and the private sector (USGS 2012).

In the “Report to the Secretary of the Interior, March 30, 2015” (ACCNRS 2015), ACCCNRS provided recommendations to the Secretary of the Interior to enhance the CSC program, including program evaluation. The committee recommended that the following four-part framework be used when developing new CSC agreements and conducting CSC program evaluations:

- **Institutional development:** These measures are intended to capture the overall health of the CSC as an institution, with an emphasis on planning processes, management and operations, finances, and institutional coordination.
- **Actionable science:** These measures are intended to capture the performance of the center in providing relevant and useful scientific products and services, with an emphasis on the relevance, quality, processes, accessibility, and impact of research and science products and services carried out directly by the CSC and through its external grant funding.
- **Capacity building:** These measures are intended to capture how well the CSC is building capacity for conducting and applying actionable science, with an emphasis on formal training (e.g., of graduate

students and postdoctoral fellows) and providing training and capacity building to the broader community in how to use and apply climate science and services.

- **Partnerships:** These measures are intended to capture how well the CSC is working with partner organizations beyond the CSC consortium itself, which is included under institutional development, with an emphasis on breadth and scope of engagements and leverage.

While the ACCCNRS report was released several years after the formation of the CSCs and therefore cannot be applied as a definitive measure of effectiveness to the CSCs in retrospect, these general categories provide a useful framework under which to organize review findings and are applied in this report. Although the PI CSC initiation predates the ACCCNRS report, the original PI CSC project proposal highlights themes of partnerships and stakeholder-driven climate science, which are further developed but consistent with the ACCCNRS framework.

### *Survey and Focus Group Methodologies<sup>4</sup>*

The partnership evaluation component of the CSC review, conducted under the lead of the HDRU, was designed to measure the quality and extent of partnership involvement at each CSC. The activity focused on the following questions:

- To what extent are science users and producers involved with the CSC?
- What are the predictors of this involvement? What limits involvement?
- To what extent do partners believe the CSC is producing actionable science?
- To what extent are CSC-affiliated science users and producers involved in coproduction? What are the predictors of this involvement?
- To what extent does the CSC play a role as a boundary organization, facilitating the co-production of actionable science? What characterizes that role?

This component of the CSC review consisted of two activities: a series of group interviews and a standardized Web-based survey.

*Group interviews.*—Two group interviews were conducted with partners of the PI CSC during the site visit. The purpose of the group interviews was to understand the range of perspectives and experiences of CSC partners in relation to their work with the PI CSC. Two groups were included: science producers (or science partners) and science users (or conservation partners).

Participants were recruited by the PI CSC with guidance from the HDRU with the intent to include participants representing a diversity of organizations and regions. Participants in the science producers group included faculty members, graduate students, and/or postdoctoral associates that had received research funding from the PI CSC. Participants in the science users group included representatives of agencies intended to benefit from the science produced by the PI CSC, including LCCs, federal natural resource agencies, state fish and wildlife agencies, tribal organizations, and NGOs. Eight science producers and six science users participated in the two group interviews during the on-site visit.

Each interview consisted of a semi-structured conversation guided by a series of open-ended questions and lasted approximately 2 hours. The questions were designed to explore how partners contributed to the work of the PI CSC and the factors that influenced the ability of the PI CSC to work with their partners. The specific topics of questions focused on how participants have worked with the PI CSC, reasons for becoming involved with the PI CSC, benefits of involvement with the PI CSC, challenges to involvement, and what the PI CSC could do to promote even more benefits from involvement.

Particular focus was placed on exploring how the PI CSC contributed to the coproduction of science and the generation of actionable science, with questions about interactions between science producers and science users and the role of the PI CSC in connecting them.

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<sup>4</sup> The material in this section is a modified version of material presented in Dayer et al. (2016).

*Web-based survey.*—A standardized, Web-based survey of partners and potential partners of the CSCs was conducted, referred to herein as the HDRU stakeholder survey (Lauber and Stedman 2018). An initial sample for the survey was compiled from science producers and science users identified by each CSC, LCC staff and steering committee members within each CSC region, and members of the Association of Fish and Wildlife Agencies Climate Science Committee. The Pacific Islands survey was sent to a total of 158 individuals, with 106 responding. The survey documented the ways in which partners were engaged with the PI CSC and the factors affecting their engagement. The survey questions were developed based on insights from group interviews conducted in previous CSC reviews and a review of the scholarly literature. The question topics included

- Nature of respondents' work
- Perspectives on the importance of addressing climate change
- Extent of involvement with the CSC
- Benefits of involvement with the CSC
- Limitations on involvement with the CSC
- Perceptions of climate adaptation science

For science users,

- Use of climate adaptation science
- Limitations on use of climate adaptation science
- Importance of and engagement in coproduction of science
- Limitations on coproduction of science

For science producers,

- Use of climate adaptation science produced by others
- Limitations on others' use of climate adaptation science
- Importance of and engagement in coproduction of science
- Perceptions of the role of the CSC

The same survey instrument was used for all the CSCs, with minor changes to reflect the region referenced.

Individuals were e-mailed at the initiation of the survey and provided with a link to a Web-based questionnaire. Individuals who did not respond to the first request received up to five additional requests to complete the questionnaire by e-mail. The Web-based survey instrument was programmed and administered using Qualtrics, which provides a means of soliciting participation in a survey via e-mail and recording responses. Qualtrics assigns each individual a unique Web link to prevent individuals outside our study population from participating in the survey and prevent access to survey data by anyone other than the research team. Implementation of survey began on September 6, 2017 and concluded on October 4, 2017. A short (5 minutes) telephone survey of nonrespondents to the Web-based survey was conducted by the Cornell University Survey Research Institute from October 11 to November 9, 2017. The survey questions included a sample of questions from the Web-based survey to determine whether and how nonrespondents differ from respondents on key criteria. Twenty-five nonrespondents completed the questionnaire.

## PI CSC Development<sup>5</sup>

The PI CSC was established on October 7, 2011, following the model established by the NCCWSC: a university consortium (led by a host university) was established to form a partnership with the USGS office. The PI CSC is hosted by UH–Mānoa, centered in Honolulu, Hawaii, in partnership with the University

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<sup>5</sup> Source material from PI CSC (2017).

of Hawaii at Hilo (UH–Hilo) and the University of Guam (UoG) as consortium partners, collectively comprising the consortium. The USGS office is located on the island of Hawaii. The vision of the PI CSC (2017) is

to develop science and other knowledge products and capabilities designed to support policy and management directed toward the sustainability of interconnected human and ecological communities and the conservation of species of concern in Hawai‘i and the Pacific Islands.

The PI CSC encompasses a large geographic area spanning the Pacific Basin from the Hawaiian Archipelago to the USAPI across the western Pacific. This large region encompasses a wide diversity of ecological, climatic, and cultural landscapes, posing many unique challenges to the PI CSC. The Hawaiian Islands alone span 10 of the world’s 14 climatic zones, and vast ocean expanses (and multiple time zones) between areas covered by the PI CSC present logistical and coordination challenges.

Funding for the PI CSC is generally US\$2.2 million annually, although it was reduced to \$1.8 million in fiscal year (FY) 2013 (Table 1).

At the time of the review, the USGS side of the PI CSC was staffed by a director (Dave Helweg, began April 2013) and a part-time acting science manager (based in Reston, Virginia) who began in July 2017. All personnel associated with the university consortium are partially funded, with 0–65% full-time equivalent (FTE) funds from the PI CSC (federal or consortium), and none spend 100% of their time on PI CSC-associated work. The university consortium is staffed by Director Darren Lerner (began August 2016) and a part-time communications specialist at UH–Mānoa, a university consortium lead at both UH–Hilo and UoG, a program coordinator and technical project specialist at UH–Hilo, and a climate science coordinator and geographic information system (GIS) coordinator at UoG. Additionally, the services of a data manager are shared with the Pacific Islands Climate Change Cooperative (PICCC).

## Institutional Development

### *Summary Observations of the PI CSC*

The SRT recognizes that the development of the PI CSC has been marked by two distinct periods. The first 2–3 years of this CSC’s existence were characterized by high turnover on the UH–Mānoa side, and within the USGS leadership in the first year (Table 2). In the first 5 years, the PI CSC has seen four university directors (three changes in leadership plus one period with an acting director while the full-time director was on sabbatical). Four individuals filled the USGS directorship in the first year alone, with the current USGS PI CSC director in place since April 2013 (PI CSC 2017). These changes in personnel slowed program implementation and, in turn, appreciably hindered the development of the PI CSC. Despite this turnover, solid research was funded and conducted by the PI CSC in the early years, albeit without a strategic vision,

**Table 1.** Annual funding (\$) for the Pacific Islands Climate Science Center in the first 5 years. (Source: PI CSC 2017). Abbreviations: FY = fiscal year; CSC-Federal = federal U.S. Geological Survey-staffed component of the Climate Science Center.

|                               | FY12<br>Year 1 | FY13<br>Year 2 | FY14<br>Year 3 | FY15<br>Year 4 | FY16<br>Year 5 |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|
| CSC-Federal                   | 1,549,591      | 1,075,000      | 1,545,000      | 1,545,000      | 1,545,000      |
| University consortium         |                |                |                |                |                |
| University of Hawaii at Mānoa | 345,052        | 345,052        | 348,639        | 346,956        | 346,956        |
| University of Hawaii at Hilo  | 300,349        | 300,349        | 265,285        | 283,283        | 283,283        |
| University of Guam            | 83,008         | 83,008         | 83,000         | 83,008         | 83,008         |
| Total                         | 2,278,000      | 1,803,409      | 2,241,924      | 2,258,247      | 2,258,247      |

**Table 2.** Pacific Islands Climate Science Center leadership timeline. Abbreviations: UH–Mānoa = University of Hawaii at Manoa; UH–Hilo = University at Hilo; UoG = University of Guam; CSC = Climate Science Center; LCC = Landscape Conservation Cooperative; ACCCNRS = Advisory Committee on Climate Change and Natural Resource Science.

|                            | Guiding documents                                                                                                                   | Center director                 |                      | Host leadership                                    |                                               |                          |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|----------------------------------------------------|-----------------------------------------------|--------------------------|
|                            |                                                                                                                                     |                                 |                      | UH–Manoa                                           | UH–Hilo                                       | UoG                      |
| February 2010–January 2011 | <ul style="list-style-type: none"> <li>• CSC/LCC implementation guidance</li> <li>• “fundamental climate impact science”</li> </ul> |                                 |                      |                                                    |                                               |                          |
|                            |                                                                                                                                     |                                 | Proposal signatories | Chip Fletcher                                      | Don Price                                     | Sam Walker               |
| March 1, 2012              |                                                                                                                                     | Loyal Mehrhoff                  | Host Award start     | Kevin Hamilton                                     | Don Price (acting for Don Straney)            | John Jensen (Sam Walker) |
| August 2012                |                                                                                                                                     | Deanna Spooner and Jeff Burgett |                      |                                                    |                                               |                          |
| February 2013              |                                                                                                                                     |                                 |                      |                                                    | Sharon Ziegler-Chong (acting for Don Straney) |                          |
| January 2013               |                                                                                                                                     | Cindy Kolar                     |                      |                                                    |                                               |                          |
| April 2013                 |                                                                                                                                     | Dave Helweg                     |                      |                                                    |                                               | John Peterson            |
| January 2014               | Current Strategic Science Agenda (Helweg et al. 2014)                                                                               |                                 |                      |                                                    |                                               |                          |
| September 2014             |                                                                                                                                     |                                 |                      | Kelvin Richards (on sabbatical Jan 2–Jun 30, 2015) |                                               |                          |
| March 2015                 | ACCNRS report “actionable science”                                                                                                  |                                 |                      | Jim Potemra                                        |                                               |                          |
| July 2015                  |                                                                                                                                     |                                 |                      | Kelvin Richards                                    |                                               |                          |

**Table 2.** Continued.

|                   | Guiding documents | Center director |                           | Host leadership |                |     |
|-------------------|-------------------|-----------------|---------------------------|-----------------|----------------|-----|
|                   |                   |                 |                           | UH–Manoa        | UH–Hilo        | UoG |
| August 2016       |                   |                 |                           | Darren Lerner   |                |     |
| February 28, 2017 |                   |                 | Host Award End (original) |                 |                |     |
| August 2017       |                   |                 |                           |                 | Bruce Matthews |     |
| January 2018      | 5-Year Review     |                 |                           |                 |                |     |

but the turnover clearly hampered collaboration between the USGS and the consortium and establishment of a common vision for the PI CSC.

With the selection of Dr. Dave Helweg as the permanent USGS director in April 2013 and Dr. Darren Lerner taking over as the university director (UH–Mānoa lead) in August 2016, significant steps have been taken to address these challenges. As a result, the SRT’s report will, where appropriate, delineate recommendations based on activities during each of these periods.

*The SRT recognizes the various periods of the PI CSC development; the early high leadership turnover at the university, and to some extent USGS, slowed the rate of implementation and has hindered development of the PI CSC. The current leadership team seems to have addressed issues of the past, and the SRT recognizes the increased collaboration that has developed.*

Overall, the *current* leadership team seems to have addressed numerous issues of the past, and the SRT recognizes the increased collaboration that seems to have developed. However, the SRT believes that this relationship can be further strengthened through increased communication. In particular, the SRT recommends additional regular (e.g., monthly) face-to-face meetings of the senior leadership and more-frequent scheduled phone calls between the USGS and university directors along with key staff. While recognizing that time differences, distance, and cost make the logistics of such interactions more challenging than those in the contiguous United States, the SRT suggests that a concerted effort to leverage other mission-related travel, advance scheduling, and an overall commitment to overcoming these barriers would likely result in significant improvements over past levels of interaction. The need for additional staffing is addressed elsewhere in this report, but the SRT also recognizes that adding USGS and university personnel at the deputy director or science/program coordinator level would likewise increase communication and cooperation across the PI CSC enterprise.

The SRT recognizes the institutional challenges created by working in this vast and diverse region, including the turnover of personnel *within* potential partner organizations and very high logistical costs. Moreover, the PI CSC must function across a mix of cultures, traditions, and political boundaries in ways that are not normally encountered in other CSCs. Taken as a whole, this operational situation demands that the PI CSC’s USGS leadership team rely heavily on university, federal, state, and local partners to help overcome these limitations. While such partnerships are addressed more fully elsewhere in this report, in the context of institutional development, the SRT suggests that the need to develop and maintain highly

collaborative efforts also creates numerous opportunities for supporting project and capacity building outside the traditional mold of RFP-dominated funding within the larger CSC network.

### *University Consortium*

The SRT strongly believes that the host-university PI CSC director should be commended for assuming this challenging role, particularly in light of his other responsibilities. The SRT appreciates the strategic vision behind the move to combine UH–Mānoa’s leadership and administration of the PI CSC consortium with that of the University of Hawaii Sea Grant program and the Water Resources Research Center. At the same time, given current staffing levels, these shared responsibilities create a situation where the amount of personnel hours devoted specifically to the PI CSC by UH–Mānoa appears relatively low compared to other university hosts throughout the CSC network. This consolidation and other factors contribute to the absence of an *obvious* physical point of contact for the PI CSC on the UH–Mānoa campus. As a result, the SRT recommends that UH–Mānoa hire or reassign staff to focus more directly on PI CSC-related activities. Ideally, staffing decisions will be made based on input from the university and USGS directors and UH–Mānoa administration, but the SRT suggests that leadership explore the possibility of hiring a university assistant (deputy) director (or equivalent staffing level) as one of its first options.

*The PI CSC’s university director should be commended for taking on this role, particularly in light of his other responsibilities. Aligning the PI CSC with the long-standing Sea Grant program at UH–Mānoa provides a well-established management infrastructure for the program.*

Additionally, the SRT recommends that UH–Mānoa work to increase branding of existing office space (e.g., adding PI CSC logos to existing signage) and more broadly advertise the location of the PI CSC on campus. In combination, the SRT believes that these approaches will help the PI CSC to be viewed as a more permanent, integral part of broader efforts related to understanding climate impacts, building resilience, and supporting adaptation on campus.

*The SRT suggests that university leadership explore hiring a university assistant (deputy) director as one of its first options for increasing the effectiveness of the PI CSC implementation.*

The PI CSC leadership at the other two consortium universities (UoG and UH–Hilo) has seen much less turnover than at the host university (Table 2). The SRT believes that substantial credit is due to the directors and staff at those universities for developing the CSC-related programs and projects at their respective institutions, as well as keeping the PI CSC overall on track during the unsettled times.

### *Funding and Financial Support*

Based on information provided to the SRT, overall financial and in-kind support passing from the UH–Mānoa administration to the PI CSC has been small when measured against some other CSC hosts. Reviews of the seven other CSCs have consistently shown that many host institutions view their CSC as an opportunity for leveraging other opportunities within their universities and that hosts often make substantial investments above and beyond the funds provided by USGS. The expectation is, in turn, that the CSC serves as a magnet for extramural support and/or that the CSC addresses capacity gaps that then allow the universities to attract additional outside funding or new faculty interested in research coproduced with CSC stakeholders. In conversations with the SRT, the UH–Mānoa vice chancellor for research emphasized the importance of the PI CSC within both the university and the state, especially as connected to the university’s coastal sustainability initiatives. The SRT feels that ample opportunity exists for further

integration with new and existing university programs and leveraging of University of Hawaii-led efforts throughout the region. In combination with increased staffing of, and cooperation with, the USGS side of the operation (detailed elsewhere), the SRT believes that the PI CSC can be a national and international leader on climate change adaptation in terrestrial and coastal environments.

*Although the university administration expressed the importance of the role of the PI CSC within the University of Hawaii system and integration with other compatible programs, minimal employee staffing and comparatively less financial support from the university (as compared to other CSCs) are of concern.*

The strong accomplishments of UH–Hilo and UoG leadership are also recognized by the SRT. In the early phases of the PI CSC development, leadership provided by UH–Hilo and UoG was particularly important for keeping the development of the PI CSC on track. More recently, UH–Hilo and UoG have been instrumental in guiding efforts related to education and capacity building, as well as coproduction with local resource managers. Education and capacity building are more fully addressed elsewhere in this report, but given the large return on investment seen to date, the SRT encourages the USGS and university leadership to explore additional avenues for supporting work by these consortium partners.

It is clear that projects are leveraging the funding provided by PI CSC, but the SRT does not have a good understanding of the extent (dollar value) of this or of other outside funding that may come in as a result of CSC investment. Rather than recreating all of these numbers since the beginning of the CSC, the SRT recommends that the universities develop a process to annually track in-kind contributions (e.g., university director salary/fringe, physical space), leveraged grants (i.e., grants led by PI CSC faculty or staff members that enhance the CSC mission), or other funding streams.

The SRT recognizes the challenges created by the uneven and erratic funding flow from DOI and dealing with flat and per-year annual budgets for 5 years, including hindering the ability to recruit and retain researchers and students. However, these challenges might also be ameliorated somewhat by improved communication and coordination across the PI CSC leadership team. In short, USGS and university leadership should work to prioritize research and capacity building efforts in light of a combination of stakeholder science needs, opportunities for leveraging, and the practical realities of both federal and academic operations.

*The SRT recognizes the challenges created by the uneven and erratic funding flow from DOI and dealing with a flat budget for 5 years, including hindering the ability to recruit and retain researchers and students.*

The SRT also recognized that University Director Darren Lerner has been able to employ well-developed relationships as a result of his past work in the Sea Grant program to generate UH–Mānoa support for the PI CSC. As noted above, to date, the financial support has been relatively limited compared to other CSCs, but Dr. Lerner’s support has already proven beneficial to the CSC program, and we expect that it will continue as the PI CSC products are continually developed and their value recognized. Similarly, the university directors at UoG and UH–Hilo have provided ongoing support through their networks for the PI CSC enterprise. Such continued engagement by PI CSC partners will be helpful in building understanding and support (funding and other) for the PI CSC.

## USGS

The hiring of USGS PI CSC Director Dave Helweg in April 2013, and his retention of this role since, brought some stability and continuity to the somewhat rocky start of the PI CSC. However, the SRT is concerned

that the USGS director is operating alone without the benefit of PI CSC-dedicated staff. Although a science director was hired in 2016, the person left for another opportunity shortly thereafter and the position has been vacant since.<sup>6</sup> Staff from the NCCWSC headquarters (based in Reston, Virginia) was temporarily assigned to assist with science manager duties in July 2017 in preparation for the CSC review. While it is understandable that the USGS desires to use as much internal funding as possible on the Strategic Science Agenda (SSA), particularly the development of baseline products similar to those resources already available to other CSCs in the contiguous United States (Appendix C)<sup>8</sup>, the SRT feels that this strategy reduces the potential of a high return on investment for the PI CSC. The key strength of all CSCs is their partnership with their respective university hosts and consortia to access the power of faculty/staff writing proposals to other funding agencies and the breadth of disciplinary expertise available. Thus, without more USGS staff to nurture relationships between USGS and university researchers, the opportunities to grow the PI CSC are minimized.

Similarly, under the current operational model, the location of the USGS PI CSC director's office away from any consortium university is not conducive to growing these collaborations or operating a cohesive CSC program as envisioned. The co-location of federal and university staff benefits both parties. In particular, students and early-career researchers benefit from experiencing the culture and priorities of federal employees. The federal employees, in turn, can help mentor early-career professionals and groom them to be future DOI employees or partners.

Some PI CSC program partners have pointed to misunderstandings from the USGS PI CSC director and mixed messages that resulted in confused expectations. Lack of USGS staff (one person) limits options for partners to obtain clarification and/or discuss issues. In addition, minimal contact with and agreement from the university participants limits the ability of others to reinforce a consistent message. The SRT feels that this is a serious issue that needs to be addressed.

*The SRT is concerned that the USGS director is operating alone without the benefit of PI CSC-dedicated support staff. The SRT recommends that priority be placed on the co-location of federal and university staff and the addition of USGS staff as a means to address communication and information exchange issues.*

## RFP Process

All of the key players in the PI CSC should understand the funding process and priorities before an RFP or funding is issued, and all key players should be aware of funded projects. There was not a clear understanding by several stakeholders/consortium members of how well the funded projects are tied to the SSA. The development of the new SSA (Helweg et al. 2017) provides an opportunity for the USGS and university to develop and implement a process to understand and advertise the funded projects for FY19 and beyond. The process should include plans to communicate results with stakeholders and disseminate project summaries across the broader research team.

*There was not a clear understanding by several stakeholders/consortium members of how well the funded projects are tied to the SSA, or the funding and priorities before an RFP or funding is issued. The SRT recommends that the leadership team develop a clear, concise RFP process to overcome the expressed confusion.*

<sup>6</sup> A hiring freeze in January–June 2017 prevented filling this position for those months.

<sup>7</sup> The total federal PI CSC budget for FY12–FY16 was \$7,259,591 (Table 1), of which approximately \$5,840,474 (80%) was used to support research (\$2,934,535 direct funded and approximately \$2,905,939 through RFPs). See Appendix C. Source: “Federal Director—Discretionary Funded Projects,” spreadsheet on funded projects provided by R. Lentz, PI CSC outreach specialist, February 15, 2018.

## *The SAC*

The PI CSC has developed two related working groups to assist in developing a partner-driven SSA and to coordinate science development. These are the Stakeholder Advisory Committee (SAC) and the Science Advisory Panel (SAP). The SAC consists of representatives from approximately 19 partner organizations in Hawaii and the USAPI while the SAP members represent the major research institutions in the service area of the PI CSC. The SAC role, membership, and general operational guidance are defined in the TOR developed by NCCWSC (October 2014). The SAP does not have a formal guidance document and is considered an ad hoc working group.

The primary role of the SAC is to act as a forum for identifying and prioritizing the science needs of the resource management community and to translate them into a SSA for the PI CSC. The current 5-year SSA for 2014–2018 (Helweg et al. 2014) was based, at least in part, on input from the SAC, which also reviewed and endorsed the final product. However, stakeholder engagement was acknowledged to be somewhat constrained due to a limited timeframe for this initial SSA development. Described as a living document, the SSA has been regularly discussed by the SAC through annual meetings, conference calls, and two substantial multi-day workshops in 2016 and 2017, which were designed to inform the development of the next science plan and reflect the continually evolving nature of the science needs. These workshops were found to be excellent opportunities for obtaining SAC engagement and were greatly appreciated.

The challenges faced by the SAC reflect those of the PI CSC in general and the vast geography and unique ecological and political environment in which it operates. The SAC participants are primarily federal and state representatives with SAC representatives from Hawaii, Palau, Guam, the Commonwealth of the Northern Mariana Islands, and the RMI. Although the SAC is not officially chartered under FACA, it operates under FACA guidelines and therefore excludes formal membership from NGOs. The PI CSC must find other ways to gain the input from NGOs, which are particularly active in the Pacific region. The PI CSC has invited the input from other participants, but frequently, groups either have declined participation or have been unable to participate due to lack of capacity or competing priorities. While the SRT recognizes that it is impossible to engage all partners, it suggests that the PI CSC continue efforts to implement a more standardized and extensive outreach process to engage science producers and users across the Pacific Islands region to voice their science needs, support conservation actions, and enhance their ability to conduct research in their regions.

The SRT noted that this engagement has been constrained by the lack of staff capacity on the federal side of the PI CSC. While acknowledging the decision to target federal funds to research rather than staff, the SRT clearly recognized the importance of better engagement. As discussed earlier, with essentially a single federal staff member (the PI CSC federal director), capacity to work with a highly diverse and geographically expansive partnership has been severely limited. One of the key roles of the PI CSC, and a core characteristic of actionable science, is to work intimately with partners to ensure that science and management are fully engaged. This requires staff time and expertise and should be considered an essential component of the PI CSC.

The complicated nature of the SAC has also been exacerbated by the lack of consistent representation on the SAC by the member organizations. It was noted that frequently among some organizations, a new representative would attend each gathering. This clearly results in diminishment of corporate memory, inefficiency due to the need to spend inordinate time reviewing past efforts, and a lack of ability to plan future activities. This inconsistent representation may simply be due to the nature of the organizations involved and the social-cultural setting and, thus, pragmatically unresolvable. However, development of expectations for participation, personnel transition support, or other means should be explored to reduce the flux of SAC participants.

The role of the SAC should also reflect the maturity of the SSA development. As the 2018–2022 5-year SSA (Helweg et al. 2017) is released, the SAC and SAP should be more engaged in assessing, evaluating the

implementation of the plan, and, in particular, focusing on the actionable nature of the plan. Stakeholder Advisory Committee members expressed a lack of understanding of their role in the future of the SSA while clearly stating an interest in full participation in the implementation and assessment of the agenda's effectiveness.

Finally, it was recognized that many conservation activities and planning processes are ongoing throughout the PI CSC service area. Increased awareness and engagement in these processes may be a valuable investment in PI CSC resources. One fascinating example is the Reimaanlok community-based marine resources management process interconnected with the joint national adaptation planning. Joint national adaptation planning is found in all six USAPI jurisdictions and has been used to identify science and information needs. Joint national adaptation planning and local NGOs might be a vehicle to implement and evaluate the actionability of science products. Finding a way to establish an intersection between such activities and the PI CSC may provide enhanced awareness of the PI CSC, understanding of science needs, and the opportunity for translation of science findings into conservation actions.

## Actionable Science

It was clear at the onset of this review that the PI CSC creates an opportunity for four very strong academic, scientific/research organizations (through UoG, UH–Hilo, UH–Mānoa, and the USGS) to develop a synergistic relationship for tackling the significant impacts of climate change in the tropical and subtropical islands of the northern Pacific Basin. The PI CSC's efforts focus on actionable science across multicultural contexts and providing climate science that is relevant to people inhabiting the islands. This synergy is most evident from the peer-reviewed publication record and the production of graduate student dissertations and theses. For example,

- From 2012 to 2017, the PI CSC has funded 54 projects that span four science themes, 27 directly through USGS RFP solicitations and 27 through university consortium allocations. The projects have spawned more than 47 peer-reviewed publications, including book chapters, journal articles, and USGS publications (PI CSC 2017).
- During that same period, the PI-CSC has supported 28 undergraduates, 45 graduate students, and 8 postdoctoral researchers, with 20 bachelor's degrees, 19 master's degrees, and 6 doctorates being conferred and 8 bachelor's degrees, 14 master's degrees, and 5 doctorates currently in progress (PI CSC 2017).

The integration of actionable science and sociological integration of cultural-values research and management studies is also highly evident. The following are prime examples of the CSC's successful strategy across the Pacific Islands:

- The *loko i'a* Hawaiian fish pond project is an excellent example of the integration of actionable science and cultural knowledge.
- The UoG's geospatial center provides a cornerstone for developing actionable science studies for the USAPI. Their study of climate change effects on small businesses reflects an important aspect of economic and cultural impacts.
- Development of high-resolution digital elevation models for Majuro, RMI demonstrated the cost-effective approach of working in collaboration with local knowledge experts and collaborative program development across program areas within USGS.
- The Manager Climate Corps (MCC) program at UH–Hilo provides an excellent model for supporting local networks of natural and cultural resource managers and connecting them to graduate students, community leaders, and others with the purpose of strengthening adaptive capacity.

Relative to the delivery of scientific information and the integration of local/cultural expertise, the SRT provides the following recommendations.

- All PI CSC publications, including journal articles, book chapters, scientific reports, dissertations, and theses, should be served on the PI CSC Web site (if possible without violating copyright laws) to provide easy access to science users.
- The PI CSC should continue to focus on integrating local knowledge experts, who sometimes feel overlooked, into study design, execution, and reporting.

The PI CSC has developed four themes to guide its research agenda: (1) climate modeling for terrestrial systems, (2) freshwater resources, (3) coastal vulnerability, and (4) biocultural sustainability. The PI CSC has faced some unique science challenges by having to develop more basic research than perhaps other CSCs (e.g. downscaling climate models for island and regional use, which still faces issues of model reconciliation).

Traditional knowledge of climate and the environment is highly respected and desired within the PI CSC, as evidenced by previously mentioned projects. However, the SRT did not observe strong evidence of prioritizing coproduction of products in the projects, although there are clearly some efforts to ascertain the needs of managers.

- Stakeholders applauded the highly valued and effective effort of the MCC; this program should be more strongly integrated into academic programs as a way to institutionalize it for early-career professionals (discussed later).
- The development of additional training or skills to help scientists identify what the resource managers need (adaptive management) would be a significant improvement to strengthen the interface between managers/scientists. The SRT recognized that managers and scientists often operate on different time frames and scales, but we believe that additional opportunities exist to bring managers and scientists together by seeking common questions.
- The new SSA for 2018–2022 provides additional opportunities for the PI CSC to strengthen the process of establishing priorities and resource allocation across institutional development, actionable science, capacity building, and partnerships.

*The MCC was highly applauded by stakeholders; the SRT encourages the PI CSC to integrate the MCC to a greater degree into academic programs as a way to institutionalize it with early-career professionals.*

In developing the SSA, the PI CSC has done an excellent job reaching out to their partners (not to be confused with some aforementioned communication issues stemming from low USGS staffing levels). However, the SRT highly recommends that the PI CSC leadership team establish a transparent process for RFPs across the four units comprising this CSC to improve the ability of science users and science producer partners to engage more fully.

- The SRT strongly recommends applying structured decision making, adaptive management, or other similar frameworks for guiding mechanisms to integrate resource managers and scientists in the development, execution, and reporting of robust actionable science projects.

Researchers expressed appreciation that PI CSC funding is focused on actionable science (rather than basic research). However, Some researchers identified a tension between conducting traditional academic research normally conducted in a university setting and the need to conduct actionable science research as part of the CSC enterprise, although this is a dynamic tension observed across most, if not all, research organizations.

- Across the review, participants expressed a great deal of gratitude for the number and quality of workshops hosted by the PI CSC.

- The SRT recommends that the PI CSC leadership maintain a balanced, strategic portfolio of actionable and basic research.

*The PI CSC has faced some unique science challenges, having to develop a great deal of the basic science that other CSCs may not have had to do. The SRT is impressed by the focus on actionable science within unique cultural contexts and addressing climate science as it is relevant to people who live on the islands.*

Survey data from HDRU validated the utility of PI CSC science products in influencing both policy and management decisions (more than 90% agree or strongly agree to both activities;  $n = 90$ ; Figure 3).

In some cases, the motivation for funding projects appears to have been to address non-CSC priorities of the partners rather than the NCCWSC mission area. There is a need to balance the pressure to fund such projects with the need to fulfill the NCCWSC mission. Additionally, the USGS funding appears to be almost totally focused on terrestrial projects rather than a mix, even though “potential effects of changing climate on freshwater resources” is a theme identified in the SSA and fisheries resources are identified in other themes. The SRT recommends a more balanced approach to funding allocations that are coordinated by the PI CSC leadership team.

*It is unclear if all funded projects fit into the themes of the original SSA. In some cases, the motivation for funding projects appears to have been to address non-CSC priorities of the partners rather than on the NCCWSC mission areas.*

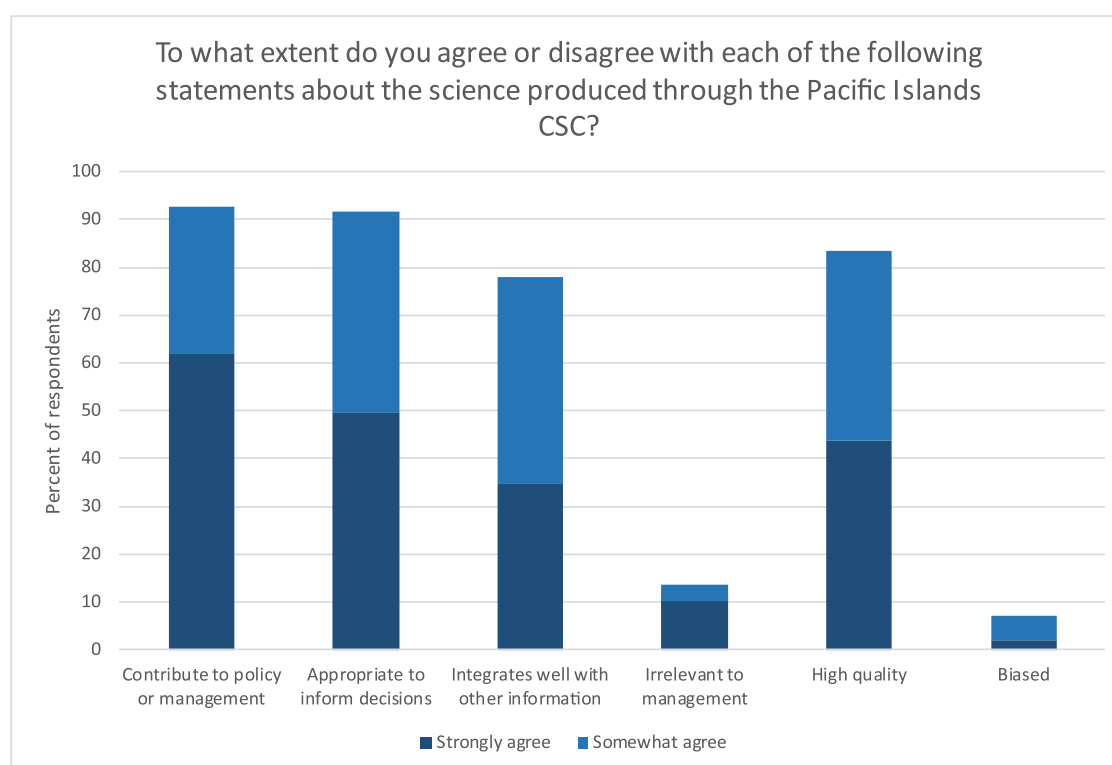


Figure 3. Perspectives on the science produced by the Pacific Islands Climate Science Center (CSC) from science users and science producers. Source: Figure PI-5, Lauber and Stedman (2018).

## Capacity Building

Because the consortium funding model supports student research, the PI CSC has a strong focus on capacity building, especially within the universities. Students from natural, physical, and social science disciplines, as well as economics, urban planning, and tropical conservation, have conducted work funded by the PI CSC. In most cases, the research links to the USGS mission areas. In other instances, a broad interpretation of theme 4 (forecasting sustainability for resource management and planning) was used in order to initiate climate change-related conversations in challenging locations. While all of the capacity building work reviewed addressed needs within the PI CSC's various stakeholder communities, the SRT encourages USGS and university staff to work closely in order to ensure that funded projects align closely with the updated SSA (Helweg et al. 2017). The SRT believes that enhanced cooperation and collaboration related to capacity building will lead to better leveraging of funds in service to overall PI CSC goals while also allowing students to better understand how their work links to USGS goals in climate adaptation and resilience in the face of climate extremes.

As previously mentioned, the PI CSC supported 28 undergraduates and 45 graduate students, with 20 bachelor's degrees, 19 master's degrees, and 6 doctorates conferred during the 5-year period, with an additional 8, 14, and 5 students in progress, respectively. In addition, eight postdoctoral researchers were part of this cadre of early-career researchers and professionals. More than half of these individuals were female and more than 13% were native to the Pacific Islands. Those who participated in the on-site review were engaging and articulate, demonstrating that the PI CSC was committed to mentoring the next generation of climate adaptation leaders. Furthermore, students and early-career professionals participating in the review expressed a strong commitment to service within their communities and the region as a whole.

The SRT likewise noted that some PI CSC researchers were particularly motivated to develop knowledge and skills within individuals who desire to stay and apply climate sciences to the needs of the Pacific Islands region. The SRT commends the PI CSC faculty mentors who are thinking not only about building capacity in the climate adaptation arena, but are actively seeking to mentor students who will be their colleagues and stakeholders in the future, thus building the PI CSC network strategically. An excellent summary of this was a statement by a participant in the focus group on science producers:

I've focused on funding graduate students that are from Hawai'i because prior to that I'd get tons of graduate students from the mainland. You train them and then they disappear to the mainland. And when it comes to climate change in any sort of resource management issue we need a workforce that's going to stay in Hawai'i. This was ... really the only source of funding focused on climate that because of my professional choices at that point I could link up with local students ... so augmenting the education of local students so that we can augment the management of local resources and local problems. (Pacific Islands Producer focus group [FG])

*Some researchers have developed a progressive focus on developing skills within individuals who will stay, and apply climate science, in the Pacific Islands, thereby retaining that knowledge and skills to benefit the region. The PI CSC has clearly engaged indigenous peoples across the region.*

Extending from its academic roots at UoG, the GIS at the Center for Island Sustainability (CIS), or GIS@CIS, program has increased technical capacity in building climate resilience by offering new trainings and curriculum materials at UoG and interested community colleges across the Federated States of Micronesia. Dr. Romina King and Ms. Maria Kottermair have led this program and expanded it through technical assistance, data, and other resources for GIS users in the natural resources management commu-

nity and, somewhat uniquely, the business community.<sup>8</sup> They included the needs of stakeholders across the region by conducting a survey of GIS users and working with researchers and stakeholders to build useful products, such as three-dimensional maps of critical coral reef habitats.

The PI CSC conducts many traditional capacity-building activities, such as research symposia, webinars, trainings, and conference forums. These activities were intended to bridge gaps between researchers and stakeholders, providing early-career professionals with opportunities for professional development and to share their research with colleagues. This also included needs assessments for future research and learning about knowledge coproduction, different ways of knowing, and place-based management. The SRT deemed all of these activities important in establishing the PI CSC and rooting it in actionable science. These types of activities may be particularly important in supporting those students who do not stay in the region but who are looking to gain training and experience in the production of actionable science—expertise that they will take with them to professional careers elsewhere.

The SRT took particular note of one capacity-building program: the MCC, mentioned previously. Developed at UH–Hilo, the MCC was designed to connect and support existing local networks of natural and cultural resource managers and expand them through collaborations with graduate students, community leaders, and others, with a focus on strengthening adaptive capacity. According to the PI CSC, the “four foundational elements of the MCC are (1) supporting and developing long-term trust; (2) building upon existing in-person professional networks; (3) knowledge coproduction, which is collaboration between researchers and decision makers in all aspects of a project; and (4) multiple ways of knowing, such as rational analytical capacities, experience, group norms and values, individual perceptions, instincts, emotions, and intuitions” (PI CSC 2017). Mr. Scott Laursen and Dr. Sharon Ziegler-Chong initiated the MCC by initially building relationships with existing networks, then connecting some of the resource managers to faculty at UH–Hilo through graduate student projects, and finally showcasing the collaborations at a Climate Boot Camp at Kioloa‘a Ranger Station in Ka‘ū on August 9–12, 2016. The 57 participants continued learning about climate adaptation during the week of the camp, but more importantly, the boot camp provided opportunities to nurture conversations among people with different worldviews, management or research priorities, and place-based contexts. The SRT encourages the PI CSC to seek ways to institutionalize the MCC and find opportunities to transition best practices or lessons learned to the broader CSC network.

*The MCC was strongly endorsed by, and helpful to, stakeholders. The SRT encourages the PI CSC to seek ways to institutionalize this program and find opportunities to transition best practices or lessons learned to the broader CSC network.*

The responsibility for capacity building has fallen predominantly on the university consortium. The UH–Hilo campus, in particular, has a long history of student training and engagement and, thus, had mechanisms in place for the kind of partnership building envisioned by NCCWSC. The University of Hawaii at Mānoa and UoG also had strong existing ties with students and local communities. These existing relationships and priorities seem to have driven this division of labor early in the PI CSC’s history, and it has remained in place. Over the past several years, other CSCs have found it beneficial to base capacity building efforts on both the university and USGS components of the CSC. Doing so provides greater opportunities to strategically link capacity building efforts to the science priorities. In addition, interaction with federal researchers exposes students to diverse career paths. The SRT encourages substantially greater engagement of USGS personnel in capacity building in the future, as well as better integration of capacity building into the development of science priorities.

<sup>8</sup> Presentation by Marcel Higgs and Dr. Romina King, “Increasing the resilience of small businesses on Guam to climate change.” January 22, 2018, Pacific Islands Climate Science Center Review, University of Hawaii–Mānoa.

## Partnerships

Based on the presentations and conversations experienced by the SRT in both Hawaii and Majuro, the role of partnerships is central to the success of the PI CSC in meeting its goal to “provide natural resource managers and cultural stewards in federal, state, and local agencies access to the best science available on climate change and other landscape-scale stressors that are impacting the nation’s natural and cultural resources” (<http://pi-csc.soest.hawaii.edu/>). The partnerships between science producers and science users/consumers are essential to the full cycle of the PI CSC goal of generating science, which can be used by policymakers to inform management strategies. The university, federal, and state roles in partnerships with the PI CSC seems strong. However, few partnerships appear to exist between the PI CSC and NGOs and/or local and indigenous partners. Anecdotal comments by potential stakeholders/partners in Majuro reflected little knowledge that there even was a PI CSC (although it could be that they are aware of the institution but not the formal name and structure). Nonetheless, this may indicate an opportunity for expanding the awareness among these potential partners about how exactly they could get involved and how the PI CSC could benefit them. It also seems that perhaps there are more science producers than science consumers. The SRT believes that opportunities exist to address these imbalances, while also acknowledging that the PI CSC is still developing and building its partnerships.

### *Partnership Perspectives*

The data summary from the HDRU survey reports that, overall, a reasonably strong engagement between the PI CSC and partners exists, as well as productive exchange and application of science between science producers and science users. However, one of the barriers to progress is a lack of time on the part of the partners to engage with the PI CSC. Some of the other challenges related to partnership development are those identified as impediments elsewhere in the report—vast geographic distances and diverse needs coupled with a small and, until recently, shifting mix of PI CSC staff. Lack of time on everyone’s part makes ongoing discussion and relationship maintenance difficult. More than one-half of the science users and producers surveyed noted that lack of time limited their interactions with the CSC (Lauber and Stedman 2018). Newer relationships may be particularly difficult to sustain when PI CSC priorities shift or cannot encompass some partner needs because of the underlying NCCWSC mission. For example, 33% of science users interviewed noted that the science produced by the PI CSC does not address the issues that they face, with some citing (during the focus groups) that there is a underlying struggle for university researchers to conduct actionable science instead of academic science. One recommendation that emanates from this report is that the PI CSC needs to be more proactive in engaging potential partners to facilitate the collaboration process. Given the SRT observation that there is a potential shortage of PI CSC staff, the ability to address this recommendation may be based on staffing levels for the PI CSC. However, the PI CSC may be able to develop and maintain partnerships by engaging in knowledge brokering when partner needs fall outside of the PI CSC mission, priorities, or capabilities.

The SRT views the inclusion of a variety of partners, representing federal, state, academic, local, indigenous, and nongovernmental entities as important. To build this diversity in partnerships, the SRT recommends that the PI CSC develop a methodology to explore and establish partnerships with collaborators in each of these stakeholder groups that would be repeated regularly on a reasonable timeline.

While the focus groups included both science producers and science users, the low number of science-user participants (six) could illustrate the small number of active PI CSC partners and/or PI CSC partners’ limited time for engagement with the PI CSC.

About three-quarters of the survey respondents felt that climate adaptation science in the Pacific Islands region

was available to decision makers, and many also believed that decision makers use the climate adaptation science to inform management. Nevertheless, nearly half believed that climate adaptation science

did not influence necessarily management actions taken, although a majority also believed that the Pacific Islands CSC had reduced the disconnect between scientists and decision makers. When asked specifically about the science produced through the Pacific Islands CSC, the vast majority of the survey respondents agreed it can contribute to policy or management. Respondents were also positive about other characteristics of the CSC science, and the majority found it appropriate to inform decisions, high quality, and able to integrate well with other information. (Lauber and Stedman 2018)

This may suggest that future actions of the PI CSC should include increased emphasis of making sure that climate adaptation science produced by the PI CSC directly informs management action.

An overwhelming proportion of both science users and producers expressed support for coproduction of knowledge. While many of the science producers indicated experience in coproduction in various phases of research projects, many fewer science users reported first-hand experience. Scientists were the most likely to have experience with coproduction in the early stages (setting priorities and identifying research questions) and late stages (interpreting, applying, and communicating results) of research, although many also had experience with coproduction during the data collection stage. Science users were most likely to have experience in coproduction by identifying research questions, collecting data, and applying results. Science users who responded to the survey reported that their involvement in co-produced research projects is most limited by scientists not reaching out to them to collaborate, not having enough time to work with scientists, having different perspectives from scientists on what science is needed, and funders not being willing to support collaboration between scientists and science users. (Lauber and Stedman 2018)

The majority of survey respondents noted a variety of contributions of the Pacific Islands CSC, including contributions to awareness of available science, communication between scientists and decision makers, collaboration between scientists, and interdisciplinary science. (Lauber and Stedman 2018)

From the HDRU stakeholder report (Lauber and Stedman 2018), it seems that a need exists to engage a larger number of science users, including those from NGOs, in addition to the necessary engagement with federal and state agencies. The MCC (detailed earlier in this report) provides an excellent example of an effective way to engage a broad cross section of potential science users into coproduction aspects of the PI CSC program.

### ***Partnerships Summary***

In general, the strength of the existing partnerships between the PI CSC and its collaborators appears strong, within and between science producers and users. The SRT recommends that the PI CSC continue to build on its strong foundation of partnerships to increase the level of representation from a wider range of stakeholder groups and broader geographical range.

*Stakeholders recognize the value in the PI CSC and the products produced. Pacific Islands Climate Science Center facilitation of in-person stakeholder meetings is extremely valuable for coordination of overall climate science research in the region.*

*The SRT encourages the PI CSC to discuss how best to support projects that have applications across all or most of the region, especially the USAPI. A coordinator focused specifically on all regions other than Hawaii and Guam (where consortium universities are located) may help to facilitate this (similar to other CSCs' approaches to tribal engagement)*

## Communication

The SRT recognizes that as a relatively new organization, the PI CSC has faced the challenge of communicating a number of distinct messages to diverse audiences for multiple purposes. These communication needs included outreach to consortium and partner institution researchers and potential management partners. Important messages to keep affiliated researchers and managers informed about funded projects and upcoming opportunities include organizational priorities, capabilities, and funding mechanisms, as well as ongoing operational communications. Finally, research results needed to be communicated to the appropriate management community and possibly the general public.

Practical complexities specific to the Pacific Islands region include the diversity of languages spoken within the geographic region and the large size of the region, which requires heavy reliance on virtual communication. As discussed elsewhere in the document, early leadership changes at the USGS (along with uncertainty related to the leadership within the university consortium) complicated the identification of PI CSC priorities during the first 2 to 3 years, increasing the difficulty of communication about organizational goals and structure.

One further challenge to the PI CSC's communication efforts has been the relatively minimal communications staff. Between 2012 and early 2016, PI CSC communication efforts were led by a 0.25 FTE communications specialist and supported by a 0.75 FTE science writer. From spring 2016 to spring 2017, all communications were managed by a single 0.25 FTE specialist who transitioned to 0.60 FTE in spring of 2017. The University of Hawaii at Mānoa has reasonably strong extension capability through Sea Grant and the College of Tropical Agriculture and Human Resources Cooperative Extension. While some of examples of partnering in communications were presented to the SRT, such as production of a *Voices of the Sea* episode, the SRT is unclear as to the extent the PI CSC leveraging of communications capacity elsewhere in the University of Hawaii or UoG system. It is also unclear whether students have been brought in to support and learn from PI CSC communication efforts in the same way that they have conducted and benefited from training in research.

Despite the challenges outlined above, the PI CSC has produced a number of excellent communication products using a range of media and targeted at a number of audiences. The SRT feels that communications staff should be commended for their work on this material. They have developed a relatively dynamic Web presence with a main PI CSC Web site hosted at UH–Mānoa and locally focused pages at the other consortium institutions. A periodically updated story map provides information about the PI CSC in a way that is suitable for a number of audiences. In addition, the PI CSC has supported the production of information about impacts of the El Niño–Southern Oscillation focused on the Marshall Islands and released the product in Marshallese and English. Many of the funded projects have been summarized in two-page research briefs and described in periodic newsletters aimed at PI CSC affiliates. Although travel within the region can be difficult or expensive, the PI CSC has also hosted 10–15 primarily in-person meetings that stakeholders identified as particularly useful.

The SRT noted that communication of research results to stakeholders and to the public generally appears to be successful. For example, the two-page research briefs are clearly written, feature engaging graphics, and cover a wide variety of the PI CSC-funded research. A recently produced episode of *Voices of the Sea*, a local documentary series produced by Sea Grant and airing on public television, highlights the CSC and its work. This was likely a direct benefit of the PI CSC being co-housed with the Sea Grant program and University Director Lerner having administrative responsibility for both programs. The SRT noted that there is a need for greater outreach and engagement within the university consortium and with potential management partners. Several researchers and stakeholders expressed lack of awareness about the projects being conducted or funded by the PI CSC and some uncertainty about how to work with the PI CSC. Federal stakeholders were engaged primarily or exclusively with the USGS side of the PI CSC and, in some cases, seemed unaware of the role of the university consor-

tium. Within the university consortium, some researchers expressed confusion about funding eligibility and mechanisms.

The SRT recognizes that when an organization is in flux, communications plans need to be flexible as well. Now that the leadership team has stabilized, the SRT recommends that the PI CSC would benefit from developing a communications strategy. This could allow existing communications personnel to better prioritize their efforts and maintain a workload commensurate with staffing levels. The SRT also encourages the PI CSC to find ways to expand their communications capacity, whether through an increase in dedicated staff time, the incorporation of student projects focused on communication, or further integration with existing extension programs within the University of Hawaii system.

*There are many examples of excellent communication products, but the lack of a strategic communications plan is likely hindering the ability to fully realize the impact of these tools and the strategic deployment of the limited communication staff resources.*

## Concluding Comments

Despite the initial years of the PI CSC being characterized by several years of instability in the university and USGS leadership positions, the PI CSC has developed into a robust and meaningful program to develop and communicate climate adaptation science in this highly diverse region. Some of the very challenges of working in this region have been turned into strengths, such as integrating traditional cultural knowledge of climate and the environment into projects supported by CSC funding. The current trajectory of the PI CSC bodes well for the development of climate adaptation science that begins to meet the unique ecological, cultural, and social aspects of this region.

Like any endeavor, steps could be taken to strengthen the PI CSC even more. Administratively, greater cohesiveness between the USGS and university consortium through more in-person interaction, physical location, and clarity in the RFP and funding process will likely provide operational benefits that extend to the university, the USGS, partners, and stakeholders alike. While the USGS PI CSC emphasis in the initial years has been on maximizing science production, the SRT believes that the time is right to consider increasing the USGS staffing to enhance the ability of partners and stakeholders to work effectively with the PI CSC in a productive manner. At the host university, increasing dedicated staff capacity and improving the physical visibility of the PI CSC will better serve what will undoubtedly be increasing stakeholder interest in PI CSC products and services. In general, stakeholders are very supportive of the science products that have been produced, and efforts should be increased to ensure not only that future projects meet their needs, but that they are meaningful participants in the coproduction of that science.

The PI CSC will always be faced with the challenge of prioritizing allocation of limited financial resources across a geographically extensive region with broad, diverse needs. Developing and implementing creative ways to leverage and extend the value of each dollar spent are essential elements to meeting as many needs as possible while minimizing the potential for spreading the funding too thin. While the needs of stakeholders in areas where consortium partners are located (Guam and Hawaii) may be more apparent, efforts should be enhanced to understand and address cross-cutting needs of all regions, particularly the USAPI, that could be addressed through common project funding. Additionally, the value of the excellent communication products that have been developed, and those that are developed in the future, will be extended if the products, pathways of dissemination, and targeted audiences are strategically guided through a formal communications plan.

Overall, the SRT is favorably impressed with the accomplishments of the PI CSC in its first 5 years. Much of this is directly attributable to the excellent, dedicated staff that has been assembled to discern how to best invest a limited amount of funding over such a large area with innumerable pressing needs posed

by changing climatic conditions. The observations and recommendations contained within this report should not be viewed as detracting from these accomplishments, but as constructive input to help build an even more vibrant and robust program in the future.

## References

- ACCCNRS (Advisory Committee on Climate Change and Natural Resource Science). 2015. Report to the Secretary of the Interior, March 30, 2015. Available: [nccwsc.usgs.gov/sites/default/files/files/ACCCNRS\\_Report\\_2015.pdf](https://nccwsc.usgs.gov/sites/default/files/files/ACCCNRS_Report_2015.pdf). (December 2015).
- Dayer, A. A., T. B. Lauber, and R. C. Stedman. 2016. Quality and extent of partnership involvement in Climate-Science Centers in Alaska, the Northwest, & the Southeast. Cornell University, Human Dimensions Research Unit (HDRU), HDRU Series No. 17-4, Ithaca, New York.
- Helweg, D. A., S. Nash, and D. Polhemus. 2014. The Pacific Islands Climate Science Center five-year science agenda, 2014–2018. U.S. Geological Survey, Open-File Report 2014-1075, Reston, Virginia. Available: <https://pubs.usgs.gov/of/2014/1075/>. (June 2018).
- Helweg, D. A., D. A. Polhemus, and B. J. E. Myers. 2017. The Pacific Islands Climate Science Center five-year science agenda, 2018–2022. Available: <https://www.sciencebase.gov/catalog/item/5a0da8f4e4b09af898cebf1>. (June 2018).
- Jones, S. A., and M. S. Dalton, compilers. 2012. U.S. Department of the Interior Southeast Climate Science Center science and operational plan. U.S. Geological Survey, Open-File Report 2012-1034, Reston, Virginia. Available: [pubs.usgs.gov/of/2012/1034](https://pubs.usgs.gov/of/2012/1034). (August 2016).
- Lauber, T. B., and R. C. Stedman. 2018. Quality and extent of partnership involvement in Climate Science Centers in the Northeast, South Central, and Pacific Islands regions. Human Dimensions Research Unit, Cornell University, Ithaca, New York.
- NCCWSC (National Climate Change and Wildlife Science Center). 2009. Proposed 5-year strategy (2009–2014), version 7-13-09. U.S. Geological Survey, Reston, Virginia. Available: [https://nccwsc.usgs.gov/sites/default/files/documents/NCCWSC\\_5\\_year\\_strategy\\_ver\\_7-13-09b.pdf](https://nccwsc.usgs.gov/sites/default/files/documents/NCCWSC_5_year_strategy_ver_7-13-09b.pdf). (September 2016).
- NCCWSC (National Climate Change and Wildlife Science Center). 2011. Providing science for climate adaptation. U.S. Geological Survey, NCCWSC and U.S. Department of Interior Climate Science Centers progress report—fall 2011, Reston, Virginia. Available: [https://nccwsc.usgs.gov/sites/default/files/documents/other/Progress%20Report\\_FINAL%2002-06-12.pdf](https://nccwsc.usgs.gov/sites/default/files/documents/other/Progress%20Report_FINAL%2002-06-12.pdf). (November 2016).
- NCCWSC (National Climate Change and Wildlife Science Center). 2014. Climate Science Center Stakeholder Advisory Committee (SAC) terms of reference. U.S. Geological Survey, Reston, Virginia.
- PI CSC (Pacific Islands Climate Science Center). 2017. Pacific Islands Climate Science Center 5-year summary report 2012–2017. U.S. Geological Survey, Reston, Virginia.
- Salazar, K. 2009. Department of the Interior, Secretarial Order 3289, Subject—Addressing the impacts of climate change on America’s water, land and other natural and cultural resources. U.S. Department of the Interior, Washington, D.C.
- TWS (The Wildlife Society) and ESA (Ecological Society of America). 2009. USGS National Climate Change and Wildlife Science Center: final report on outreach and recommendations. TWS, Bethesda, Maryland. Available: <https://nccwsc.usgs.gov/sites/default/files/documents/TWS-ClimChgReportFINAL.PDF>. (September 2016).
- USGS (U.S. Geological Survey). 2009. National Climate Change and Wildlife Science Center proposed 5-year strategy (2009–2014). USGS, Reston, Virginia.
- USGS (U.S. Geological Survey). 2012. Advisory Committee on Climate Change and Natural Resource Science charter. USGS, Reston, Virginia. Available: <https://nccwsc.usgs.gov/accnrs>. (March 2017).
- USGS (U.S. Geological Survey). 2013. Providing science for climate adaptation. USGS, National Climate Change and Wildlife Science Center and Department of Interior Climate Science Centers progress report—summer 2013, Reston, Virginia.
- Varela-Acevedo, E., and R. O’Malley. 2013. The National Climate Change and Wildlife Science Center annual report for 2012, version 1.1. U.S. Geological Survey, Circular 1387, Reston, Virginia. Available: <http://pubs.usgs.gov/circ/1387>. (November 2016).

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## Appendix B

### Pacific Islands Climate Science Center On-Site Review Schedule

**January 21 to January 26, 2018**

University of Hawaii at Mānoa

Honolulu, Hawaii 96822, USA

**Sunday, January 21, 2018**

| Time         | Activity                                                                                                                                                                                                                                                                                                                                              | Desired output | Lead entity/<br>person(s) |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------|
|              | <b>Travel day. Review Team arrives.</b>                                                                                                                                                                                                                                                                                                               |                |                           |
| 5:00–6:30 pm | Pre-meeting of Review Team members. <ul style="list-style-type: none"> <li>• Review schedule of meetings/discussions</li> <li>• Overview of goals and expected products</li> <li>• Writing expectations</li> <li>• Identification of additional information needs</li> </ul>                                                                          |                |                           |
| 6:30–8:00 pm | Dinner gathering of Review Team members.<br><b><u>(only Review Team members and USGS-Reston staff)</u></b><br>Follow-up discussion questions: <ul style="list-style-type: none"> <li>• From the material that you've seen so far, what is missing? What do you want to see more of?</li> <li>• What new questions do you have for the CSC?</li> </ul> |                |                           |

**Monday, January 22, 2018**

| Time          | Activity                                                                                                                                                                                                                                                       | Desired output                                                                     | Lead entity/<br>person(s) |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------|
| 8:15 am       | Arrival at UH-Mānoa, HIG 210                                                                                                                                                                                                                                   |                                                                                    |                           |
| 8:30–9:30 am  | <b>Greetings and Introductions</b> <ul style="list-style-type: none"> <li>• Cultural greeting (Oli)</li> <li>• Campus and host welcome (Michael Bruno)</li> <li>• Introductions and background statements</li> <li>• Review charge to the committee</li> </ul> |                                                                                    | Austen, Darren Lerner     |
| 9:30–10:15 am | <b>Institutional Development</b><br>Review of structure, function, and key components of the PI CSC, including main points from preparatory conference                                                                                                         | Ensure that SRT has full understanding of the structure of the CSC, including core | Lerner, Austen            |

**Monday, January 22, 2018 (continued)**

| Time           | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Desired output                                                                                                                                                                                                                                                                                                                                                                           | Lead entity/ person(s)                                                                                                                  |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
|                | calls focusing on structure, funding, staffing, strategic plan, science agenda, and related aspects of the PI CSC. <ul style="list-style-type: none"> <li>• Q&amp;A and discussion of issues raised from the calls.</li> <li>• Identification of additional information needs.</li> <li>• Science Agenda, science themes, RFP process, funding pathways, SAC, working together (USFS and universities).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | documents and key processes. Presentations and discussion should enable the SRT to recognize the linkage between these issues and the strategic plan and science agenda of the PI CSC.                                                                                                                                                                                                   |                                                                                                                                         |
| 10:15–10:30 am | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                         |
| 10:30–11:00 am | <b>University Consortium Discussion</b> — review of partners, mechanisms for engagement, assessment of strengths, weaknesses, and opportunities of the consortium.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Status of consortium coordination, involvement, management, adequacy of coverage, etc.                                                                                                                                                                                                                                                                                                   |                                                                                                                                         |
| 11:00–12:00 pm | <p><b>Actionable Science</b></p> <p>Establishment of the climate change science and conservation context of the PI CSC, to include presentations by graduates and postdoctorates on research updates, outreach, and engagement.</p> <p>This is a series of presentations highlighting projects supported by the PI CSC with a focus not on the technical details of projects (i.e., not a traditional science presentation as would be done at a conference). Rather, selected projects are identified that reflect key priorities of the PI CSC as identified in the science plan. The projects are presented to clarify why it was selected, the intended audience, how users were engaged, outreach, and, of course, some of the key aspects of the project itself.</p> <p><u>Presenters:</u></p> <p>Steven Colbert &amp; Kamala Anthony, UH–Hilo, with Blake McNaughton, Fishpond Manager</p> <p>Romina King &amp; Marcel Higgs, University of Guam, with Vince Leon Guerrero, Climate Change Asst for Governor of Guam</p> | <p>Presentations and discussion should enable the SRT to recognize the linkage between these issues and the strategic plan and SSA of the PI CSC.</p> <p>Understanding of the main drivers of science-management needs that define the CSC and relevant other climate science providers. What is the context of the CSC with regard to the most significant conservation challenges?</p> | <p>Lerner and staff.</p> <p>CSC director and university PI to identify and select presentation with conferral of Review Team chair.</p> |

**Monday, January 22, 2018 (continued)**

| Time           | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Desired output | Lead entity/<br>person(s) |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------|
|                | Victoria Keener, East-West Center,<br>UH–Mānoa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                           |
| 12:00–12:30 pm | Break for buffet lunch and then reassemble                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |                           |
| 12:30–1:15 pm  | <b>Continuation of Actionable Science<br/>Part 2</b><br><u>Presenters:</u><br>Tom Giambelluca, UH–Mānoa & Abby<br>Frazier, U.S. Forestry Service, with<br>Neal Fujii, Dept of Land and Natural<br>Resources<br>Maxine Burkett & Juno Fitzpatrick,<br>UH–Mānoa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                           |
| 1:15–1:30 pm   | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                           |
| 1:30–3:30 pm   | <b>CLOSED SESSION:</b> Partnership<br>Dialogue #1 (Cornell Team) – science<br>“producers”<br>Participation limited to Cornell Team,<br>invited science producers, SRT, and<br>NCCWSC-Reston<br><u>In-person</u><br>Maxine Burkett, William S. Richardson<br>Law School, UH–Mānoa<br>Charles Fletcher, Geology &<br>Geophysics Department, UH–Mānoa<br>Rosie Alegado, Hawaii Sea Grant,<br>UH–Mānoa<br>Steven Colbert, Marine Science Dept,<br>UH–Hilo<br>Kamala Anthony, UH–Hilo<br>Matthew Widlansky, UH Sea Level<br>Center, UH–Mānoa<br><u>Remote</u><br>Jeff Danielson, Earth Resources<br>Observation and Science Center,<br>USGS<br>Oliver Elison Timm, Dept of Atm and<br>Env Sciences, SUNY Albany<br>Christian Giardina, Inst. Pacific Islands<br>Forestry, USDA<br>Philip Thompson, UH Sea Level Center,<br>UH–Mānoa |                | Lauber and<br>Stedman     |
| 3:30–3:45 pm   | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                           |
| 3:45–5:00 pm   | Review Team Only Discussion ( <b>Closed<br/>Session</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                           |

**Monday, January 22, 2018 (continued)**

| Time    | Activity                                                          | Desired output | Lead entity/<br>person(s) |
|---------|-------------------------------------------------------------------|----------------|---------------------------|
| 6:00 pm | Group Dinner – All involved in review are invited to participate. |                |                           |

**Tuesday, January 23, 2018**

| Time           | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Desired output                                                                           | Lead entity/<br>person(s) |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------|
| 8:00–8:30 am   | Gather, review agenda, identify additional questions and information requests.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          |                           |
| 8:30–9:30 am   | <b>CLOSED SESSION</b><br>Review Team briefing and discussion with <b>University/Host Institution</b> principal investigators and relevant other university partners only: Darren Lerner and others at University of Hawaii PI CSC university consortium.                                                                                                                                                                                                                                                                        | Review responses to submitted questions and information requests, open discussion of CSC | Austen                    |
| 9:30–9:45 am   | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                          |                           |
| 9:45–10:15 am  | <b>Communications</b> – tools (e.g., media), staff programs, partner efforts, etc. Provide a review of communications efforts to convey science, tools, projections, etc. to other researchers, partners, science users, and conservation practitioners. Should identify audience, messaging, communication tools, evaluation, etc.<br><u>Presenter:</u> Rachel Lentz, UH–Mānoa                                                                                                                                                 |                                                                                          |                           |
| 10:15–10:45 am | <b>Capacity Building</b> – fellows and partners, workshops/trainings. Series of presentations, panel discussions, or program descriptions to provide an understanding of how the PI CSC has trained and developed the next generation of climate scientists, provided training and outreach opportunities to partners to expand overall climate science capacity in the PI CSC operational area.<br><u>Presenters:</u><br>Rachel Lentz, UH–Mānoa<br>Scott Laursen, UH–Hilo<br>Romina King & Maria Kottemair, University of Guam |                                                                                          | Lerner                    |

**Tuesday, January 23, 2018 (continued)**

| Time           | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Desired output                                                                           | Lead entity/<br>person(s)     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------|
| 11:15–12:15 pm | <b>CLOSED SESSION</b><br>Review Team briefing and discussion with<br><b><u>USGS-PI CSC staff only</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Review responses to submitted questions and information requests, open discussion of CSC | Austen                        |
| 12:15–1:00 pm  | Lunch (catered to meeting room)<br>(Participants in the next panel—science users—could be invited to join the group for lunch on site)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                          |                               |
| 1:00–3:00 pm   | <b>CLOSED SESSION: Partnership Dialogue #2 (Cornell Team) – science “users”</b><br>Participation limited to Cornell Team, invited science producers, SRT, and NCCWSC-Reston<br>In-person<br>Jeff Burgett, Pacific Islands Climate Change Cooperative Science Coordinator<br>Matt Kier, Rare Plant Conservation Network<br>Sam Lemmo, Hawaii Department of Land and Resources<br>Lenore Ohye, Commission on Water Resources Management<br>Remote<br>Susan Ching, State Botanist<br>Sierra McDaniel, Botanist, Hawaii Volcanoes National Park<br>Kehau Springer, Conservation International                   |                                                                                          | Bruce Lauber and Rich Stedman |
| 3:00–3:15      | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                          |                               |
| 3:15–4:00 pm   | <b>CLOSED SESSION: Role of SACs and other advisory bodies</b> – participants in Science Users focus group and members of SAC invited to continue discussions of the roles of advisory bodies.<br>Participation limited to SAC members, SRT, and NCCWSC-Reston<br><b><u>Stakeholders</u></b><br>Mary Abrams, mary_abrams@fws.gov (present)<br>Laura Brewington, brewingl@eastwestcenter.org (present)<br>Christian Giardina, giardina@hawaii.edu (remote)<br>Sanuel M. ‘Ohukani‘ōhi‘a Gon, sgon@tnc.org (remote)<br>Amy Koch, amy.koch@hi.usda.gov (remote)<br>Natalie Kurashima, nakurash@ksbe.edu (remote) |                                                                                          |                               |

**Tuesday, January 23, 2018**

| Time         | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Desired output | Lead entity/ person(s) |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------|
|              | <p>Melia Lane-Kamahele, melia_lane-kamahele@nps.gov (present)</p> <p>Xavier Matsutaro, erbai.oerc@palaugov.org (remote)</p> <p>Lenore Ohye, lenore.n.ohye@hawaii.gov (remote)</p> <p>Richard Salas, richardsalas@becq.gov.mp (remote)</p> <p>Hudson Slay, slay.hudson@epa.gov (maybe, remote)</p> <p>Namaka Whitehead, nawwhiteh@ksbe.edu (remote)</p> <p>Jeff Burgett, jeff_burgett@fws.gov (maybe, present?)</p> <p><u>Science Advisors</u></p> <p>Thomas Frost, tfrost@usgs.gov (remote)</p> <p>Victoria Keener, keenerv@eastwestcenter.org (present)</p> <p>John Marra, john.marra@noaa.gov (maybe, remote)</p> <p>Michael Seki, michael.seki@noaa.gov (maybe, remote)</p> |                |                        |
| 4:15–5:30 pm | <p><b>Review Team only</b>, closed session #1</p> <ol style="list-style-type: none"> <li>1. Gather initial thoughts and questions.<br/>Quick gathering of initial observations (e.g., lightening round of 2–3 minutes for each team member to share thoughts), compilation of shared observations, gathering of questions and information requests for day #2.</li> <li>2. Initial discussion of report authorship.<br/>This will have been addressed on pre-site visit conference calls but should be leading to team members accepting authorship responsibility.</li> </ol>                                                                                                 |                |                        |
| 6:00 pm      | <p>Review Team Only Dinner –</p> <p>Continue to work on observations/ recommendations from Monday and Tuesday. Discuss morning logistics.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                        |

**Wednesday–Thursday, January 24–25, 2018 (cross International Date Line)**

| Time | Activity                                                                                                                                    | Desired output | Lead entity/ person(s) |
|------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------|
|      | <p>Wednesday (1/24/2018)</p> <p>Fly from Honolulu to Majuro</p> <p>Arrive Thursday, January 25, 2018 because of International Date Line</p> |                |                        |

**Thursday, January 25, 2018**

| Time         | Activity                         | Desired output | Lead entity/ person(s) |
|--------------|----------------------------------|----------------|------------------------|
| 10:30 am–    | Arrive in Majuro at 10:35 am.    |                | Austen                 |
| 12:30 pm     | Travel to lodging and check in.  |                |                        |
| 1:00–1:30 pm | Travel to conference site at MIR |                |                        |

**Thursday, January 25, 2018 (continued)**

| Time         | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Desired output | Lead entity/<br>person(s) |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------|
| 1:30–4:30 pm | Science talks and stakeholder panel discussions <ul style="list-style-type: none"> <li>• Climate science issues in Marshall and other similar island systems in the operational area of PI CSC</li> <li>• Challenges of doing actionable science in highly remote and isolated settings</li> <li>• Ongoing research presentations</li> </ul> <u>Presenters</u><br>David Helweg, USGS<br>Charles Fletcher, UH–Mānoa<br>Maria Haws & Katie Friday, UH–Hilo |                |                           |
| 4:30–5:30 pm | Review panel only session (Closed)                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                           |
| 6:00 pm      | Reception dinner for remaining guests                                                                                                                                                                                                                                                                                                                                                                                                                    |                |                           |

**Friday, January 26, 2018**

| Time                | Activity                                                                                                                                                                                                | Desired output                                                                                                                                                                                                 | Lead entity/<br>person(s) |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 7:30–8:30 am        | Working breakfast                                                                                                                                                                                       |                                                                                                                                                                                                                |                           |
| 8:30–9:00 am        | Gather for tour preparation                                                                                                                                                                             |                                                                                                                                                                                                                |                           |
| 9:00 am–<br>2:30 pm | <ul style="list-style-type: none"> <li>• Site visits in Majuro and other atoll</li> <li>• Lunch (box lunches while on tour)</li> <li>• Site visits in Majuro</li> <li>• Travel back to hotel</li> </ul> | Site visits would be with a mixed group of researchers and local conservation practitioners who would be able to discuss issue identification, research needs, project development, and transferal of results. |                           |
| 3:00–5:00 pm        | Review Team closed work session – further gathering of findings, observations, and discussion of report design (at hotel)<br>Dinner during this session                                                 |                                                                                                                                                                                                                |                           |
| 5:00–5:15 pm        | Get ready for departure                                                                                                                                                                                 |                                                                                                                                                                                                                |                           |
| 5:15 pm             | Shuttle to airport<br>Arrive at airport for boarding passes<br>Flight departure at 8:10 pm.                                                                                                             |                                                                                                                                                                                                                |                           |

**Friday, January 26, 2018** *(note crossing of International Date Line)*

| Time         | Activity                                                                                                                                                                               | Desired output                                                                                                                                                                                                                                                    | Lead entity/ person(s)                                                                                                                  |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 2:50 am      | Arrive from Majuro<br>Rest and Recuperate                                                                                                                                              |                                                                                                                                                                                                                                                                   |                                                                                                                                         |
| 10:00 am     | Meet with University of Hawaii<br>Vice-Chancellor                                                                                                                                      | University<br>administration<br>perspective on<br>CSC hosting                                                                                                                                                                                                     | Austen                                                                                                                                  |
| Noon         | Review Team only closed session –<br>assemble at university conference room<br>Lunch catered in to Review Team.<br>Refine key initial observations. Discuss<br>writing assignments.    |                                                                                                                                                                                                                                                                   |                                                                                                                                         |
| 2:00–3:00 pm | Report out of Review Team to<br>CSC/university hosts                                                                                                                                   | <ul style="list-style-type: none"> <li>• Open discussion and Q&amp;A about initial observations</li> <li>• Develop list of follow-up items, responsibilities, and timelines for report construction as well as report review and finalization timeline</li> </ul> | All participants are invited to this open presentation by the Review Team and discussion                                                |
| 3:30–5:00 pm | Working time for Review Team. Further<br>compilation of comments, reflection on<br>report-out, initial writing of key findings,<br>assignment of additional writing, and<br>deadlines. |                                                                                                                                                                                                                                                                   | Helpful to have<br>PI CSC staff<br>available to<br>respond to<br>questions or make<br>clarifications as<br>needed by the<br>Review Team |
| 5:00 pm      | Complete working sessions of Review<br>Team and adjourn                                                                                                                                |                                                                                                                                                                                                                                                                   |                                                                                                                                         |
| 6:30 pm      | Dinner or departure of Review Team<br>members                                                                                                                                          |                                                                                                                                                                                                                                                                   |                                                                                                                                         |

## Appendix C

### Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium

(Source: "Federal Director—Discretionary Funded Projects," provided by R. Lentz, Pacific Islands Climate Science Center [PI CSC] outreach specialist, February 15, 2018. Abbreviations: RFP = request for proposal; FY = fiscal year; UH–Manōa = University of Hawaii at Manōa; PICCC = Pacific Islands Climate Change Cooperative; UH–Hilo = University of Hawaii at Hilo; Hale = Haleakalā Climate Network; PNNL = Pacific Northwest National Laboratory; UoG = University of Guam; RMI = Republic of the Marshall Islands; CNMI = Commonwealth of the Northern Mariana Islands; NCCWSC = National Climate Change and Wildlife Science Center; UCSB = University of California, Santa Barbara; DOI = U.S. Department of the Interior; HAVO = Hawaii Volcanoes National Park; WERI = Water and Environmental Research Institute of the Western Pacific.)

| Title                                                                                                                                                   | Institution | Research location     | Primary science agenda theme | Year funded | RFP/direct             | Award amount (through FY17)                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|------------------------------|-------------|------------------------|-------------------------------------------------|
| <b>U.S. Geological Survey (USGS)-funded projects</b>                                                                                                    |             |                       |                              |             |                        |                                                 |
| Developing High-Resolution Rainfall Change Scenarios for the Hawaiian Islands                                                                           | UH–Manōa    | Main Hawaiian Islands | pre-agenda (1)               | 2012–2014   | RFP (joint with PICCC) | 260,177 (approx; may have had PICCC cost-share) |
| Modeling Climate-Driven Changes to Dominant Vegetation in the Hawaiian Islands                                                                          | UH–Hilo     | Main Hawaiian Islands | pre-agenda (4)               | 2012–2015   | RFP (joint with PICCC) | 196,848 (approx; may have had PICCC cost-share) |
| 21st Century High-Resolution Climate Projections for Guam and American Samoa                                                                            | UH–Manōa    | Guam, American Samoa  | pre-agenda (1)               | 2012–2015   | RFP (joint with PICCC) | 382,885                                         |
| Assessing the Viability of the Haleakala Silversword to Uncover the Effects of Climate Change on Effects of Climate Hawai'i's High-Elevation Ecosystems | UH–Manōa    | Maui (HALE)           | pre-agenda (4)               | 2012–2016   | RFP (joint with PICCC) | 104,981 (approx; may have had PICCC cost-share) |
| Vulnerability of Hawaiian Forest Birds to Climate Change                                                                                                | USGS        | Main Hawaiian Islands | pre-agenda (4)               | 2013–2016   | RFP (joint with PICCC) | 258,530 (approx; may have had PICCC cost-share) |

### Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                                                            | Institution          | Research location            | Primary science agenda theme | Year funded | RFP/direct | Award amount (through FY17) |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|------------------------------|-------------|------------|-----------------------------|
| Understanding the Response of Native and Nonnative Forests to Climate Variability and Change to Support Resource Management in Hawaii            | UH–Manōa; PNNL; USGS | Main Hawaiian Islands        | 2                            | 2013–2015   | RFP        | 215,809; 13,888; 11,065     |
| Coral Reef Resilience to Climate Change in the Commonwealth of the Northern Mariana Islands                                                      | UoG                  | Mariana Islands (Guam/ CNMI) | 3                            | 2013–2014   | RFP        | 81,175                      |
| Very Fine Resolution Dynamical Downscaling of Past and Future Climates for Assessment of Climate Change Impacts on the Islands of Oahu and Kauai | UH–Manōa             | Oahu, Kauai                  | 1                            | 2013–2015   | RFP        | 204,404                     |
| Establishing Climate Change Vulnerability Rankings for Hawaiian Native Plants                                                                    | USGS                 | Main Hawaiian Islands        | 4                            | 2013–2016   | RFP        | 179,470                     |
| Projections of Future Coral Reef Communities in DOI-Managed Coastal Areas in the Hawaiian Islands                                                | UH–Manōa; USGS       | Main Hawaiian Islands        | 1                            | 2013–2016   | RFP        | 166,631; 106,250            |
| Valuing Climate Change Impacts on Coral Reef Ecosystem Services                                                                                  | UH–Manōa; USGS; USGS | Maui                         | 3                            | 2013–2016   | RFP        | 190,784; 33,702; 25,032     |
| Modeling the Response of Hawai'i Streams to Future Rainfall Conditions                                                                           | USGS                 | Main Hawaiian Islands        | 2                            | 2014–2015   | Direct     | 138,810                     |

### Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                                                                      | Institution    | Research location            | Primary science agenda theme | Year funded | RFP/direct                                         | Award amount (through FY17) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------|------------------------------|-------------|----------------------------------------------------|-----------------------------|
| Forecasting Beach Loss from Sea-Level Rise on the Island of Kaua'i                                                                                         | UH–Manōa       | Main Hawaiian Islands        | 3                            | 2014–2016   | Direct                                             | 132,020                     |
| Assessing the Potential Effects of Climate Change on Vegetation in Hawai'i Volcanoes National Park                                                         | USGS           | Hawaii Island (HAVO)         | 4                            | 2014–2016   | Direct                                             | 246,390                     |
| Changing Hawaiian Seascapes and Their Management Implications                                                                                              | UH–Hilo        | Hawaii Island                | 4                            | 2014–2016   | Direct                                             | 153,468                     |
| Measurement of El Niño Southern Oscillation (ENSO)-Related Climate Conditions and Ecosystem Responses in Hawaii                                            | UH–Manōa       | Maui (HALE)                  | 1                            | 2014–2017   | Direct (quick response to rapidly forming El Niño) | 81,877                      |
| "Vegetative Guide Dashboard" Relating Traditional Atoll Agroforestry Recommendations to Predicted Climate and Sea Level Conditions in the Marshall Islands | UH–Hilo        | RMI                          | 4                            | 2014–2017   | Direct                                             | 247,919                     |
| Understanding Future Sediment Transport to Coastal Waters and Coral Reef Ecosystems                                                                        | UH–Manōa; USGS | Maui                         | 3                            | 2015–2017   | Direct (supplement to 2013)                        | 21,867; 26,609              |
| Assessing the Sustainability of Culturally Important Marine Sites in Guam and CNMI                                                                         | UoG            | Mariana Islands (Guam/ CNMI) | 3                            | 2015–2017   | RFP                                                | 179,695                     |

## Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                                                    | Institution           | Research location     | Primary science agenda theme | Year funded                                 | RFP/direct                      | Award amount (through FY17) |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|------------------------------|---------------------------------------------|---------------------------------|-----------------------------|
| Projecting the Frequency and Impact of Future Coastal Flooding and Inundation Events in the Pacific Islands                              | UH–Manōa              | Pacific-wide          | 3                            | 2015–2018<br>(PICCC selected, PICSC funded) | RFP                             | 294,613                     |
| Cloud Water Interception in Hawai'i: Mapping Current and Future Exchange of Water Between Clouds and Vegetation in Hawai'i's Mountains   | UH–Manōa              | Main Hawaiian Islands | 1                            | 2015–2017                                   | Direct (link to NCCWSC drought) | 191,582                     |
| Cloud Water Interception in Hawai'i: Understanding the Impact of Fog on Groundwater and Ecosystems and Future Changes to These Processes | UH–Manōa; USGS; USGS; | Main Hawaiian Islands | 2                            | 2015–2019                                   | Direct (link to NCCWSC drought) | 458,861; 89,343; 28,479     |
| Influences of Climate Change, Climate Variability, and Drought on Human Communities and Ecosystems in Hawai'i                            | U.S. Forest Service   | Pacific-wide          | 2                            | 2016–2019                                   | Direct (link to NCCWSC drought) | 200,000                     |
| Collecting Elevation Data to Understand Climate Change Effects in the Marshall Islands                                                   | USGS                  | RMI                   | 3                            | 2016                                        | Direct                          | 100,000                     |
| Understanding the Effect of Climate Change on the Migration of Marshallese Islanders                                                     | UH–Manōa              | RMI                   | 4                            | 2015–2018                                   | Direct                          | 96,000                      |

## Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                 | Institution           | Research location     | Primary science agenda theme | Year funded                        | RFP/direct                                                             | Award amount (through FY17)       |
|-------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|------------------------------|------------------------------------|------------------------------------------------------------------------|-----------------------------------|
| Changes in Water Flow through Hawaiian Forests due to Invasive Species and Changing Rainfall Patterns | USGS;<br>USGS<br>UCSB | Main Hawaiian Islands | 2                            | 2016–<br>2018<br><br>2016–<br>2018 | Direct (link to NCCWSC drought)<br>Direct (link to Fortini water flow) | 178,205;<br>114,389<br><br>40,462 |
| Effects of Drought on Soil Moisture and Water Resources in Hawai'i                                    | USGS                  | Main Hawaiian Islands | 2                            | 2016–<br>2019                      | Direct (link to NCCWSC drought)                                        | 300,000                           |
| Simulating the Impacts of Sea Level Rise on Majuro Atoll                                              | UH–Manōa              | RMI                   | 3                            | 2017–<br>2018                      | Direct                                                                 | 88,254                            |

### University consortium-funded projects (all projects funded directly)

| Title                                                                                                              | Year funded   | Institution | Primary location        | Primary science agenda theme | PI CSC award |
|--------------------------------------------------------------------------------------------------------------------|---------------|-------------|-------------------------|------------------------------|--------------|
| Monitoring and Analysis of Climate Variability and Change in Hawaii                                                | 2012–<br>2015 | UH–Manōa    | Maui                    | pre-agenda (1)               | 71,658       |
| Modeling Endemic Parasitic Wasp Elevational Range Shift as a Result of Climate Change                              | 2012–<br>2015 | UH–Manōa    | Oahu                    | pre-agenda (4)               | 29,508       |
| Empirical Projection of Future Shoreline Position and Inundation due to Sea Level Rise                             | 2012–<br>2017 | UH–Manōa    | Oahu and Kauai          | pre-agenda (3)               | 130,000      |
| Archipelago-wide Demography of Hawai'i's Most Abundant, but Declining, Native Tree, <i>Metrosideros polymorpha</i> | 2013–<br>2015 | UH–Manōa    | Main Hawaiian Islands   | pre-agenda (4)               | 46,247       |
| Predicting the Effects of Climate Change: Ecosystem Drivers in the Tropical Subalpine Shrubland                    | 2013–<br>2015 | UH–Manōa    | Maui and Hawai'i Island | 4                            | 57,978       |
| Baseline Assessment of Coral-Coral-Associated Microbial Communities                                                | 2015          | UH–Manōa    | French Polynesia        | 3                            | 13,070       |

### Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                                                        | Year funded | Institution | Primary location      | Primary science agenda theme | PI CSC award |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-----------------------|------------------------------|--------------|
| The Effects of Climate Change on High Elevation Ecosystems and Freshwater Resources in Hawaii                                                | 2015–2016   | UH–Manōa    | Maui and Hawai'i      | 2                            | 32,358       |
| Forecasting Climate Change Impacts on Coastal Ecosystem Services in Hawaii through Integration of Ecological and Social Participatory Models | 2015–2016   | UH–Manōa    | Maui                  | 3                            | 11,000       |
| Coral Adaptation and Acclimatization to Global Change: Resilience to Hotter, More Acidic Oceans                                              | 2015–2016   | UH–Manōa    | Oahu                  | 3                            | 12,000       |
| Kilo Honua: Reconstructing Historical Climate Patterns in Hawaii Using Traditional Knowledge and Dendrology                                  | 2016–2017+  | UH–Manōa    | Main Hawaiian Islands | 4                            | 30,000+      |
| Assessing the Vulnerability of Coastal Wastewater Infrastructure to Climate Change                                                           | 2016–2017   | UH–Manōa    | Main Hawaiian Islands | 3                            | 19,170       |
| Predicting Hawaii Water Demand Under Climate Change                                                                                          | 2016–2017   | UH–Manōa    | Oahu                  | 2                            | 29,268       |
| Mitigating Climate Change Impacts: What Drives Thermal Resiliency in Hawaii's Coral Reefs                                                    | 2016–2017   | UH–Manōa    | Oahu                  | 3                            | 29,309       |
| Evaluating the Economic Impacts of Climate Variability and Change on Maui's Freshwater Resources and Ecosystem Services                      | 2016–2018   | UH–Manōa    | Maui                  | 2                            | 70,388       |
| Reconstructing Pre-Historic Climate Variability in Hawaii and the Tropical Pacific Using Tree Rings                                          | 2013–2015   | UH–Hilo     | Main Hawaiian Islands | pre-agenda (1)               | 116,965      |
| Epiphytes as a Bioindicator of Climate Change in the Hawaiian Islands                                                                        | 2013–2015   | UH–Hilo     | Main Hawaiian Islands | pre-agenda (1)               | 91,172       |
| Real-time Observations of Benthic Ocean Chemistry on Two Coral Reefs in West Hawaii                                                          | 2013–2016   | UH–Hilo     | Hawaii Island         | 3                            | 130,468      |

## Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)

| Title                                                                                                                                                                        | Year funded | Institution | Primary location                        | Primary science agenda theme | PI CSC award |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-----------------------------------------|------------------------------|--------------|
| Stand Level Water-use in Forests of Contrasting Rainfall Regimes: Assessing the Impacts of Future Drying on Native Hawaiian Ecosystems                                       | 2013–2016   | UH–Hilo     | Hawaii Island                           | 2                            | 188,898      |
| Manager Climate Corps                                                                                                                                                        | 2015–2018   | UH–Hilo     | Hawaii Island                           | program                      | 235,808      |
| Investigating Climate Driven Shifts in <i>Staphylococcus aureus</i> and MRSA for Water Resource and Land Management Solutions                                                | 2016–2018   | UH–Hilo     | Hawaii Island                           | 2                            | 37,568       |
| Impact of Climate Change on Hydrology and Primary Production of Three Hawaiian Fishponds                                                                                     | 2016–2018   | UH–Hilo     | Hawaii Island                           | 3                            | 190,953      |
| Can Albizia Mulch Be Used on Agricultural Land to Replace Fertilizer, Improve Agroecosystem Functioning, and Provide Climate Change Mitigation and Resilience?               | 2016–2018   | UH–Hilo     | Hawaii Island                           | 4                            | 76,450       |
| Quantifying Historic and Current Shoreline Change for Selected Priority Areas on Hawai'i Island to Determine Appropriate Shoreline Setbacks in the Face of Rising Sea Levels | 2016–2018   | UH–Hilo     | Hawaii Island                           | 3                            | 85,082       |
| Reconstruction of West Pacific Climate History                                                                                                                               | 2012–2015?  | UoG/WERI    | Guam                                    | pre-agenda (2)               | 185,640      |
| Groundwater Percolation in Northern Guam: Insights from Jinapsan Cave                                                                                                        | 2015?–2017  | UoG         | Guam                                    | 2                            | 36,124       |
| Tracking Climate Variability through Chloride Concentration in Municipal Production Well Histories of the Yigo-Tumon Basin, Northern Guam                                    | 2015?–2017  | UoG         | Guam                                    | 2                            | 6,634        |
| GIS@CIS program/project                                                                                                                                                      | 2015–2018   | UoG         | Guam and Federated States of Micronesia | program                      | 27,095       |

### **Pacific Islands Climate Science Center Projects Funded by the U.S. Geological Survey and University Consortium (Continued)**

| Title                                                                                 | Year funded | Institution | Primary location               | Primary science agenda theme | PI CSC award |
|---------------------------------------------------------------------------------------|-------------|-------------|--------------------------------|------------------------------|--------------|
| Traditional Ecological Knowledge in Micronesia                                        | 2016–2017   | UoG         | Federated States of Micronesia | 4                            | 13,729       |
| Developing Resilience for Small Businesses Affected by Climate Change                 | 2016–2018   | UoG         | Guam                           | 4                            | 12,780       |
| Culturally Relevant Educational Resources and Lesson Plans on Climate Science in Guam | 2016–       | UoG         | Guam                           | 4                            | 26,530       |

## Appendix D

### Partnership Effectiveness Focus Group Questions

#### Science Producers

1. Why did you become involved with the Climate Science Center?
2. What are the benefits of your involvement with the Climate Science Center? (probe for benefits to them as individuals, to scientific knowledge, to people who are in need of scientific information, to professional development of others)
3. What are the challenges you face in your involvement with the Climate Science Center?
4. To what degree have you worked with the intended “users” of your climate science produced with/for the Climate Science Center?
5. Tell us more about your efforts to work with these potential climate science users. Why and how have you worked with them?
6. What challenges have you faced in working with or reaching out to science users?
7. How have you overcome (or tried to overcome) barriers to working with or reaching out to climate science users? [or to ensuring that the science you produce is used]? (probe for whether and how the CSC staff has played a role in overcoming barriers)
8. Generally speaking, what could generate more benefits from your involvement with the CSC—whether to you individually, to scientific knowledge, to people who use currently or could use climate scientific information, etc.?

#### Science Users

1. Why did you become involved with the Climate Science Center?
2. What are the benefits of your involvement with the Climate Science Center? (probe for benefits to them as individuals, to scientific knowledge, to people who are in need of scientific information, to professional development)
3. What are the challenges you face in your involvement with the Climate Science Center?
4. To what degree have you worked with climate scientists or used the science produced in association with the Climate Science Center?
5. Tell us more about your impressions of this climate science. Has it been useful? How have you used it?
6. What challenges have you faced in using the science as part of the CSC? (probe for challenges in working with scientists in using science)
7. How have you overcome (or tried to overcome) barriers to using climate science? (probe for whether and how the CSC staff has played a role in overcoming barriers)
8. Generally speaking, what could generate more benefits from your involvement with the CSC—whether to you individually, to scientific knowledge, to people who use currently or could use climate scientific information, etc.?

## Appendix E

### Report from the Cornell University Human Dimensions Unit: Pacific Islands Climate Science Center Results

NOTE: See Introduction to this report or refer to Lauber and Stedman (2018) for methodology.

Excerpted from Lauber, T. B., and R. C. Stedman. 2018. Quality and extent of partnership involvement in Climate Science Centers in the Northeast, South Central, and Pacific Island regions. Cornell University, Human Dimensions Research Unit, Ithaca, New York.

#### Respondents

We sought to survey both partners and potential partners of the Pacific Islands CSC. Specifically, we attempted to include people who were working to address climate change either as “science producers” (those who produce climate adaptation science) or “science users” (those who make decisions about natural resource policy, management, or programs). This population is not well defined. As described above, we compiled our sample from three sources, but this approach may have yielded different numbers and types of partners from region to region. Consequently, we characterize our respondents in this section.

Forty percent ( $n = 39$ ) of the respondents reported that they make decisions about natural resource policy, management, or programs as part of their jobs. We refer to these individuals as science users. Fifty-two percent ( $n = 50$ ) reported that they have produced climate adaptation science through an affiliation with the Pacific Islands CSC, while 13% ( $n = 13$ ) have produced climate adaptation science but never with such an affiliation. We refer to both of these groups as science producers (65%;  $n = 63$ ). Twenty of the respondents (21%) were both science users and producers.

Fifteen respondents (15%) were neither users nor producers. These individuals were less engaged in work involving “climate adaptation science” or “management or policy related to climate change adaptation” (Table PI-1).

All of our respondents did work that involved climate adaptation science, management, or policy to at least some extent. Nearly two-thirds of respondents (66%,  $n = 65$ ) were involved to a large or very large extent (Table PI-1). Eight percent ( $n = 8$ ) were involved only to a small extent. Respondents who were producers or both producers and users were more involved than other respondents.

Almost all respondents (85%;  $n = 82$ ) reported that they have had at least some interest in or involvement with the Pacific Islands CSC (Table PI-2). Just 13% ( $n = 12$ ) reported that they had no involvement but

**Table PI-1.** Respondents’ extent of involvement with climate adaptation science or management or policy related to climate change adaptation.

| Extent of involvement  | User | Producer | Both user and producer | Neither user nor producer | Total |
|------------------------|------|----------|------------------------|---------------------------|-------|
| To a small extent      | 5%   | 7%       | 5%                     | 20%                       | 8%    |
| To a moderate extent   | 63%  | 12%      | 16%                    | 33%                       | 26%   |
| To a large extent      | 16%  | 30%      | 37%                    | 13%                       | 26%   |
| To a very large extent | 16%  | 51%      | 42%                    | 33%                       | 40%   |

**Table PI-2.** Respondents' relationships with the Pacific Islands CSC.

| Extent of involvement                                                                     | User | Producer | Both user and producer | Neither user nor producer | Total |
|-------------------------------------------------------------------------------------------|------|----------|------------------------|---------------------------|-------|
| Heard of the Pacific Islands CSC, but no interest or involvement                          | 11%  | 0%       | 0%                     | 0%                        | 2%    |
| No involvement with the Pacific Islands CSC, but someone else in my organization involved | 28%  | 0%       | 15%                    | 27%                       | 13%   |
| At least some interest or involvement with the Pacific Islands CSC                        | 61%  | 100%     | 85%                    | 73%                       | 85%   |

someone else in their agency or organization did, and another 2% ( $n = 2$ ) had no interest or involvement at all.

Respondents worked in locations throughout the Pacific Islands region, but they were most likely to work in Hawai'i (Table PI-3). About two-thirds of respondents worked at the state (69%;  $n = 69$ ) or local (66%;  $n = 66$ ) scale for some or all of their work. More than half worked at the watershed scale (58%;  $n = 58$ ). Smaller percentages worked at the regional/multi-state scale (36%;  $n = 36$ ), national (23%;  $n = 23$ ), or international (23%;  $n = 23$ ) scale.

The majority of respondents were affiliated with either federal agencies or universities (Table PI-4). Fewer were affiliated with local government, non-profit organizations, or state agencies. None were affiliated with tribal governments or private industry.

More than half of respondents held research positions (53%;  $n = 53$ ). About one-quarter were in leadership/administration (25%;  $n = 25$ ). Only a few were in operations (13%;  $n = 13$ ) or policy (6%;  $n = 6$ ).

### Extent of Involvement with the CSC

On average respondents have been involved with the Pacific Islands CSC for 2.8 years. Respondents reported a variety of types of involvement (Table PI-5). Most common was as a participant in a CSC training, webinar, workshop, or conference (47%;  $n = 47$ ) or CSC grant recipients, applicants, or partners on a grant (36%;  $n = 36$ ). One-fifth were resource managers or decisions makers who had used the CSC's science (20%;  $n = 20$ ) or CSC-funded graduate student or postdoctoral fellows (20%;  $n = 20$ ).

**Table PI-3.** Locations in which respondents work.

| Location                       | Percentage of respondents | <i>N</i> |
|--------------------------------|---------------------------|----------|
| Hawai'i                        | 78%                       | 78       |
| Guam                           | 25%                       | 25       |
| Northern Mariana Islands       | 23%                       | 23       |
| American Samoa                 | 21%                       | 21       |
| Federated States of Micronesia | 18%                       | 18       |
| Republic of Marshall Islands   | 18%                       | 18       |
| Republic of Palau              | 14%                       | 14       |

**Table PI-4.** Respondents' affiliations.

| Affiliation            | Percentage of respondents | <i>n</i> |
|------------------------|---------------------------|----------|
| University             | 42%                       | 42       |
| Federal agency         | 31%                       | 31       |
| Local government       | 13%                       | 13       |
| Nonprofit organization | 11%                       | 11       |
| State agency           | 5%                        | 5        |
| Tribal government      | 0%                        | 0        |
| Private industry       | 0%                        | 0        |

The respondents reported on their frequency of interaction with five types of CSC representatives and affiliates (Figure PI-1). At least 70% of respondents interacted with each of four of the types (CSC-affiliated researchers, University leads/PIs for the CSC; CSC graduate or postdoctoral fellows, and U.S. Geological Survey CSC staff) at least a few times a year. For their interactions with CSC Stakeholder Advisory Committee members, the modal level of interaction was “not at all,” although 54% interacted with these individuals at least some of the time.

### Benefits of Involvement

The most frequently identified benefits attributed to the CSC (Figure PI-2) were “access to climate adaptation science” (83% described as “important” or “very important”; *n* = 70), “access to a broader network of people interested in climate adaptation science” (80%; *n* = 67), “source of funding for climate adaptation science” (77%; *n* = 65), and “avenue to put climate adaptation science in the hands of decision makers” (73%; *n* = 65). Partners described all of these benefits during the focus groups.

Focus group participants believed that the CSC’s science was important for addressing existing regional problems:

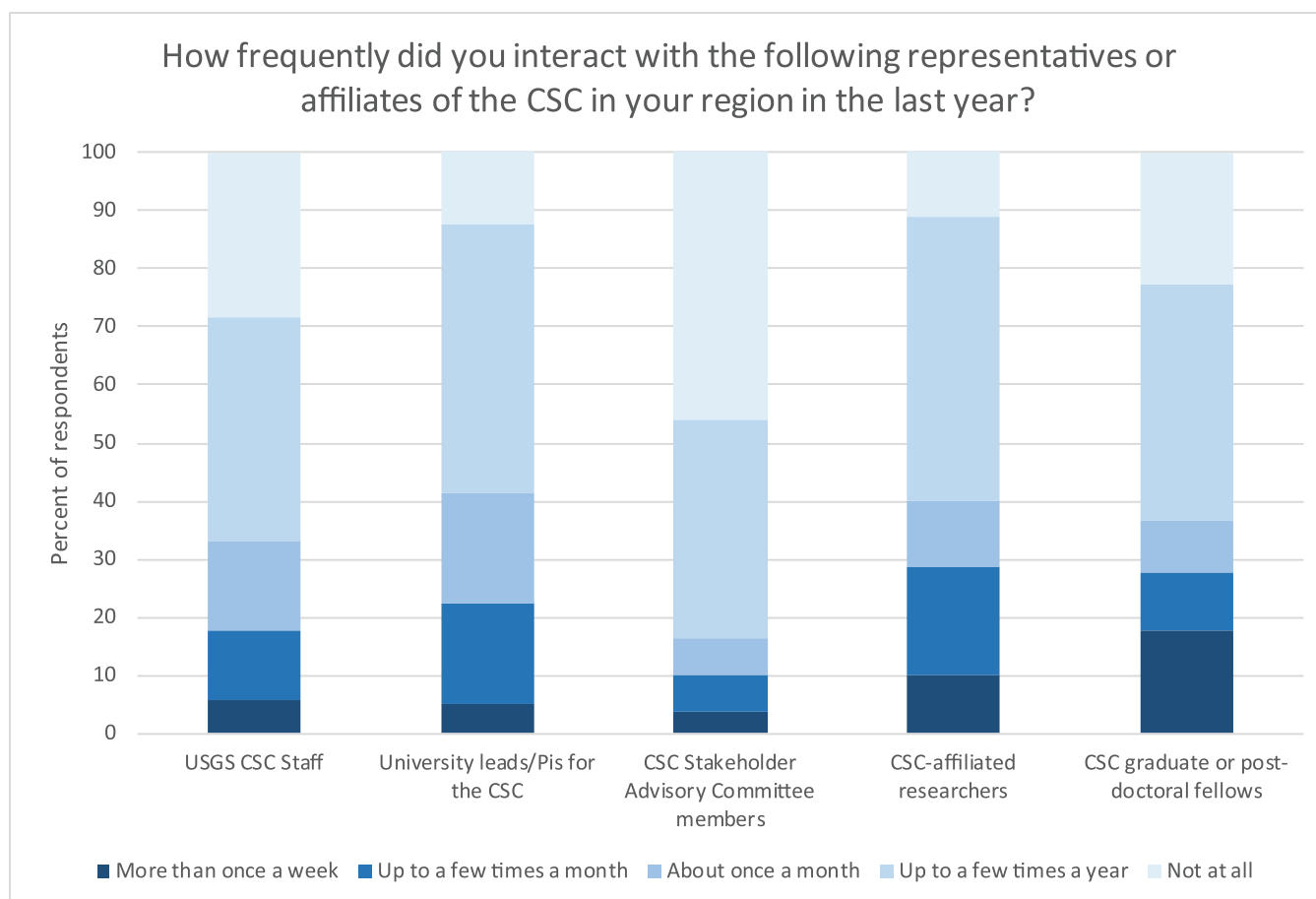
One of the things that I think was very positive outcome of the introduction of the CSC to Hawai’i and development of the CSC structure is a very strong focus on this drought issue ... rallying of people around the issue as well as bringing significant funding to the topic. And so by collecting those different features into a large research portfolio for Hawai’i the CSC in a very short amount of time has been able to elevate the drought issue, do some really good synthetic work bringing together the really nice research that has happened in the past in different research groups, and then the value added work whether it’s new research or packaging of the existing research, synthesis of existing research.... That’s been really a positive outcome. (PI Producer FG)

It also served to keep people up to date on relevant science:

I think one of the straight benefits is that it’s a way for us to know when papers come out, when studies

**Table PI-5.** Types of involvement with Pacific Islands CSC in the last five years.

| Affiliation                                                     | Percentage of respondents | <i>n</i> |
|-----------------------------------------------------------------|---------------------------|----------|
| Participant in a CSC training, webinar, workshop, or conference | 47%                       | 47       |
| CSC grant recipient, applicant, or partner on a grant           | 36%                       | 36       |



**Figure PI-1.** Based on survey question 8.

get published.... A lot of studies that I would not otherwise have known came out, I now have knowledge that I can share with my team. So that's great. (PI User FG)

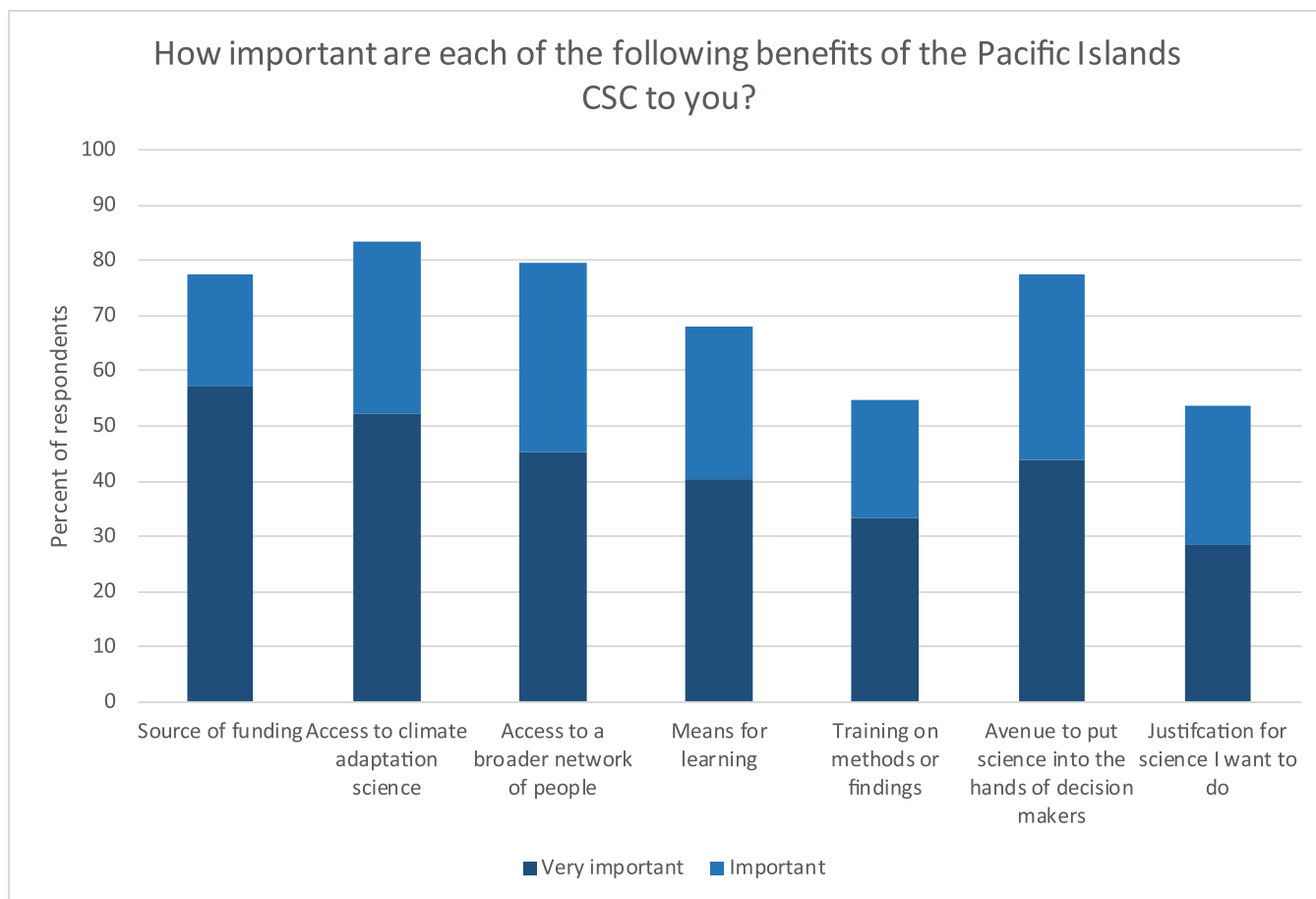
People who attended the focus groups also spoke frequently about the value of the opportunities the CSC provided to interact with others who were interested in climate adaptation science:

I'm a fish pond manager<sup>1</sup>.... What they offered was this opportunity to ... do a project that collaborates a lot of different entities. And that's kind of something that I was already doing as a manager and student, meeting with other fish pond practitioners, meeting with different scientific experts. (PI Producer FG)

One of the things that I received as a collaborator, as a partner, was to be invited to the ... Climate Science Boot Camp in 2016.... I thought it was beneficial because you know sometimes we are working quite alone ... it doesn't necessarily allow you to connect that work that a person does to actually sitting down and meeting with various stakeholders, politicians, managers, Hawaiian culture practitioners.... So that is one thing that I felt was really a highlight of me being a part of this collaborative. (PI User FG)

These network opportunities could contribute to improved science:

<sup>1</sup> Hawaiian fish ponds are established in brackish water habitats along the coast. They provide a sustainable food source and are the focus of traditional cultural practices. They are, therefore, areas where environmental health and culture are closely interconnected



**Figure PI-2.** Based on survey question 9. Text in items shortened for presentation in graph, and only “important” or “very important” responses are shown.

For me it enabled a whole new research direction to flourish.... I cannot emphasize enough how valuable it is ... to be able to access the Hawaiian language database because 97% of the database no one has ever read because there are so few native speakers now. And so it has been extremely cross cutting and bringing together fields that never talked to each other like Hawaiian language and climate scientists ... to do it in a very respectful and appropriate way.... The science ... was made possible through CSC.... This was a deep dive.... It was really special in that way. It really changed not only my paradigms of what I thought about how Hawaiians approached climatology. It enabled a collaboration. (PI Producer FG)

The CSC also helped to connect scientists and decision makers, which contributed to the use of the science developed through the CSC:

One of the things I’ve gotten out of it was the way our most recent project on the fish pond work was put together with the Climate Science Center.... It was fantastic. It was like speed dating for actionable science because the managers presented their work and researchers were then able to kind of think ... what are their interests and how does it relate to the needs, the broader needs of these managers. And then have that conversation of can we work together and is it something that would be useful for you. Building those relationships ... can be difficult to meet the right people who are interested in doing the work and then take time ... to develop those relationships. I really felt like this process that they put together sped that up by months if not longer. And we were then able to pull together a project that has been very productive. (PI Producer FG)

The funding the CSC provided was also an important benefits to focus group participants. They indicated that the PI CSC would fund work that was hard to fund through other sources:

The project I'm interested in pursuing ... [is] trying to understand the long-term impacts that have affected the ... indigenous built structures in the environment. And so we felt that the most direct way would be approach from a historical standpoint. Unfortunately, the kind of research ... it's hard to find funding. 'Cause it's kind of weird junk ... semi-qualitative, so there wasn't a good ... standard funding mechanism.... And then in kind of thinking with people, it seemed that the Climate Science Center was interested in potentially funding this research.... I would say the key thing to me is it funded a project that was hard to find a normal funder for. (PI Producer FG)

There was no existing climate change funding available on campus or much in the state.... We saw this as another federal unit wanting to support climate research so we worked very hard on producing the initial proposal that went in. (PI Producer FG)

CSC funding also provided opportunities to leverage other funding sources:

We ... looked at this Climate Science Center as a way to leverage, basically add more emphasis to the same issues that we were dealing with.... Initially there was more money for the same issues. There's no way in the Pacific Islands that we could spend enough money to answer the questions ... there's a big deficit in terms of the underlying science that you need to talk about impacts of climate change. So the ability to have more funding to leverage the university consortium's expertise and ... researcher base was really important for addressing the common questions that we all share. (PI User FG)

A majority of survey respondents also believed that important or very important benefits of the CSC included serving as a "means for learning about climate adaptation" (57%;  $n = 68$ ), "justification for climate adaptation science I want to do" (54%;  $n = 45$ ), and "training on climate adaptation science methods or findings" (55%;  $n = 46$ ). Focus group participants also described the learning and training that the CSC facilitated. In particular, they described the learning opportunities provided to students:

I've always been enthralled by paleoclimatology and so being able to have ... a focus on climate change at our camp was really an exciting concept. And the opportunities for funding for students, undergraduates, and graduate projects is what really steered me to the program. (PI Producer FG)

The graduate student, he had never taken a science class at his high school. And so for him to learn about science through his own cultural lens ... and he was from a rural community.... He had never been off island before, and to think through the CSC he went to Guam. And so it ... totally expanded his world being able to interact with other students, other indigenous cultures. It was extremely enriching for him. (PI Producer FG)

The CSC helped to train local students to address local problems:

I've focused on funding graduate students that are from Hawai'i because prior to that I'd get tons of graduate students from the mainland. You train them and then they disappear to the mainland. And when it comes to climate change in any sort of resource management issue we need a workforce that's going to stay in Hawai'i. This was ... really the only source of funding focused on climate that because of my professional choices at that point I could link up with local students ... so augmenting the education of local students so that we can augment the management of local resources and local problems. (PI Producer FG)

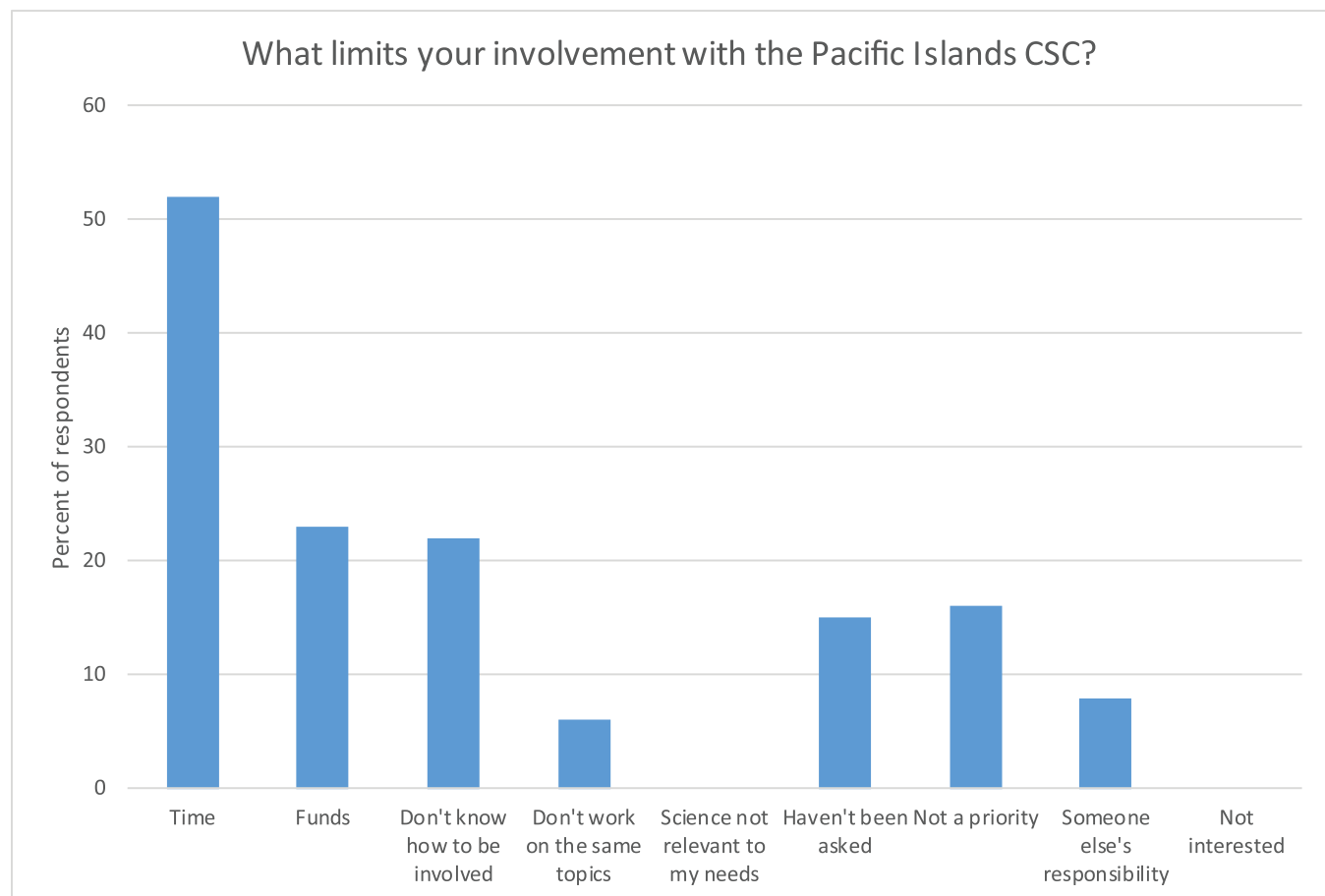
## Limitations on Involvement

The most common limit on involvement with the CSC was not having enough time (52%;  $n = 52$ ), which more than half of the partners stated (Figure PI-3). More than one-fifth were also limited by funds (23%;  $n = 23$ ) and not knowing how to be involved (22%;  $n = 22$ ).

During the focus groups, discussions about funding limitations focused primarily on the concern that the funding the CSC provided was insufficient to motivate engagement. The University of Hawai'i was reluctant to commit substantial resources to the CSC given limits to the resources available through the CSC:

The original concept was for significant ... federal footprint here with actual offices.... One of the setbacks was the administration at UH was not interested in throwing much in the way or anything in the way of matching funds towards it. When you look at the budget that is provided the overhead that comes to the university is not large. I mean it's hundreds of thousands of dollars but it's not enough to make it worth the administration's dedication of a floor of a building or a bunch of offices considering that we are already very crowded in many places. So ... from the federal side it sort of morphed into smaller and smaller budget. From the UH side the reaction was that's not enough to get a high degree of interest from us in terms of throwing resources at anything. (PI Producer FG)

Some partners of the CSC had similar perceptions about funding limitations:



**Figure PI-3.** Based on survey question 10. Text in items shortened for presentation in graph.

At the end of the day without money it's a little bit of a waste of time for most people.... They don't have, there's no money. I mean I went to a meeting recently and there were federal budget cuts.... At some point people just say have to ask themselves if it's worth my time any longer ... keep participating in something that doesn't really seem like it's going anywhere.... I sincerely had to ask myself whether I was interested in even going any further with this period or if I was even going to come to this. I know that there's just no resources out there to actually engage in meaningful research efforts. (PI User FG)

The funding limitations required prioritizing which partners to engage in the CSC:

Another challenge I observed is conflicts between ... entry vs. wanting ... to continue the research program already supported.... I think that balance is between bringing on new research groups with new ideas vs. wanting to see who's continuing on. I would just state that as a challenge of this. (PI Producer FG)

Another challenge that partners faced in working with the CSC was a lack of information about how to navigate various aspects of their relationship with it. Some researchers found it difficult to navigate the proposal development and review process:

There was so many different avenues of preparing proposals, I found it really difficult to navigate.... Reviewers didn't seem to be conversant with some of the language that I used.... I mean there were translational issues there.... Drafting a proposal that was satisfactory ... that seemed like it was happening with a blindfold on to some degree.... I do think that there would be better for more establishment supporting those who aren't as familiar with the processes. I think that would be helpful. (PI Producer FG)

Some found it similarly confusing to determine what their obligations were once they had been funded:

We had to write quarterly reports and then a final report. We published. We had the papers; the CSC was listed in the acknowledgments, but that didn't seem to be what was being encouraged as the end product. The end product seemed to be these reports, at least in my case. And we were told at one point, "Oh, you won't need to do a final report." And then we did have to do a final report.... If peer-reviewed, published research and a statement from resource managers that the data has been used, [if] that's the ultimate end goal then that could be gotten to fairly easily, a paper and then some sort of interview or statement from the resource managers. (PI Producer FG)

Potential science users found it hard to even figure out what scientific studies has been supported by the CSC:

The nature of the Climate Science Center is that it's a university consortium-based partnership. It's very difficult for anybody from the outside to really understand what the priorities or the actual studies underway on the university side are.... Last year I asked ... where's the list of the ... I didn't have a list of the university's funded CSC projects. He didn't know either.... There's no mechanism to find out what those studies are. Or there wasn't. I think ... that's improved. (PI User FG)

Some partners also said that interpersonal relationships with some CSC staff members were sometimes difficult to navigate and impeded communication.

Some partners were limited in their interactions with the CSC because their priorities differed from the CSC. One science user argued that the CSC focused more on the impacts of climate change on ecology than the impacts of climate change on people:

The Climate Science Center seems to see its priorities in the ecological realm.... A lot of the efforts that are undertaken by them has to do with the ecological consequences of climate change, fauna, flora shifting ... shifting habitats, that kind of stuff. I dwell on kind of a little bit of a different realm where we're looking at sea level rise, and sea level rise you know one of the biggest problems with respect to climate change.... But the issue is really the impact on human beings, impact on coastal communities and infrastructure, that kind of stuff.... I was always ... can we get some more emphasis on... the implication for humans in society as a result of climate change? (PI User FG)

Another argued that the geographic scale of the PI CSC region made it impossible to support research that was relevant to everyone:

This center services the Pacific basin basically.... How do you realistically say I represent the Pacific Basin without a budget? You know, you either you need to start cutting back on your expectations or people's expectations. And it's hard for us in Hawai'i to sit in meetings where they're talking about solving problems on Majuro.... I mean the research and the science isn't really that relevant to what's happening in Hawai'i because it's a completely different sort of island ecology (PI User FG)

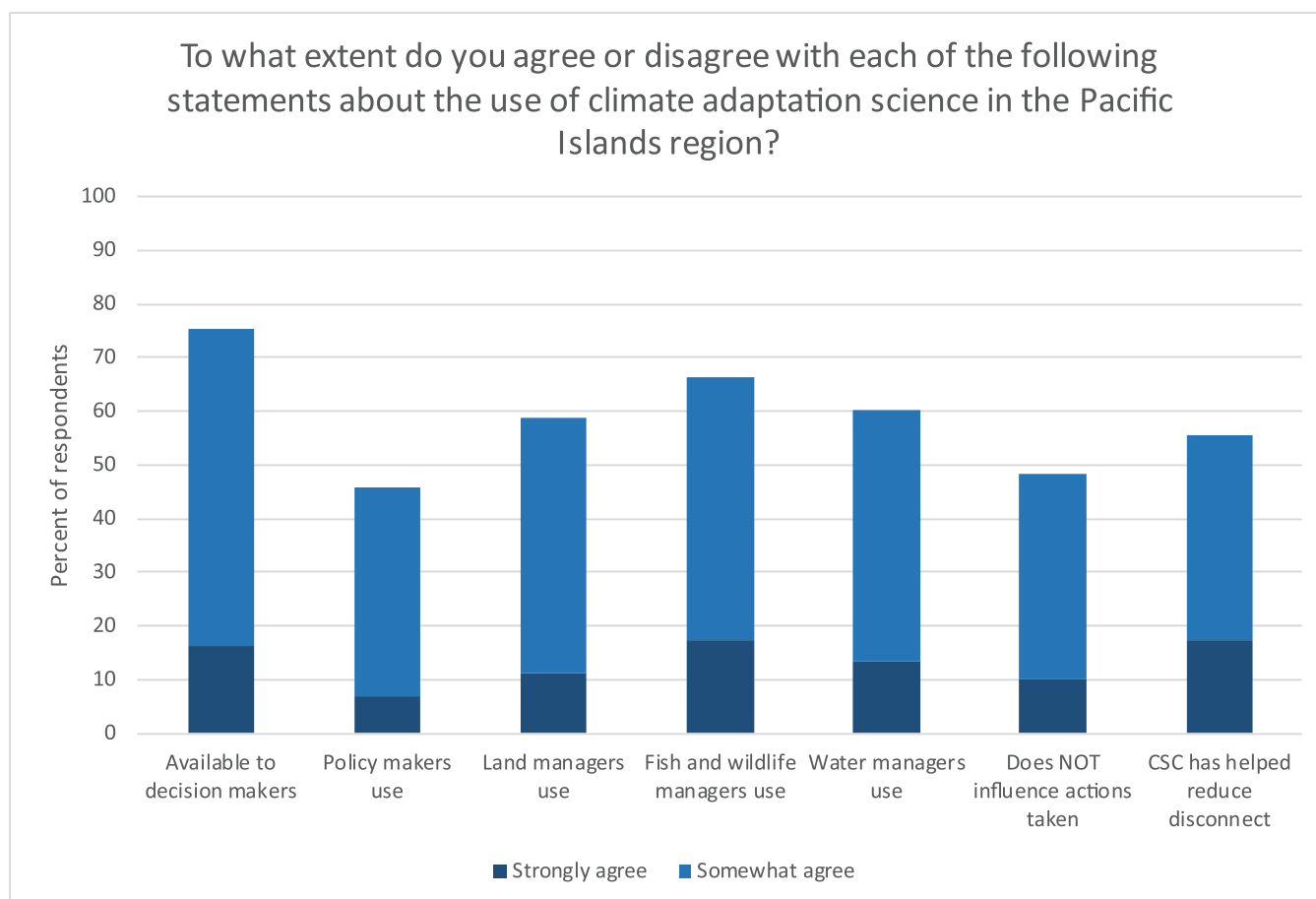
### **Is Climate Adaptation Science Actionable?**

Respondents shared their perceptions both of climate adaptation science, in general, and of the climate adaptation science produced by the CSC. With regard to climate adaptation science in general, more than three-quarters of respondents (76%;  $n = 74$ ) agreed or strongly agreed that climate adaptation science in the Pacific Islands region is available to decision makers (Figure PI-4), and one-half to two-thirds thought that it was used to inform management by fish and wildlife managers (66%;  $n = 65$ ), water managers (60%;  $n = 59$ ), and land managers (59%;  $n = 57$ ). Fewer than half (46%;  $n = 45$ ) believed that policy makers used this science to inform policies. Nearly half (48%;  $n = 47$ ) maintained that what is known about climate adaptation does not necessarily influence actions taken by decision makers in the region.

More than half (56%;  $n = 54$ ), however, agreed that the CSC has helped to reduce the disconnect between what is known about climate adaptation and the actions taken by decision makers in the region.

During the focus groups, one science user described an example of how the CSC had helped reduce this disconnect between science and management actions:

Our agency is entrusted with management of the public water resources.... And of course climate change has the potential to drastically affect what we know about the resource in terms of you know its current availability, quantities, and whatnot.... We became engaged with the Climate Science Center, that provided a forum to bring the different climate scientists that were doing things in the state together. And at the time initially when I got involved there were actually two models that had been done for climate change in Hawai'i ... and they were showing disparate results. And so we were wanting to know you know what we should make out of this. And so one of the first very productive initiatives that Dave took on was to bring the two sort of models together and try to come up with ... agreements, points for the models to agree on, and sort of give us managers something ... maybe results that we could have more high confidence in than others. And so it was very helpful for us to have one conduit for getting the climate scientists and researchers together and helping us understand and transforming for us what that science meant, so that we could turn it into a management policy or whatnot. (PI User FG)



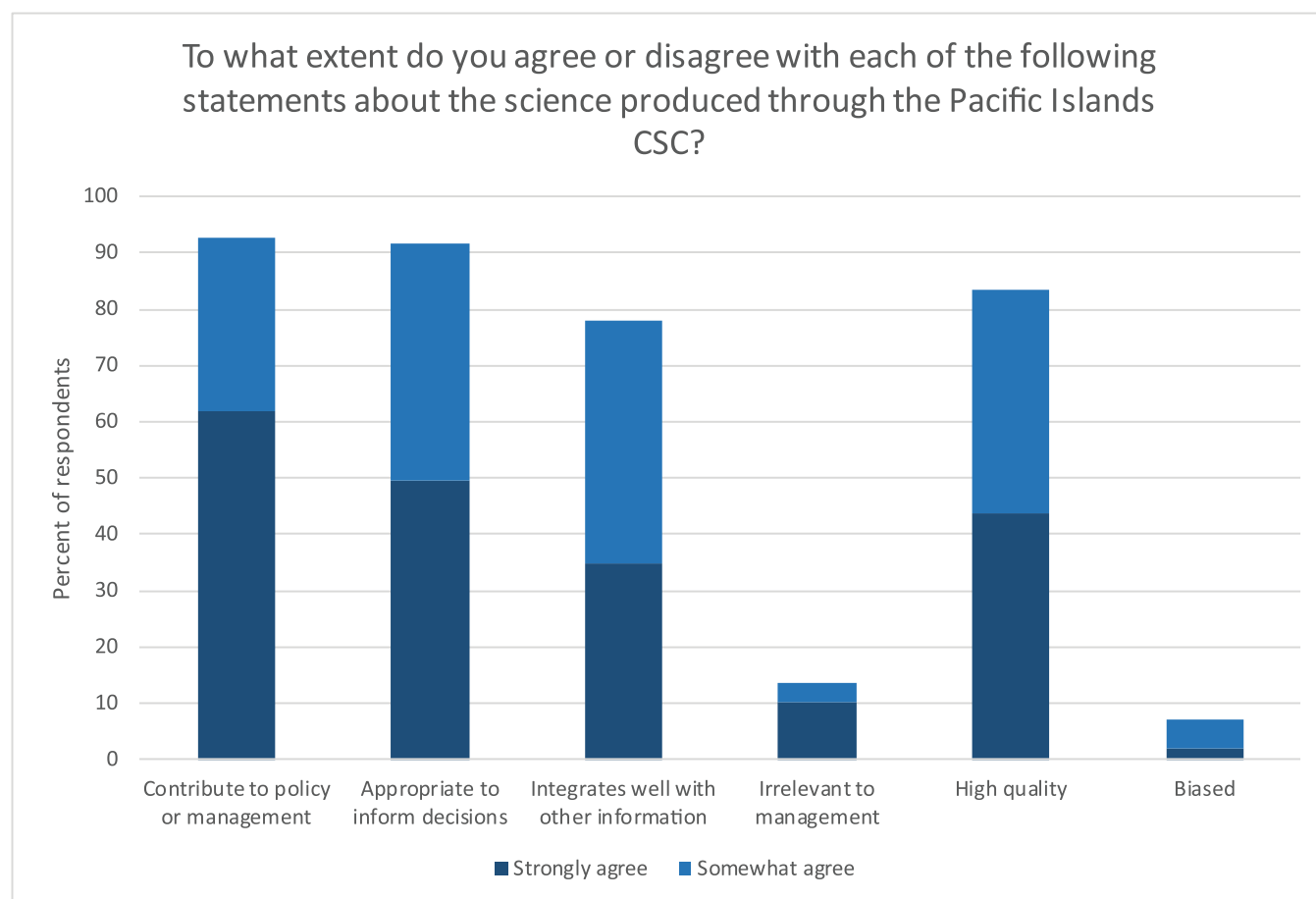
**Figure PI-4.** Based on survey question 11. Text in items shortened for presentation in graph.

In terms of the Pacific Islands CSC science specifically, nearly all respondents strongly or somewhat agreed the CSC science can contribute to policy or management (93%;  $n = 90$ ) and that it was appropriate to inform decisions (92%;  $n = 89$ ) (Figure PI-5). Similar comments were made in the focus groups:

The work that the CSC has been doing that is on the ecological side is very beneficial for us to be able to manage those resources.... We're looking at these intensely managed special ecological areas. We haven't changed our management yet um but the work that the CSC has done has definitely started a dialogue about ... how viable those areas are going to be and what exactly we're managing for. You know we're managing these natural ecosystems but we're also managing for change as well.... We have limited resources as well and so where are you going to be directing those resources? And that takes first doing ... the downscaling and then having a translator you know translate that into the ecological information, and then translating it into management. (PI User FG)

Respondents were also positive about other characteristics of the CSC science, with large majorities finding it high quality (83%;  $n = 80$ ) and able to integrate well with other information (78%;  $n = 74$ ). Very few thought that the Pacific Islands CSC's science was irrelevant to management (14%;  $n = 13$ ) or biased (7%;  $n = 7$ ). Focus group participants also argued that the CSC science was relevant to their decision making:

I just wanted to point out that I think both PI CCC and the CSC have been working very hard to try to make their science more relevant..... Hats off to Dave and the stakeholder working group ... or the staff or whatever it was that ... have been trying to actually apply that to what people need.... I think both



**Figure PI-5.** Based on survey question 12. Text in items shortened for presentation in graph, and only “strongly agree” or “somewhat agree” responses are shown.

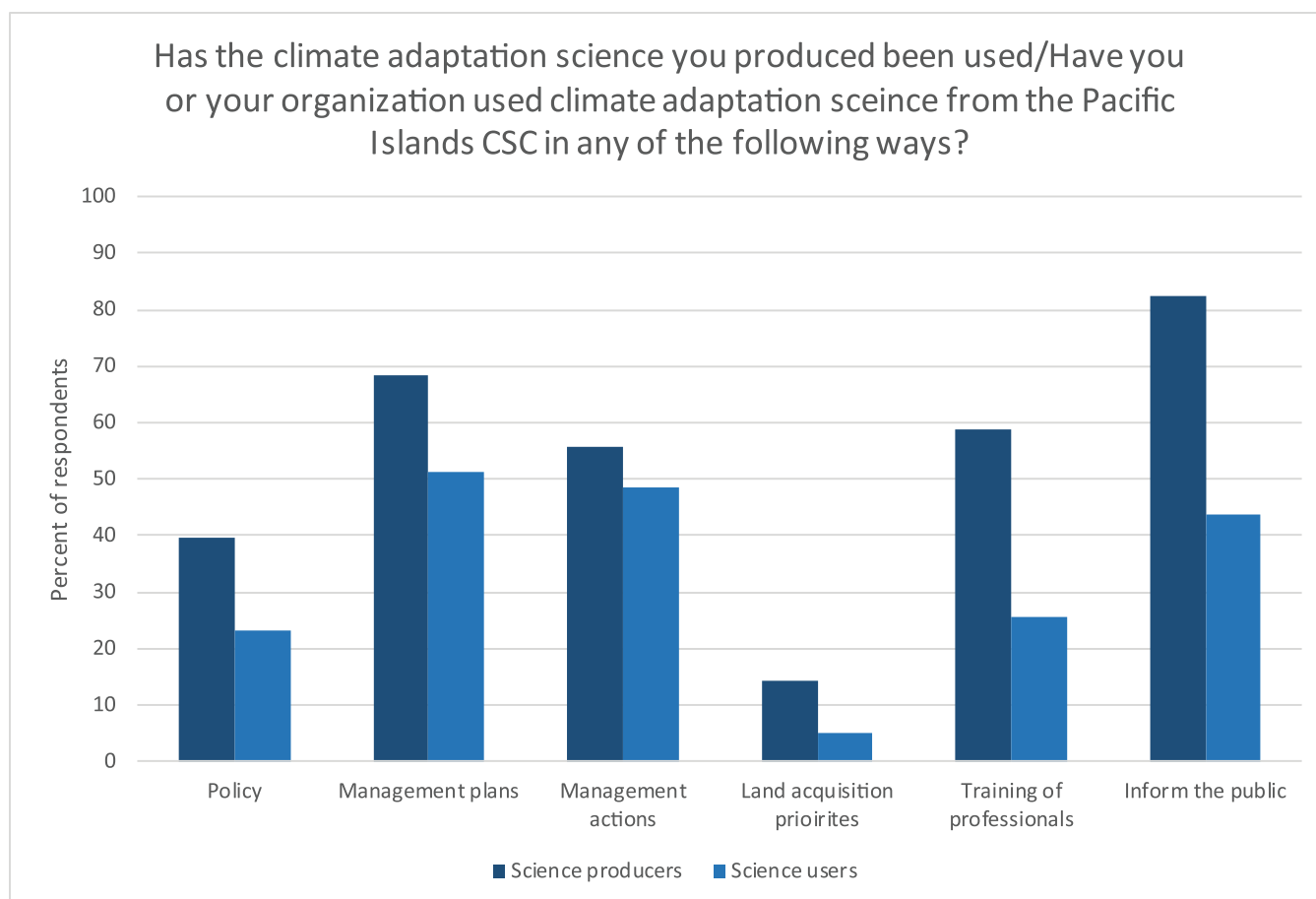
the CSC and PI CCC are examples of trying to focus the application more ... on livelihoods and how people relate to their surrounding ecological systems um as opposed to just birds and bees and bats. (PI User FG)

### Science Users’ and Producers’ Use of Climate Adaptation Science

Among respondents who reported that they were science users, 59% ( $n = 23$ ) reported that they or someone in their organization used climate adaptation science from sources affiliated with the Pacific Islands CSC. (Eighteen percent did not know whether they had.) More than three-quarters (79%;  $n = 30$ ) reported that they or someone in their organization used climate adaptation science from sources not affiliated with the CSC.

The most common ways science users reported using the Pacific Islands CSC science (Figure PI-6) were to inform management plans (51%;  $n = 20$ ), inform management actions (49%;  $n = 19$ ), and inform the public about climate change and its impacts (44%;  $n = 17$ ).

When science producers were asked a parallel set of questions about how the science they had produced had been used, the frequency of all of the types of reported uses was greater. More than half said their science had been used to inform the public about climate change and its impacts (83%;  $n = 52$ ), inform management plans (68%;  $n = 43$ ), inform the training of conservation professionals (59%;  $n = 37$ ), and



**Figure PI-6.** Survey questions 15 & 21. Text in items shortened for presentation in graph.

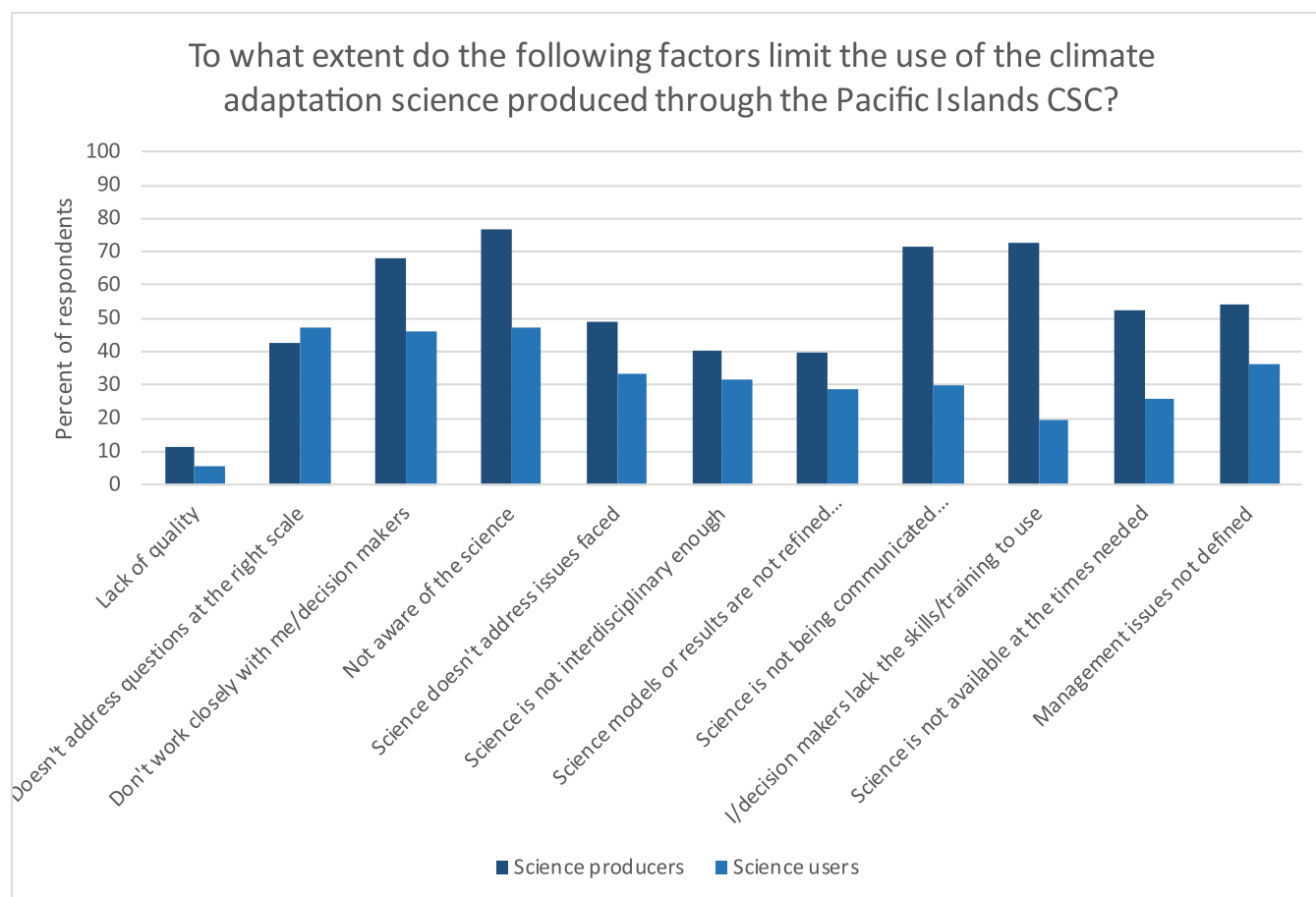
inform management actions (56%;  $n = 35$ ). The differences between science users' and science producers' responses could reflect differences in perceptions about how frequently CSC science is used. It could also reflect that the use of CSC science is concentrated in a subset of potential CSC science users.

Nevertheless, CSC partners recognized factors that limited the use of CSC science. Science users and producers differed in their perceptions of what these factors were (Figure PI-7). In almost all cases, more science producers than science users perceived limits to the use (not necessarily their own use) of CSC science to a moderate, large, or very large extent. The one exception was that 47% of science users said that the CSC science did not address questions at the right scale and 42% of science producers agreed. Focus group participants also discussed the importance of the scale at which science was done. Scientists found it hard to produce results at timescales that were relevant to science users:

Climate change has this long-term scale perspective.... So we have these outlooks by 2100 or the middle of the 20th century. And one of the things that was so challenging is to make this kind of science that we can do ... timescales that are outside the range, the horizon in which managers can really operate and work. (PI Producer FG)

Similarly, science users often needed results at a finer geographic resolution than scientists could provide:

I talked about the downscale climate models.... Although there was some general agreement, which was helpful for us to at least communicate to the decision makers ... it wasn't specific enough.... It was



**Figure PI-7.** Survey questions 16 & 22. Text in items shortened for presentation in graph, and only “to a moderate extent,” “to a large extent,” or “to a very large extent” responses are shown. Also, text varied slightly for science producers and users.

... helpful to know what the general trends are at least. What we really wanted at the water commission was more finely downscale climate model.... The scale right now of the models is much too gross for us to use in our management but the trend that leads are helpful. (PI User FG)

More than two-thirds of science producers thought that the use of CSC science was limited by lack of awareness of the science (77%), decision makers lacking the skills and training to use the science (73%), the science not being communicated understandably (72%), and scientists not working closely enough with decision makers (68%). From the science users’ perspective, the top limits were that the CSC science did not address questions at the right scale (47%), lack of awareness of the science (47%), and scientists not working closely enough with decision makers (46%).

Some of these constraints were also discussed during the focus groups. During these groups, one scientist argued that the university side of the CSC was not that interested in doing actionable science initially.

From the university side, the whole thing began without actionable science being a key theme. And where the CSC was housed at the university ... actionable science was not a theme at all, very fundamental scientists. The actionable science from the USGS end caught us at the university side with the CSC being managed by people who were not interested in management aspects of it. It took two years. Now it’s in the right place. It’s in Sea Grant so I think the university took a little bit to catch up to the actionable science because originally that was not a big ... purpose. (PI Producer FG)

One scientist in the focus group also argued that there was value in doing science that was not actionable:

Right now, there needs to be a clear line between the research that you propose and a partner manager.... Yet ... we have very interesting information that could be applied to climate models. We could extend back beyond the modern period of observation by using climate proxies, geologic proxies and yet that's not encouraged. Sea Grant doesn't encourage it.... Climate proxy research is valuable for the Hawaiian Islands.... But that was strongly discouraged and they were turned very strongly into more immediately actionable ... sciences.... Because the planner, the county planner on the big island, may not be interested in it. (PI Producer FG)

Focus group participants recognized, however, that the CSC has provided valuable opportunities for researchers to connect with decision makers that are central to actionable science:

The opportunity of meeting managers and working with managers ... meeting the fish pond manager who we've been talking with, but also ... that opportunity to interact with those that are the superintendents of the National Park Services. We have 3 national parks on Hawaii Island. Having the opportunities to talk and work with them have been very useful. (PI Producer FG)

Maintaining these connections between researchers and local decision makers, although important for producing actionable science, is challenging to do throughout the Pacific Islands region without more funding:

In the Pacific ... you need to really have credibility. And you get credibility by being consistent and doing what you say you're going to do and being there long term.... As a set of islands that have a long colonial history, people are very wary of folks that just fly in and say, "Oh, we have your best interest in mind. And we have some money for something. And here's what we're going to do for you. And you'll love it." And then they leave.... The last thing you want to do is, is parachute in, make a promise, not keep it, and be gone.... That's why the consortium actually is very powerful because ... you have kind of a local foothold, but it's very, very hard without a substantial increase in funding for the CSC to really be considered ... a presence that will be able to you know deliver and then deliver on the delivery. (PI User FG)

Science users who participated in the focus groups also spoke frequently about the necessity for translating science into a form that decision makers could use:

I think one of the things that's actually been really important for ... the CSC is that as we've gone forward I think we've realized ... [it] started with kind of a deficit model of science delivery. Right? The problem is lack of science. The answer is create science, and it's originally kind of the loading dock approach. I mean you've dumped the study off and, and everybody just does good things with it. And as we move forward I think ... out here in the Pacific Islands especially, we've been very motivated by the failure of that model to really change anything.... I think the big benefit for everyone involved is the realization that it's the translation of the science into product and tools that people can actually use that's the main challenge.... When you look around, it's nobody's job to do it, but it's the critical part. It's kind of that last mile getting from the journal article to the actual decision point of a ... manager. To decide to do one thing or another.... You can generate a lot of climate data that does not inform people. You know they look at that and they don't know what to do with it because it doesn't translate into effects on their system.... It's more of ... knowing how to relate to the manager's needs that takes time, and it takes a lot of staff time, and it takes a commitment to do that.... That translation is the critical component. (PI User FG)

I wouldn't be able to just take the downscale information and try to figure out exactly how it's going to impact plants. There has to be somebody in-between the climate modelers and then some ecologist that's going to really look at the impact on resources and then maybe collaboratively be able to talk with managers about ... our options. (PI User FG)

Some of the scientists wanted more support in communicating science to users because they believed that they did not have the necessary expertise themselves:

Ideally I would have liked to have a contact person ... that way you can go to talk about it.... As a kind of hard core scientist, that first focus on science and that we're going to communicate and produce actionable products and over the years. I found it got better on my side. I learned a lot but ideally there would have been a little bit more ... permanent persons that don't change from one year to another and that know what the products are, where the databases are located, and how to transfer the knowledge.... Somehow there's one layer missing still in the process of communicating the actual science to the right end users.... There's one person to ask, "How do we do that? How do we produce our data best? And what are the best products?" I feel like that it would have helped if there would have been another person in some form responsible for this communication of the – maybe you want to call it the datasstream. (PI Producer FG)

Other ideas about actionable science also emerged during the focus groups. In particular, one scientist argued that integrating more social science into the CSC's work would increase the actionability of the science:

I think we need more social scientists in the long haul.... Cultivating interdisciplinary relationships is really important.... I think engaging other departments ... is a big part of the suggestion as well as how we can make science more actionable. (PI Producer FG)

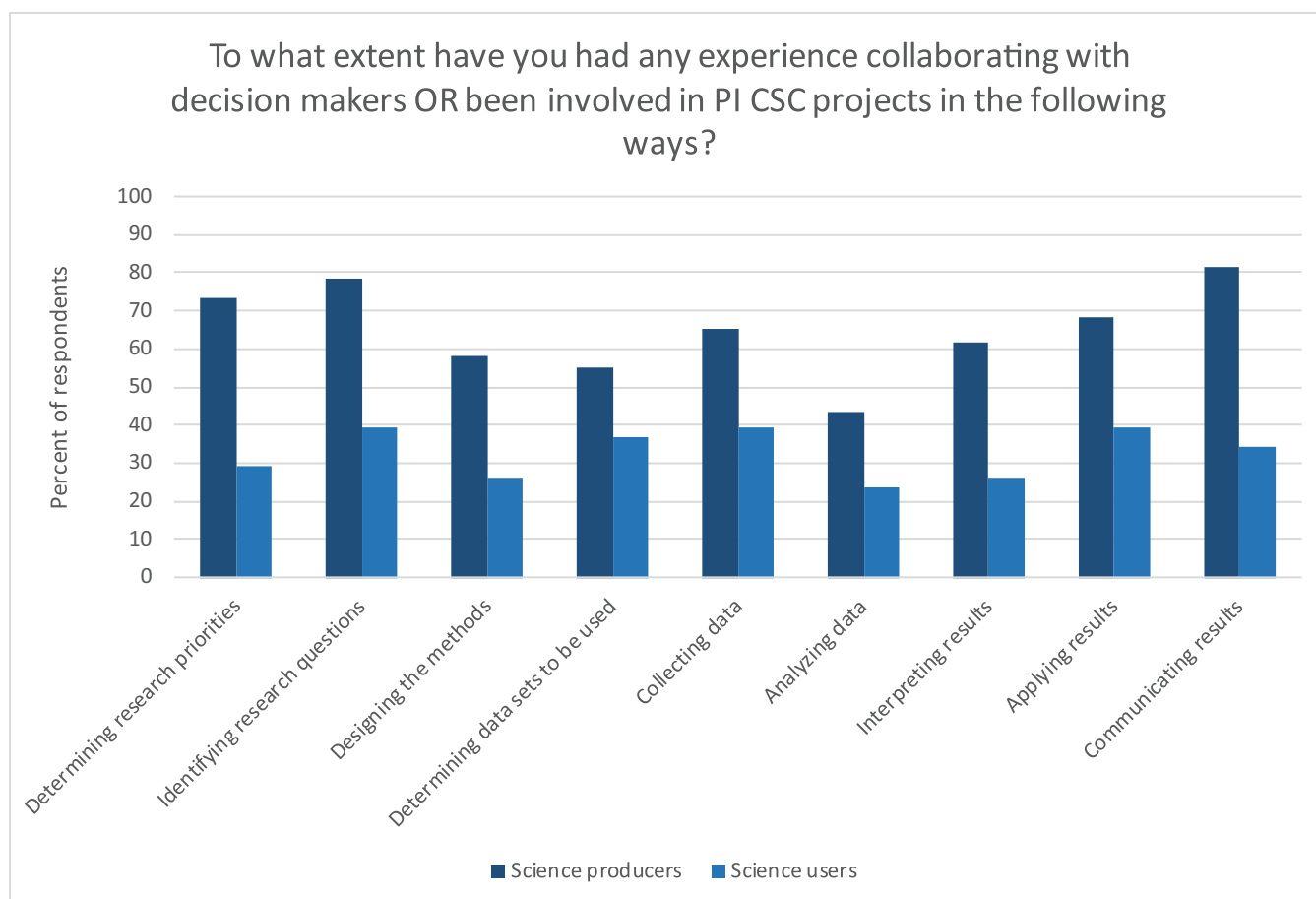
### **Science Users' and Producers' Engagement in Co-production of Knowledge**

Respondents reported on their beliefs about co-production of knowledge in general. A large majority of the science producers (95%;  $n = 58$ ) and all of the science users (100%;  $n = 38$ ) expressed support for co-production, indicating it was important or very important for climate adaptation scientists and natural resources decision makers to work together to produce science research.

Many science producers indicated experience in co-production in various phases of research projects, much more so than did science users<sup>2</sup> (Figure PI-8). For all phases of research projects, at least 40% of the science producers had experience collaborating with decision makers to a moderate, large, or very large extent. The only phase that fewer than half of science producers had experience collaborating with decision makers was analyzing the data (43%;  $n = 9$ ). (These results apply to all types of research, not just CSC-sponsored research.) In contrast, when science users were asked about their experience collaborating on research with CSC science, there were only 3 phases of research with which at least 40% of science users had experience: collecting data (40%), applying results (40%), and identifying research questions (40%).

The factors that science users thought were most likely to limit their involvement in research projects were scientists not reaching out to them (35%;  $n = 13$ ), the science users not having enough time (32%;

<sup>2</sup> As noted in a previous section, the science producers in our sample were also more extensively engaged with climate adaptation science, management, or policy – as well as with the CSC itself – than the science users in our sample.



**Figure PI-8.** Note: Survey questions 18 & 24. Text in items shortened for presentation in graph, and only “to a moderate extent,” “to a large extent,” or “to a very large extent” responses are shown. Additionally, the text of the question varied slightly for science producers and users (e.g., the users’ version referencing “you or someone in your organization” and specifying a Pacific Islands CSC project).

$n = 12$ ), different perspectives from scientists on what science is needed (29%;  $n = 11$ ), and funders not supportive of collaboration between scientists and science users (26%;  $n = 10$ ). Very few users thought that their involvement in research was limited by scientists not being interested in listening to them (8%;  $n = 3$ ).

Science users who participated in the focus groups generally recognized and appreciated the CSC’s efforts to have scientists reach out to them about their information needs:

To reach out to resource managers to find out what our applied science needs are. In the past a lot of research came out that was very academic, but we did not know what to do with that information. So the fact that researchers are asking us what specific research questions we have, and then trying to design a study around that, is just appreciated. (PI User FG)

With this one project that we’re working on with special ecological areas, getting that translation of the information ... We sat down with the researchers you know before the projects kind of got initiated. What are your needs? And then there was kind of this process, iterative process, back and forth ... with us as managers and the scientists.... And that sort of project was really beneficial in just making those connections. (PI User FG)

The scientists also described how the CSC facilitated these interactions:

One thing that the Climate Science Center ... has done with this most recent round of funding ... about a year ago, one-and-a-half years ago, they helped to bring together the managers and the researchers to kind of develop the project.... And then about 9 months into the project they made sure, they organized another meeting with all of us on the proposal to have us sit down and talk about and see where things were.... They helped facilitate that. (PI Producer FG)

Many of them saw these interactions as valuable and think that it would be useful to have more such opportunities:

Managers know what problems they have and what their goals are. And having researchers able to come in and help them identify those really interesting research questions that help them ... gain insight into their issues and allow the researchers to do quality science, having that type of forum that allows that to happen would be helpful. (PI Producer FG)

Yet not every scientist believed that interacting directly with end users of science was feasible or valuable:

I have had limited discussions or communication directly with end users. But I think that's very likely also where the strength of the PI CSC is, that there is this ... middle that helps with the communication. And everybody has a full day and works hard, so a manager won't have much time to talk to each and every individual researcher.... As we have these good communication channels through the PI CSC and I think that worked quite well. What worked extremely well for me was connecting to the next level, that is the people who use my climate information to bring it down to their environmental ... impact layer here in Hawai'i. And that worked extremely well and that would have not been possible without the funding and the PI CSC. (PI Producer FG)

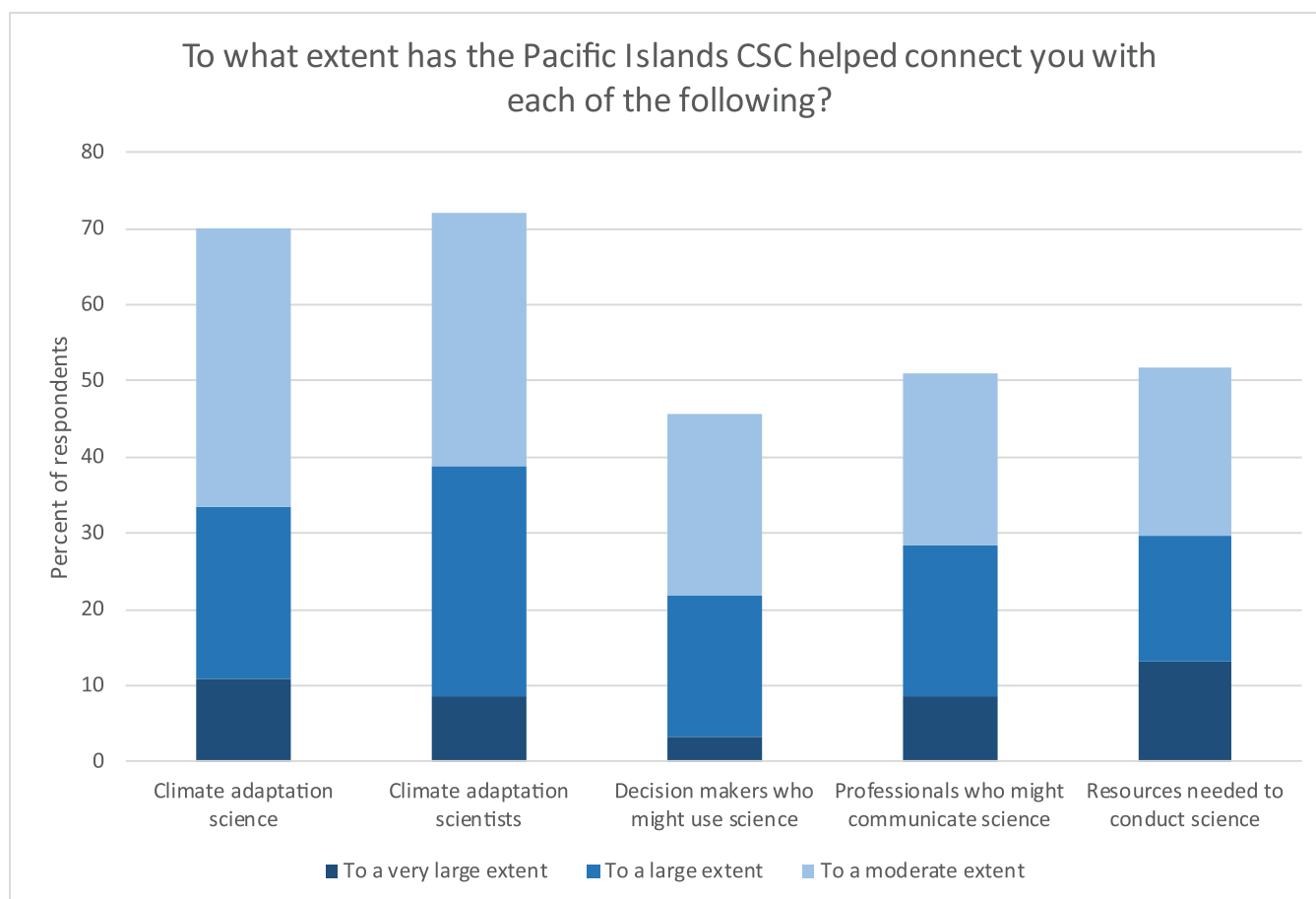
### **Perceptions of the Role of the CSC**

The Pacific Islands CSC has helped facilitate various connections (Figure PI-9). Nearly three-quarters of respondents reported connections with climate adaptation scientists (72%;  $n = 67$ ) and climate adaptation science (70%;  $n = 65$ ). About half thought the CSC had helped connect them with resources needed to conduct science (52%;  $n = 47$ ), professionals who might communicate science (51%;  $n = 47$ ), and decision makers who might use science (46%;  $n = 42$ ).

Most than three-quarters of respondents agreed that the Pacific Islands CSC made a variety of contributions to the region (Figure PI-10). The contributions that were most widely perceived were awareness of available science (83%;  $n = 77$ ), communication between scientists and those who might use the science (77%;  $n = 72$ ), collaboration between scientists (75%;  $n = 70$ ), and interdisciplinary science (74%;  $n = 69$ ).

### **Summary of Pacific Islands Results**

Survey respondents were comprised of more than one-third science users, nearly two-thirds science producers, and some individuals who fell into neither group. All were involved with climate work to some extent, but producers were more involved than users. All were aware of the Pacific Islands CSC to at least some extent, but producers were more involved with the CSC than users were. Respondents included employees of a variety of types of organizations and agencies, but universities and federal agencies were most prominent.



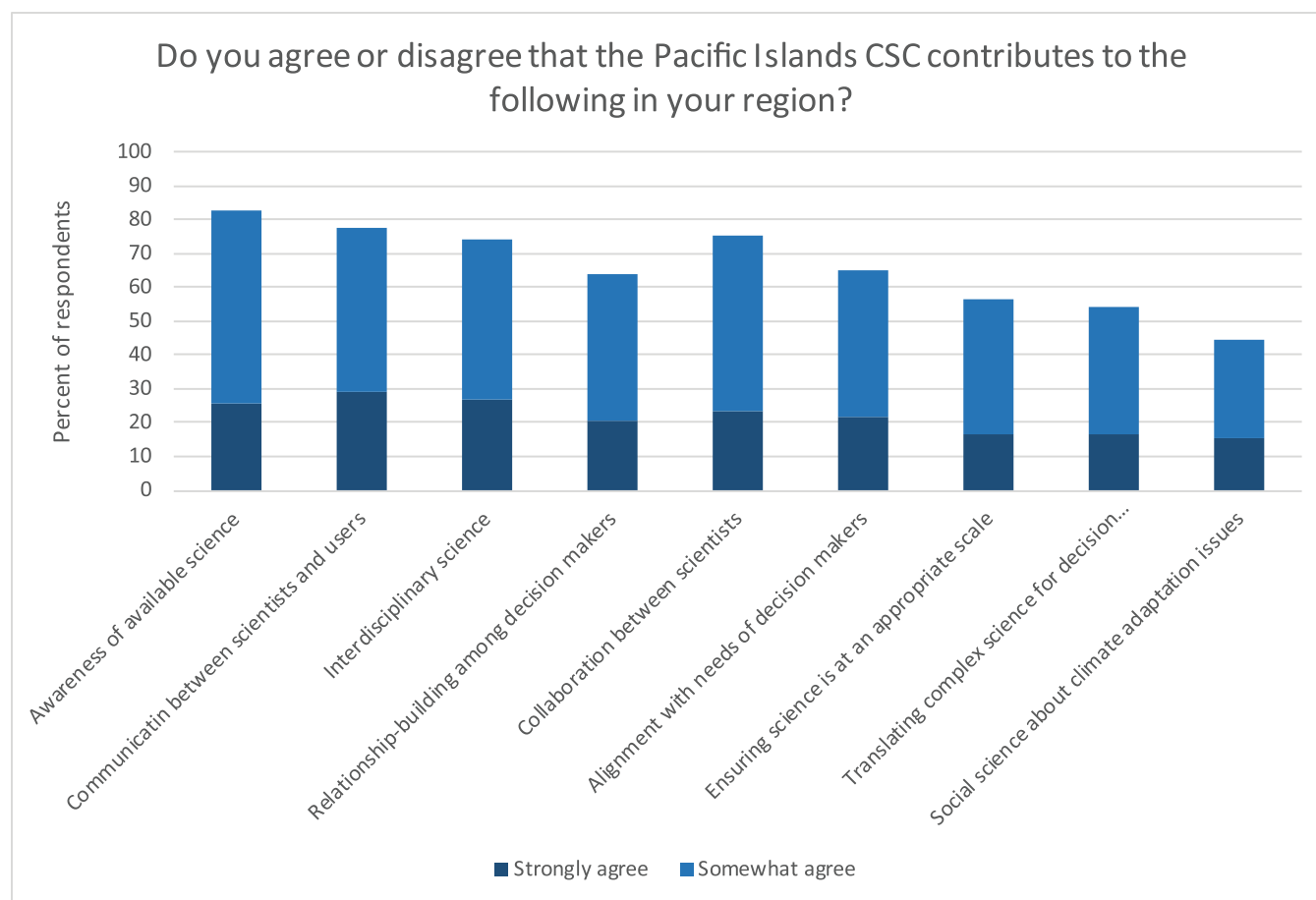
**Figure PI-9.** Text in items shortened for presentation in graph, and only “to a moderate extent,” “to a large extent,” or “to a very large extent” responses are shown.

Survey respondents were involved with the Pacific Islands CSC in a variety of ways, but the most common was as participants in CSC trainings, webinars, workshops, or conferences with nearly half of respondents having taken advantage of one of these opportunities. More than one-third were CSC grant recipients, applicants, or partners on a grant. Only one-fifth were resource managers or decision makers who had used the science produced by the CSC.

The CSC provided many important benefits to partners with the top ones identified by survey participants being providing access to climate adaptation science, providing access to a network of people interested in climate adaptation science, serving as an avenue to put science into the hands of decision makers, and providing a source of funding. Focus group participants spoke about all of these benefits as well as the opportunities the CSC provided to educate local students. Survey respondents reported they were limited in their involvement with the CSC by a variety of factors with the most common one being limits on their time.

About three-quarters of the survey respondents felt that climate adaptation science in the Pacific Islands region<sup>3</sup> was available to decision makers, and many also believed that decision makers use the climate adaptation science to inform management. Nevertheless, nearly half believed that climate adaptation science did not influence *necessarily* management actions taken, although a majority also believed that the Pacific

<sup>3</sup> All climate adaptation science in the region, not solely the science produced by the CSC.



**Figure PI-10.** Text in items shortened for presentation in graph, and only “strongly agree” or “somewhat agree” responses are shown.

Islands CSC had reduced the disconnect between scientists and decision makers. When asked specifically about the science produced through the Pacific Islands CSC, the vast majority of the survey respondents agreed it can contribute to policy or management. Respondents were also positive about other characteristics of the CSC science, and the majority found it appropriate to inform decisions, high quality, and able to integrate well with other information.

The most common ways science users and producers reported that the Pacific Islands CSC science was used were to inform the public and inform management plans and actions. Focus group participants described translation of the science into a form that decision makers could use was a key factor in ensuring it was used.

Science users and producers differed in their perceptions of what limits the use of CSC science. Science producers perceived issues to be more limiting, than science users found them to be. Focus group participants maintained that one of the limits on the use of the science was that the scale at which scientists tended to work was often different from the scale of the information that decision makers needed.

An overwhelming proportion of both science users and producers expressed support for coproduction of knowledge. While many of the science producers indicated experience in coproduction in various phases of research projects, many fewer science users reported first-hand experience. Scientists were the most likely to have experience with coproduction in the early stages (setting priorities and identifying research

questions) and late stages (interpreting, applying, and communicating results) of research, although many also had experience with coproduction during the data collection stage. Science users were most likely to have experience in coproduction by identifying research questions, collecting data, and applying results. Science users who responded to the survey reported that their involvement in co-produced research projects is most limited by scientists not reaching out to them to collaborate, not having enough time to work with scientists, having different perspectives from scientists on what science is needed, and funders not being willing to support collaboration between scientists and science users.

The majority of survey respondents noted a variety of contributions of the Pacific Islands CSC, including contributions to awareness of available science, communication between scientists and decision makers, collaboration between scientists, and interdisciplinary science.