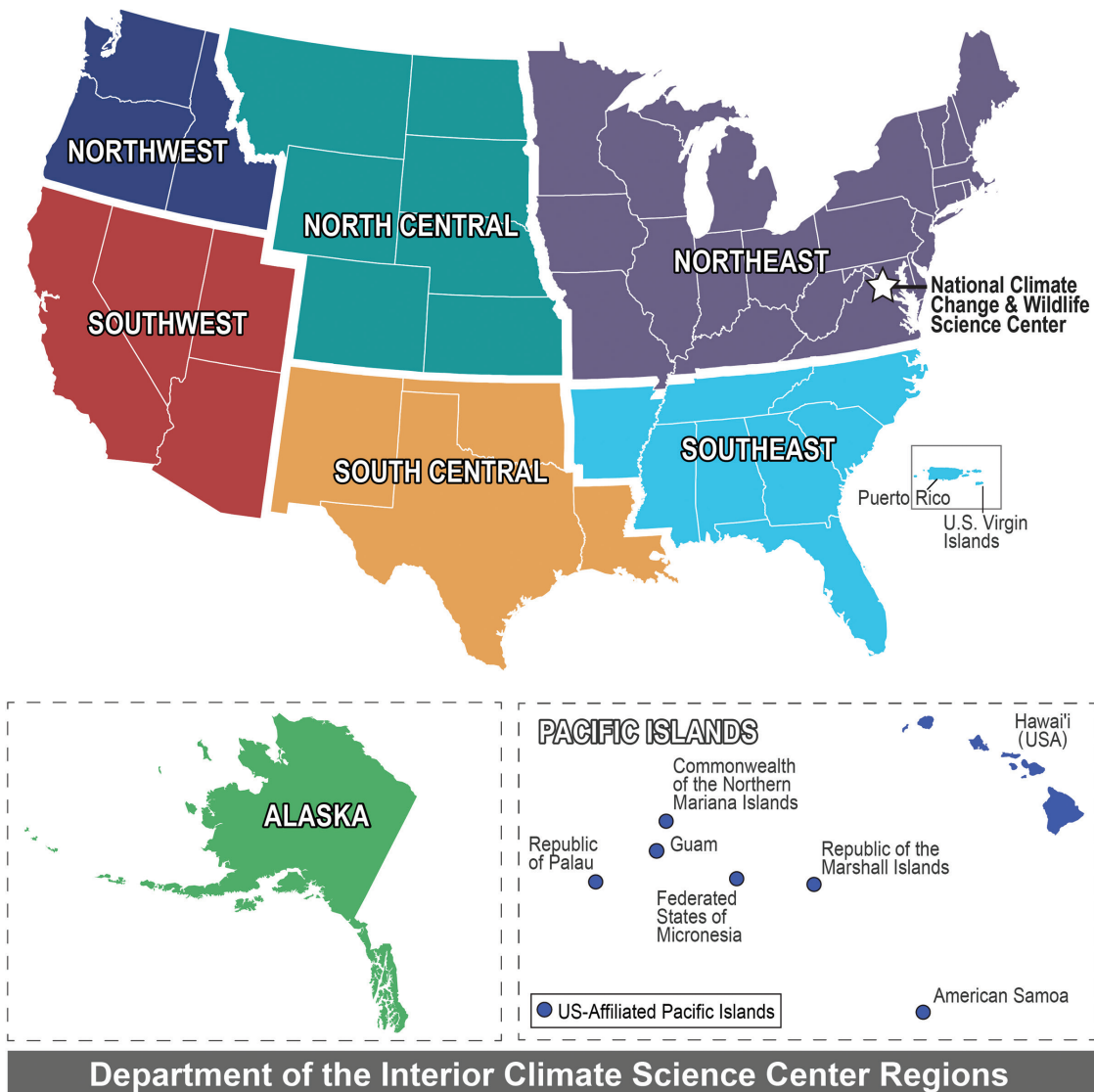


# Five-Year External Reviews of the Eight Department of Interior Climate Science Centers

## Alaska Climate Science Center



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American Fisheries Society  
Cornell University Human Dimensions Research Unit  
U.S. Geological Survey

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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

## Alaska Climate Science Center

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## Executive Summary

In 2008, the U.S. Congress authorized the establishment of the National Climate Change and Wildlife Science Center (NCCWSC) within the U.S. Department of Interior (DOI). 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. From 2010 through 2012, NCCWSC established eight regional Climate Science Centers (CSCs). Each of these regional CSCs operated with the mission 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). The model developed by NCCWSC for the regional CSCs employed a dual approach of 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. At the conclusion of this 5-year agreement, a review of each CSC was undertaken, with the Alaska Climate Science Center (AK CSC) reviewed in February 2016.

The AK CSC is hosted by the University of Alaska Fairbanks (UAF) and is physically housed within the International Arctic Research Center. The federal USGS component of the AK CSC is housed in the USGS Alaska Science Center in Anchorage. The AK CSC has overlapping boundaries with five Landscape Conservation Cooperatives (LCCs): Aleutian and Bering Sea Islands LCC, Arctic LCC, Northwest Boreal LCC, North Pacific LCC, and Western Alaska LCC. The geographic area covered by the AK CSC is also home to 229 federally recognized tribes and an extensive diversity of Alaska native tribal entities, including 13 Alaska native regional corporations.

The review addressed several purposes:

- Evaluate the effectiveness in meeting the project goals;
- Assess the level of scientific contribution and achievement with respect to climate modeling; climate change impacts assessments; vulnerability and adaptation of fish, wildlife, and habitats; and collaborative development of adaptation strategies for regional stakeholders;
- Evaluate the competencies and efficiencies of each CSC host university in managing the administrative and program requirements; and
- Aid the NCCWSC in developing improved requirements for recompetition of the next university hosting agreements.

This report primarily addresses the first two purposes of the review while providing comments on the third as identified by the science review team (SRT). A separate report of recommendations for the recompetition, based upon compiled observation from all three reviews conducted in 2016, was submitted to NCCWSC on April 15, 2016 to assist with the development of recompetition documents. To further address host-university administrative competencies and efficiencies, separate interviews of host-university faculty and administrators were conducted by NCCWSC staff in conjunction with the on-site component of the reviews.

The review of the AK CSC was conducted as a project of the Cornell University Human Dimensions Research Unit in conjunction with the American Fisheries Society as a subcontractor. The review was conducted in two parts: an on-site review by a 7-person SRT and a subsequent Web-based survey of science users and producers. The SRT was chaired by a USGS scientist selected from outside of the NCCWSC but with knowledge and interest in AK CSC activities. A second team member was a CSC director from one of the other seven CSCs. The five other SRT members were selected based upon a national solicitation of experts in the field of climate science, including the impacts of climate change on fisheries, wildlife, and related environmental and cultural issues. The 7-member SRT was also selected to represent a variety of federal agencies and universities. The review was conducted in two parts, the first taking place at UAF on February 10–11, 2016 focused on the university host and related research.

The second component was on February 12, 2016 in Anchorage and focused on the partnership component of the AK CSC.

Prior to the on-site review, relevant AK CSC documents were compiled for examination by the SRT. These documents included the hosting cooperative agreement, annual reports, strategic plans, annual work plans, call for proposals, examples of communications documents, and access to all individual research project reports and publications. The on-site review consisted of a series of presentations, structured interviews, panel discussions, and informal dialogues between the members of the AK CSC and the SRT. A general design for the review was based upon the work of the Advisory Committee on Climate Change and Natural Resource Science, a federal advisory committee of NCCWSC. This defined four major review components:

- *Institutional development*: Measures of the overall health of the CSC as an institution, with an emphasis on planning processes, management and operations, finances, and institutional coordination.
- *Actionable science*: Characterizes 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*: Designed to address 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*: The effectiveness of the CSC in 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.

The Cornell University Human Dimensions Research Unit component of the review focused on the partnership evaluation and was designed to measure the quality and extent of partnership involvement at each CSC. This component of the CSC review consisted of two activities: a series of group interviews conducted as part of the on-site review and a standardized Web-based survey that was completed after the on-site review and 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 actionable science and coproduction? What characterizes that role?

The work of the SRT resulted in a series of 29 recommendations that are detailed in the report. The overall observation of the SRT was that the science and resultant findings being produced by the AK CSC has added substantial value to the efforts of the research and natural resources management community of Alaska and the Arctic region. The current and anticipated impacts of climate change on Alaska will have profound effects upon the natural resources and human communities of the region. Yet the magnitude of the geography, the lack of instrumentation, and the cost and sheer physical challenges of work in the region has left the community with limited data and immense challenges in addressing even fundamental needs. While the federal and state agencies working in Alaska have dedicated substantial resources to addressing these needs, they are far from sufficient. It is in this setting that the AK CSC has been situated and has, by all measures, provided a valued and significant scientific effort.

The SRT agreed with the general observations of those on the various panels assembled for the on-site visits in both Fairbanks and Anchorage that (1) the AK CSC was a timely addition to the group of agen-

cy programs focused on climate change and has provided needed and visionary additional capacity; (2) AK CSC management has been effective and efficient, although there are areas in need of attention; (3) the AK CSC does work that is challenging and needed and accomplishes this in a highly collaborative manner; and (4) projects by the AK CSC have been characterized by a high degree of leveraging, tend to amplify and enhance ongoing work, and have addressed important funding gaps.

There were challenges identified that the AK CSC is facing as the program matures, some of which are consequences of the setting. It was noted that there is a struggle between acquisition and development of fundamental information about climate impacts in the Alaska and Arctic region and the need to identify specific and timely resource management challenges, conduct targeted research, and develop management guidance for stakeholders. Given the magnitude of the geography and limitations on resources, this will likely be a constant companion for researchers and managers for the foreseeable future. The typical response is to suggest greater levels coordination, leveraging of resources, and better identification of needs. Much of this is already taking place among the rather close-knit community in Alaska. That being said, the roles of the AK CSC and the five LCCs as organizations that are positioned (i.e., boundary organizations) to address this important role can be enhanced. Acquiring expertise to focus on nurturing, managing, and utilizing highly effective partnerships of diverse stakeholders, plus carrying on informative dialogue, is a need throughout the conservation community and Alaska is no exception.

As the AK CSC continues to evolve along with the knowledge of climate change impacts in Alaska, the SRT is optimistic that it will continue to be an effective source of science-based findings and information for the Alaska and Arctic community.



## Abbreviations and Acronyms

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| ACCAP          | Alaska Center for Climate Assessment and Policy                   |
| ACCER          | Alaska Climate Change Executive Roundtable                        |
| ACCCNRS        | Advisory Committee on Climate Change and Natural Resource Science |
| AFS            | American Fisheries Society                                        |
| AFSC           | Alaska Fire Science Consortium                                    |
| AK CFWRU       | Alaska Cooperative Fish and Wildlife Research Unit                |
| AK CSC         | Alaska Climate Science Center                                     |
| AKDEC          | Alaska Department of Environmental Conservation                   |
| AKDNR          | Alaska Department of Natural Resources                            |
| AOOS           | Alaska Ocean Observing System                                     |
| BLM            | U.S. Bureau of Land Management                                    |
| C-4            | Climate Change Coordinating Committee                             |
| CGC            | Center for Global Change and Arctic System Research               |
| CIFAR          | Cooperative Institute for Alaska Research                         |
| CSC-Federal    | Federal USGS-staffed component of the CSC                         |
| CSC-University | Host-university component of the CSC                              |
| DMP            | Data management plans                                             |
| DOI            | Department of Interior                                            |
| GPR            | Ground-penetrating radar                                          |
| HDRU           | Human Dimensions Research Unit                                    |
| IAB            | Institute of Arctic Biology                                       |
| IARC           | International Arctic Research Center                              |
| IDC            | Indirect cost                                                     |
| IEM            | Integrated ecosystem model                                        |
| LCC            | Landscape Conservation Cooperatives                               |
| NCCWSC         | National Climate Change and Wildlife Science Center               |
| NGO            | Nongovernmental organization                                      |
| NOAA           | National Oceanic and Atmospheric Administration                   |
| NPS            | U.S. National Park Service                                        |
| NW CSC         | Northwest Climate Science Center                                  |
| NWS            | National Weather Service                                          |
| PI             | Principal investigator                                            |
| RFP            | Requests for proposals                                            |
| RISA           | Regional Integrated Sciences and Assessments                      |
| SAC            | Stakeholder Advisory Committee                                    |
| SE CSC         | Southeast Climate Science Center                                  |
| SRT            | Science Review Team                                               |
| SNAP           | Scenarios Network for Alaska and Arctic Planning                  |
| UA             | University of Alaska                                              |
| UAF            | University of Alaska Fairbanks                                    |
| USFWS          | U.S. Fish and Wildlife Service                                    |
| USGS           | U.S. Geological Survey                                            |
| USFS           | U.S. Forest Service                                               |
| WERC           | Water and Environmental Research Center                           |



# Introduction

## *Review Purpose*

In 2008, the U.S. Congress authorized the establishment of the National Climate Change and Wildlife Science Center (NCCWSC) within the U.S. Department of Interior (DOI). 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. Further direction for NCCWSC was provided through 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). Through this Secretarial Order, the original concept of eight "climate hubs" was redefined as DOI Climate Science Centers (CSCs), and their mission was slightly expanded to "synthesize and integrate climate change impact data and develop tools that the DOI'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). The model developed by NCCWSC for the regional CSCs employed a dual approach of 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 first three regional CSCs, located in Alaska (AK), the Pacific Northwest (NW), and the Southeast (SE), were established in 2010. These CSCs have completed their initial 5-year project cycle and are into their sixth year through a 1-year funding extension. As such, the university hosting agreements for these CSC regions are 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 host universities to ensure that established goals and obligations under the hosting agreements were met, as well as to identify obstacles and areas of improvement for future agreements.

This report primarily addresses the first two purposes of the review while providing comments on the third as identified by the science review team (SRT). A separate report of recommendations for the recompetition, based upon compiled observation from all three reviews conducted in 2016, was submitted to NCCWSC on April 15, 2016 to assist with the development of recompetition documents. To further address host-university administrative competencies and efficiencies, separate interviews of host-university faculty and administrators were conducted by NCCWSC staff in conjunction with the on-site component of the reviews.

## *NCCWSC and CSC Missions and Guiding Principles*

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

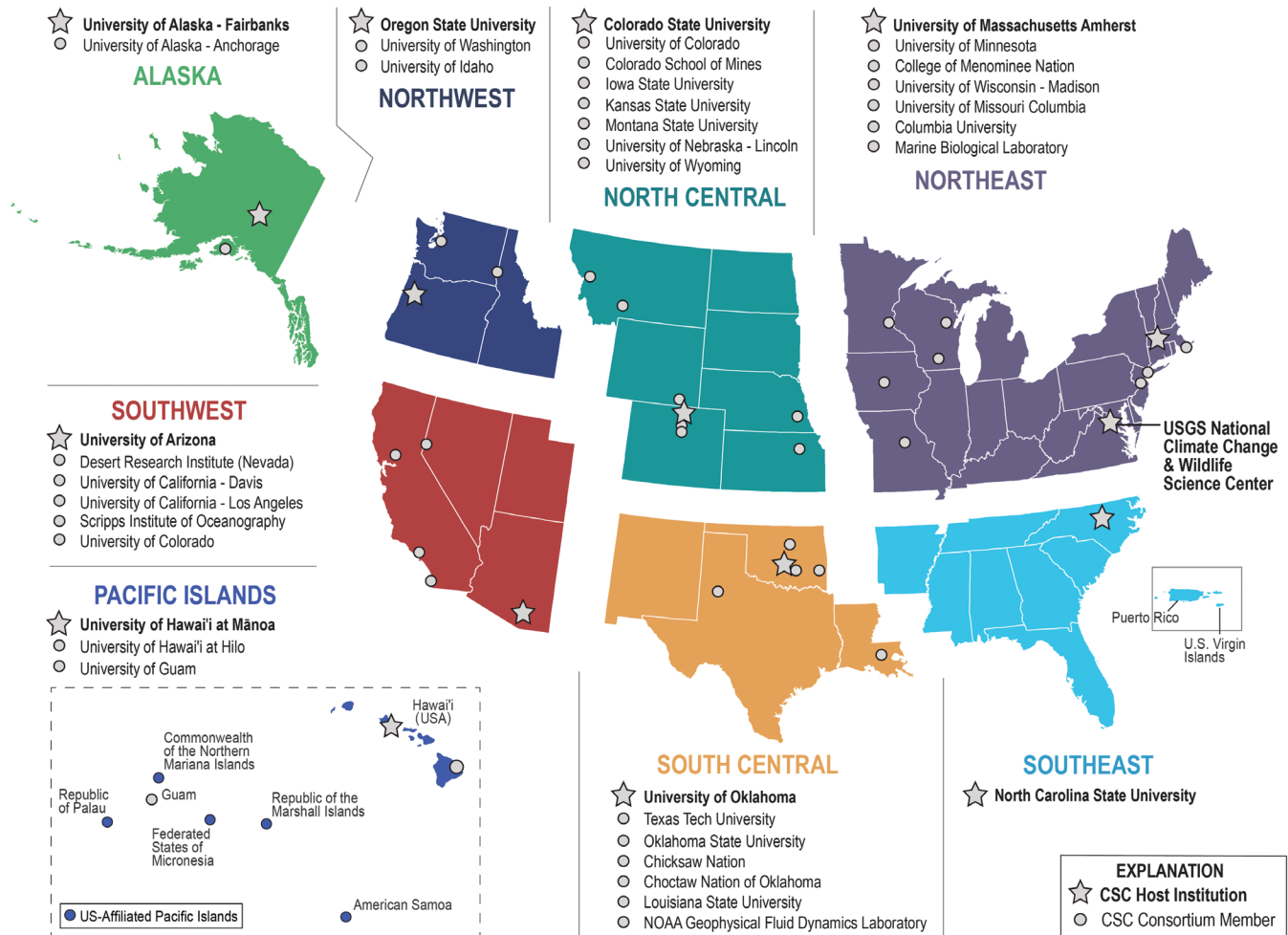
The mission of NCCWSC is to provide natural resource managers with the tools and information they need to develop and execute management strategies that address the impacts of climate change on fish, wildlife and their habitats (USGS 2013).

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<sup>1</sup> 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.

## Department of the Interior Climate Science Center (CSC) Regions

*The CSCs collaborate across boundaries to address shared ecosystems, watersheds, and landscapes*



**Figure 1.** Map of the eight Climate Science Centers and consortia.

The mission of the 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 strategic plan (2009–2014; USGS 2009) was developed to guide the efforts of the NCCWSC–CSC network. 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, and
- Deliver these relevant tools and information in a timely and useful way directly to resource managers.

The NCCWSC strategic plan 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 produce key information that is needed to forecast ecological and population response at national, regional, and local levels.

**The purpose of the Climate Science Center review was to**

- Evaluate the effectiveness in meeting the project goals;
- Assess the level of scientific contribution and achievement with respect to climate modeling, climate change impacts assessments, vulnerability and adaptation of fish, wildlife, and habitats, and collaborative development of adaptation strategies for regional stakeholders;
- Evaluate the competencies and efficiencies of each Climate Science Center host university in managing the administrative and program requirements; and
- Aid the National Climate Change and Wildlife Science Center in developing improved requirements for recompetition of the next university hosting agreements.

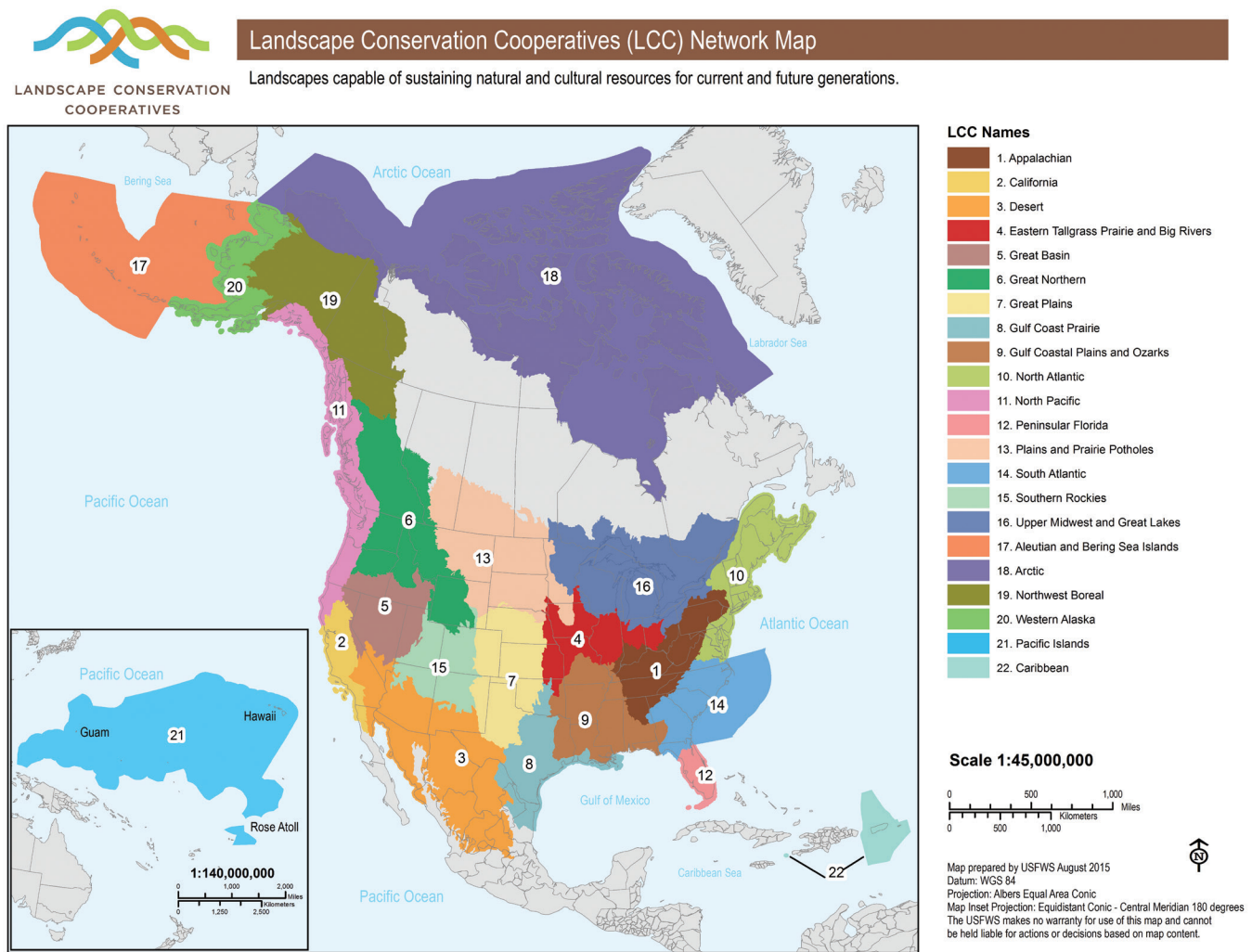
- Integrate physical climate models with ecological, habitat, and population response models.
- Forecast fish and wildlife population and habitat changes in response to climate change.
- Assess the vulnerability and risk of species and habitats to climate change.
- Develop standardized approaches to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

The NCCWSC strategic plan states that a key component of NCCWSC and the CSCs is to work with partners. Two major groupings of partners include (1) science partners (many 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., doctoral-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.

During roughly the same time period as the establishment of NCCWSC and the CSCs, the DOI established the Landscape Conservation Cooperatives (LCCs) as an effort to organize and coordinate large-scale conservation efforts. The LCCs, designated as a primary CSC partner, 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 the United States, extending into Mexico and Canada (Figure 2).

The process of identifying the CSCs began in fiscal year 2010 with the identification of the University of Alaska Fairbanks (UAF) as the host university for the first CSC, after which USGS initiated a competitive selection of host institutions for the NW CSC and the SE CSC (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 land, water, wildlife, and other natural and cultural re-



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

source managers (NCCWSC 2011). All of the CSCs employ some form of stakeholder advisory committee (SAC) as a means of formally engaging partners in the strategic direction of the CSC. The SAC provides a vehicle for building collaborative partnerships and determining science priorities. The National Climate Change and Wildlife Science Center has established a set of guidelines (NCCWSC 2014) for the SACs that defines membership, primary purpose, and other operating guidance. For the AK CSC, the Alaska Climate Change Executive Roundtable (ACCER) acts as the SAC while the Climate Change Coordinating Committee (C-4) acts in a manner similar to that of the Science Implementation Panels of other CSCs. Under this model, the AK CSC, with the advice and review of ACCER, develops annual work plans that drive science priorities and requests for proposals (RFPs). 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 national wildlife refuge, national park, or U.S. Bureau of Land Management (BLM) unit.

Though not formally designated as such, this NCCWSC–CSC construct has at least partially evolved to be a network of boundary organizations (i.e., organizations that bridge and broker knowledge between scientists and decision makers; ACCCNRS 2015). The National Climate Change and Wildlife Science Center serves as both a central hub and a national research node while the eight CSCs serve as the regional nodes (ACCCNRS 2015).

## **Alaska Climate Change Executive Roundtable**

### *Purpose*

The Alaska Climate Change Executive Roundtable (ACCER) is an effective vehicle for providing management perspective, ensuring overall coordination, and facilitating consensus among partners for the new capacities that are being developed to address climate change and other stressors in a cooperative manner.

### *Membership*

- Senior executives of state and federal land and resource management agencies.
- Co-chair: ACCER will have federal and state co-chairs rotated among the member agencies.

### *Roles and Responsibilities*

- Share information, discuss challenges faced and solutions.
- Identify broad areas of interest or concern.
- Identify opportunities to leverage resources to meet highest priority needs based on recommendations by statewide workgroups and Landscape Conservation Cooperatives (LCCs) through the Alaska Climate Change Coordinating Committee (C-4).
- Ensure that the efforts of the LCCs, the Alaska Climate Science Center, and National Oceanic and Atmospheric Administration Climate Service are complimentary and integrated.
- Provide executive-level guidance to the efforts of C-4.
- Resolve any issues elevated from C-4.
- Convene statewide workgroups.

## **Review Process**

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

The CSC evaluations consisted of two parts: an external programmatic review led by AFS and the HDRU and an internal operational review led by NCCWSC. To evaluate the performance of the host university, AFS and the HDRU established SRTs for each CSC. A SRT consisted of a team of 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 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, discussions, etc.), developing review reports from evaluation findings, and logistical planning (travel, lodging, food, etc.). The Human Dimensions Research Unit 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 CSCs as well as barriers to engagement. The internal review led by NCCWSC evaluated the operational components of the hosting agreements, including staffing, physical assets, and grant management.

The AK CSC on-site review was conducted over a period of 3 days with sessions in Fairbanks on the campus of UAF and in Anchorage at the USGS Alaska Science Center (Appendix B). The review process was designed to develop a full understanding of the AK CSC beginning with the administrative structure, foundational documents, and processes (e.g., strategic and science planning) through the final research

### **Alaska Climate Change Coordinating Committee**

#### *Purpose*

The Alaska Climate Change Coordinating Committee (C-4) is an interagency group comprised of Alaska Climate Change Executive Roundtable (ACCER) member agency science officers, or their equivalent, with the purpose of providing a point of synthesis for the Landscape Conservation Cooperatives (LCCs), the Alaska Conservation Science Center (AK CSC), National Oceanic and Atmospheric Administration (NOAA) Regional Climate Centers (RCCs), and agency priorities.

#### *Membership*

- State and federal senior-level managers with sufficient authority to represent their agencies on a policy level on a statewide basis.
- One representative from each agency.
- AK CSC director, NOAA RCC director, and LCC coordinators serve as ex officio members and provide staff support.
- State and federal co-chairs, rotating among member agencies.

#### *Roles and Responsibilities*

- Address cross-LCC integrating/coordinating considerations and decisions.
- Integrate goals being developed by LCCs.
- Compile and rank combined science priorities of LCCs and agencies.
- Integrate work of the LCCs, NOAA RCC, and the AK CSC; identify gaps; and eliminate duplication.
- Provide interagency, management-level guidance to the AK CSC to ensure that it is meeting the needs of interagency partners.
- Provide overall science priorities for the AK CSC.
- Establish statewide goals and science priorities for the AK CSC, NOAA RCC, and the LCCs.
- Leverage resources at the statewide level to meet priority science needs (especially statewide needs) and conservation goals.

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.

### ***Program Evaluation Measures for CSCs***

There currently exists no satisfactory, systemwide, performance measures (e.g., specific deliverables or activities completed by given dates) for the CSCs. Each CSC was established within the general framework of the mission of NCCWSC and the CSCs and in response to the needs of the region in which they operate. As described below, the AK CSC, in conjunction with ACCER and C-4, developed a strategic plan and annually develops work plans. While the strategic plan and annual work plans could provide a basis for assessment, they are not consistent across the CSCs. As a result, while still providing observations and comment on these core documents and efforts to implement them, the CSC SRTs sought other models upon which to construct the review process.

In the “Report to the Secretary of the Interior, March 30, 2015” (ACCCNRS 2015), ACCCNRS provided recommendations to the Secretary of the Interior to enhance the CSC program, including program evaluation. The committee recommends 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 CSC 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 center 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.

### *HDRU Methodologies<sup>2</sup>*

The partnership evaluation component of the CSC review 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 that 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 actionable science and the coproduction of science? What characterizes that role?

This component of the AK 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 AK 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 AK CSC. Two groups were included: science producers and science users.

Participants were recruited by the AK CSC with guidance from the HDRU. The Human Dimensions Research Unit attempted to include participants that represented a diversity of organizations and regions. Participants in the science producers group included faculty members, graduate students, or postdoctoral associates that had received research funding from the AK CSC. Participants in the science users group included representatives of agencies intended to benefit from the science produced by the AK CSC: LCCs, federal natural resource agencies, state fish and wildlife agencies, tribal organizations, and NGOs. A total of 21 individuals participated in the two group interviews during the site visit: 10 science producers and 11 science users.

Each interview consisted of a semi-structured conversation guided by a series of open-ended questions (Appendix C) and lasted approximately 2 hours. The questions were designed to explore how partners contributed to the work of the AK CSC and the factors that influenced the ability of the AK CSC to work with their partners. The specific question topics focused on how participants have worked with the AK CSC, reasons for becoming involved with the AK CSC, benefits of involvement with the AK

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<sup>2</sup> The material in this section is a modified version of material presented in Dayer et al. (2016).

CSC, challenges to involvement, and what the AK CSC could do to promote even more benefits from involvement. Additionally, the HDRU specifically explored how the AK 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 AK CSC in connecting them. The group interviews were used to inform the development of the survey, and thus, the HDRU does not report separately on their results.

*Web-based survey.*—A standardized, Web-based survey of partners and potential partners of the AK CSC was conducted. An initial sample for the survey was compiled from science producers and science users identified by each CSC, LCC staff, and steering committee members with regions that overlap with the three CSCs regions, and members of the Association of Fish and Wildlife Agencies Climate Science Committee.

The survey documented the ways in which partners were engaged with the CSCs and the factors affecting their engagement. The survey questions were developed based on insights from the group interviews and a review of the scholarly literature. The question topics included

- The 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 adaption science
- For science users:
  - o Use of climate adaptation science
  - o Limitations on use of climate adaptation science
  - o Importance of and engagement in coproduction of science
  - o Limitations on coproduction of science
- For science producers:
  - o Use of climate adaption science produced by others
  - o Limitations on others' use of climate adaptation science
  - o Importance of and engagement in coproduction of science
- Perceptions of the role of the CSC

The survey instrument was reviewed by subject matter experts, including NCCWSC staff, SRT members for each CSC, and other researchers. 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 SurveyMonkey, which provides a means of soliciting participation in a survey via e-mail and recording responses. SurveyMonkey 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 April 11, 2016 and concluded on May 9, 2016.

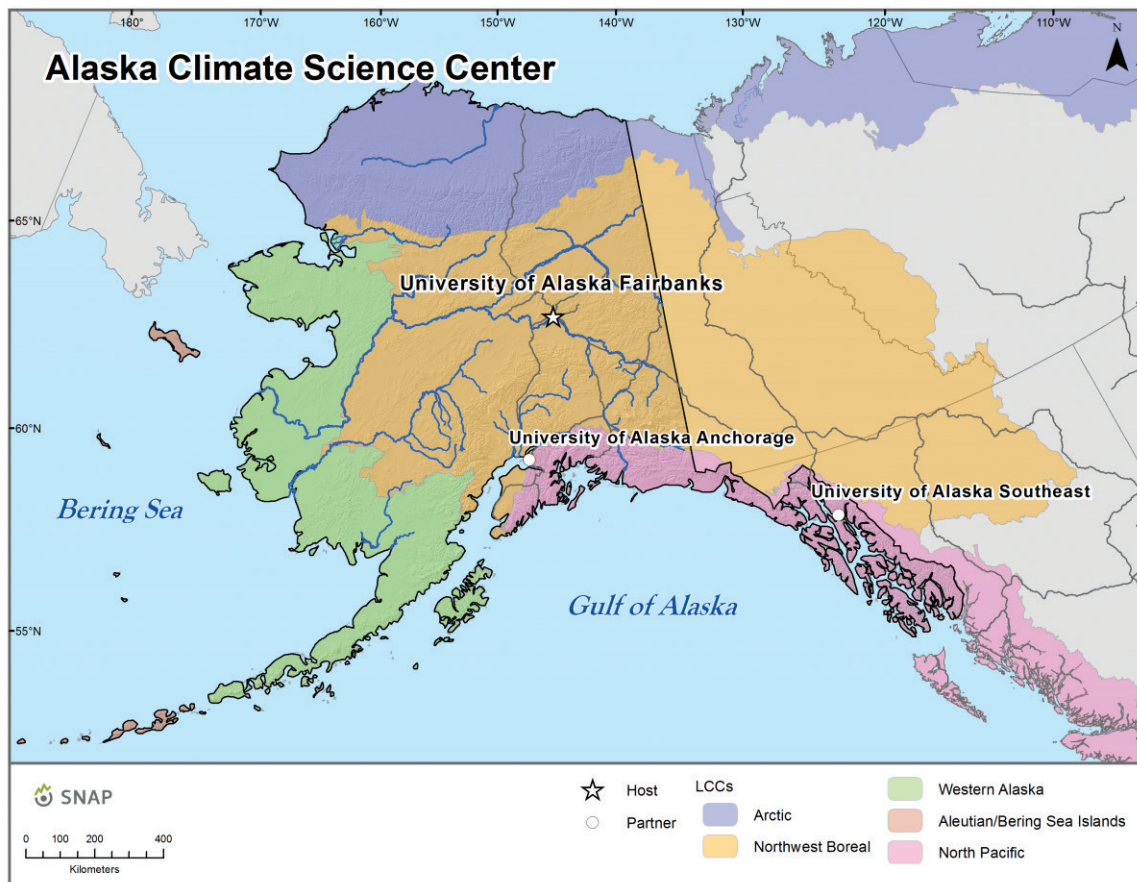
### *Overview of the AK CSC*

The university component of the AK CSC is hosted by UAF and is physically housed within the International Arctic Research Center (IARC). The federal USGS component of the AK CSC is housed within the USGS Alaska Science Center in Anchorage. This split location was predicated upon the need to ensure the greatest possible engagement of the AK CSC with the primary conservation partners, which are principally based in Anchorage, while yet taking advantage of the significant research capacity at UAF. While it is

possible that this pragmatic solution of geographical separation of the federal from the university could create challenges in full integration of the two components, the SRT did not find evidence that this was, in fact, the case.

The host university is a Land, Sea, and Space Grant institution. At UAF, the capacity exists for extensive climate change research and services. The University of Alaska Fairbanks is the principal research center for the statewide university system and is comprised of six major research units: Agricultural and Forestry Station, Geophysical Institute, Institute of Arctic Biology (IAB), Institute of Marine Science, Institute of Northern Engineering, and the IARC. The AK CSC is housed within the IARC, along with the Alaska Center for Climate Assessment and Policy (ACCAP; a National Oceanic and Atmospheric Administration [NOAA] Regional Integrated Sciences and Assessments [RISA] program), the Alaska Fire Science Consortium (AFSC), the NOAA Cooperative Institute for Alaska Research (CIFAR), the Scenarios Network for Alaska and Arctic Planning (SNAP), the Center for Global Change and Arctic System Research (CGC), and the Fairbanks forecast office of the National Weather Service (NWS). The Alaska Cooperative Fish and Wildlife Research Unit (AK CFWRU) is housed at UAF IAB. This extensive suite of research institutes creates significant potential for collaboration and can greatly enhance the research potential of the AK CSC.

The AK CSC has overlapping boundaries with five LCCs: Aleutian and Bering Sea Islands LCC, Arctic LCC, Northwest Boreal LCC, North Pacific LCC, and Western Alaska LCC (Figure 3). The geographic area covered by the AK CSC is also home to 229 federally recognized tribes and an extensive diversity of Alaska native tribal entities, including 13 Alaska native regional corporations.



**Figure 3.** Operational area of the Alaska Climate Science Center and the five relevant Landscape Conservation Cooperatives.

Funding for the AK CSC consists of three funding streams: (1) an annual allocation from USGS to conduct or support strategically important scientific activities that address science priorities at UAF and the USGS science centers, either through RFPs or directed research projects; (2) the cooperative agreement with the host university (hosting agreement), which is used for the majority of university support, including faculty salaries and associated expenses, overhead costs, stipends for students and postdoctoral researchers, and all other aspects of university research administration and management; and (3) salary and other operational expenses (primarily travel) that AK CSC federal staff receive separate from the hosting agreement or annual allocation (Table 1).

## Institutional Development

The Institutional Development program evaluation component measures the overall health of the CSC as an institution, with regard to planning processes (e.g., 5-year strategic plans, annual plans, advisory committees, and stakeholder engagement), management and operations (e.g., staffing, physical assets), finances (e.g., hosting agreement), and institutional coordination (e.g., between CSC-Federal and CSC-University, among other consortia members, and with other federal agencies (ACCCNRS 2015).

### *AK CSC Operational and Strategic Planning*

The AK CSC receives funding and oversight from NCCWSC, located at the USGS National Center in Reston, Virginia, as well as guidance for national science priorities as part of the USGS Climate and Land Use Change mission area (Burkett et al. 2013). The National Climate Change and Wildlife Science Center oversees the general operations of the AK CSC. The AK CSC federal director reports to NCCWSC and is responsible for the AK CSC's operations, including strategic decision making and administration of the center's financial resources. The AK CSC federal director is responsible for the development and preparation of

- The “Alaska Climate Science Center Strategic Plan”—a 5-year plan to outline the general direction of the center's science enterprise (AK CSC 2011),
- Annual science work plans—short-term (1–2 years) plans that provide specific guidance on coordination and implementation of science priorities, and
- Annual reports—joint AK CSC annual reports are developed by the AK CSC federal director and the AK CSC university director that address reporting requirements specified in the cooperative agreement as an obligation of the AK CSC university director.

The “Alaska Climate Science Center Strategic Plan” (2011–2016) was completed in October 2011 (AK CSC 2011). The plan defines the overall vision and major goals of the AK CSC and establishes seven

**Table 1.** Total Alaska Climate Science Center funding through the annual allocation to the federal component and the university consortium through the hosting agreement with the University of Alaska Fairbanks.

| Fiscal year | U.S. Geological Survey<br>allocation | Hosting agreement | Total        |
|-------------|--------------------------------------|-------------------|--------------|
| 2010        |                                      | \$1,306,021       |              |
| 2011        | \$1,707,000                          | \$1,320,381       | \$3,027,381  |
| 2012        | \$2,003,000                          | \$1,354,562       | \$3,357,562  |
| 2013        | \$1,704,000                          | \$1,359,420       | \$3,063,420  |
| 2014        | \$1,645,000                          | \$1,362,266       | \$3,007,266  |
| 2015        | \$1,645,000                          | \$1,362,266       | \$3,007,266  |
| Total       | \$6,901,300                          | \$8,064,916       | \$16,768,916 |

major science themes, each with a set of tasks, to serve as the framework for AK CSC research, collaboration, and cooperative activities; it also provides guidance on how the long-term goals can be converted into 1-year action plans (AK CSC 2011).

The vision of the AK CSC is to “improve the understanding of how Alaska’s ecosystems, natural resources, and cultural resources will respond to changing climate regimes, while supporting effective management, sustainable use, and sustainable communities” (AK CSC 2011).

The AK CSC has six strategic goals: (1) to support high-quality research projects and other scientific activities, both strategic and long term, identified through the partnership processes established by ACCER, LCCs, and NCCWSC; (2) to improve and quantify the capacity to downscale global climate models for climatic variables significant to predicting landscape-scale ecosystem response in northern latitudes; (3) to improve understanding of the relative vulnerability of key Alaska ecosystems and ecosystem services to the effects of climate variability and climate change; (4) to support interdisciplinary activities at regional and larger scales that are aimed at integrating physical climate models with ecological, habitat, and population response models; (5) to inform partnership-driven climate change adaptation actions by improving the capacity to forecast and respond to effects of change; and (6) to develop an information collection and sharing architecture consistent with DOI policies and the ACCER AlaskaData Integration effort (AK CSC 2011).

The strategic plan identifies seven science themes as the primary basis for operationalizing AK CSC strategic research, collaboration, and cooperative goals: (1) downscaling and application of global climate models and/or production of variables with significance to ecological forecasting, (2) conceptual model development for identification of key drivers and response variables, (3) terrestrial ecosystem vulnerability and response, (4) marine ecosystem vulnerability and response, (5) human community vulnerability and response, (6) development of advanced forecasting and modeling techniques, and (7) integrated scientific programs (AK CSC 2011).

The strategic plan also acknowledges that the AK CSC is significantly challenged by the lack of biophysical baseline data needed to assess trends in physical conditions and biological populations, combined with the lack of the infrastructure and capacity to conduct long-term, comprehensive monitoring projects, and therefore states that the science activities of the AK CSC need to be highly collaborative and leverage the capacities of federal and state member agencies, university partners, the five Alaska LCCs, and other key stakeholders (AK CSC 2011). The plan states that the initial focus of the AK CSC should be to work with partners to identify (1) critical gaps in the existing monitoring network as they relate to AK CSC scientific activities, and (2) activities aimed at facilitating the development of longer-term and sustainable monitoring programs to meet partner needs (AK CSC 2011).

The first 5-year AK CSC strategic plan was written to guide the center during its physical establishment and initial stages of operation. The plan described the center’s overall vision, strategic goals, science themes, key partnerships, research approaches, science challenges, and premises used to identify research efforts. The science themes identified were broad and reflected the paucity of data for the region, as well as the uncertainty associated with climate change. Furthermore, most of the science themes identified required a much greater time frame to address than the 5-year horizon of the plan. The strategic plan also presented a phased planning or operationalization approach that was initiated by the identification of broad priorities (i.e., ACCER role) and proceeded in a logical path through translation into 1-year action plans with review and comment provided by the C-4 group. In following through on this process, the AK CSC produced a detailed annual action plan for fiscal year 2012 that listed specific projects and funding to address key elements of the strategic plan and the emphasis areas from the C-4 group. The subsequent annual report for 2012–2013, while describing a diverse set of excellent projects and accomplishments, did not provide any mapping of work plan proposed projects to accomplishments. For the SRT, this meant that a strict evaluation of deliverables against objectives was challenging. Furthermore, AK CSC annual reports and other administrative reporting documents

were focused more on communication to the conservation community, the project accomplishments, and future efforts, with limited information on completion of strategic objectives, funding distribution, other funding contributions or match administrative structure of the AK CSC, and other details on the financial and administrative management of the AK CSC.

### *Recommendations for the AK CSC Strategic and Annual Plans*

- Future AK CSC strategic plans should have clearly defined objectives and deliverables and should be produced jointly with the CSC advisory body (ACCER), LCCs, and CSC-University, with clearly defined roles and responsibilities for each entity.
- Strategic planning should address issues of both the AK CSC and the CSC network. Network-level planning could provide guidance and resources for the implementation of actionable science (i.e., what it is, how to do it, and what is needed or expected in terms of staffing).
- The CSC-University, with inclusion of comparable material from all university partners or research entities, should provide a complete annual report that addresses all financial components and research findings of the CSC-University agreement. This includes the CSC-University funds leveraged into other projects, grants, and related activities, as well as any additional university contributions, such as indirect cost (IDC) recovery. Mapping of annual action plan proposed work with accomplishments is recommended.

### *Data Management and Integration*

Data management plans (DMPs) are required for all projects funded through the CSC-Federal component. Principle investigators (PIs) must submit a DMP to the AK CSC federal director prior to project initiation. Principal investigators are also required to share any related data, information, or supporting materials in accordance with the NCCWSC data policy. The AK CSC suggested that project and program management could be improved. The AK CSC did a fair job of tracking outcomes of research funded through the host university, but less so for graduate student projects.

### *Recommendations for Data Management and Integration*

- The SRT recommends clear requirements that all projects receiving AK CSC funds (projects from university base award and CSC science-funded directed RFP projects) be entered into the RFP Manager system so that data and products can be tracked in ScienceBase and proper crediting is possible.

### *AK CSC Stakeholder Engagement*

*AK CSC ACCER.*—The AK CSC federal director receives guidance on regional science priorities from ACCER, which serves as the advisory committee for the AK CSC (AK CSC 2011). The roundtable, established jointly by USFWS and USGS in 2007, comprises senior-level executives from both federal and state agencies in Alaska, including the U.S. National Park Service (NPS), BLM, U.S. Bureau of Indian Affairs, U.S. Forest Service (USFS), Alaska Department of Natural Resources (AKDNR), Alaska Department of Environmental Conservation (AKDEC), Alaska Department of Fish and Game, University of Alaska (UA), Alaska Ocean Observing System (AOOS), Minerals Management Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, USFWS, USGS, and NOAA. Native representation, through groups such as the Denali Commissions and the Alaska Native Tribal Health Consortium, has been added to ACCER recently as well. The mission of ACCER is “to promote collaborative efforts in advancing the knowledge of climate change as it relates to each member’s responsibilities in (1) promoting effective adaptation and mitigation strategies, and (2) resource management activities” (AK CSC 2011). The roundtable has three goals: (1) to identify climate change-related issues of common concern, (2) to facilitate collaborative action by combining resources, and (3) to ensure that efforts to address issues of common concern are complimentary and integrated (AK CSC 2011). In 2010,

### Stakeholder Engagement Example

The Climate, Conservation, and Community in Alaska and Northwest Canada Conference was co-hosted by the Alaska Conservation Science Center (AK CSC) and its five regional Landscape Conservation Cooperative (LCC) partners in November of 2014 in Anchorage, Alaska. The conference was a way for the AK CSC to facilitate engagement with its partners (decision makers and resource managers from throughout the five LCC regions). The overall goal of the workshop was to check in with the science user community to hear how the AK CSC products were being used and how the products could improve to better meet management needs. The program included plenary sessions, a poster session, parallel sessions, and innovative SWIRL panels and audience discussion sessions to provide not just one way, but two-way communication between the two groups. A total of 150 participants attended, with 75 being from LCC steering committees. The participants represented federal, state, and local agencies and governments; tribal groups; academia; and other parties interested in conservation and land management from Alaska and Canada. The workshop resulted in two important findings. First, participants agreed that the AK CSC–LCC network had produced a lot of decision-relevant scientific research in the first 5 years. However, the science users need the research to be synthesized and translated in the decision context managers operate within in order to be truly actionable science. Second, the science users are ready for the application of results to management actions, which requires continued knowledge coproduction within the science community. Participants stated that a potential role for the AK CSC is in translational climate services, meaning moving research results from funded projects beyond scientific results towards useful formats and information.

*Partners in the Climate Conservation and Community in Alaska and Northwest Canada Conference*

Alaska Climate Science Center

Aleutian and Bering Sea Islands Landscape Conservation Cooperative

Arctic Landscape Conservation Cooperative

International Arctic Research Center

North Pacific Landscape Conservation Cooperative

Northwest Boreal Landscape Conservation Cooperative

SNAP (Scenarios Network for Alaska + Arctic Planning)

University of Alaska Fairbanks

a charter formally established ACCER, as well as a second-tier committee, the C-4 (AK CSC). The C-4 membership is composed of ACCER member agency managers, science officers, or their equivalents with sufficient authority to represent their agency on a statewide policy level (AK CSC 2011).

The AK CSC strategic and annual plans outline three potential opportunities for ACCER and its C-4 committee to provide input and guidance to the AK CSC (AK CSC 2011):

1. Alaska Climate Science Center strategic plan. The Alaska Climate Change Executive Roundtable identifies broad priorities from within core ACCER/CSC mission areas.
2. Alaska Climate Science Center annual work plans. The C-4 committee works with the LCCs and the AK CSC federal director to refine the broad science priorities into specific questions or themes. The AK CSC federal director then translates questions and themes into an annual work plan.
3. The Alaska Climate Change Executive Roundtable provides a venue to review the AK CSC's yearly progress (AK CSC 2007).

The ACCER structure was developed, among other purposes, to prevent stakeholder fatigue due to the low number of stakeholders in Alaska. However, the ability or capacity of ACCER to provide guidance on the AK CSC strategic plan varies with leadership priorities. The Alaska Climate Change Executive Roundtable is currently co-chaired by the USGS regional director and the AKDEC commissioner.

*Role of the Alaska LCCs as CSC stakeholders.*—The AK CSC strategic plan states that specific activities in annual action plans should include input from meetings with the LCC coordinators to review broad research priorities, identify areas of common interest, and collaborate to leverage existing capabilities and avoid duplication of effort. The AK CSC relies heavily on collaborations with the LCCs, and the bulk of the AK CSC’s activities are intended to address LCC-related needs (AK CSC 2007).

Workshops sponsored by the AK CSC and LCCs provide a forum for science users (LCC community) and science producers (CSC community) to identify science needs and priorities in addition to places for synergy and strategies for future work. The data gathered at workshops will be used in the continuous development and refinement of the longer-term “Alaska Climate Science Center Strategic Plan” (AK CSC 2011).

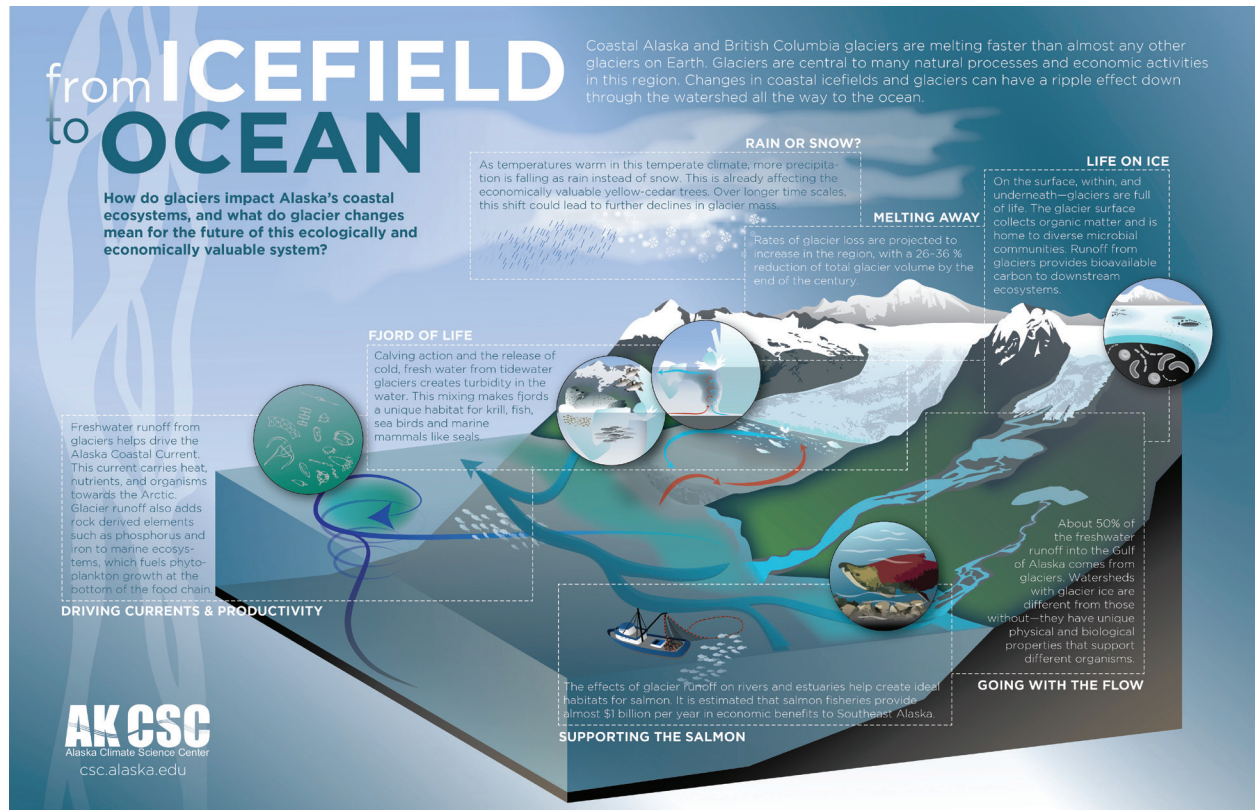
The Human Dimensions Research Unit roundtable discussions with partners in Anchorage revealed that the AK CSC has strong support from its LCC partners. These entities felt that the AK CSC was approachable for questions about science and that the AK CSC facilitated interactions among science producers and science users that were invaluable in identifying science needs and priorities. Workshops (e.g., “Alaska Climate Downscaling,” 2011; “From Icefield to Ocean,” 2013; “Climate, Conservation, and Community in Alaska and Northwest Canada,” 2014; “Data Storage, Harvesting and Dissemination,” 2015) were seen as important strengths at facilitating discussions and highly valued by partners.

Both the ACCER and the LCCs expressed concern about the lack of specific resource management decision support capability provided by the AK CSC. Similarly, the AK CSC noted that there was a challenge in obtaining specific statements of management needs from the partners. This was identified to be a result of multiple factors but was complicated by a diverse set of opinions, SRT perspectives, and sometimes conflicting information provided in various presentations and discussions with AK CSC partners. As a result, the SRT was unable to make a clear and definitive determination as to any singular cause and solution but accumulated several observations. First, the composition of the members of ACCER (primarily agency administrators) was such that they may be somewhat removed from on-the-ground, resource-management decision making and thus are unable to provide explicit guidance regarding the exact nature of management advice or decision support that is required. Second, the LCC steering committees, which include, among the five Alaskan LCCs, a much broader diversity of partners and generally represent agency staff at a level closer to on-the-ground decision making, were still potentially characterized as being limited in their ability to reflect specific resource management decision needs. The LCCs were also initially constrained by the lack of state agency involvement with their steering committees due to political decisions beyond the control of the LCCs or AK CSC. Third, it was posited that the state of climate science in Alaska, the magnitude of the geography, and the relatively limited instrumentation, mapping, and detailed understanding of the ecosystem responses to climate change are such that it would be inappropriate at this time to expect that the AK CSC should be positioned to provide specific resource management decision guidance. In fact, it was noted by AK CSC University Director Scott Rupp that no resource managers have approached the AK CSC for specific on-the-ground, resource-management decision guidance. However, requests for involvement at a detailed level of specificity may not be appropriate. Rather, the AK CSC is used to providing more general guidance as a source of information contributing to decision making and for other decision support purposes.

Regardless of some of the challenges noted above, the relationship between the AK CSC and the LCCs was noted by numerous partners as being of tremendous value. Several specific examples were mentioned on this topic. The LCCs and AK CSC, for example, created an informal northern latitudes discussion group that was characterized as resulting in advancement of complementary working rela-

## From Icefield to Ocean

One of the most engaging communications products of the Alaska Climate Science Center (AK CSC) is the poster describing the linkage between glacial melting and ocean impacts, as well as the many ecological processes and effects along that path.



Alaska Climate Science Center-funded scientists Shad O'Neel and Eran Hood and AK CSC Science Communications Lead Kristin Timm received the 2015 Eugene M. Shoemaker Communication Award from U.S. Geological Survey for their poster "From Icefield to Ocean."

The poster depicts the important linkages between glaciers and the ocean. The team felt that it was particularly important to find a compelling way to communicate these research findings to Alaskans because Alaska's coastal glaciers are among the most rapidly changing areas on the planet and glacier runoff can influence marine habitats, ocean currents, and economic activities.

tionships among the six entities. The Aleutian and Bering Sea Islands LCC stated that climate vulnerability assessments were an early critical need and that the partnership with the AK CSC was productive in addressing that need. It was widely acknowledged by participants in the HDRU science users' focus group, particularly by the LCC representatives, that the AK CSC acted as a critical go-to source for climate science information and access to other researchers. Others suggested that the ACCAP and NOAA's RISA program also provided such services and that some form of a climate knowledge exchange would be helpful but that the AK CSC did address key gaps in information. The funding partnership between the Western Alaska LCC and the AK CSC in development of the integrated ecosystem model (IEM) was particularly beneficial.

As the AK CSC, and the CSC network in general, and the LCCs build the relationships, processes, and tools for an actionable science approach (such as presented by ACCCNRS), as well as implementing components of a science coproduction model, the role of the LCCs will be critical. Clearly, there already exists a strong partnership between the LCCs and the AK CSC, and this will be a useful foundation for future collaboration.

### *Recommendations for AK CSC Stakeholder Engagement*

- The SRT recognizes the historic challenge of the LCCs in engaging state agency involvement and the consequent limitations that affect the LCC's relationship with the AK CSC. However, the SRT is encouraged that this is being addressed and the state is now a full partner in the LCCs. Full state involvement will strengthen the LCC and therefore improve the ability of the LCCs to provide advice and recommendations to the AK CSC. This should be encouraged to the greatest degree possible.
- The lack of specificity regarding climate-change-related resource management decision support needs is understandable given the paucity of data and instrumentation in Alaska. Furthermore, the SRT is encouraged by the multiple workshops and related events coordinated or supported by the AK CSC to bring together researchers and managers to identify key research needs. The SRT supports and encourages further development of regular processes (see Actionable Science section below and related discussion of coproduction) to further elucidate research needed to support resource management needs.
- We recommend that the next generation strategic plan for the AK CSC begin with a broad-based management needs assessment incorporating a larger body of stakeholders from tribes, the state of Alaska, and other decision makers in such a manner that it not be limited to current steering committees (e.g. ACCER, C-4) or the LCCs but should be more inclusive of indigenous groups, NGOs, and others.

### *AK CSC Hosting Agreement*

The cooperative agreement with UAF provides around US\$1.3 million per year. The majority of funding (77%) is spent on human capital (support staff, researchers, and faculty), followed by contractual services (7%), equipment (5%), student aid (5%), travel (3%), and commodities (3%). To date, \$1,764,054 of IDC recovery has been generated by the cooperative agreement: \$882,024 to central administration (50%), \$176,405 to IARC administration (10%), and \$705,621 to the AK CSC (40%). Approximately \$775,000 has been reinvested directly into AK CSC operations. In particular, UAF has strategically utilized the cooperative agreement to further build its capacity, particularly human capacity, through the reinvestment of IDC recovery returns (40%) to the IARC. The University of Alaska Fairbanks has applied this funding in a variety of ways:

- Graduate student research awards
- Computing equipment
- Program coordinator salary
- International internship fees and fellowships
- Alaska Climate Science Center office lease costs
- Graduate student and postdoctoral training and travel
- Science meeting and workshop costs (e.g., "Climate, Conservation, and Community in Alaska and Northwest Canada")
- U.S. Department of State Peer-to-Peer program

This funding has allowed the AK CSC flexibility in responding to opportunities and tasks that would have been challenging or impossible if a federal entity like USGS was acting alone.

It was also recognized by the SRT that the current strong working relationship between the host university and AK CSC federal staff is built upon a strong and mutually positive working relationship among the AK CSC co-directors (USGS and UAF). With inevitability of personnel changes over time, this strong rela-

tionship could suffer and the AK CSC could be diminished as a result. Currently, there exists in the host-university agreement no statements of joint mutual interests or other agreement language that memorializes the characteristics of an effective partnership. Such an agreement could address the challenges of the different cultural drivers of the two partner institutions and their staff, as well as the strong benefits derived from a partnership that brings potentially highly complementary assets to the table.

### *Recommendations for AK CSC Hosting Agreement*

- Revise the hosting agreement so that additional funds can be transferred by USGS (i.e., raise fund ceiling), as needed, to respond rapidly to new directives or unexpected opportunities, similar to their agreement with NOAA's RISA program. The current cumbersome administrative process of redirecting funds to address important research needs through partners was found to be a serious obstacle to effective collaboration.
- Revise the hosting agreement to ease the transfer of funds from the AK CSC to non-DOI partners, such as AOOS/NOAA.
- Establish a statement of shared values and mutual intent—constructed to be foundational to a positive working relationship and recognize the unique interests, values, capabilities, resources, and limitations of each party while providing for a recognition and adherence to a set of common goals and relationship expectations—fully endorsed by the CSC-University and the CSC-Federal partners.

### *AK CSC Institutional Coordination*

*USGS and university host.*—The AK CSC received strong support from UAF. The upper administration supports and embraces the overall concept and housing of the AK CSC on campus. This placement provides the AK CSC with access to a broad, integrated group of experts in climate science, ecology, environmental impacts assessment, modeling, cultural impacts, and advanced information technology. Recognized as a world leader and international collaborator in arctic research, UAF hosts a strong suite of climate- and environmental-based research groups, both in terms of the number and the quality of science and international reputation (e.g., SNAP, ACCAP, CIFAR, AFSC, IARC, Water and Environmental Research Center [WERC], and CGC). The AK CSC is viewed by UAF's leadership and research community as an integral part of this larger, systemwide effort aimed at adapting to climate change in the Arctic, with the AK CSC complementing and expanding other research efforts. In 2012, to further increase science capacity and coordination of research groups, UAF strategically relocated the AK CSC, SNAP, ACCAP, CIFAR, and AFSC within the same building in the IARC. Additionally, the CGC at UAF has awarded student research grants in conjunction with the AK CSC.

A strong culture of collaboration and knowledge sharing exists in Alaska and UAF. This culture can be partially attributed to the massive size of Alaska, as well as its geographic remoteness and isolation, which contributes to an extremely high cost of living and doing research. In addition, a paucity of data exists on understanding even the basic science of many Alaskan ecosystems. With so many hurdles to face, in regards to knowledge gaps and research capacity, scientists in Alaska have had to rely on each other in order to move science forward.

The CSC model (federal–university partnership) has fostered research groups working together by enabling multiple sources of funds, not just base or science dollars, to be leveraged and brought to bear on science needs, which has led to progress in the foundational needs of climate research in Alaska.

The USGS–UAF partnership has benefited both the university and the federal side. The science capacity of USGS has increased through access to UAF resources (e.g., high-speed computational capacity [downscaling, modeling, and spatial analysis], equipment [ground-penetrating radar {GPR}], and science expertise, especially social sciences, communication, and downscaling. For example, the development and application of an integrated ecosystem model project for Alaska led by the USGS AK CFWRU depended on the high-performance computing system of UAF's SNAP, purchased with IDC funds, to run

model simulations. Indirect cost funds also purchased a GPR to improve the efficiency in glacier research. The system has been used extensively and collaboratively among individuals at UAF, the Alaska Division of Geological and Geophysical Surveys, and USGS to study glaciers, winter fish habitats, permafrost conditions, and snow accumulation over tundra and glaciers.

The U.S. Geological Survey also has benefitted from the purchasing flexibility of a nonfederal entity (e.g., IDC purchased the GPR). The benefit of USGS to UAF is access to stakeholders in order to shape broader understanding of management needs and bring these needs into university researcher research programs, as well as access to USGS resources (e.g., helicopter flight time) and science expertise, including long-term data sets (e.g., the USGS Glacier Benchmark Monitoring Program).

*With other universities, federal agencies, and tribal organizations.*—The AK CSC routinely collaborated and leveraged resources, including data and equipment, with other universities (e.g., Oregon State University, University of Texas, University of British Columbia, and University of Notre Dame), federal agencies (e.g., USFS, NPS, USFWS, NOAA, BLM, NWS, USGS science centers, national wildlife refuges, and National Snow and Ice Data Center), and tribal organizations (e.g., Columbia River Inter-Tribal Fish Commission, Chugachmiut Tribal Consortium, Chilkoot Indian Association, and Quartz Valley Indian Reservation). During the science users' dialogue, one participant noted that the AK CSC and the work of AK CSC Federal Director Stephen Gray helped immensely in improving science coordination work between the USFS and DOI agencies. In particular, vulnerability assessment work in the Tongass and Chugach National Forests were identified as critical projects that addressed key information needs. A second participant described how the AK CSC partnership contributed significantly to the work of AOOS. In general, the focus group participants described the AK CSC as characterized by a strong collaborative spirit, collegiality, and commitment to data sharing.

Of the 21 projects funded by the AK CSC, five PIs were from UAF; five PIs were from other UA universities; one PI was from outside the UA system; four tribal entities served as PIs; and 12 PIs were from other federal agencies, including the USGS Volcano Science Center (1), USGS Alaska Science Center (6), USGS AK CFWRU (3), USGS Branch of Regional Research, Central Region (1), and NOAA National Center for Environmental Prediction (1). Furthermore, federal agencies, including ACCAP (a NOAA RISA program), USFS, and USGS science centers, help fund AK CSC postdoctoral fellows, as well as the Long Term Ecological Research Network created by the National Science Foundation. The diversity of research partners on these projects exemplifies the open, collaborative nature of the AK CSC research program and was seen as a strong attribute by the SRT and AK CSC partners.

The AK CSC also provided input and support for the National Climate Assessment for the Alaska region. Alaska Climate Science Center co-directors authored portions of the technical input while partner scientists contributed in other ways. The AK CSC also provided scientific expertise for the arctic theme in the U.S. Climate Resilience Toolkit. The Melting Glaciers, Snow, and Ice section includes information from the "Icefield to Ocean" research project. Alaska Climate Science Center scientists also contributed input on the ways changing ice impacts physical, biological, and social systems in Alaska.

The AK CSC, along with the network of CSCs and NCCWSC, is administratively located within the Climate and Land Use Change mission area of USGS. Thus, they are outside of the typical regionalized science structure of USGS. This is somewhat ameliorated in the AK CSC by the federal component of the AK CSC located in close proximity to the USGS Alaska Science Center in Anchorage. Despite that juxtaposition, it was noted that there has yet to be a level of integration that is desired. Initially, it was anticipated that USGS research scientists would participate in the AK CSC through submission of proposals in response to AK CSC RFPs. Unfortunately, initial RFPs were tightly constructed to address narrow science needs, which resulted in limited engagement. When more-open RFPs were provided, proposals were often submitted that were not relevant to AK CSC needs. Future efforts are planned that will better engage USGS researchers in strategic discussions about research needs.

*With other CSCs.*—The AK CSC and the NW CSC have collaborated on and co-funded four projects together: (1) A Coupled (Ocean and Freshwater) Assessment of Climate Change Impacts on Pacific Lamprey and Pacific Eulachon, (2) Berry Risk Mapping and Modeling of Native and Exotic Defoliators in Alaska, (3) Identifying Climate Vulnerabilities and Prioritizing Adaptation Strategies for Eulachon Populations in the Chilkoot and Chilkat Rivers and the Application of Location Monitoring Systems, and (4) Klamath Basin Traditional Ecological Knowledge and Climate Change Science Internship. While this relationship has provided valuable collaborative research, it was noted by several participants that there is little sense of overall national climate research needs and how the individual CSCs contribute to larger regional or national efforts. Addressing such a need, however, risks the diminishment of resources on priority local needs. A thoughtful and balanced approach is needed to ensure that local, regional, and national needs are addressed in a timely and efficient manner.

*Summary comments.*—The SRT was impressed by the general characterization of the value of the AK CSC to the climate research and resource management community. Four key themes emerged from the two focus group discussions:

1. There is a significant but yet insufficient amount of climate work in Alaska, and the projected impacts of climate change are of great ecological and human concern. The AK CSC was a timely addition to the group of agency programs focused on this issue and has provided needed and visionary additional capacity.
2. Alaska Climate Science Center management, as seen by partners, has been effective and efficient.
3. The AK CSC does work that is challenging and needed in a collaborative manner
4. Projects by the AK CSC have been characterized by a high degree of leveraging. They have addressed important funding gaps and tend to amplify and enhance ongoing work.

### ***Recommendations for AK CSC Institutional Coordination***

The AK CSC is to be commended for its substantial degree of collaboration and effective partnerships. Yet, there were several areas of administrative and programmatic coordination and integration identified where further attention would be beneficial.

- Continued effort to better engage a larger group of USGS scientists would benefit all parties. This can be partially addressed by means of more effective communication of AK CSC activities throughout the USGS science community. Other activities may include greater inclusion of USGS scientists in the new round of AK CSC strategic planning or related activities. Another approach suggested by panelists was the establishment of interdisciplinary USGS teams targeted at identified AK CSC climate science needs to develop proposals for funding.
- Expanded partnerships through additional adjunct and affiliate positions at University of Alaska Anchorage or UAF for USGS (Alaska Science Center) scientists should be explored. Clearly university rules will dictate the options available, but there is a solid history of USGS and other federal agencies developing jointly beneficial mechanisms for greater engagement of federal researchers within the university environment.
- As the level of climate research activity expands in Alaska, there was expressed a need to build more effective systems to share knowledge and experiences. Some form of climate knowledge hub for Alaska was an approach suggested by participants in the panels, but there was no concept design or proposal made available. Components of this are currently addressed by various existing entities, including the AK CSC, but additional design considerations would need attention.
- Clearly, engaging graduate students in science coproduction processes and methodology will result in students with a greater recognition of resource management needs and final theses or dissertation products that are more attuned to management decision requirements.

## Actionable Science

The 2015 ACCCNRS report has provided useful guidance on critical emphasis areas for the CSCs and NCCWSC, particularly so for the concept of actionable science as they continue to evolve programmatically and as a network. The SRT also fully recognizes that the AK CSC has been in operation since 2010 and consequently that strategic and operational plans were in place well before the ACCCNRS report was published. Therefore, the AK CSC's performance cannot be evaluated against criteria published in 2015 that was neither part of its original hosting agreement nor defined as a specific output or performance measure of the CSCs. Yet, the issue of actionable science or various elements of actionable science, although rarely characterized during the review by panelists or presenters using that terminology, was frequently raised and discussed during the review process.

As defined by ACCCNRS, the actionable science program evaluation component measures the performance of the CSC in providing relevant and useful scientific products and services, with an emphasis on the relevance (support for stakeholder, regional, and national priorities; geographic scope of science priorities), quality (peer-reviewed publications, adherence to standards), processes (coproduction of science, RFP processes, data management), accessibility (online accessibility of products and resources, tailored communication), and impact of research and science products and services carried out directly by the CSC and through its external grant funding (ACCCNRS 2015).

A working definition of actionable science used by ACCCNRS follows:

Actionable science provides data, analyses, projections, or tools that can support decisions regarding the management of the risks and impacts of climate change. It is ideally coproduced by scientists and decision makers and creates rigorous and accessible products to meet the needs of stakeholders.

Furthermore, the ACCCNRS report provided five guiding principles for coproducing actionable science:

1. Actionable science is most reliably coproduced by scientists and decision makers or resource managers working in concert. For some projects or programs, other stakeholders and funders may also be engaged.
2. Start with a decision that needs to be made. The research needs, which are rarely known (and almost never clearly specified) in advance, must be identified collaboratively and iteratively.
3. Give priority to processes and outcomes over stand-alone products.
4. Build connections across disciplines and organizations and among scientists, decision makers, and other stakeholders.
5. Evaluate coproduction products, processes, and the actionability of the science.

Indeed, many of the components of actionable science are already in place and have been a part of the core operations of the AK CSC since its inception. For example, the relationship between the AK CSC and the five LCCs was intended to provide direct linkage to resource managers and decision needs and provide a forum for interaction among researchers and the management community. Ideally, the LCCs, through their steering committees, would be a key source of information on critical natural resources decisions for which AK CSC science needs would be identified. The LCC steering committees collectively comprise a far more diverse set of partners who generally represent a more on-the-ground knowledge of resource management needs. That ideal, however, has yet to be fully realized due to a variety of factors, including LCC staff limitations and the aforementioned challenges of resource management in Alaska where fundamental information on resource status and accurate models for management decision modeling are lacking in many areas. As a result, the LCCs have built a series of research needs statements, but they are often generalized and therefore are insufficient to guide specific research. Furthermore, the state of Alaska was not, at least in the initial years of the LCCs, a full and effective partner in the LCCs. This has resulted in a key voice representing natural resources management not being as engaged as would be needed for full science co-development.

With these limitations in mind, there have been a number of very positive efforts to bring together resource managers and researchers to identify and address needs. For example, the workshop on glacier and ocean interactions was critical because it brought land managers into the discussion to describe information needs. National Park Service Inventory and Monitoring Program staff collect data that are useful to research scientists and awareness and access to this data was not known prior to this workshop. In another example, a climate model downscaling workshop, which included Aleutian and Bering Sea Islands LCC involvement, identified wind (e.g., coastal storms) as a key driver in models that was not previously recognized. Thus, although specific resource management decisions were not identified, key process or information sharing results were accomplished that would not have been realized without the specific linkage of management-knowledgeable personnel with researchers.

The Advisory Committee on Climate Change and Natural Resource Science, NCCWSC, and the CSCs and their partners are still trying to understand the full extent and methods to implement an actionable science model. Clearly, there appears to be a strong commitment by the AK CSC partners to the production of research-based information that enables decision makers and other stakeholders to understand and frame climate adaptation decisions and assess how well potential adaptation actions address stakeholder objectives. The Human Dimensions Research Unit survey found strong (more than 90% of respondents) support for science coproduction among both science users and producers. Actual experience with coproduction, though, was greater among the research community than the science user (e.g. resource management) community. Nonetheless, there appears to be a substantial willingness for further engagement in coproduction activities.

### *Recommendations on Actionable Science*

- The AK CSC, other CSCs, and NCCWSC should commit time and resources to fully assess the implementation of an actionable science approach within the construct of the CSCs. Clearly, this is not a simple challenge, nor should it be viewed as the sole responsibility of the CSCs. For actionable science to be even viable, it must be embraced by the partners and include a willingness by them to concurrently invest resources into the understanding and implementation of the approach.
- Alaska Climate Science Center federal staff devote significant time and resources to partnership building and coordination. In fact, over the life of the center, AK CSC federal staff have allocated a far greater percentage of their effort to fostering such collaborations than to any other aspect of AK CSC operations. However, engagement activities by AK CSC federal staff often take place in isolation from AK CSC university-led work that tends to focus on foundational research (e.g., dynamical downscaling) and training of fellows. The results likely include missed opportunities for cooperation that more fully bring together both federal and university resources. Similarly, the efforts of AK CSC federal staff have concentrated on LCCs at the expense of connections to a wider swath of the natural resource management and decision-making community. As such, the AK CSC should consider strategies for partnership building that better incorporate the strengths and capacities of UAF while also promoting joint USGS–university efforts to broaden the AK CSC’s stakeholder base. Furthermore, the AK CSC, the CSC network, and NCCWSC should consider building expert capacity in partnership engagement in order to build a community of practice and models of best practices in order to ensure that critical partnership bodies are well structured and effective and efficiently managed.

### *AK CSC Communications*

The AK CSC does not have a specific communication plan. However, in the one-paragraph Education and Outreach section of the AK CSC strategic plan, it is stated that each project is required to disseminate research findings and other information generated by the AK CSC’s science program to various groups and individuals. “These efforts may be general in nature, such as the use of Web sites or other broadly distributed media, or they may be specific and targeted, such as presentations in stakeholder meetings” (AK CSC 2011).

The AK CSC communicates about science products and services through a variety of channels. Not all of these products were discussed in the on-site review. While the SRT appreciates the communication efforts of the AK CSC, especially given staffing capacity, the SRT believes that there are needs and opportunities for additional efforts and a reorientation of existing efforts. The SRT found that much of the annual report content was oriented toward plan for projects with little included on findings. During the review, the SRT saw presentations on a number of findings where there were opportunities for constructing very relevant materials for stakeholder consumption. This includes topics like permafrost findings and prospects, downscaled climate scenarios as they show implications for Alaska regions and management actions, and perhaps more on glaciers, ice, river flows. Other topics could also be listed.

Reports, workshops, and papers could be grouped by findings and activities addressing major project goals. The SRT also thought that accountability mandates the production of multiple forms of annual reports, one of which addresses the science findings and selected details on projects underway as they contribute to basic project directions and aspirations.

While the listing of journal articles is admirable from a scientific basis, it does not provide information to less-technical personnel on the significance of the findings. Reports and the CSC-University Web page (<https://csc.alaska.edu>) should have nontechnical abstracts explaining research findings and significance and relevance of the work. Popular short communication pieces should translate findings to stakeholder information.

### *Importance of Conveying Uncertainty*

The SRT felt that an area of climate science that could be given more attention is uncertainty in results, both to guide future research and to communicate confidence to users, and that perhaps efforts on spatially explicit modeling could be reduced (at least for some objectives). Decision making and adaptation relies on the best available information; however, it is likely that most users do not understand the nuances of the modeling done by the AK CSC and therefore have little idea of the sensitivity and uncertainty associated with model results. Examples of recommendations about reporting relevant uncertainty include sensitivity of IEM results to CO<sub>2</sub> levels, spin-up conditions, and inputs such as climate projections, and IEM (e.g., fire regimes, carbon stocks and fluxes, vegetation and permafrost distribution) and dynamical downscaling accuracy relative to (ideally independent) observations.

### *Recommendations for AK CSC Communications*

- The SRT recommends the development of a strategic and operational communications plan after the new strategic plan is completed. The communications plan should identify key audiences and the most effective communications approaches for those audiences in order to increase access to and understanding of climate-related science and data. The plan should include how to embed communications resources at all stages of a research project and also include guidelines for the appropriate attribution of credit and disposition of research products.
- The need exists at the AK CSC for more regular outreach to partners, for example, quarterly or annually newsletters that summarize AK CSC research and key accomplishments in climate change research.
- Develop more effective joint communication, branding of AK CSC information, and other products of the AK CSC enterprise.
- There is a need for more communication, coordination, and collaboration among individual CSCs within communities of practice related to downscaling; integrated models; decision analysis for reserve design; back-end communication (translation; data services; extension (how to make use of models and data)).
- The University of Alaska Fairbanks has the potential to play a larger role in technology transfer and extension, as well as data services and information transfer. The University of Alaska Fairbanks' in-

volvement in development of the AK CSC communication plan and access to UAF communications capacity are strongly recommended.

- The AK CSC needs to further develop Web capability to access data (data services); this is especially true for accessing downscaled data variables.
- Data and model construction and summaries should include appropriate measures and expressions of uncertainty (such as with measures of variance, confidence intervals, etc.), and how error and uncertainty compound and propagate in the various models. Further, we recommend that formal sensitivity analyses be conducted on the models so as to identify the degree of uncertainty in variables and functions. Such information is vital for use in climate risk assessments. This will allow the AK CSC to communicate such analyses of uncertainty, error, and sensitivity in clear terms to advise managers and decision makers in a risk management context, particularly in a framework for use in structured decision making.

## Capacity Building

The capacity building program evaluation component explores how well the CSC is building capacity for conducting and applying actionable science, with an emphasis on formal training (e.g., graduate students and postdoctoral fellows) and providing training and capacity building to the broader partner/stakeholder community (e.g., webinars, workshops) in how to use and apply climate science and services (ACCCNRS 2015).

### *Training the Next Generation of Scientists and Managers*

The AK CSC has been productive in terms of training and involving undergraduate and graduate students, postdoctorates, and early career professionals. The University of Alaska Fairbanks clearly has the lead on this activity and has been able to apply this commitment of training to the mission of the AK CSC. The AK CSC has provided support to 8 postdoctoral fellows (5 partial supported), 9 doctoral students (4 partial supported), 11 master's students (5 partial supported), and 4 undergraduate students. The research from these groups has been grounded in stakeholder needs and priorities and was not just curiosity driven. Every research project funded by the AK CSC has supported at least one or more science themes from the strategic plan. One graduate fellow, working with a research team, created a set of 13 Alaska climate divisions and associated data needed for seasonal climate prediction and monitoring (theme 6). These divisions were accepted for use by the NOAA National Climatic Data Center and integrated into the center's Web site, and they provide a successful example of transforming scientific research into a practical application. Additionally, students mentored by affiliated faculty, but not AK CSC-funded, have also contributed valuable time and expertise to the AK CSC. For example, a paleoecologist visited UAF from the University of Illinois during the fall 2012 semester to interact with the Tundra Fire and Treeline subgroup to learn how to use the Dynamic Vegetation, Dynamic Organic Soil, Terrestrial Ecosystem Model (DVM-DOS-TEM) to model the effects of fire on carbon storage in Alaska during the Holocene. During the interviews by the HDRU, partners stated that they found the graduate program a great use of host and science funding to support climate data and analysis. University of Alaska Fairbanks' leadership also viewed the CSC-University research as a key asset in their university portfolio to understanding and responding to climate change.

The AK CSC has also sponsored a wide range of activities to foster interactions among early career scientists, graduate and undergraduate students, scientists, educators, and other leaders in climate research, as well as stakeholders and resources managers, including the Girls on Ice program, IARC Summer School: Climate System Modeling, Downscaling Techniques and Practical Applications (2012), American Geophysical Union Fall Conference (2013), AK CSC Early Career Scientist Gathering (2013), Northern Research Basins Symposium and Workshop "Water Resources: Developments in a Changing Environment," Early Career Mentoring Lunch, and Climate, Conservation, and Community in Alaska and Northwest Canada (2014).

### Girls on Ice Program



In 2012, the Alaska Climate Science Center sponsored the Girls on Ice program (<http://girlsonice.org/alaska/>), where a team of high school girls from Alaska and the Pacific Northwest and four instructors explored the Gulkana Glacier in Interior Alaska for 8 days. During this time, the girls hiked, camped, and lived on the glacier, participating in daily science lessons, mountaineering excursions, and art activities. In small groups, the girls designed and implemented their own science experiments. The Girls on Ice program is free for participants. The program enables young women who may not otherwise have such an opportunity—whether it is due to socioeconomic status or being a member of a group underrepresented in the sciences—to become engaged in research and the sciences.

Support from the Alaska Climate Science Center was leveraged to update mountaineering equipment and educational resources, cover some logistical costs, and provide training for the all-female team of expedition leaders. Girls on Ice continues to inspire the next generation of self-confident advocates for science and the environment.

However, several challenges were identified that have limited or created obstacles for more effective graduate programs. Most significant is the timing and longevity of funding for research projects based on graduate researchers. The timing of research funds and graduate student cycling are out of sync and the obvious challenges with the recompetition of the AK CSC host institution have led to funding uncertainty. Both of these issues have led to hesitancy in bringing on new graduate students.

### *Partner/Stakeholder Capacity Building*

To build capacity among decision makers and other stakeholders in the coproduction and appropriate use of climate science products and services, the AK CSC has held several webinars and workshops on how

to use and apply climate science and services, including Data Storage, Harvesting and Dissemination Workshop, Alaska Climate Downscaling Workshop, How Can We Use Climate Science to Answer Land Management Questions?, Climate Scenarios and Vulnerabilities in the Aleutian and Bering Sea Islands, Fire Management, Fire Science, and Climate Change: Where Do We Go From Here?, and From Icefield to Ocean: Impacts of Glacier Change in Alaska.

### *Recommendations for Capacity Building*

- Explore solutions to address the mismatch between timing and longevity of USGS funding and that of the university and graduate student needs, with the former shorter term, and often seasonally out of synchrony, than needed by students.
- Continue efforts to engage decision makers and stakeholders with regularly, publically accessible webinars on AK CSC research that is targeted towards specific audiences.
- Expand the hosting of Web-based seminars to facilitate interactions between consortium member institutions and provide outreach opportunities to the greater AK CSC region, including the public.
- Explore the utilization of the Structured Decision Making framework and associated skill development to assist in identifying and refining research questions and as a set of capacity building skills useful for students and partners.

## **Partnerships**

The partnerships program evaluation component measures how well the CSC is working with partners beyond the core staff and researcher associated with the AK CSC. This includes a wide spectrum of realized or potential climate change and natural resource researchers and the vast array of potential users of climate science with federal, state, and local governmental resource management agencies, as well as tribes, nonprofits, and others. This component of the review emphasizes breadth and scope of engagements (geographic and institutional reach, multi-institutional collaboration), leverage (financial and in-kind), and partnerships outcomes. Some of these issues have been previously addressed. This particular section focuses on the work of the HDRU and the survey of science users and producers. A full report of the HDRU's work is available from NCCWSC. The material presented below are only those results relevant to the AK CSC.

### *Respondents*

Response rate to the Web-based survey was 42% ( $n = 90$ ) for the AK CSC. Respondents who reported that their work does not at all involve climate adaptation science, or management or policy related to climate change adaptation, were excluded from our analysis as were those who reported that they had never heard of the AK CSC. *Please note that in the discussion below, all respondents did not answer all questions. Therefore, the response numbers and rates are not equivalent for all questions.*

Forty-eight percent ( $n = 38$ ) 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. Thirty-nine percent ( $n = 29$ ) reported that they have produced climate adaptation science through an affiliation with the AK CSC while 22% ( $n = 16$ ) have produced climate adaptation science but never with such an affiliation. We refer to both of these groups as science producers (61%;  $n = 45$ ). Sixteen of the respondents (20%) were both science users and producers.

Most respondents (89%;  $n = 64$ ) worked in Alaska. Fifteen percent worked in other states and Canadian provinces all or part of the time, including California, Hawaii, Oregon, Washington, British Columbia, Yukon Territory, and the Northwest Territories.

Most respondents (74%;  $n = 53$ ) worked at the scale of a state for some or all of their work while 58% ( $n = 42$ ) worked at the regional/multistate scale and 49% ( $n = 35$ ) at the watershed scale. A smaller per-

centage conducted all or some of their work at the local (43%;  $n = 31$ ), international (40%;  $n = 29$ ), and/or national scales (39%;  $n = 28$ ).

A majority of respondents were affiliated with federal agencies (58%;  $n = 42$ ), followed by universities (31%;  $n = 22$ ). A handful of respondents were affiliated with nonprofit organizations (11%;  $n = 8$ ), state agencies (6%;  $n = 4$ ), local governments (1%;  $n = 1$ ), tribal governments (1%;  $n = 1$ ), or provincial governments (3%,  $n = 2$ ).

Almost half of respondents (46%;  $n = 34$ ) held research positions in their agency or organization while about a quarter (26%;  $n = 19$ ) held leadership/administration positions. Few held policy (5%;  $n = 4$ ) or operations (12%;  $n = 9$ ) positions. Eight respondents wrote in a variety of other types of positions, including education, software engineer, program manager, and partnership coordinator. See Appendix B for tables of results for all survey items.

*Nonrespondent telephone survey.*—A short (5 minute) telephone survey of nonrespondents to the Web-based survey was conducted by the Cornell University Survey Research Institute from May 13 to 20, 2016. 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. The survey was implemented. Twenty-six nonrespondents from the AK CSC completed the questionnaire.

*Nonresponse analysis.*—Results in this report are based on respondents to the Web-based survey, but these respondents differed in some ways from the Web-survey nonrespondents, who were reached subsequently through the phone survey. Respondents and nonrespondents did not differ in the extent to which their work involves climate adaptation science, management, or policy, nor did they differ considerably in their thinking about whether climate change is a threat and the urgency of taking policy action. A greater proportion of respondents had at least some involvement with the AK CSC and perceived it to be beneficial, as we might expect. Yet, the number of years for those involved was the same for respondents and nonrespondents. The relative proportion of natural resource decision makers was considerably less for respondents than nonrespondents, perhaps because the pool of decision makers that we sampled included more individuals with less direct involvement with the AK CSC. Respondents included a greater proportion of individuals from federal agencies and universities.

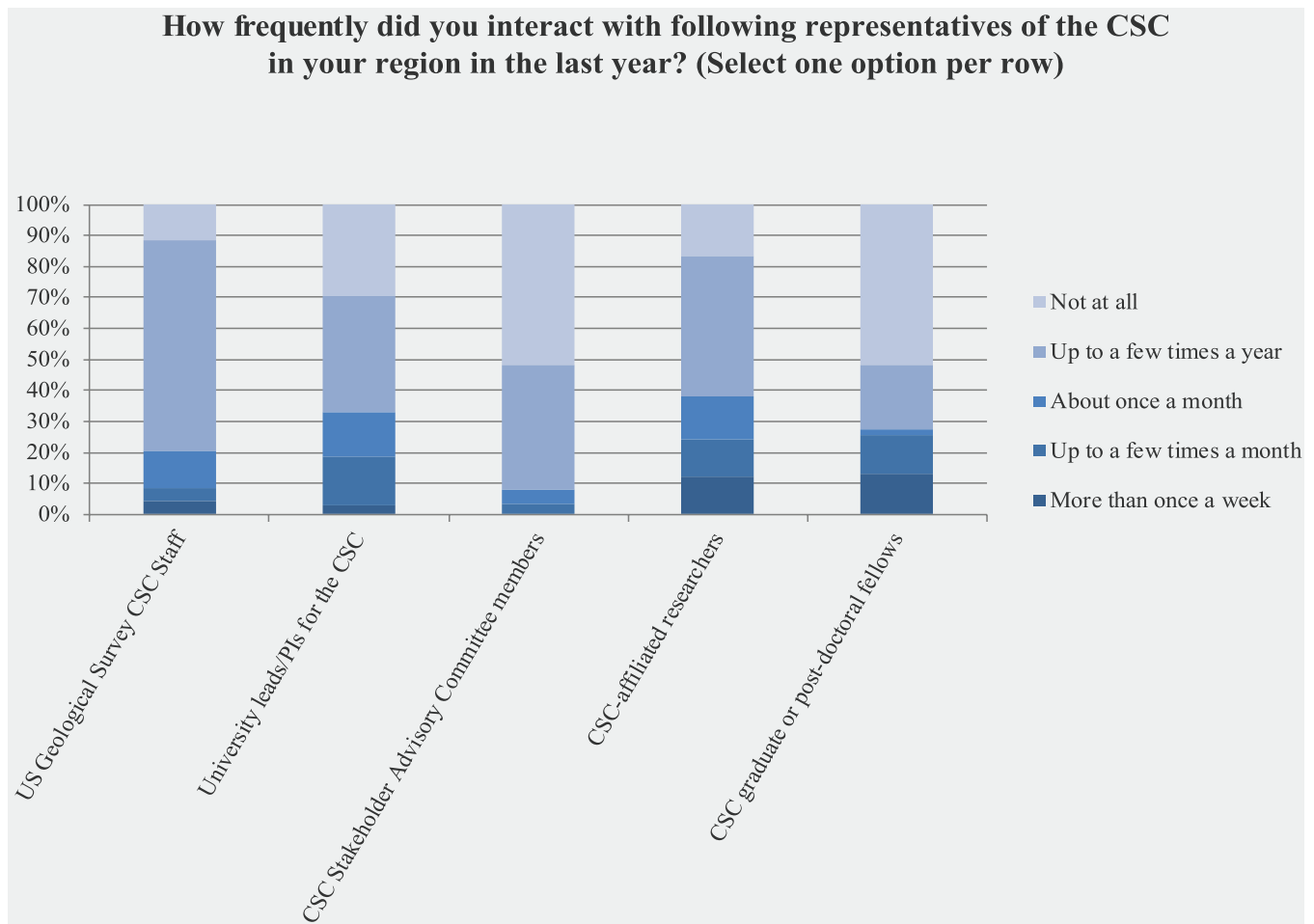
### *Extent of Involvement with the AK CSC*

Most respondents (84%;  $n = 70$ ) reported that they have had at least some interest in or involvement with the AK CSC. Just 13% ( $n = 11$ ) reported that they had no involvement but that someone else in their agency or organization did, and another 1% ( $n = 1$ ) had no interest or involvement at all. A very small percentage (1%;  $n = 1$ ) of the respondents had never heard of the AK CSC and were not included in additional analysis.

Respondents reported involvement with the AK CSC in a variety of ways. Most common (33%;  $n = 23$ ) was involvement as a resource manager or decision maker who has used the science produced by the AK CSC. Participating in a AK CSC training, webinar, workshop, or conference (29%;  $n = 20$ ) or as a AK CSC grant recipient, applicant, or partner (20%;  $n = 14$ ) or as a university member affiliated with the AK CSC (17%;  $n = 12$ ) was also relatively common.

Only 13% ( $n = 9$ ) were AK CSC-funded graduate students or postdoctoral fellows, and 4% ( $n = 3$ ) were AK CSC federal staff. Only a single (1%) AK CSC SAC member (ACCER) responded to the survey. Additionally, a high proportion (62%;  $n = 43$ ) reported that they were LCC Steering Committee members, and 4% ( $n = 3$ ) reported that they were LCC staff members. On average, respondents have been involved with the AK CSC for 3.7 years.

The respondents reported on their frequency of interaction with five types of AK CSC representatives (Figure 4). For their interactions with three of the types (AK CSC federal staff, university leads/PIs for the AK CSC, and AK CSC-affiliated researchers), the modal response was “up to a few times a year.” For their interactions with AK CSC graduate or postdoctoral fellows, the modal level of interaction was low-

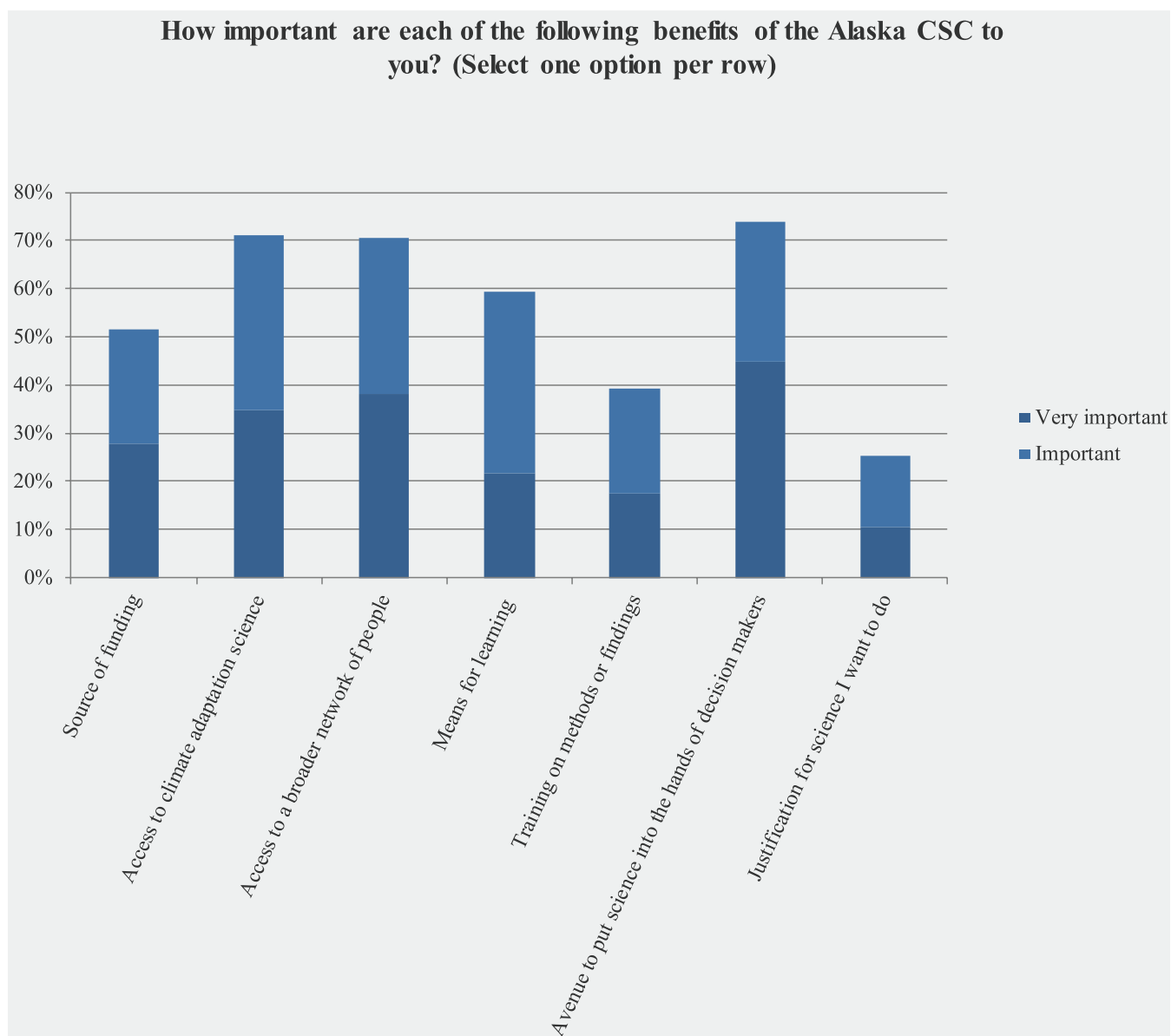


**Figure 4.** Responses to the HDRU partnership survey regarding interaction with AK CSC staff. It should be noted that SAC members are not representative of the AK CSC, but rather reflect an interaction between a survey respondent and a person who, by nature of being an SAC member, would be expected to have substantial knowledge of the AK CSC and can provide input into the strategic direction of the AK CSC.

er: 52% of respondents interacted with them not at all, and 21% interacted with them up to a few times a year. The level of interaction respondents had with AK CSC federal staff was higher than with university leads/PIs. Thirty percent (30%) of respondents had had no interaction with the university leads/PIs in the past year. It should be noted that SAC (i.e., ACCER) members are not representative of the AK CSC, but rather reflect an interaction between a survey respondent and a person who, by nature of being an SAC member, would be expected to have substantial knowledge of the AK CSC and can provide input into the strategic direction of the AK CSC.

### ***Benefits of Involvement***

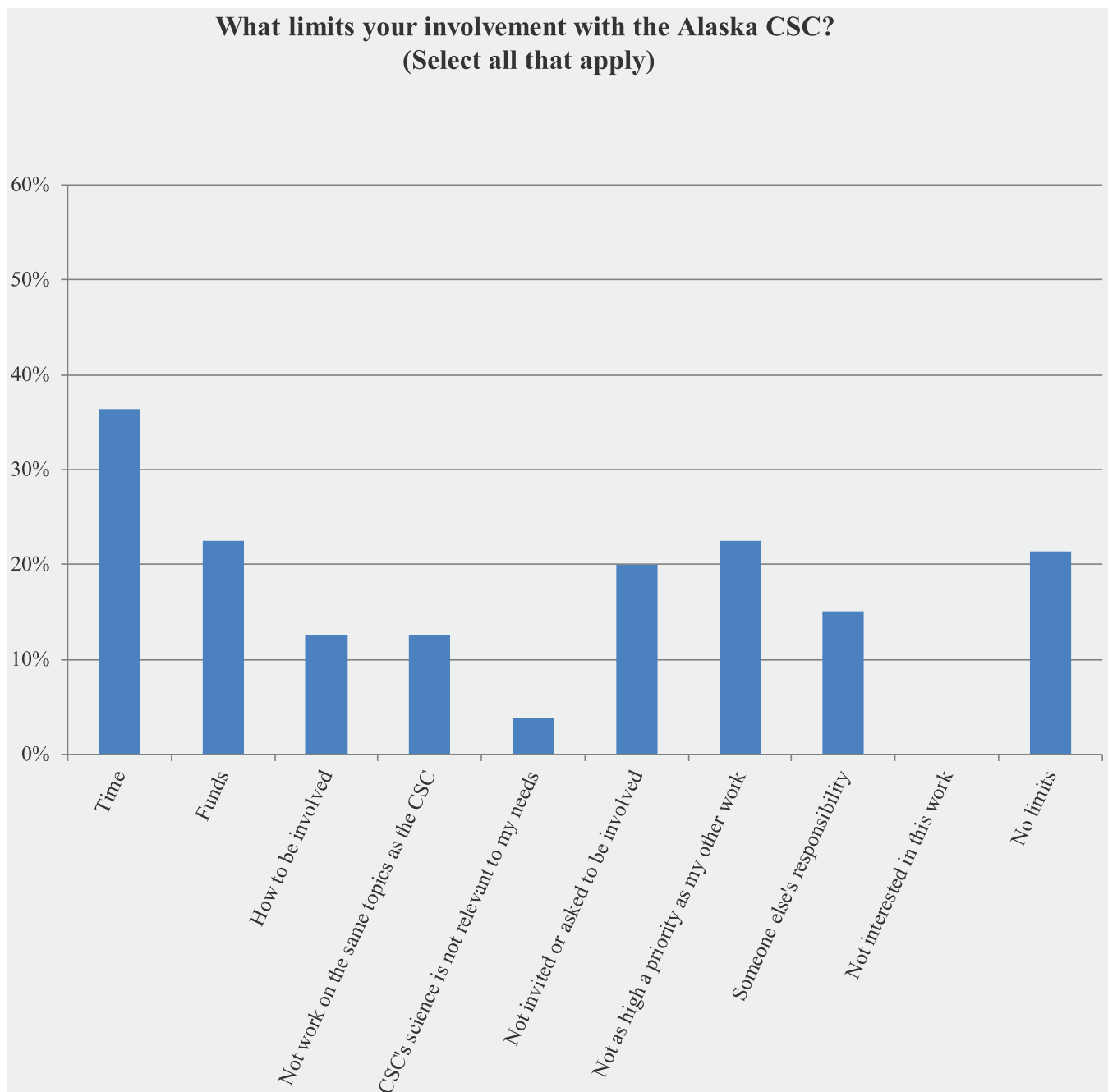
The most important benefits of the AK CSC were “avenue to put climate adaptation science into the hands of decision makers” (74%;  $n = 51$  describing as “important” or “very important”), “access to climate adaptation science” (71%;  $n = 49$ ), and “access to a broader network of people interested in climate adaptation science” (71%;  $n = 48$ ; Figure 5). In contrast, “justification for science I want to do” (25%;  $n = 17$ ) and “training on climate adaptation science methods or findings” (39%;  $n = 27$ ) were considered least important. Finally, in between the extremes, about half of the respondents found the benefits “source of funding for climate adaptation science” (51%;  $n = 35$ ) and “means for learning about climate adaptation” (59%;  $n = 41$ ) to be important or very important.



**Figure 5.** Responses to the HDRU partnership survey regarding importance of AK CSC benefits to survey respondents. Note: text in items shortened for presentation in graph, and only “important” or “very important” responses are shown.

### *Limitations on Involvement*

Most respondents (79%;  $n = 63$ ) reported limits to their involvement with the AK CSC (Figure 6). The most common (36%;  $n = 29$ ) limit was not having enough time, followed by not having enough funds (23%;  $n = 18$ ) or not being as high of a priority as other work for respondents (23%;  $n = 18$ ). Fewer reported limits that could be addressed by the AK CSC, including not being invited/being asked to be involved (20%;  $n = 16$ ) or not knowing how to be involved (13%;  $n = 10$ ). Other limits, which may be more challenging for the AK CSC to address, included not working on the same topics as the AK CSC (13%;  $n = 10$ ) or the AK CSC’s science being perceived as irrelevant to their needs (4%;  $n = 3$ ). No respondents, however, reported not being interested in this work. Eighteen respondents wrote in additional comments about limitations, including multiple comments about working in a geography that does not always relate to the work of the AK CSC (e.g., in Canada) or not being able to engage because they were recent graduates looking for a job. Notable concerns—although reported by a single

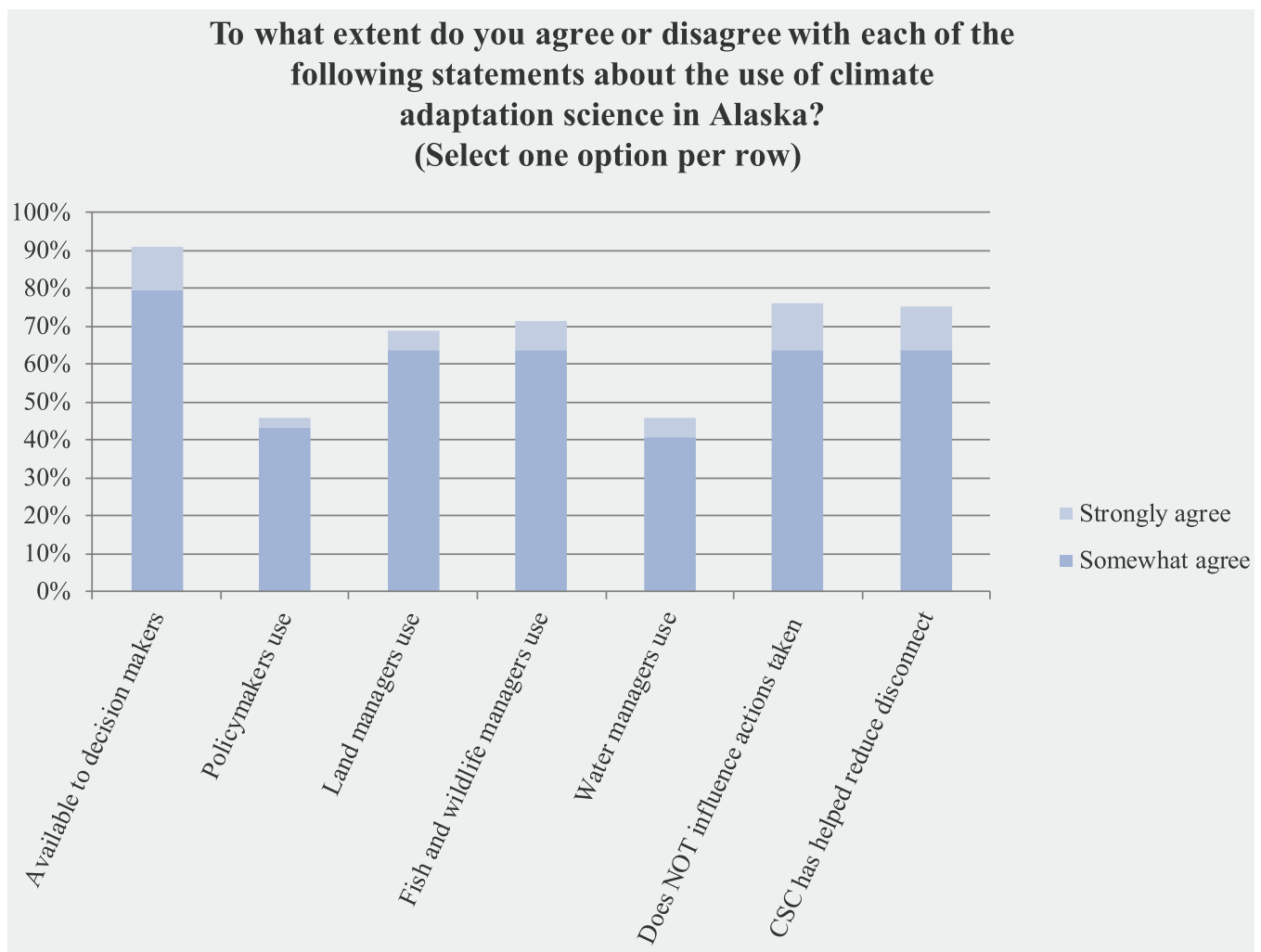


**Figure 6.** Responses to the HDRU partnership survey regarding limitations to involvement in the AK CSC. Note: text in items shortened for presentation in graph.

respondent each as part of the comments—including that the AK CSC was not working in a participatory fashion and that the AK CSC was not interested in partnering unless the partner had funds to bring to the table.

### *Is Climate Adaptation Science Actionable?*

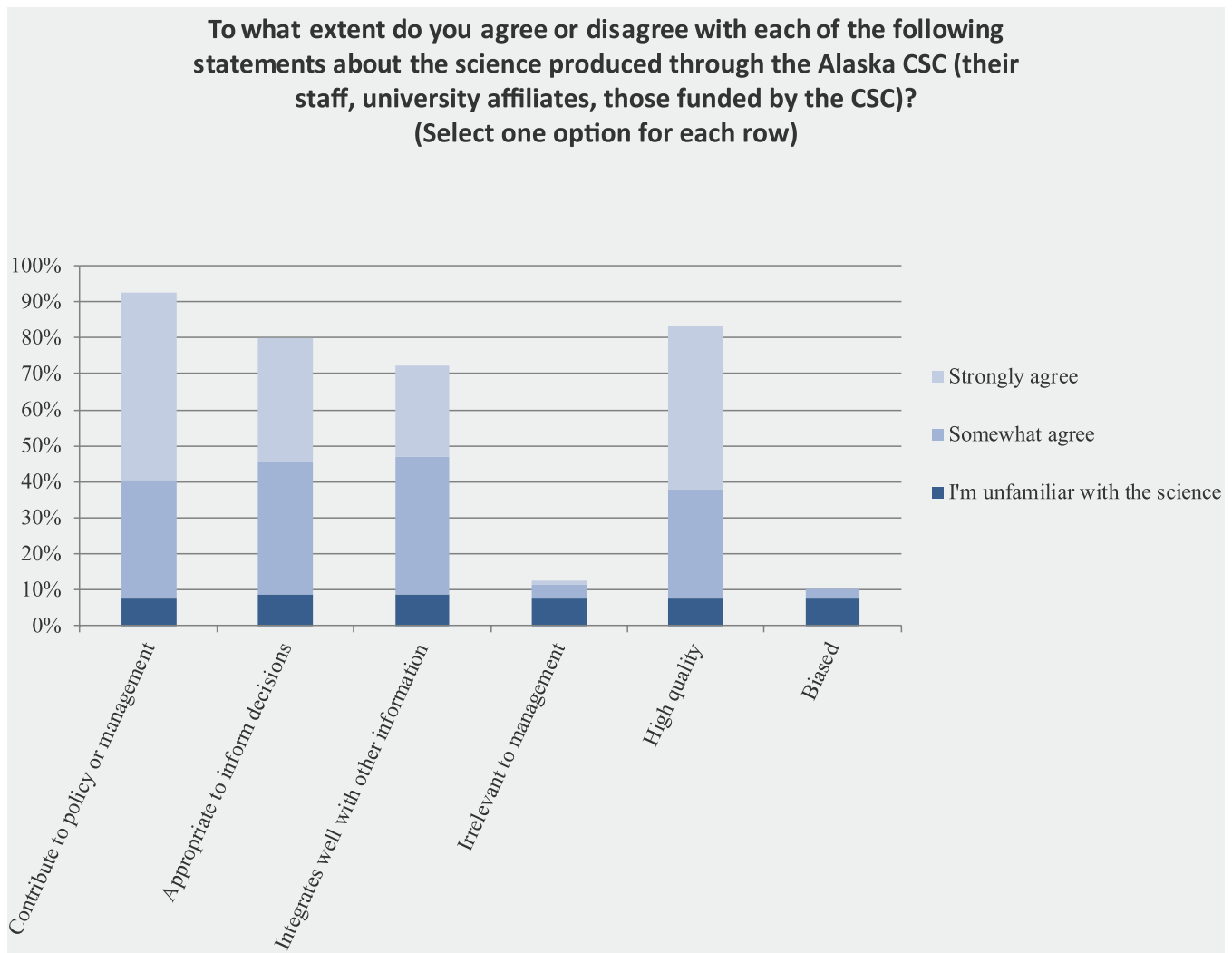
Respondents shared their perceptions both of climate adaptation science, in general, and of the climate adaptation science produced by the AK CSC. With regard to climate adaptation science in general, more than half of respondents (56%;  $n = 44$ ) agreed or strongly agreed that climate adaptation science in Alaska is available to decision makers (Figure 7), but fewer respondents believed that various types



**Figure 7.** Responses to HDRU partnership survey regarding utilization of AK CSC climate science products. Note: text in items shortened for presentation in graph.

of decision makers used the climate adaptation science to inform policies and management. Many respondents (43%;  $n = 34$ ) believed that fish and wildlife managers used the science, along with land managers (41%;  $n = 32$ ) and, to a lesser extent, water managers (28%;  $n = 22$ ). The fewest number of respondents (27%;  $n = 21$ ) believed that policymakers used the science. More generally, about half of the respondents (48%;  $n = 38$ ) felt that climate adaptation science did not influence actions taken by decision makers. Yet, about the same number of respondents (47%;  $n = 37$ ) felt that the AK CSC has helped reduce this disconnect between what is known about climate adaptation and the actions taken by decision makers in the region.

In terms of the AK CSC science specifically, respondents (85%;  $n = 67$ ) strongly or somewhat agreed that AK CSC science can contribute to policy or management (Figure 8). Of those that did not agree, about half reported that they were unfamiliar with the science (8%;  $n = 6$ ). Respondents were also generally positive about other characteristics of the CSC science, finding it appropriate to inform decisions (71%;  $n = 56$ ), high quality (76%;  $n = 60$ ), and able to be integrated well with other information (63%;  $n = 50$ ). Only two respondents believed the science to be biased, and four believed it was irrelevant to management. For all of these items, 8–9% of the respondents reported that they were unfamiliar with the science and did not respond about its characteristics.



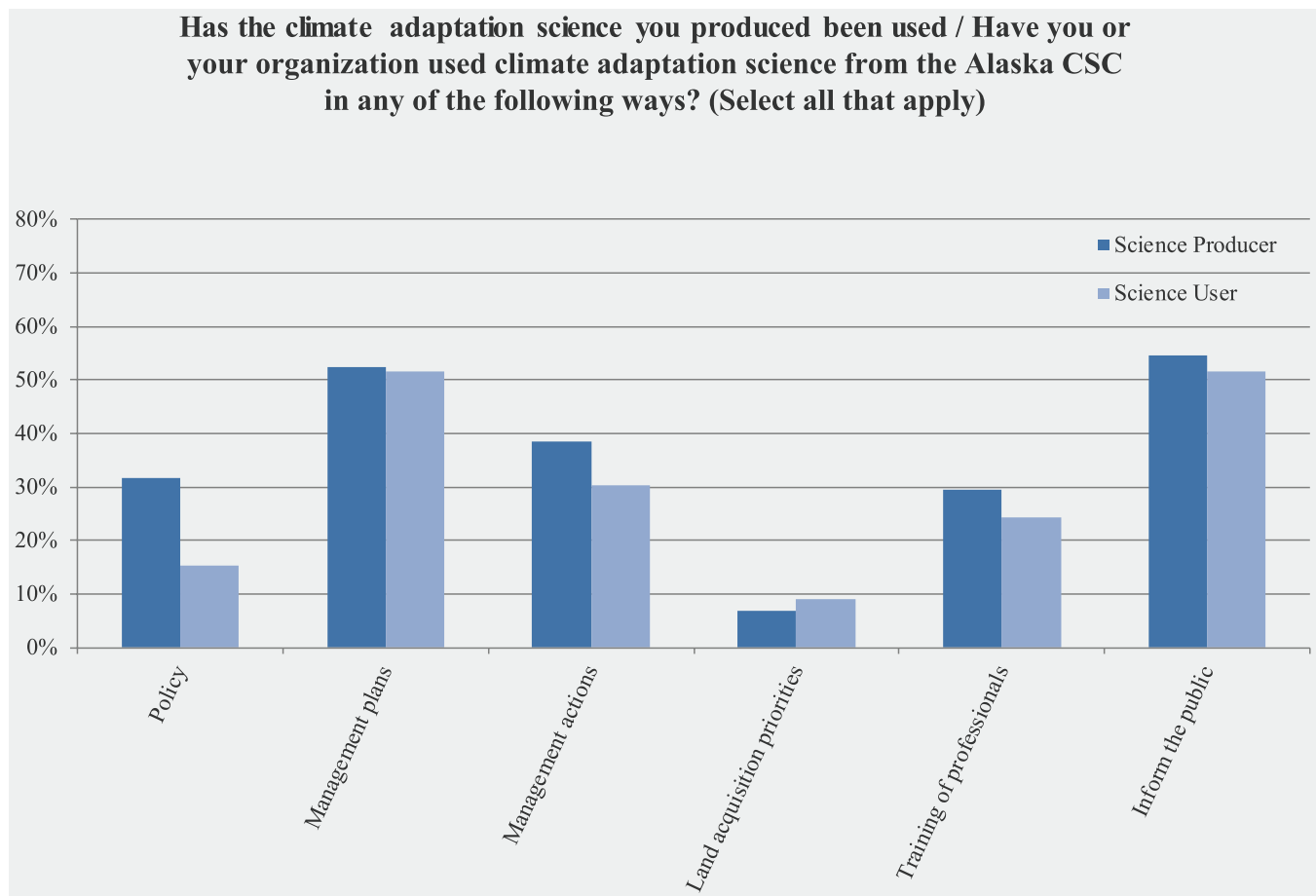
**Figure 8.** Responses to the HDRU partnership survey characterizing contribution of AK CSC products to policy, management, and quality and biases of science products. Note: text in items shortened for presentation in graph, and only “strongly agree,” “somewhat agree,” or “I’m unfamiliar with the science” responses are shown.

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

Among respondents who reported that they were science users, 63% ( $n = 20$ ) reported that they or someone in their organization used climate adaptation science from sources affiliated with the AK CSC. In contrast, 91% ( $n = 29$ ) reported that they or someone in their organization used climate adaptation science from sources not affiliated with the AK CSC.

The most common ways science users reported using AK CSC science were to inform management plans (52%;  $n = 17$ ) or inform the public about climate change and its impacts (52%;  $n = 17$ ). Less common ways science user respondents reported using AK CSC science were to inform management actions (30%;  $n = 10$ ), training of conservation professionals (24%;  $n = 8$ ), policy (15%;  $n = 5$ ), and land acquisition priorities (9%;  $n = 3$ ).

Responses to these same questions posed to science producers yielded a similar pattern of the most common and least common ways science was used, with a similar frequency for most items except related to informing policy. (Figure 9). The most common ways science producer respondents reported using the science were to inform management plans (52%;  $n = 23$ ) or the public about climate change and its impacts (55%;  $n = 24$ ). Less common ways science producer respondents reported using AK CSC science were to inform



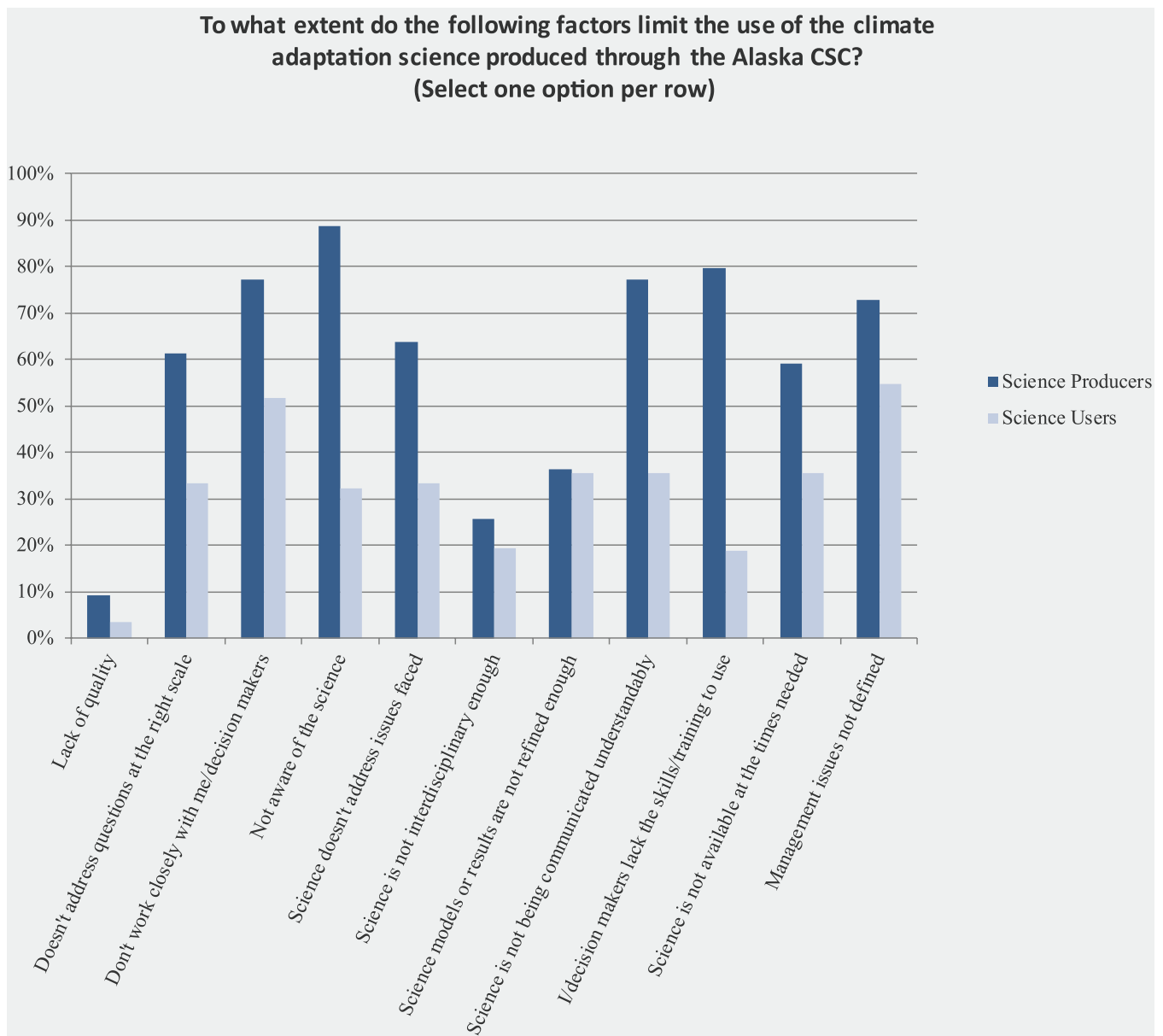
**Figure 9.** Responses to the HDRU partnership survey regarding utilization of AK CSC science products. Note: text in items shortened for presentation in graph. Additionally, text varied slightly for science producers and users.

management actions (39%;  $n = 17$ ), training of conservation professionals about climate change and its impacts (30%;  $n = 13$ ), policy (32%;  $n = 14$ ), and land acquisition priorities (7%;  $n = 3$ ).

Science users and producers differed in their perceptions of what factors limit the use of AK CSC science (Figure 10). In nearly all cases, more science producers than science users perceived limits (not specifically to them) to using AK CSC science to a moderate, large, or very large extent. Two of the most common limitations cited were the same for science users and producers: scientists not working closely with decision makers (science users—52%; science producers—77%) and management issues not defined clearly enough (science users—55%; science producers—73%). Most science producers (89%) also felt that decision makers not being aware of the science was a limitation while few science users (32%) agreed. The same pattern was found for decision makers lacking the skills to use the science (science users—19%; science producers—80%) and the science not being communicated in ways that is understandable to decision makers (science users—35%; science producers—77%). Both groups agreed on the limitations that were least important: lack of quality of the science (science users—3%; science producers—9%), and science not interdisciplinary enough (science users—19%; science producers—26%).

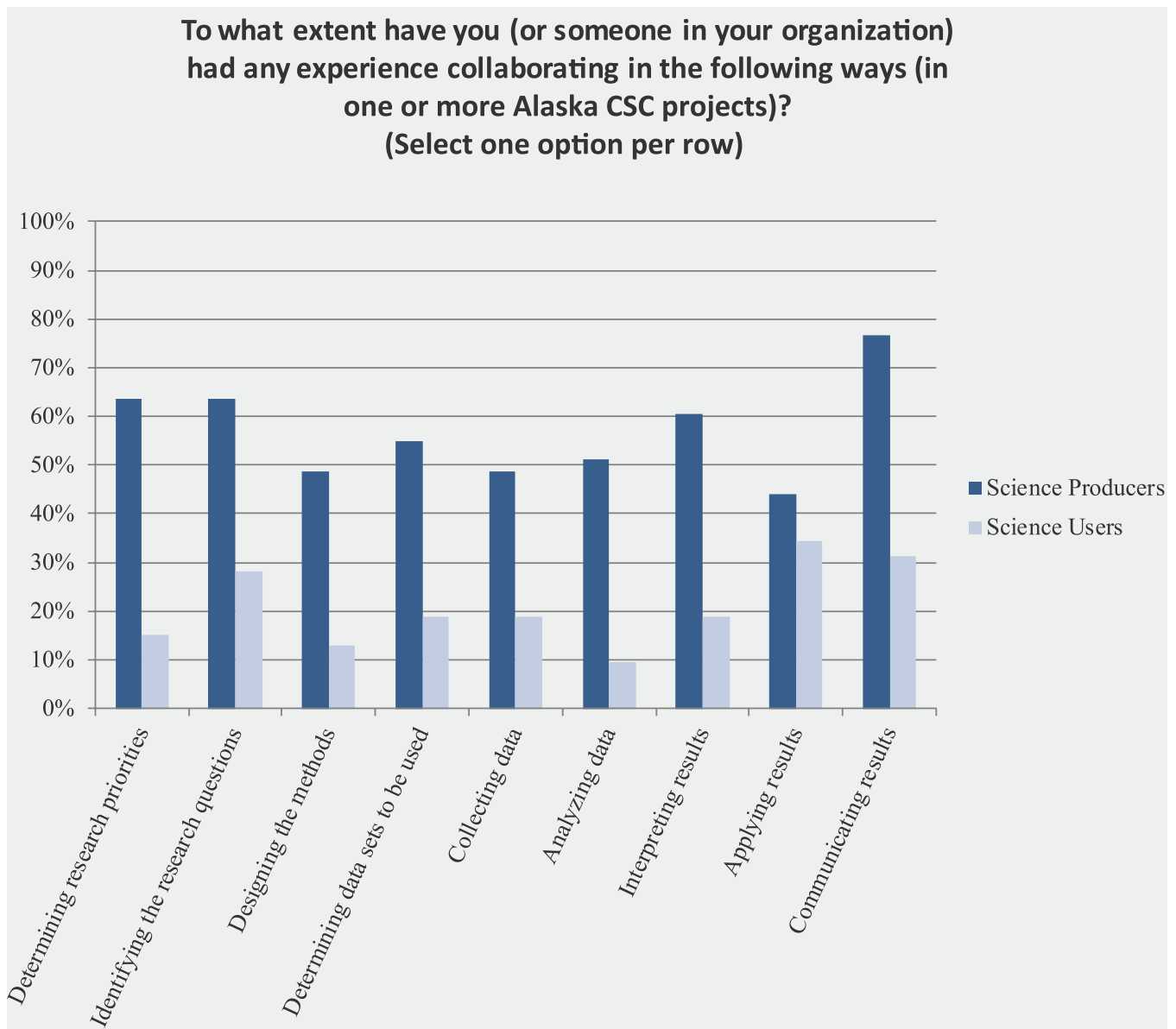
### *Science Users' and Producers' Engagement in Coproduction of Knowledge*

Respondents reported on their beliefs about coproduction of knowledge in general. An overwhelming proportion of both science users (91%;  $n = 30$ ) and producers (91%;  $n = 40$ ) expressed support for coproduction, indicating that it was important or very important for climate adaptation scientists and natural resources decision makers to work together to produce science research.



**Figure 10.** Responses to the HDRU partnership survey regarding limitations to the use of AK CSC products. Note: 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, text varied slightly for science producers and users.

Many science producers indicated experience in coproduction in various phases of research projects, more so than did many science users (Figure 8). For all phases of research projects, at least half of the science producers collaborated with decision makers to a moderate, large, or very large extent. It should be noted that this question was asked in reference to the AK CSC specifically for users but that specification was not made for producers. In contrast, the science users’ experience of collaborating during all phases ranged from a very low 9% for collaborating on analyzing data to 34% for collaborating on applying results. For both groups, communicating results (science users—31%; science producers—77%) and identifying research questions (science users—28%; science producers—64%) were two of the most common types of the frequent collaboration. Two of the other phases with a high proportion of science producers reporting experience collaborating had few science users reporting experience collaborating: determining research priorities (science users—15%; science producers—64%), and interpreting results (science users—19%; science producers—60%).

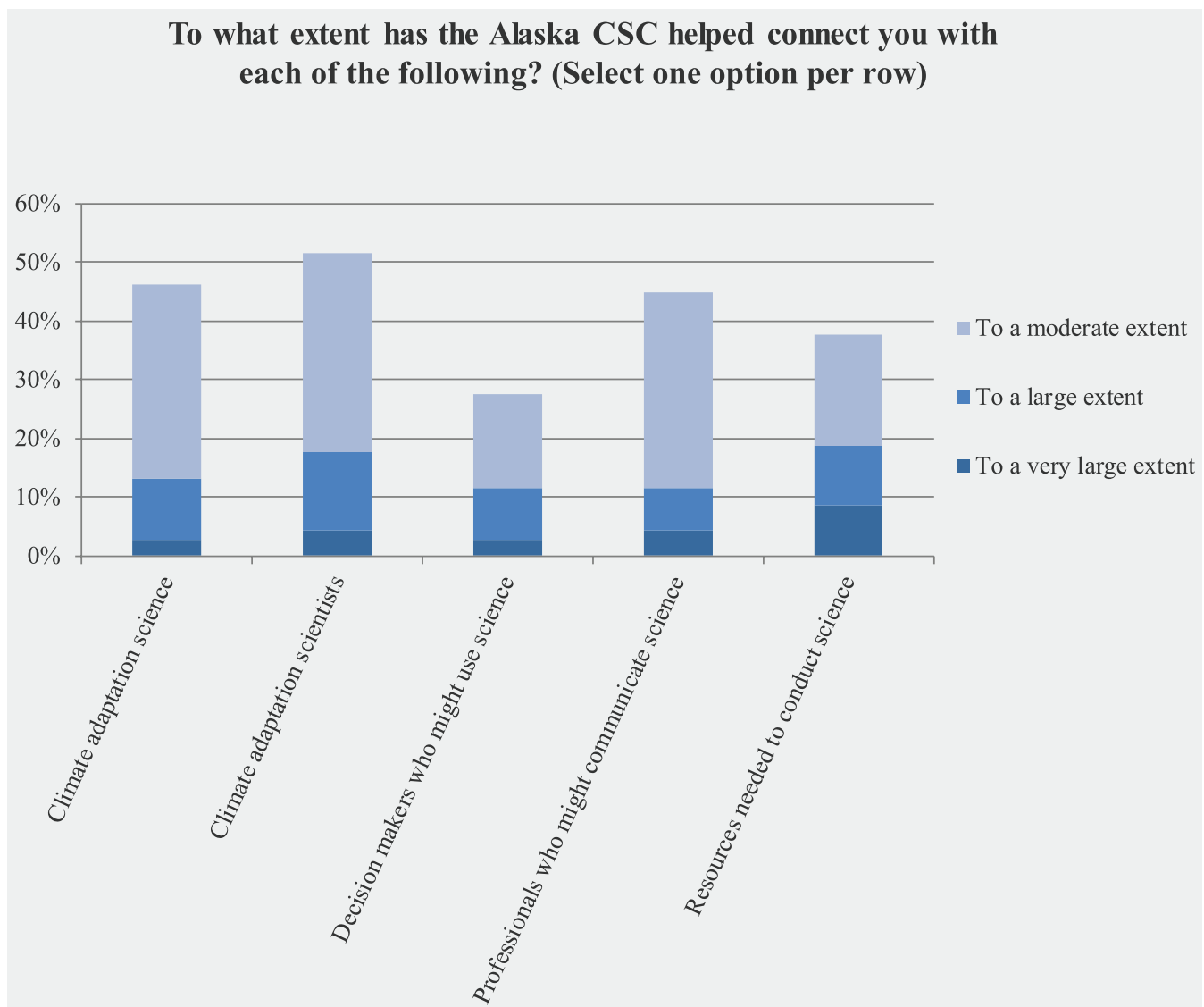


**Figure 11.** Responses to the HDRU partnership survey regarding collaboration activities with the AK CSC. Note: text in items shortened for presentation in graph, and only “to a moderate extent,” “to a large extent,” or “to a very large extent” responses are shown. Additionally, the text of the question varied slightly for science producers and users (e.g., the users’ version referencing “you or someone in your organization” and specifying a AK CSC project).

The factors most likely to limit science users’ involvement in research projects were scientists not reaching out to them (39% agreed or strongly agreed;  $n = 13$ ), followed by different perspectives on what science is needed (33%;  $n = 11$ ). Other factors were perceived to limit the involvement of smaller numbers of respondents: funders not supportive of collaboration between scientists and science users (27%;  $n = 9$ ), different perspectives on how research projects should be conducted (21%;  $n = 7$ ), and scientists not interested in listening to them (21%;  $n = 7$ ). Notably, not having enough time was a limitation for few science users (15%;  $n = 5$ ), although it had limited their involvement in the AK CSC (see Figure 8).

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

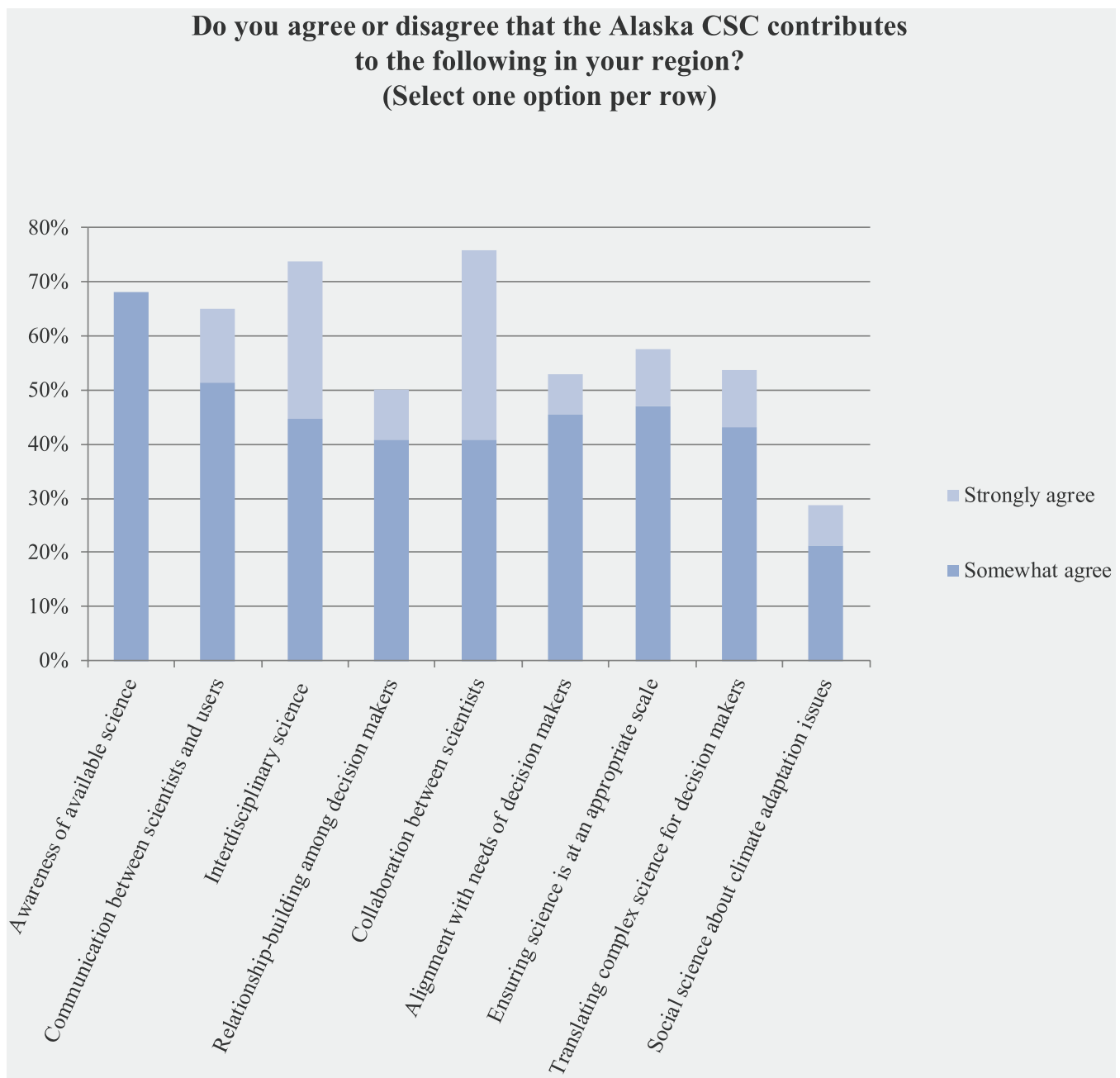
The AK CSC has helped facilitate various connections, with most respondents reporting help making connections made “to a moderate extent” (Figure 12). The most common connections reported were with



**Figure 12.** Responses to the HDRU partnership survey regarding the establishment or enhancement of connections developed through or as a result of the AK CSC. Note: 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.

climate adaptation scientists (51%;  $n = 35$ ), climate adaptation science itself (46%;  $n = 32$ ), professionals who might communicate climate adaptation science (45%;  $n = 31$ ), and resources needed to conduct science (38%;  $n = 26$ ). Fewer reported help in connecting with decision makers who might use science (28%;  $n = 19$ ).

Most respondents agreed that the AKCSC contributed to awareness of available science (80%;  $n = 53$ ), collaboration between scientists (76%;  $n = 50$ ), interdisciplinary science (74%;  $n = 48$ ), and communication between scientists and decision makers (65%;  $n = 43$ ; Figure 13). Although many respondents agreed that the AK CSC made interdisciplinary science contributions, social sciences is largely not included: only 29% of the respondents ( $n = 19$ ) felt that the AK CSC contributed to social science about climate adaptation issues. About half of the respondents indicated that the AK CSC contributes to relationship building among decision makers, alignment of science with needs of decision makers, translating complex science for decision makers, and ensuring that science is at an appropriate scale.



**Figure 13.** Responses to the HDRU partnership survey regarding AK CSC contributions to a variety of potential benefits of the AK CSC. Note: text in items shortened for presentation in graph, and only “strongly agree” or “somewhat agree” responses are shown.

### *Summary of AK CSC Results*

Respondents included science users and science producers (both those affiliated with the AK CSC and those not so affiliated) and a variety of types of organizations and agencies and positions, with federal agencies and universities being most prominent.

Most of the respondents had at least some interest in or involvement with the AK CSC. This involvement came in a variety of forms, with the most common forms as science users or participants in a training, webinar, workshop, or conference. The level of interaction respondents had with AK CSC federal staff was somewhat higher than they had with AK CSC university leads/PIs.

The AK CSC provided many important benefits to partners, with the top ones being putting science in the hands of decision makers, providing access to science, and providing access to a network of people interested in climate adaptation science. Respondents reported that they were limited in their involvement with the AK CSC by a variety of factors, most commonly by time, funds, and other priorities.

About half of the respondents felt that climate adaptation science in Alaska was available to decision makers, but fewer respondents believed that decision makers use the climate adaptation science to inform policies and management. When asked specifically about the science produced through the AK CSC, the majority of the respondents agreed that it can contribute to policy or management. Respondents were also generally positive about other characteristics of the AK CSC science, and the majority found it appropriate, high quality, and able to integrate well with other information.

The most common ways science users and producers reported that the AK CSC science was used were to inform management plans or inform the public about climate change and its impacts. Science users and producers differed in their perceptions of what limits the use of AK CSC science. Science producers perceived issues to be more limiting, than science users found them to be.

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. Coproduction was more common in the early stages (setting priorities and identifying research questions) and late stages (interpreting and communicating results) of research than the middle stages. Science users reported that their involvement in coproduced research projects is most limited by scientists not reaching out to them to collaborate and having different perspectives from scientists on what science is needed.

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

### *Recommendations for Partnerships*

- As can be expected, resource managers and those interested in climate science obtain information from a variety of sources beyond the AK CSC. There are multiple programs available to gather and convey climate information, each with capacity and audiences that may or may not overlap with other organizations. It was noted earlier that the AK CSC has developed strong complementary programs that were seen to add overall value to climate efforts in the region. Enhanced coordination with other climate science organizations with regard to targeted partners, communication audiences, and outreach efforts would increase efficiency and effectiveness of outreach efforts and to better ensure full engagement.
- Expanding involvement of partners with the AK CSC, or any partnership-based organization, is challenging due to the obvious limitations of time, resources, and interest. Indeed, the most frequent limitation noted in the HDRU survey was lack of time followed closely by funding limitations. This was also a component of the partnership fatigue syndrome noted by panelists. As with stakeholder engagement, finding more efficient ways to communicate with and engage partners is a constant challenge. Partners also need different levels of information often conveyed through different media for mats in order to be received effectively. The AK CSC would benefit from an overall review of partnerships, in essence, a partnership mapping exercise. This would assess completeness of coverage, areas where partners are more effectively engaged by other climate science organizations (and thus provide alternate mean of conveying AK CSC information), and provide for an evaluation of relative contribution by UAF and USGS components of the AK CSC.

## Concluding Comments

The overall observation of the SRT was that the science and resultant findings being produced by the AK CSC has added substantial value to the efforts of the research and natural resources management community of Alaska and the Arctic region. The current and anticipated impacts of climate change on Alaska will have profound effects upon the natural resources and human communities of the region. Yet the magnitude of the geography, the lack of instrumentation, and the cost and sheer physical challenges of work in the region has left the community with limited data and immense challenges in addressing even fundamental needs. While the federal and state agencies working in Alaska have dedicated substantial resources to addressing these needs, they are far from sufficient. It is in this setting that the AK CSC has been situated and has, by all measures, provided a valued and significant scientific effort.

The SRT agreed with the general observations of those on the various panels assembled for the on-site visits in both Fairbanks and Anchorage that (1) the AK CSC was a timely addition to the group of agency programs focused on climate change and has provided needed and visionary additional capacity; (2) the AK CSC management has been effective and efficient, although there are areas in need of attention; (3) the AK CSC does work that is challenging and needed and accomplishes this in a highly collaborative manner; and (4) projects by the AK CSC have been characterized by a high degree of leveraging, tend to amplify and enhance ongoing work, and have addressed important funding gaps.

There were challenges identified that the AK CSC is facing as the program matures, some of which are consequences of the setting. It was noted that there is a struggle between acquisition and development of fundamental information about climate impacts in the Alaska and Arctic region and the need to identify specific and timely resource management challenges, conduct targeted research, and develop management guidance for stakeholders. Given the magnitude of the geography and limitations on resources, this will likely be a constant companion for researchers and managers for the foreseeable future. The typical response is to suggest greater levels coordination, leveraging of resources, and better identification of needs. Much of this is already taking place among the rather close-knit community in Alaska. That being said, the roles of the AK CSC and the five LCCs as organizations that are positioned (i.e., boundary organizations) to address this important role can be enhanced. Acquiring expertise to focus on nurturing, managing, and utilizing highly effective partnerships of diverse stakeholders plus carrying on informative dialogue is a need throughout the conservation community and Alaska is no exception.

As the AK CSC continues to evolve along with the knowledge of climate change impacts in Alaska, the SRT is optimistic that it will continue to be an effective source of science-based findings and information for the Alaska and Arctic community.

## Acknowledgments

The SRT would like to extend its sincere appreciation to the AK CSC federal hosts and university partners in providing critical support for this review. The AK CSC Federal Director Stephen Gray was gracious with his time, intellect, and energy in helping the SRT to schedule review activities, visits, and identify participants for on-site discussions and the Web survey of partners. The AK CSC host-university team, led by Scott Rupp and Kristin Timm, were similarly generous with their time and resources throughout the entire review process. Rupp and Timm arranged for meeting room space in the IARC building on the UAF campus, engaged numerous faculty and graduate students for presentations and discussions, and invited critical university leadership to meet with the SRT as part of illustrating the connection of the AK CSC with the host university. Similarly, USGS Alaska Science Center Director Mark Shasby and his staff arranged for meeting space at the USGS Alaska Science Center in Anchorage. Both Gray and Rupp worked with the AFS and HDRU teams to identify speakers, developed contacts

lists for the HDRU review, and provided insight and recommendations for structuring the on-site SRT schedule. The SRT fully recognizes that with less than 3 days on site, the review of a substantial, yet still limited set of documents and reports, and various other discussions, cannot hope to fully understand the full nature and extent of the AK CSC through its 6 years of work. The SRT can only hope that through the collective observations of SRT members, the various related discussions and preparations, and the introspection of AK CSC staff, the observations and recommendations of this review will add value to the efforts of the AK CSC to better serve the natural resource conservation community of Alaska and the Arctic region.

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## Appendix A

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## Appendix B

### Alaska Climate Science Center Schedule of Activities

Wednesday, February 10, 2016, University of Alaska Fairbanks

| Time                         | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Desired output                                                                                                                       |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Day 1—<br>Morning<br>Session | Introductions—Science Review Team (SRT) and hosts (Alaska Climate Science Center [AK CSC] and university representatives.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Develop a full understanding of the AK CSC structure, including federal and university components.                                   |
| 8:00–8:30                    | Gather for coffee and get settled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |
| 8:30–9:00                    | Welcome, introductions, and charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                      |
| 9:00–10:15                   | Review of fundamental AK CSC strategic vision, planning, administrative structure, and 5-year status report.<br>Presentations: <ul style="list-style-type: none"> <li>• Introduction by AK CSC director and overview of AK CSC staff, structure, and brief history. Review of AK CSC strategic plan, work plans, funding history, and key accomplishments</li> <li>• Review of the Stakeholder Advisory Committee (SAC) or comparable structure—frequency of meetings, membership, summary of recommendations (presentation could be done by SAC chair or member)</li> <li>• Research project development, request-for-proposal management and grant process overview</li> </ul> | Develop a full understanding of the structure of the AK CSC, including core documents and key processes.                             |
| 10:15–10:30                  | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                      |
| 10:30–11:00                  | AK CSC facilities tour and discussion (if applicable).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                      |
| 11:00–noon                   | Introduction by university-host principle investigator(s): <ul style="list-style-type: none"> <li>• Description of host agreement, accomplishments, integration of AK CSC within various university structures. This should also include a description of the broader host university consortium if that exists beyond the core host institutions.</li> <li>• Description of climate change structures within the host institutions. This may include presentations by key entities, including their engagement with the AK CSC.</li> </ul>                                                                                                                                      | Full understanding of the host-university component of the AK CSC, including the primary hosts as well as other university partners. |
|                              | <b>Scott Rupp</b> , university AK CSC director, University of Alaska, Fairbanks (UAF)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                      |
|                              | <b>Larry Hinzman</b> , vice chancellor for research, UAF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                      |
| Noon–1:00                    | Lunch break—catered lunch<br><i>and</i><br><b>Kristin Timm</b> , AK CSC and UAF AK CSC communications and outreach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |

**Wednesday, February 10, 2016, University of Alaska Fairbanks (continued)**

| Time      | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Desired output                                                                                                                                                                                                                    |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1:00–2:45 | Establishment of the climate change science and conservation context of the AK CSC. Selected presentations on significant climate change issues that characterize the AK CSC operational area.<br><b>Hajo Eicken</b> , director, International Arctic Research Center (IARC), UAF<br><b>Rick Thoman</b> , National Weather Service, National Oceanic and Atmospheric Administration<br><b>Scott Rupp</b> , AK CSC university director, UAF<br><b>Brad Griffith</b> , Alaska Cooperative Fish and Wildlife Research Unit, UAF<br><b>Bob Bolton</b> , IARC, UAF<br><b>Amy Breen</b> , IARC, UAF<br><b>Uma Bhatt</b> (invited), Cooperative Institute for Alaska Research, UAF | Understanding of the main drivers of science-management needs that define the AK CSC and relevant other climate science providers. What is the context of the AK CSC with regard to the most significant conservation challenges? |
| 2:45–3:00 | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                   |
| 3:00–4:00 | CLOSED SESSION<br>SRT briefing and discussion with university/host institution principle investigators and relevant university partners only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                   |
| 4:00–5:00 | SRT only, closed session #1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                   |
| Evening   | Group dinner—all are invited to participate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                   |

**Thursday, February 11, 2016, University of Alaska Fairbanks**

| Time        | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                                                                | Desired output                                                                                             |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 8:00–8:30   | Gather. Review day-1 notes and day-2 schedule of activities.                                                                                                                                                                                                                                                                                                                   |                                                                                                            |
| 8:30–10:00  | AK CSC and host-university research forum—graduate and postdoctoral research updates, outreach, and engagement.<br><b>Joanna Young</b> , Ph.D. candidate<br><b>Simon Filhol</b> , Ph.D. candidate<br><b>Katia Kontar</b> , Ph.D. candidate<br><b>Helene Genet</b> , research faculty<br><b>Nathan Kettle</b> , research associate<br><b>Peter Bieniek</b> , research associate | Full understanding of the science development component of the host institution.                           |
| 10:00–10:15 | Break                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                            |
| 10:15–noon  | Partnership dialogue—science producers (Cornell team facilitation):<br><b>Amy Breen</b> , UAF<br><b>John Pearce</b> , U.S. Geological Survey (USGS)<br><b>Josh Koch</b> , USGS<br><b>Chris Heimstra</b> , U.S. Army Corps of Engineers, Engineering Research and Development Center                                                                                            | See Cornell document.<br>Bruce Lauber will work with Scott Rupp and Stephen Gray to identify participants. |

**Thursday, February 11, 2016, University of Alaska Fairbanks (Continued)**

| Time       | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                         | Desired output                                                                               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
|            | <b>Gabe Wolken</b> , Alaska Department of Natural Resources<br><b>Uma Bhat</b> , UAF<br><b>John Walsh</b> , IARC<br><b>Peter Bieniek</b> , UAF<br><b>Bob Bolton</b> , IARC<br><b>Vladimir Romanovsky</b> , IARC<br><b>Eugenie Euskirchen</b> , IARC<br><b>Brad Griffith</b> , IARC<br><b>Eran Hood</b> , University of Alaska Southeast |                                                                                              |
| Noon–1:30  | Lunch (catered) and continued discussion with science panel                                                                                                                                                                                                                                                                             | Will include all guests (estimated lunch number will be about 25).                           |
| 1:30–1:45  | Break                                                                                                                                                                                                                                                                                                                                   |                                                                                              |
| 1:45–2:45  | CLOSED SESSION<br>Review panel briefing and Q&A with USGS staff only                                                                                                                                                                                                                                                                    | Review responses to submitted questions and information requests; open discussion of AK CSC. |
| 2:45–3:00  | Break                                                                                                                                                                                                                                                                                                                                   |                                                                                              |
| 3:00–4:30  | SRT only, closed session #2                                                                                                                                                                                                                                                                                                             |                                                                                              |
| 4:30–5:00  | Report-out (debriefing) of review team to university hosts and open Q&A                                                                                                                                                                                                                                                                 |                                                                                              |
| 5:30 or so | Dinner in Fairbanks, location TBD                                                                                                                                                                                                                                                                                                       |                                                                                              |
| Evening    | Travel to Anchorage                                                                                                                                                                                                                                                                                                                     |                                                                                              |

**Friday, February 12, 2016, USGS Alaska Science Center**

| Time       | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Desired output |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 8:30–9:00  | Gather. Introductions of new guests. Review day-2 notes and day-3 schedule of activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |
| 9:00–10:00 | Partnership dialogue—part 1 <ul style="list-style-type: none"> <li>Alaska Climate Change Executive Roundtable structure, organization and role of AK CSC</li> <li>Selected partner presentations. Mini-partnership forum (Stephen Gray and Scott Rupp, moderators)</li> </ul> <i>AK CSC partners will be invited to describe their collaborations with the center and how these efforts are supporting management, planning, and adaptation in the region. Invitees will be asked to focus on aspects of the AK CSC's efforts that rely on the hosting agreement with UAF.</i><br>Likely invitees: |                |

**Friday, February 12, 2016, USGS Alaska Science Center (Continued)**

| Time                    | Preparatory or on-site activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Desired output                                                                                                                                                                                                                                              |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <ul style="list-style-type: none"> <li>• Greg Hayward (U.S. Forest Service regional office)</li> <li>• Gabe Wolken (Alaska Department of Natural Resources)</li> <li>• Sarah Trainor (NOAA's Regional Integrated Sciences and Assessments [RISA] program)</li> <li>• Various Land Conservation Cooperative (LCC) coordinators</li> </ul>                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                             |
| 10:00–10:15             | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                             |
| 10:15–noon              | Partnership dialogue, part 2 (Cornell facilitation)<br><b>Rick Thoman</b> , National Weather Service, Alaska Region<br><b>Cheryl Rosa</b> , U.S. Arctic Research Commission<br><b>Cynthia Jacobson</b> , U.S. Fish and Wildlife Service<br><b>Durelle Smith</b> , USGS<br><b>Molly McCammon</b> , Alaska Ocean Observing System<br><b>David Frenier</b> , U.S. Army Corps of Engineers, Alaska District<br><b>Jim Lawler</b> , National Park Service<br><b>Karen Murphy</b> , Western Alaska LCC<br>Douglas Burn, Aleutian and Bering Sea Islands LCC<br><b>Aaron Poe</b> , Aleutian and Bering Sea Islands, LCC<br><b>Joel Reynolds</b> , Western Alaska LCC<br><b>Greg Hayward</b> , U.S. Forest Service |                                                                                                                                                                                                                                                             |
| Noon–1:00 or thereafter | Lunch—open discussion with panel members                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                             |
| 1:00–1:30               | Flex time for undetermined topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                             |
| 1:30–2:30               | SRT, closed session #3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Identify key initial observations. Discuss writing assignments.                                                                                                                                                                                             |
| 2:30–2:45               | Break                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                             |
| 2:45–3:30               | Final report out of SRT to CSC and Q&A session.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <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 time lines.</li> <li>• Draft report development; review and finalize timeline</li> </ul> |
| 3:30                    | Adjourn meetings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                             |

## Appendix C

### Partnership Effectiveness Focus Group Questions

#### Science Producers

1. Why did you become involved with the Climate Science Center (CSC)?
2. What are the benefits of your involvement with the CSC? (Probe for benefits to them as individuals, to scientific knowledge, to people who are in need of scientific information, and to professional development of others.)
3. What are the challenges you face in your involvement with the CSC?
4. To what degree have you worked with the intended “users” of your climate science produced with/for the CSC?
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, and so forth?

#### Science Users

1. Why did you become involved with the CSC?
2. What are the benefits of your involvement with the CSC? (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 CSC?
4. To what degree have you worked with climate scientists or used the science produced in association with the CSC?
5. Tell us more about your impressions of this climate science. Has it be 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, and so forth.