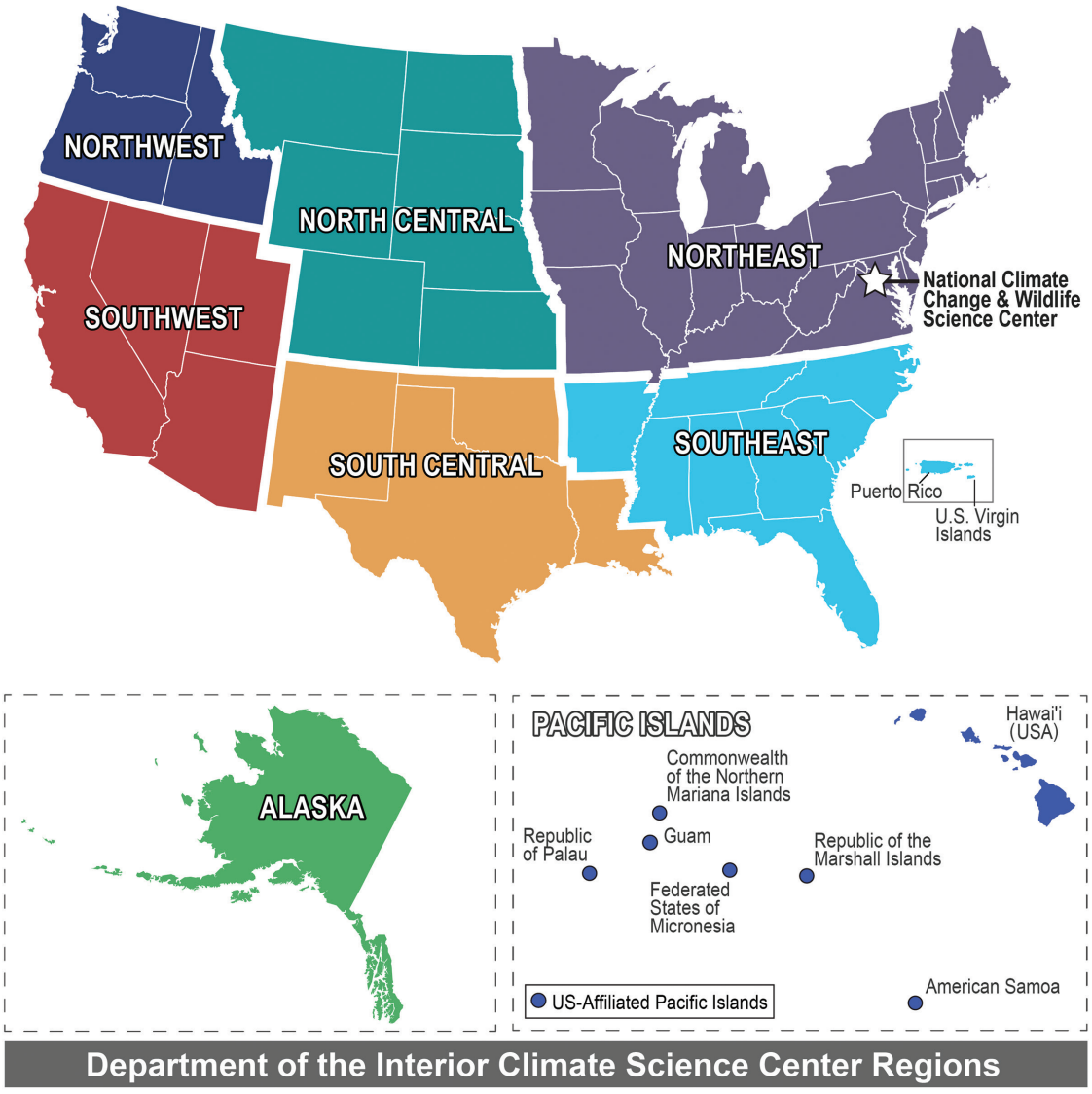
Five-Year External Reviews of the Eight Department of Interior Climate Science Centers

Northwest Climate Science Center



Department of the Interior Climate Science Center Regions

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Cover image: 2016 map of the Climate Science Center regions and consortia. U.S. Geological Survey, www.sciencebase.gov.

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

Northwest 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 and a parallel host-university component 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 first of these eight CSCs, the Northwest Climate Science Center (NW CSC), being reviewed in January 2016.

The NW CSC is hosted by Oregon State University in Corvallis and supported by an academic consortium consisting of two primary universities, the University of Idaho and the University of Washington; eight secondary university partners; and three federal laboratory partners. The NW CSC's primary geographic operational area includes Washington, Oregon, Idaho, and western Montana and has overlapping boundaries with three Landscape Conservation Cooperatives (LCCs): Great Northern, Great Basin, and North Pacific. The geographic area covered by the NW CSC is also home to 52 federally recognized tribes. 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 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. 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 NW CSC was conducted as a project of the Cornell University Human Dimensions Research Unit in conjunction with the American Fisheries Society (AFS) as a subcontractor. The review was conducted in two parts: an on-site review by a 7-person science review team (SRT) and a subsequent Web-based survey of science users and producers. The review team was chaired by a USGS scientist selected from outside of NCCWSC but with knowledge and interest in 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 impacts of climate change on fisheries, wildlife, and related environmental resources and cultural issues. The 7-member team was also selected to represent a variety of organizations, including federal, state, university, and nongovernmental organizations. The review was conducted during January 20–22, 2016, on the campus of Oregon State University and at the office of the USGS NW CSC director in Corvallis, Oregon.

Prior to the on-site review, relevant NW 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 NW 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 center as an institution, with an emphasis on planning processes, management and operations, finances, and institutional coordination.
- *Actionable science*: Characterize 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 center and through its external grant funding.
- *Capacity building*: Designed to address how well the center 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 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 focus 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 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 coproduction? What characterizes that role?

The work of the SRT resulted in a series of general conclusions and 41 specific recommendations. The overall observation of the review team was that the science being produced by the NW CSC is of high quality and has provided useful information for a variety of users. The SRT recognized, through presentations by researchers, comments by NW CSC partners, and a limited review of published material, that the researchers engaged in production of science through the NW CSC are doing work that is adding value to the knowledge of climate change impacts on natural resources in the region. In that context, the NW CSC has proven to be successful. The review team was also impressed by some key innovative projects of the NW CSC, such as the climate boot camp, a key mechanism for engaging graduate students with working professionals, building a sense of community among the students across multiple universities, and teaching useful skills about climate communication and other topics. There were other examples of value-added efforts, such as key collaborations with the North Pacific Landscape Conservation Cooperative and USGS Western Ecological Research Center, that illustrated the possibilities that the NW CSC creates for linking science and management in a coproduction-type model.

The review team also recognized several critical areas that need attention if the NW CSC is to fully meet its mission, and these topics are the responsibility of USGS and the university hosts. For example, among these issues on the university side was the poor to almost nonexistent involvement of the other 11 members of the host-university consortium, the lack of a cohesive and targeted communications strategy, a noticeable lack of cohesion between the mission of the NW CSC and that of the university efforts, and missed opportunities by limited engagement of the Cooperative Fish and Wildlife Research Units and some other potential partners with a solid history of connections with resource management agencies. Similarly, it was clear that the Executive Stakeholder Advisory Committee (ESAC), as managed by the USGS, is in need of redefinition and an improved management model. Members were disengaged, unclear about roles, and possibly mismatched for the roles that they were asked to play in the ESAC. Fundamentally, the NW CSC and NCCWSC need to build a better mechanism to ensure compatibility in mission between the USGS CSC staff and the university hosts. The inherent differences in culture, internal evaluative and hence motivational structures, and other factors, while creating the possibility for creative approaches to science, also create tensions, lack of unity of vision, and mismatches between management-based research needs and the individual research interests of faculty.

The review team found that many these issues can be resolved and strongly encourages the NW CSC and its partners to use the opportunity presented by the development of a new strategic plan, science plan, and other related foundational documents as a vehicle for introspection and recalibration. We encourage the NW CSC, through this process, to engage outside expertise in redesigning the relationship between the USGS and the university. We also strongly encourage the NW CSC to completely re-evaluate the ESAC's role, structure, membership, and inclusion of the research community. This body is critical in building the partnerships essential to realizing the intimate linkage between the natural resources management community and the researchers in such a way as to advance coproduction and actionable science.

The NW CSC was built from scratch as one of the first three of eight CSCs nationwide and with no existing model upon which to design the staffing, administrative structure, relationships, or research-management processes. Furthermore, there was no baseline of performance metrics upon which the NW CSC could orient its efforts to meet a predetermined benchmark for success. The review recognized this challenge and encourages the CSC network to engage in a structured exploration and dialogue to develop a common framework for performance while also recognizing the unique nature of each CSC and the environment, socially and ecologically, in which it works.

Abbreviations and Acronyms

ACCCNRS	Advisory Committee on Climate Change and Natural Resource Science
AFS	American Fisheries Society
CEOAS	College of Earth, Ocean, and Atmospheric Sciences
CIRC	Climate Impacts Research Consortium
CSC	Climate Science Center
DOI	U.S. Department of Interior
ESAC	Executive Stakeholder Advisory Committee
FY	fiscal year
HDRU	Cornell University Human Dimensions Research Unit
IGERT	Integrative Graduate Education and Research Traineeship program
LCC	Landscape Conservation Cooperative
LT	Climate Science Center Leadership Team
NCCWSC	National Climate Change and Wildlife Science Center
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
NPLCC	North Pacific Landscape Conservation Cooperative
NSF	National Science Foundation
NW CSC	Northwest Climate Science Center
OCCRI	Oregon Climate Change Research Institute
OSU	Oregon State University
PI	principal investigator
RFP	request for proposal
RISA	Regional Integrated Sciences and Assessment program
SAC	Stakeholder Advisory Committee
SRT	science review team
TOR	Terms of Reference
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UI	University of Idaho
UW	University of Washington

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).[1] 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 into DOI Climate Science Centers (CSCs), and their mission was slightly expanded to "synthesize and integrate climate change impact data and develop tools that the Department's managers and partners can use when managing the Department's land, water, fish and wildlife, and cultural heritage resources" (Salazar 2009). As a result, NCCWSC established eight regional DOI CSCs from 2010 through 2012 (Figure 1). 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, the Pacific Northwest (NW), and the Southeast, 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 host-university agreement is subject to a recompete by the USGS for the host university. As part of the recompete process, NCCWSC, with the engagement of the American Fisheries Society (AFS) and the Human Dimensions Research Unit of Cornell University (HDRU), coordinated an operational and programmatic review and evaluation of the entirety of the NW CSC, including the host university and USGS federal component to ensure that established goals and obligations under the hosting agreements, strategic plan, and related goal and objective establishing documents 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. 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 of the 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.]
>
> 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.]

[1] 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.

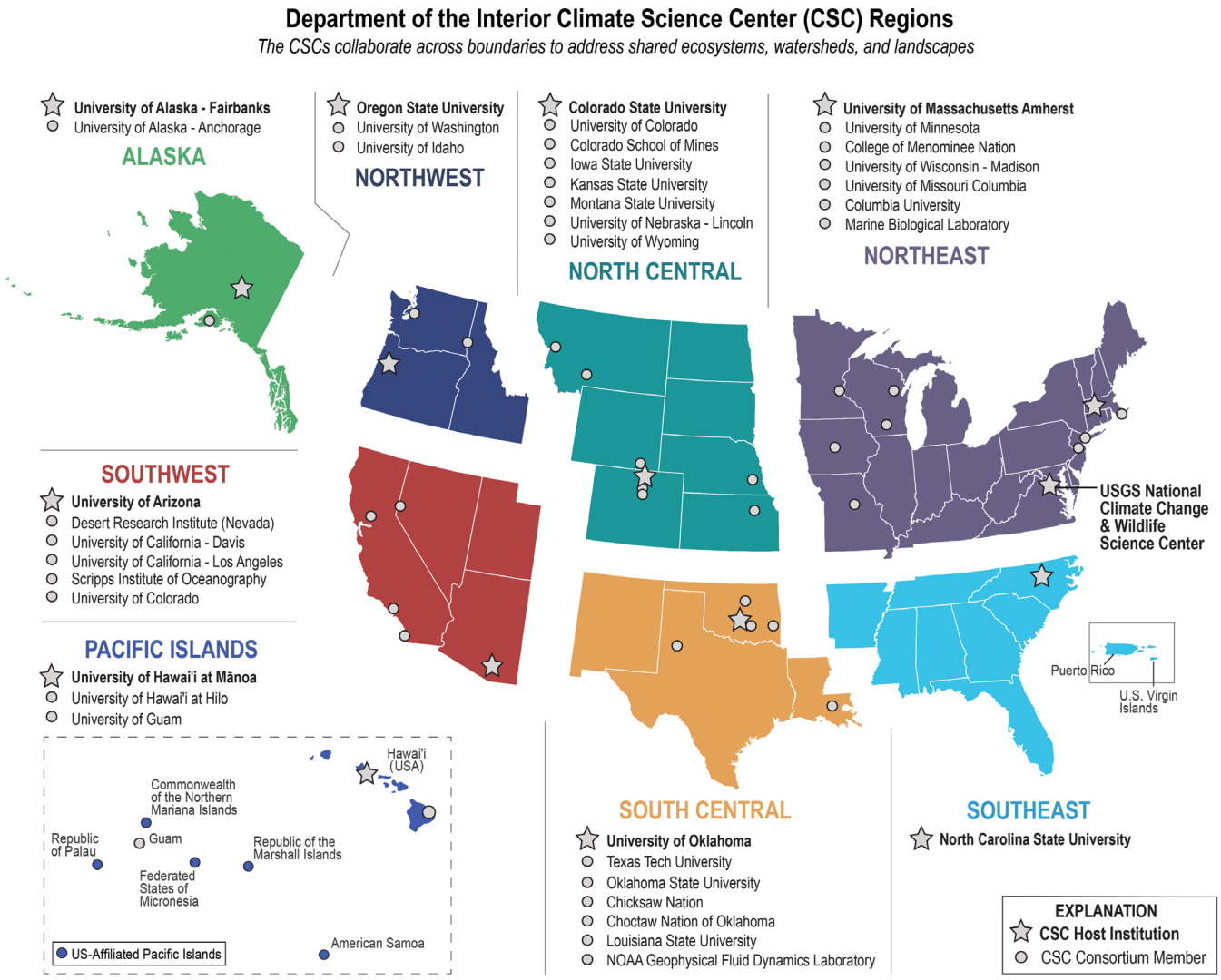


Figure 1. Map of the eight Climate Science Centers and consortia.

Though these mission statements are substantially similar, the singular difference is that climate change effects on cultural resources are specifically identified in the CSC mission but not in that of NCCWSC. 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 of NCCWSC:

- 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 plan also identifies scientific priorities 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.
- Integrate physical climate models with ecological, habitat, and population response models.
- Forecast fish and wildlife population and habitat changes in response to climate change.

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.

- 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.

A key component of NCCWSC 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). A major indicator of success of NCCWSC is, therefore, the degree to which partners are effectively engaged and benefit from the work of NCCWSC.

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, the primary CSC partners, 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). It is intended that the CSCs and LCCs work collaboratively and cooperatively to support natural resources managers in their efforts to implement conservation actions.

The process of identifying the CSCs began in fiscal year 2010 with the identification of the University of Alaska as the location for the first CSC, after which the USGS initiated a competitive selection of host institutions for the additional centers (NCCWSC 2011). The Alaska, Northwest, and Southeast centers were formally established in September 2010 with fiscal year 2010 funds. 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. The final three CSCs (Northeast, South Central, and Pacific Islands) were established formally in March 2012, completing the planned suite of eight regional CSCs.

The NCCWSC–CSC network is committed to a partnership-driven model. 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 resource managers (NCCWSC 2011). These landscape-level needs are reviewed by the CSC and its Stakeholder Advisory Committee (SAC) to identify key regional priorities and guide in the development of CSC science and operational plans. Regional priorities are similarly reconciled to build a higher level national-scale agenda.

Although constructed after the establishment of the CSCs, the Advisory Committee on Climate Change and Natural Resource Science (ACCCNRS) also serves to provide input and recommendations on the stra-

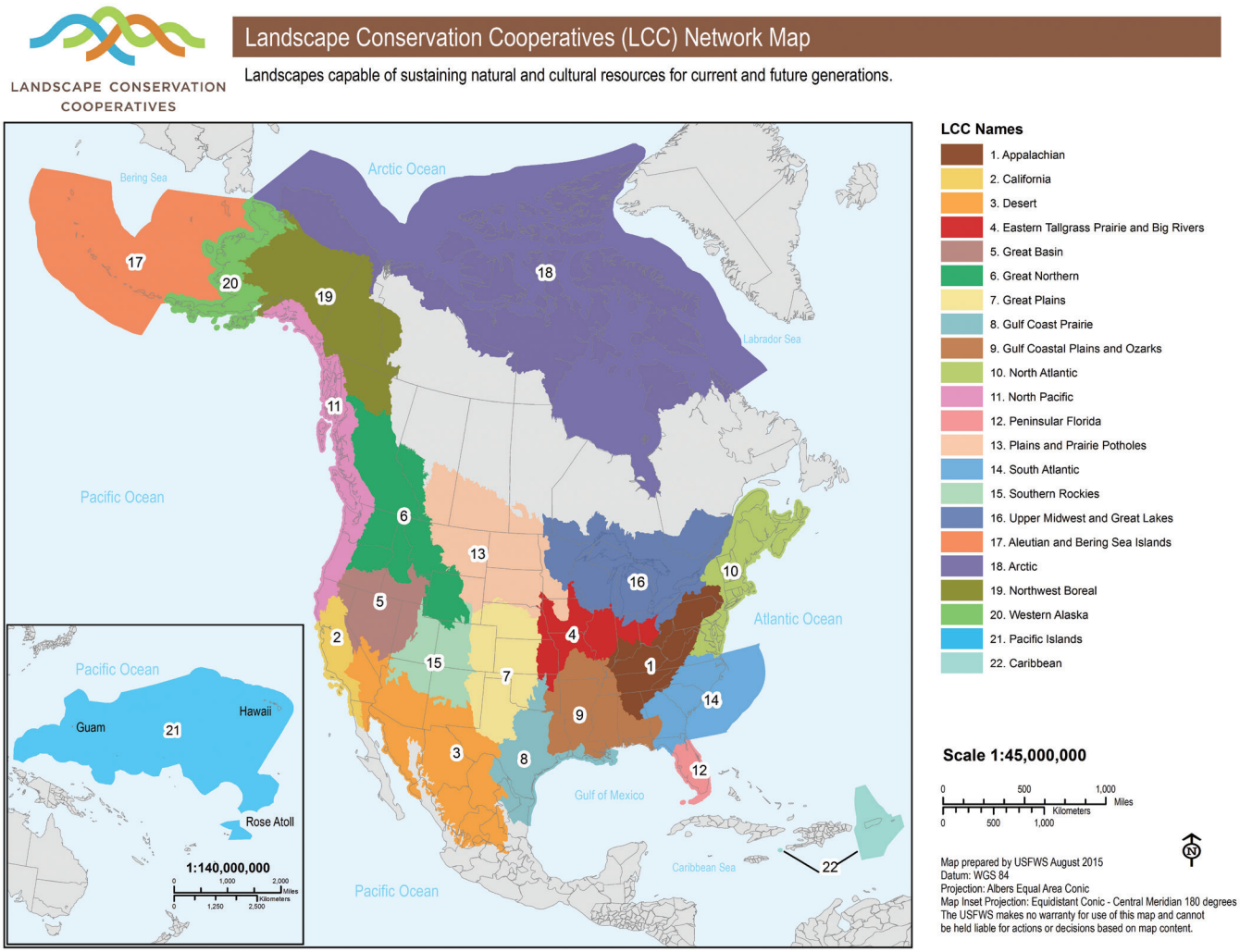


Figure 2. Map of the 22 Landscape Conservation Cooperatives.

tegic direction of the CSCs. The Advisory Committee on Climate Change and Natural Resource Science is a multistakeholder federal advisory committee established by the DOI in 2012 and chartered under the Federal Advisory Committee Act to provide guidance and input on the overall NCCWSC–CSC network. The committee has 25 members from the DOI, other federal agencies, state and local governments, tribal nations and partners, NGOs, academia, and the private sector.

This NCCWSC–CSC construct has evolved to act as 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. Each CSC is a partnership between the USGS and university-based consortia selected through a competitive process. The SAC at each CSC provides bridges to additional partners (e.g., LCCs), who assist CSC directors in the identification of regional natural and cultural resource management priorities and science needs.

The NCCWSC–CSC network forms the cornerstones of DOI's integrated approach to climate change science and adaptation. The CSCs assess climate impacts that typically extend beyond the borders of any single federal holding, state, or even regional boundary. These climate change challenges demand that resources be assessed, science developed, and management implemented at scales and across geopolitical lines in a manner that reflects the magnitude and importance of climate change impacts on our nations natural and cultural resources.

Review Process

Roles of the HDRU, AFS, 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 the NCCWSC that is not addressed in this report. To evaluate the performance of the host university, AFS and the HDRU established a 7-person science review team (SRT) for each CSC. The SRTs consisted of a team of five non-CSC affiliated experts selected through a national solicitation and review of credentials. In constructing this team, an attempt was made to balance a series of factors, including diversity of expertise and employer (federal, state, nonprofit, or tribal). The SRT was chaired by a nonvoting USGS Science Center director (non-CSC affiliated). The seventh SRT member was a CSC director from outside the reviewed CSC. Both USGS representatives were selected by the NCCWSC deputy chief (see Appendix A for a listing of all members). The American Fisheries Society was tasked with assembling the SRTs, developing review metrics, managing the on-site review process (data collection, interviews, discussions, etc.), logistical planning (travel, lodging, food, etc.), and developing review reports from evaluation findings. HDRU investigators focused on the evaluation of CSC partnerships. During on-site reviews, the HDRU interviewed stakeholders and partners to assess the quality and extent of partnership involvement with the respective CSC. Using the interview data, the HDRU constructed a standardized survey that was sent out to a diverse set of current and past CSC partners in each region with the goal of identifying patterns of engagement with the CSCs as well as barriers to engagement.

The onsite review was conducted over a period of 3 days in Corvallis and on the campus of Oregon State University (OSU) (schedule of activities provided in Appendix B). The review process was designed to develop a full understanding of the CSC, beginning with the administrative structure and foundational documents and processes (e.g., strategic and science planning) through the final research projects, communications of results, and engagement of stakeholders and others in an actionable science pathway approach that includes assessment of the utility of the science products.

Program Evaluation Measures for CSCs

No formally accepted, system-wide, performance measures (e.g., specific deliverables or activities completed by given dates) currently exist for the CSCs. Each CSC was established within the general framework of the mission of the NCCWSC and the CSCs and in response to the needs of the region in which they operate. As described below, the NW CSC developed a strategic plan and annually develops work plans. The work plans establish objectives for the fiscal year within the five core service areas of the NW CSC as defined by the strategic plan (executive, science, data, communications, education, and training). While these core service areas and the related annual work plan objectives could provide a basis for assessment, they are not consistent across the CSC network and are more reflective of activities than measures of impact. As a result, the construction of the CSC reviews 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*: Measures of the overall health of the center as an institution, with an emphasis on planning processes, management and operations, finances, and institutional coordination.
- *Actionable science*: Characterize 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 center and through its external grant funding.

- *Capacity building*: Designed to address how well the center 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.

In the ACCCNRS (2015) report, each of these four categories included a series of proposed metrics to assist in quantifying status and, over time, progress toward attainment of the larger CSC goals. However, none of these were specified in the hosting agreement, nor were they part of any programmatic evaluation framework or management objectives established for the CSCs. Therefore, the CSCs could not be held accountable to these measures, but they do, nonetheless, provide a good framework for the organization of this review. As such, the major review categories were employed as a means of seeking background information, identifying presentation and discussion topics and acting at the main thematic components of this report.

HDRU Methodologies[2]

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 the CSC is producing actionable science?
- To what extent are CSC-affiliated science users and producers involved in coproduction of science? 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?

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

Group interviews.—Two group interviews were conducted with partners of the CSCs 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 CSC. One group at each CSC included science producers and the other included science users.

Participants were recruited by the NW CSC with guidance from the HDRU. We attempted to include participants that represented a diversity of organizations and regions. Thirteen participants in the science producers group included faculty members, graduate students, or postdoctoral associates that had received research funding from the CSC. The 14 participants in the science users group included representatives of agencies intended to benefit from the science produced by the CSC. This included representative from the LCCs, federal natural resource agencies, state fish and wildlife agencies, tribal organizations, and conservation NGOs. Essentially, this panel included a number of members from the Executive Stakeholder Advisory Committee (ESAC) and was seen, to a limited degree, to represent the issues and concerns of the current ESAC.

Each interview consisted of a semistructured 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 CSCs and the factors that influenced the ability of the CSCs to work with their partners. The specific question topics focused on how participants have worked with the CSC, reasons for becoming involved with the CSC, benefits of involvement with the CSC, challenges to involvement,

[2] The material in this section is a modified version of material presented in Dayer et al. (2016).

and what the CSC could do to promote even more benefits from involvement. Additionally, we specifically explored how the CSCs contributed to the coproduction of science and the generation of actionable science, with questions about interactions between science producers and science users and the role of the CSC in connecting them. The group interviews were used to inform the development of the survey, and thus, we do not report separately on their results. However, discussion content from each of the two panel discussions was used by review team members as part of the overall material available to them in constructing this report.

Web-based survey.—A standardized, Web-based survey of partners and potential partners of the three CSCs 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 AFWA 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

- Nature of respondents' work
- Perspectives on the importance of addressing climate change
- Extent of involvement with the CSC
- Benefits of involvement with the CSC
- Limitations on involvement with the CSC
- Perceptions of climate adaptation science
- For science users:
  - Use of climate adaptation science
  - Limitations on use of climate adaptation science
  - Importance of and engagement in coproduction of science
  - Limitations on co-production of science
- For science producers:
  - Use of climate adaptation science produced by others
  - Limitations on others' use of climate adaptation science
  - Importance of and engagement in coproduction of science
- Perceptions of the role of the CSC

The survey instrument was reviewed by subject matter experts, including staff from NCCWSC, members of the review teams for the CSCs, 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 Survey Monkey, which provides a means of soliciting participation in a survey via email and recording responses. Survey Monkey 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 Northwest Climate Science Center

The Northwest Climate Science Center (NW CSC) is hosted by Oregon State University in Corvallis and supported by an academic consortium consisting of two primary universities, the University of Idaho and the University of Washington; eight secondary university partners; and three federal laboratory partners (Figure 3). The center encompasses Washington, Oregon, Idaho, and western Montana and has overlap-

Northwest Climate Science Center Consortium

Host university: Oregon State University
Primary partners: University of Washington, University of Idaho
Additional partners: Boise State University, Idaho State University, Montana State University, Oregon Health and Science University, Portland State University, University of Idaho, University of Montana, University of Oregon, Washington State University, Idaho National Laboratory, Pacific Northwest National Laboratory, and Western Regional Climate Center

ping boundaries with three LCCs: Great Northern, Great Basin, and North Pacific (Figure 4). The geographic area covered by the NW CSC is also home to 52 federally recognized tribes.

The host university is a Land, Sea, Space, and Sun Grant institution. Oregon State University has the capacity for extensive climate change research and services. Oregon State University is the host to the Oregon Climate Change Research Institute (OCCRI), a network of more than 150 researchers, including faculty at OSU, the University of Oregon, Portland State University, Southern Oregon University, and affiliated federal and state labs. The National Oceanic and Atmospheric Administration (NOAA) selected OCCRI as the host for the Climate Impacts Research Consortium (CIRC), its Regional Integrated Sciences and Assessment (RISA) program for the Pacific Northwest. Oregon State University's campus also hosts the U.S. Department of Agriculture (USDA) Northwest Climate Hub. The Washington and Oregon Cooperative Fish and Wildlife Research Units are housed at the primary host universities (Table 1).

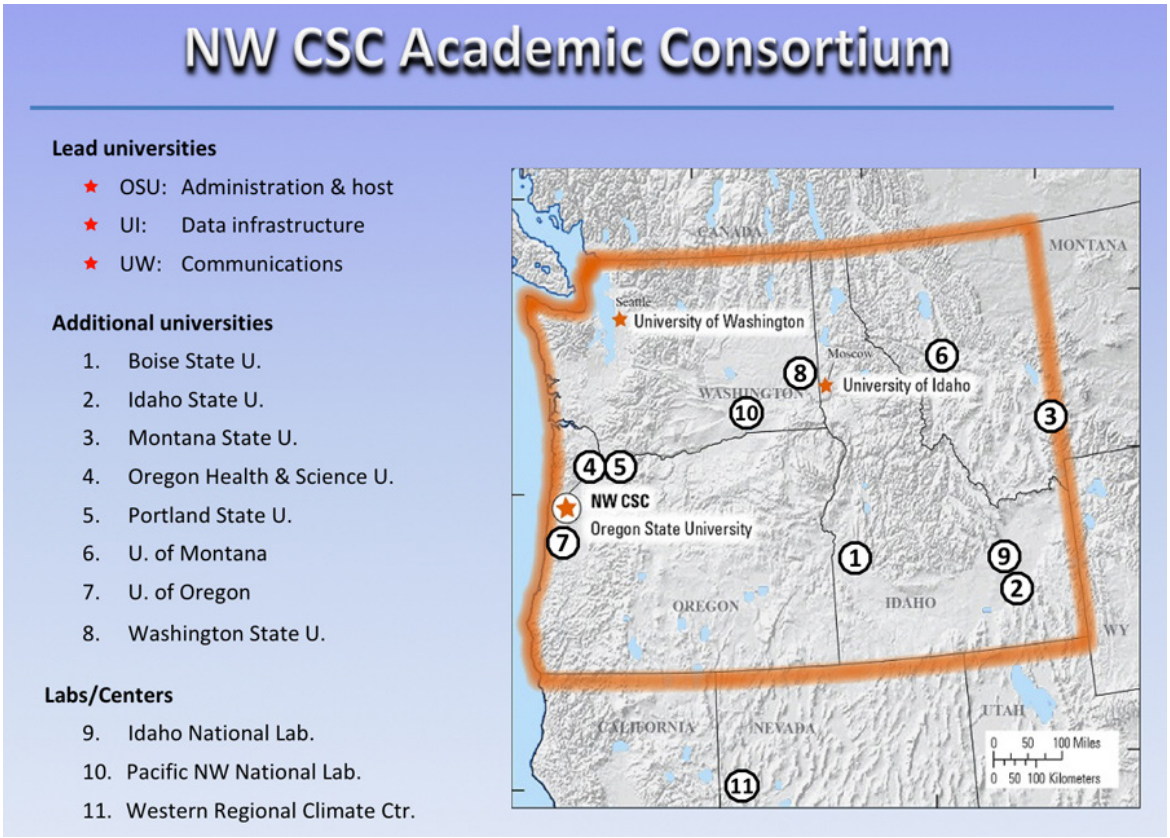


Figure 3. Map of the Northwest Climate Science Center academic consortium.

Figure 4. The Northwest Climate Science Center has overlapping boundaries with three Landscape Conservation Cooperatives: Great Northern, Great Basin, and North Pacific.

Funding for the NW CSC consists of two parallel streams: (1) an annual allocation from the USGS to support the USGS staff, center management, and research programs (i.e., CSC-Federal); and (2) the cooperative agreement with the host university (hosting agreement), which is used for all nonresearch components 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

Table 1. Primary partners in the Northwest Climate Science Center.

Name	Host agency	Mission or purpose statement	Location
Northwest Climate Hub	U.S. Department of Agriculture	Deliver science-based knowledge and practical information to farmers, ranchers, forest landowners, and Native American tribes that will help them to adapt to climate change.	Corvallis Forestry Sciences Laboratory, Corvallis, Oregon
Oregon Climate Change Research Institute	Oregon State University (OSU) and the state of Oregon	Facilitate research by faculty at Oregon's public universities on climate change and its effects on natural and human systems in Oregon; Serve as a clearinghouse for climate change information; Provide climate change information to the public in integrated and accessible formats; Support the Oregon Global Warming Commission in developing strategies to prepare for and to mitigate the effects of climate change on natural and human systems; and Provide technical assistance to local governments to assist them in developing climate change policies, practices, and programs.	OSU
Pacific Northwest Climate Impacts Research Consortium	National Oceanic and Atmospheric Administration (NOAA)	Provide policymakers, resource managers, and fellow researchers with the best available science covering the changing climate of Oregon, Washington, Idaho, and western Montana. One of 11 NOAA-sponsored Regional Integrated Sciences and Assessments program projects.	OSU
Cooperative Research Unit	U.S. Geological Survey	Enhance graduate education in fisheries and wildlife sciences and facilitate research between natural resource agencies and universities on topics of mutual concern. Cooperative Research Units are located at OSU, the University of Idaho (UI), and the University of Washington (UW)	OSU, UI, and UW

management (i.e., CSC-University) (Table 2). Research is conducted through support from both funding streams.

Hosting Agreement

The original hosting agreement between OSU and USGS (September 2010) species five primary functions of the NW CSC:

1. Work with downscaled global change model to create derivative models and tools that link physical forcing factors with biological, physical, ecological, and cultural resource response variables;
2. Develop regional response models and projections for priority ecosystem, species, habitats, and other natural and cultural resources within the region;
3. Work with advisory councils to set priorities for development of response models and forecasts to support adaptation and adaptive management strategies;
4. Help partners define natural, physical, and cultural resource outcomes and endpoints for their adaptation activities in a way that can be measured and used to refine the next iteration of models and outputs; and
5. Facilitate and fund research that supplies regional-level information on the effects of climate change on land, water, fish and wildlife, and cultural heritage resources and on related model and tool development.

It was expected that the CSC would address these issues as the initial focus of the CSC but that the advisory council, later formulated as the ESAC, would refine these and prioritize the focus of the CSC as it matured.

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 science plans, advisory committees, and stakeholder engagement), management and operations (e.g., staffing, physical assets), finances (e.g., budget, hosting agreement), and institutional coordination (e.g., between USGS and university host, among CSC consortium, and with other federal agencies).

NW CSC Operational and Strategic Planning

The NW CSC receives funding and oversight from NCCWSC 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 "U.S. Geological Survey Climate and Land Use Science Strategy" (Burkett et. al 2013) specifically refers to NCCWSC and CSCs as a major vehicle for addressing the document's seventh goal: "[i]mprove understanding and prediction of biological responses to global climate change." As an expression of this

Table 2. Total NW CSC funding through the annual allocation to the CSC-Federal component and the CSC-University consortium through the hosting agreement with Oregon State University.

Fiscal year	Annual allocation	Hosting agreement	Total
2010	$0	$681,153	$681,153
2011	$835,000	$680,130	$1,515,130
2012	$2,045,847	$727,282	$2,727,000
2013	$1,625,000	$763,881	$2,388,881
2014	$1,725,000	$797,409	$2,522,409
2015	$1,530,000	$797,409	$2,327,409
Total	$7,760,847	$4,447,264	$12,208,111

goal, a vision statement was created: "The USGS will provide scientific knowledge needed to manage the Nation's biological endowment affected by rapidly changing climate and land use" (Burkett et al. 2013). Furthermore, the USGS Climate and Land Use Science Strategy identifies NCCWSC and CSCs as one of the primary instruments for building collaborative partnerships and delivering science with particular emphasis on engagement with the LCCs, NGOs, and others.

The USGS NW CSC director also reports to NCCWSC and is responsible for strategic decision making and is accountable for the administration of the center's financial resources. The director is responsible for the preparation of

- *NW CSC strategic plan*—This document guides CSC science priorities and operations (Bisbal et. al 2012).
- *Science agenda* (contained as Appendix B within Bisbal et al. 2012) and *Annual Science Work Plans*—The annual work plan is established at the start of the fiscal year and it contains goals and metrics for that year's activities.
- *Annual reports*—While the hosting agreement stipulates an annual report by the NW CSC university director, since 2011 a joint annual report has been developed by the USGS NW CSC director and the university director that summarizes the activities and achievements of the CSC during the previous fiscal year.

The NW CSC strategic plan (2012–2015) was adopted in January 2012 (prior to the finalization of the USGS science priority document). As a result of the recompetition process and NW CSC review, as described in this report, in October 2014, the ESAC agreed to an extension of all NW CSC strategic documents through September 30, 2016. These documents will need to be revisited in fiscal year (FY) 2017 upon completion of the recompetition.

The NW CSC adopted the vision statement "To become nationally recognized as a best-practice model for the provision of climate science and decision support tools to address conservation and management issues in the Pacific Northwest Region" (Bisbal et al. 2012). A series of guiding statements further clarified this vision and emphasized the engagement of resource managers in the identification of science needs through collaborative research, active communication, networking, and decision-support tools. Two overarching goals were developed: (1) establish a significant and effective leadership presence to strengthen the region's ability to plan and implement a coordinated climate science portfolio, and (2) develop resources and programs to enhance climate science literacy and give regional audiences the necessary tools and information to promote climate change awareness. Importantly, the strategic plan also identifies the clients or those entities that the NW CSC had defined as the primary users of the produced science: "In accordance with the overall goals of the LCC/CSC concept as described in Secretarial Order 3289, science conducted by the NW CSC will be focused on addressing the climate science needs of the LCCs, natural- and cultural-resource managers, tribes, and other stakeholders in the Pacific Northwest" (Salazar 2009). The 4-year science agenda also adopted in 2012 has seven themes: (1) climate science and modeling, (2) response of physical systems to climate change, (3) response of biological systems to climate change, (4) vulnerability and adaptation, (5) monitoring and observation systems, (6) data infrastructure, analysis, and modeling, and (7) communication of science findings. The center also adopted three other strategy plans in 2013: communication, tribal engagement, and education and training.

The review team recognizes that the NW CSC strategic plan was written in the very early stages of development of the NW CSC and, indeed, the entire CSC network. There was little guidance and certainly no background and history upon which to base the strategic plan. As such, the strategic plan focused on the development of administrative and process aspects of the CSC. Partially, as a result, the seven research priorities identified in the science agenda of the strategic plan are too broad to effectively guide project selection. Further identification of research priorities was intended to be provided by the ESAC and would then be incorporated into the annual work plans or otherwise expressed through calls for research propos-

als. However, the review team did not observe that these various processes were working in a systematic, sequential and connected manner and this was reflected in comments provided by the science users panel convened for the HDRU dialogue. As noted above, the strategic plan has reached its intended expiration date and needs to be revised. The NW CSC would benefit from a narrowed scope and clarification of research priorities and focus. A clear differentiation between the strategic plan, a science agenda, and operational plans with clear objectives and timelines would be helpful. The re-engineering of these documents and the process for developing them and a clearer understanding of this by the ESAC would lead to improved planning, common understanding of direction, and overall CSC effectiveness.

Annual reports were available to the review team for FY11 through FY15. The reports provided a solid overview of the projects underway and recently completed by the NW CSC. Written in a nontechnical style that conveys information on activities of the NW CSC to a broad audience, they were very useful in assisting the reader to develop a good understanding of the breadth and depth of the NW CSC. Unfortunately, there was no component of the annual reports, nor companion reports, which summarized financial aspects of the NW CSC. The annual reports grouped projects under the general headings of the strategic plan but did not explicitly map goals and objectives with specific products. In general, the SRT found that annual reporting by both the CSC-Federal and CSC-University was insufficient to fully understand the financial aspects of the research funding activities and the research products arising from the projects. Match is not a requirement of CSC-Federal research funds. However, there have likely been projects that included in-kind or monetary match where documentation would have been useful in describing outside contributions to the project. As a result, reviewers were limited in their ability to fully understand the degree of additional support, such as through match, investment of indirect funds, and other contributions to the entirety of each research project. It should be noted, however, that the reporting requirements in the cooperative agreement (i.e., hosting agreement) are general in nature and do not specify detailed funding reporting. The requirements were

- A comparison of actual accomplishments to the goals established for the period and any significant research findings;
- Reasons why established goals were not met, if applicable;
- Other pertinent information, including, where appropriate, analysis and explanation of cost overruns or projected changes in time or funding needed for completion of project objectives; and
- One copy of any publication resulting from the USGS-supported projects.

While the reports reviewed from FY11 through FY15 met these requirements in a very general manner, the level of detail could be improved. In order to maintain the integrity of the design of the current reports and provide information to the broader audience to which it is intended, it may be necessary to develop a companion reporting format that addresses the more detailed needs to better characterize the full impacts of the CSC in meetings specific goals and to more completely document the financial aspects of the CSC.

Recommendations for the NW CSC Strategic and Annual Plans

1. The next NW CSC strategic plan, anticipated to be developed in 2017, should provide a more specific programmatic focus, prioritize investments, prepare to track progress, and identify outcomes.
2. On an annual basis, the CSC-University, with inclusion of comparable material from all partner universities or research entities should provide a complete annual report that addresses all financial components and research findings of the CSC-University agreement.
3. As the CSC-University will leverage CSC funds into other projects, grants, and related activities, these funds will need to be fully documented and included in the annual report.
4. Additional university contributions, such as indirect cost recovery, need to be documented as an over all university component of the CSC.

NW CSC Executive Stakeholder Advisory Committee

The USGS NW CSC director regional science priorities from ESAC. Executive Stakeholder Advisory Committee seats are to be held by executive-level representatives from relevant federal, state, local, regional, and tribal organizations. Currently (as of March 2016), the NW CSC ESAC comprises representatives from 4 state agencies, 6 tribal entities, 3 LLCs, and 16 federal agencies, as shown in Appendix D. The purpose, role, and membership of the NW CSC ESAC is guided by NCCWSC through the Terms of Reference (TOR) document (NCCWSC 2014).

There are multiple opportunities for the ESAC to provide input and guidance to the NW CSC:

- NW strategic plan development, evaluation, and modifications.
- NW CSC annual work plan development. The USGS NW CSC director circulates a draft of this document to the ESAC for comment.
- NW CSC annual report review. The USGS NW CSC director circulates a draft of this document to the ESAC for comment.
- Semiannual conference calls and the annual in-person meeting, as well as participation and discussions at the Pacific Northwest Climate Science Conference.

The ESAC has one in-person meeting per year and approximately two conference calls per year. In the beginning, the in-person meetings were 2 days. However, because of low attendance during the second day, the ESAC meetings were shortened to 1 day. The semiannual conference calls are typically 2 hours in length and provide an opportunity for the CSC director to update the ESAC on the activities and achievements. The USGS NW CSC director also provides the ESAC with periodic updates and announcements about CSC activities. Furthermore, the USGS NW CSC director also visits ESAC members when traveling through the region. The review team recognizes the time limitations of ESAC members as well as NW CSC staff and host-university researchers. Partnership fatigue is a commonly cited challenge throughout the conservation community, reflecting the nature of conservation activities that are frequently dependent upon the joint actions of multiple partners. The often seemingly excessive demands for already overextended staff to participate in multiple meetings and other coordination activities is a challenging

The Stakeholder Advisory Committee Terms of Reference Definitions

Purpose

Stakeholder Advisory Committees assist Climate Science Center (CSC) directors in the identification of regional natural and cultural resource management priorities and science needs. This guidance helps to shape the development and implementation of CSC strategic science plans and periodic funding actions. Stakeholder Advisory Committees are also crucial for providing feedback on the direction and effectiveness of the CSC program.

Roles and Responsibilities

1. Provide counsel for the development and periodic updating of the regional science agenda (5 year) for the CSC.
2. Provide counsel on the development of CSC planning and implementation documents, including periodic short-term science plans and strategic solicitation documents for periodic funding opportunities.
3. Provide and facilitate feedback concerning how effectively CSC products meet the needs of stakeholders.

reality. Yet, the review team was informed by ESAC members and others of the sense of diminished meaningful engagement. Executive Stakeholder Advisory Committee meetings and communications should be re-evaluated, ESAC members engaged in discussions about the form of their involvement, and models of engagement modified to enhance involvement.

When the ESAC was first constituted, it was composed of the highest ranking individuals in each of the partner organizations. This composition was desirable and warranted for identifying, coordinating, and communicating regional management priorities as guided by NCCWSC during the NW CSC initial formation, as it matched the skills and expertise of the ESAC membership. The ESAC was described by one presenter as a "board of directors" and the member organizations initial set of representatives matched that level of authority. The regional executives on the ESAC are intended to help ensure that NW CSC research activities are not redundant and can be leveraged by other federal and state agencies where the opportunities arise. However, as the CSC matured over time, the focus and role of the ESAC seemingly shifted more to operational guidance role, causing participation in the highest ranking individuals from each of the partner organizations to decrease. In a sense, this may have been a natural progression where initial strategic-level positioning of the CSC relative to the missions and program of other agencies was central. Executive Stakeholder Advisory Committee member agencies sent representatives who would be both able to discuss interagency relationships and strategic partnerships. Subsequently, the ESAC moved into other charges of the TOR that focused on annual work plans, management needs, science prioritization, and related activities. Partially as a result, as well as due to the limited availability of high level administrators, the ESAC member agencies and organizations modified the staff selected to represent them in more recent meetings. At present, most of the individuals that participate in the ESAC are mid-level managers/coordinators for their respective organizations. The TOR for the ESAC is simply too broad to expect that a single, consistent representative would be appropriate to address charges that range from the strategic, to science priorities, identification of resource management needs, to operational guidance.

The ESAC is chaired by the USGS regional director. Therefore, the effectiveness and level of engagement of the ESAC with stakeholders is strongly influenced by the ESAC chair. In a separate interview by SRT Chair Jill Rolland and AFS Executive Director Doug Austen with USGS Regional Director Rich Ferrero, it was recognized that turnover in that position has led to inconsistent ESAC leadership in the past. Furthermore, despite the seemingly hard-wired structural connection of USGS regional leadership of the ESAC, there has historically been a limited engagement of USGS science centers with the NW CSC. Recent efforts are being made to enhance the broader USGS involvement. While the SRT recognizes the intent of the prescribed USGS leadership role of the ESAC to further enhance USGS involvement, it also suggests that such a construct could have multiple negative effects. These may include (1) lack of opportunity for other partners to engage in leadership roles and consequent reduced commitment, (2) inherent lack of available time and attention by high-level USGS leadership, and (3) perceived possible conflict of interest resulting from elevated USGS strategic guidance or influence of a USGS program that is predicated upon a partnership model (although there is no explicit authority).

There appears to be some confusion about the original purpose of the ESAC as well as the current expectations, particularly among those ESAC members or representatives who participated in the review process. The USGS NW CSC director noted that the original purpose of the ESAC, as outlined by NCCWSC, was to provide guidance on the regional management priorities. However, the work plan for FY15 states, "The NW CSC receives guidance from the Executive Stakeholder Advisory Committee (ESAC), which helps identify **strategic science priorities** (*emphasis added*) and sets the NW CSC's long-term climate science agenda" (NW CSC 2014). This same language was present in earlier annual work plans. Furthermore, the TORs specifically state, "Stakeholder Advisory Committees (SAC) assist Climate Science Center (CSC) Directors in the identification of regional natural and cultural resource management priorities and science needs." In an effort to identify management needs of the organizations represented on the ESAC, the CSC conducted a focused activity as its October 28–29, 2014, ESAC meeting. This exercise used "lightening talks" by the

ESAC members as "an experiment at this year's meeting in which ESAC members were asked to present their agencies' top 2–3 management priorities related to climate change and concepts for needed science or decision support" (ESAC 2014). This was followed by a facilitated discussion to further explore the items identified in the talks. Yet, from the results, it seemed difficult for the ESAC participants to differentiate among management questions, tools, information needs, science needs, or a variety of other responses. This reflects in no way the adequacy of the NW CSC, but rather the challenge in isolating specific management needs in a setting consisting of representative reflecting a wide variety of agencies, levels of staff, and responsibilities.

The review team recognizes the consistent effort by the USGS NW CSC director to differentiate between management needs and science needs. Yet, this separation seemed to consistently be difficult to maintain throughout the development of various CSC documents, discussions, and understandings of the ESAC members. A number of challenges can be identified that contribute to this challenge.

1. The foundational documents (TOR, work plan, etc.) clearly state that both management and science needs identification and prioritization are within the defined roles of the ESAC.
2. Members of the ESAC have, inevitably, changed over time in terms of the individuals as well as the agency administrative level represented by the participant. This lack of corporate memory results in participants' failure to understand previously agreed upon roles and expectations. Whether those expectations are explicitly defined in documents, the result of cumulative conversation, or simply the product of the investment in developing common understandings through the personal involvement in programmatic maturation, they are lost or confused over time with resulting lack of consistent understanding by ESAC members.
3. The original composition of the ESAC was intended to include agency representatives operating at the strategic level. Input was desired on strategic management priorities, guidance for developing the central mission and vision, and other needs reflecting the establishment of the CSC. Knowledge of specific management needs would not be expected to be resident in that particular initial ESAC assemblage.
4. Executive Stakeholder Advisory Committee member organizations likely did not implement specific exercises within their host organizations to identify the unique management (or research) needs that could be addressed by the NW CSC (although this was not validated by the review team through specific directed questions or surveys). It was, however, noted in ESAC meeting minutes (October 28–29, 2014) that the LCCs conducted self-assessments partially to address this need. Furthermore, most agencies have assembled lists of management needs as part of their own internal strategic planning and plan-of-work activities. Such general efforts, though, frequently lack specificity and are unlikely to include the feedback processes to iteratively result in recommendations and needs assessments that provide the necessary direction to the CSC.

The role of the university partners in the ESAC also would benefit from clarification. The ESAC TOR states that "Institutions that are members of a CSC host consortium *may not* be formal members of the SAC, but are encouraged to be participants/observers and to provide technical input to the SAC" (NCCWSC 2014). Therefore, CSC-University hosts are not allowed to be formal ESAC members in the sense of participating in votes or formal actions. This protects participants from potential conflict-of-interest violations that could result from researcher involvement in identifying priority research needs that they then would be advantaged in a competitive proposal process. However, such formalities have not been a component of ESAC activities, so such a distinction is not relevant. University partners have been consistently invited to ESAC meetings and conference calls. For example, multiple representatives of the three primary host universities participated as observers or presenters in the lightening talk activity and other components of the October 28–29, 2014 ESAC meeting. It was noted that university partners were invited to provide feedback on management priorities identified in the lightening talks, but no such response was provided. Furthermore, university ESAC participation has only been by rep-

resentatives of the three primary institutions (OSU, UO, and UW); representatives of other consortium members have not participated in ESAC discussion. If the purpose of the ESAC is to provide management priorities (again, noting the perceived confusion described above), which in turn help define science priorities for the NW CSC, there should be a means for more clarity in roles, inclusive participation of the full university consortium, and more substantive participation by the NW CSC university consortium in ESAC discussions.

While there are numerous opportunities for the ESAC to advise and guide the NW CSC, the potential value of the ESAC has not been fully realized. There appears to be challenges in getting the ESAC consistently and deeply engaged in advising and guiding the management priorities of the NW CSC. Indeed, and as discussed in more detail in the Partnerships section, the SRT discussion with a science user focus group, primarily represented by ESAC members, found that the depth of engagement by the ESAC was limited. Executive Stakeholder Advisory Committee members expressed frustration that they were not fully engaged in meaningful dialogue, but rather were mainly provided information without sufficient opportunity to effectively and constructively impact science priorities. The review team recognizes that the NW CSC has worked to maintain a connection between management applications and research projects and are consistent with ESAC priorities, yet this was often not clear to the ESAC members.

In practice, most of the codevelopment and actionable science takes place at the principal investigator (PI), or project, level through interactions with specific stakeholders. It appears that a number of barriers inhibit the effectiveness of the ESAC, including lack of clarity regarding the purpose and role, challenges regarding ESAC leadership (time and effort required to effectively lead this group), and mismatches between the knowledge and expertise of ESAC representatives and the proposed and realized roles in providing recommendation and guidance to the CSC.

Recommendations for the NW CSC Advisory Committees

- The purpose and role of the ESAC needs to be clarified and better communicated to all of the parties involved. Even though this likely has been done in the past, it was clear from discussions with ESAC members that there was uncertainty, lack of clarity, or lack of concurrency between the TOR and either the expectation or the desires of the ESAC members. Furthermore, there was confusion and misunderstanding about the application of Federal Advisory Committee Act guidance with regard to inclusion of university researchers on ESAC or other advisory groups.
- Improved training and guidance, including best practices, needs to be developed by NCCWSC and the consortium of CSCs to improve construction, management, and overall utilization of the ESAC or comparable bodies. Throughout all strategic planning, science guidance, and work plan documents, the importance of partnership engagement is identified as a critical activity. Yet, little or no emphasis is given to employing expertise in working with advisory bodies. The NCCWSC–CSC network should make a priority of establishing, through strategic hiring or acquiring through contractual services, expertise in managing such bodies. The NCCWSC–CSC network should establish internal work teams to ensure that best practices are employed and a learning environment developed to ensure that advisory bodies are well managed, provide useful guidance to the CSCs, and fully understand a jointly establish set of TOR.
- The effectiveness of the ESAC is, in part, reliant upon the ability of the ESAC members to fully engage in CSC discussion in their host organizations. Yet there appears to be limited understanding of that liaison or representation role, expectations, and commitment to fully embrace that role. Discussion of those expectations should take place among the ESAC and verification or commitment obtained that ESAC members and their organizations will fulfill those roles to the greatest degree possible.
- The CSC and NCCWSC, through its TOR for the SACs, should reconsider mandatory

leadership of the SAC by USGS regional director. This defined leadership model may be seen by some as constraining, somewhat parochial, and a limiting factor in the full engagement by interested partners. A self-governing model may help the SAC to more fully develop as an advisory body to the CSC.

- Consideration should be given to maintaining an ESAC comprised of executive leadership to focus on the development of strategic management priorities. This group should function at the oversight level and interagency coordination level.
- Although the review team had varied opinions on this, it is suggested that a second advisory body could be established to act as a guiding coalition in setting operational and science priorities. The membership of this science advisory committee would be comprised of practitioners and science users who are actively involved in research in the region. This might include, for example, scientists from USGS centers, USFWS, NPS, and academic institutions. This committee should also include the CSC-University hosts and other academic institutions in the region. Such a working group is suggested as simply a means to enhance the opportunities for engagement in the establishment and communication of science priorities.
- There currently exist multiple advisory bodies in the Pacific Northwest with charges similar enough and quite likely with overlapping membership to that of the NW CSC, such that there could be mechanisms developed to enhance efficiencies and collaboration. While not diminishing the support and focus on the NW CSC, efficiencies may be gained by scheduling joint or concurrent meetings, hosting joint workshops, or creating joint leadership groups. The issue of partnership fatigue is real and has resulted in diminished participation in the ESAC, and any reasonable mechanism should be explored to identify ways to increase the efficient use of participants' time.
- As constructed, the ESAC seems to be charged with a diversity of purposes, none of which it is currently able to accomplish successfully, and although the review cannot provide a singular solution, it clearly recognizes the need for careful review and possible redesign of the advisory process.
- The science user focus group (as constructed for the HDRU partnership dialogue) was not far from being a knowledge utilization study. Each of the members was able to say what information he or she found useful. With only slight modification, this format can be modified to (1) assay the value of CSC products to the user community, (2) assay the user community's priorities for the upcoming funding cycle, and (3) provide some accountability and transparency for the CSC decision making and spending plans.

NW CSC Institutional Coordination

USGS and university host.—Both the CSC-University hosts and CSC-Federal staff meet together as the CSC Leadership Team (LT) to discuss science priorities. The LT is composed of the USGS NW CSC director, the USGS regional executive officer, and PIs from the primary host universities, and was established to allow for open and regular communication among key entities and individuals involved with the functions of the NW CSC. The team addresses business matters, program management, education and training, communications and data management coordination, and other emerging issues through conference calls every 2 months and semiannual face-to-face meetings.

However, CSC-University hosts and CSC-Federal staff do not seem to engage in joint research project development. The CSC-Federal and the CSC-University hosts have seemingly separate mechanisms for receiving advice on science priorities. There appears to be a compartmentalization where the CSC-Federal and their ESAC partners operate separately from the CSC-University hosts and other climate science organizations with little flow between the two compartments. The selection and funding of university fellows and the NW CSC request for proposal (RFP) processes could also be better coordinated. Furthermore, there appeared to be limited interaction and insufficient coordination between the host-agreement funded research projects and support of graduate students and postdoctoral researchers with projects funded through CSC-Federal funds. It was recognized that there was awareness of the various projects, but the

degree of full engagement, development of joint project teams, integrated research efforts, and other characteristics of a fully integrated program were not apparent.

The review team acknowledges that there may be timing issues, particularly associated with the university calendar and traditional graduate student academic schedules that limit the degree of coordination with existing processes. However, better linkage may assist in the overall challenge of alignment of graduate research and the defined management needs of the NW CSC.

One of the key attributes of OSU as a host organization for the NW CSC was the proposed linkage and engagement of multiple academic departments from throughout campus. Ideally, this would enhance the diversity of expertise, bring in new perspectives, and create more effective partnerships with faculty. Ideally, this would enhance the usability of the research in natural resources management issues where such direct application is often not the primary focus of the host department. However, although the SRT recognized that such outreach was apparent, there appeared to be a much greater potential that what currently exists. In particular, it was noted that greater engagement with the OSU Department of Fisheries and Wildlife and the Cooperative Fish and Wildlife Research Unit would be beneficial. The appointment of USGS NW CSC director as a courtesy faculty in the Department of Fisheries and Wildlife in January 2015 may help with this effort.

Numerous possibilities resulted in and continue to perpetuate this disjunction between the federal and university components of the NW CSC. Cultural differences with regard to academic motivations, goals, and performance measures differ from those of federal agency scientists and program managers. In a simplified characterization, the CSC-University is focused on educating students and research program development while the CSC-Federal is focused on the coproduction of science to address the needs of resource management agencies. However, it is acknowledged that there are certainly examples of coproduction among the university partners. A direct result of this compartmentalization is the appearance that the CSC-University scholars have little knowledge of the CSC-Federal or the natural resource questions that the management agencies on the ESAC are posing to the CSC. There is significant disconnect among the ESAC, CSC-University hosts, and the CSC-Federal regarding understanding of roles, priorities, and even fundamental goals of the NW CSC entity.

Among CSC consortium.—The CSC-University primary partners and the other academic consortium partners are not fully engaged amongst themselves or with the CSC-Federal. The host consortium (described on page 8), for all practical matters, consists of the three lead academic institutions operating with little engagement from the 11 secondary universities or the federal laboratories.

Of 77 projects enumerated in Appendix G, 37 were led by principal investigators at the three primary host institutions. Thirty-eight went to other federal agencies, NGOs, and other entities, and only two were provided to other host university consortium partners. Furthermore, there was little engagement of secondary university representatives in any advisory body, forum, or other NW CSC advisory, coordination, or planning activity that was brought to the attention of the SRT.

The SRT fully recognizes that there are pragmatic limits to the amount of time available for coordination, and limitations on funding may preclude broad inclusion of partners at some level. Yet, the SRT was disappointed by the nonsubstantive and inconsequential involvement of such partners who could have provided valuable capacity to the NW CSC. The SRT was made aware that CSC-Federal staff have near-term plans to reach out to these partners. However, this consortium structure was a component of the host-university proposal and it should be an obligation on their part of make such efforts. That such little progress had been made in fully engaging the entire consortium was disappointing and should result in a full reassessment of value of such a large consortium structure.

With other federal agencies.—The NW CSC university director is also the coleader for the NOAA-funded CIRC, the RISA program for the Pacific Northwest. It was suggested that this coleadership would lead to effective integration of CIRC and NW CSC activities; however, evidence of such integration was not

fully explored by the SRT, and additional documentation would be beneficial. The two entities jointly funded the 2012 project "Integrated Scenarios of Climate, Hydrology, and Vegetation for the Northwest." In a similar manner, the USGS NW CSC director serves on the steering committees for the North Pacific, Great Northern, and Great Basin LCCs and is also a member of the USDA NW Climate Hub Steering Committee. Furthermore, the coordinators of these three LCCs and the hub director serve on the NW CSC ESAC. In the past 5 years, several projects have been funded jointly and developed in coordination with the NW CSC and these other organizations. In 2015, the NW CSC capitalized on other regional partnerships when it worked with the USDA Northwest Regional Climate Hub and the Great Basin LCC on the reintroduction of beavers to the northern Great Basin.

The NW CSC has also partnered with two other CSCs to produce timely, actionable science. The NW CSC worked with the Alaska CSC to support a project incorporating glacier dynamics into streamflow models for Alaska and Washington. The NW CSC also cosponsored a project with the Joint Fire Science Program and Southwest CSC to examine the relationship between climate change and fire and subsequent impacts to sensitive-status birds in the Great Basin. The SRT was also informed about the potential development of a trans-Pacific project that would include the Pacific Islands, Alaska and, possibly, the SW CSCs. These are excellent examples of cross-CSC partnerships to address large-scale climate challenges.

The SRT did not observe the development of a strong working relationship with the USGS Cooperative Fish and Wildlife Research Units, although it may have existed without being brought to the attention of the SRT. These joint university-federal-state partnerships may provide access to an existing and generally effective working relationship among management agency staff, university researchers, and students that could prove valuable to the NW CSC.

Need for a General Statement of Joint Mutual Intent

The absence of a fully mature administrative/organizational model upon which to base the CSC federal–university partnership and lack of understanding of differing cultural norms between university hosts and federal sponsors were identified as significant issues. The essential and foundational relationship aspects of the federal–university partnership are key and often ill-considered components of any model like the CSCs. Establishing a mutually agreeable set of joint interests that reflect both the nature of the work to be accomplished and, possibly more importantly, the unique and different cultural norms of the partners is essential to long-term viability. This becomes increasingly important as the individuals who constructed the initial agreements move on to other roles or are succeeded by new staff who lack the corporate memory of the shared values. Development of an agreement, either as a component of the contractual process or required in the response to the RFP to ensure that proposals reflect such values, is a critical and necessary step in the process.

Recommendations for NW CSC Institutional Coordination

- The SRT recognized that the driving philosophies of the two components of the NW CSC—federal and university—were different. The review team encourages all projects, regardless of origin, to be linked to commonly defined NW CSC topics with clear links to resource management applications. Mapping of all projects to NW CSC science agenda themes and subthemes should be a requirement.
- Establish a statement of shared values and mutual intent among CSC-University, CSC-Federal, and NCCWSC to define the 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. Other partnership constructs (e.g., Cooperative Ecosystem Studies Unit) may provide a model statement that can be used to construct such a document (see Appendix F). Such a statement should be attached to or otherwise incorporated into the final hosting agreement or defined as an initial product of the partnership.

- A statement of shared values, intent, and expectations for all CSCs should be included in the RFPs, and all respondents should be required to provide a full description of how they will adhere to the statement or, if necessary, provide specific documentation of proposed modifications with appropriate explanations for the necessity of such modifications.
- Expand and coordinate work with the USGS Cooperative Fish and Wildlife Research Units at OSU, UI, and UW.
- Although not a direct target of the NW CSC review, it was clear that national coordination is an important component in the maturation of the NW CSC and the CSC network. The USGS CSC staff meet quarterly to address a myriad of administrative challenges, including such activities a receiving training on grant management. However, there have been limited opportunities for CSC host-university PIs to similarly gather to exchange information and coordinate projects and other fundamental activities to enhance research and learn from CSC experiences. The SRT understands that such an event is planned for late 2016 and encourages such activities to be scheduled on a regular basis.
- Encourage the host universities to invite USGS scientists to participate as adjunct or affiliate to enhance engagement in the CSC.

CSC-Federal Staff and CSC-University Engagement

Due to the breadth of USGS scientific expertise available to the NCCWSC and CSC community, as well as in support of the development of a collaborative and collegial environment, mechanisms promoting increased communication and engagement (e.g., exchange of knowledge, ideas, and personnel) among the CSC-University and USGS staff and stakeholders should be promoted. The development of formal university affiliations (e.g. adjunct status) by federal agency scientists is a common practice and has produced many benefits to both parties. As noted previous, the USGS NW CSC director has courtesy faculty appointments at OSU with the Department of Fisheries and Wildlife (established in January 2015) as well as an earlier appointment with the College of Earth, Ocean, and Atmospheric Sciences (CEOAS) obtained in November 2011. The NW CSC research coordinator also holds a courtesy faculty appointment with CEOAS. While this effort may not have yet resulted in the benefits intended, the effort has been initiated.

To expand upon this, it is recommended that the NCCWSC and CSCs work with the host universities to identify and employ mechanisms to expand engagement of USGS scientists throughout the NW CSC operational area with the CSC-University scientists across the consortium.

Recommendations

- The relationship established between the USGS NW CSC director and staff and that of the NW CSC university leadership is critical to the overall success of the NW CSC entity. All efforts should be made to enhance regular interaction between these NW CSC partnership components. Under the appropriate circumstances, location of NW CSC federal staff within the host academic department could provide substantial benefits to all parties.
- Where USGS rules and university policies and procedures allow, CSC-Federal staff should be encouraged to collaborate and engage in academic activities such as graduate committees and the like. The review team recognizes the courtesy appointments obtained at OSU by USGS NW CSC director and staff and we encourage exploration of an expansion of this to other select and relevant USGS researchers throughout the NW CSC operational area with any of the three main host institutions.
- One of the goals of the CSCs is the development of climate change researchers and informed professionals through support of graduate students and postdoctoral fellows, yet there appears to be few mechanisms developed to take further advantage of resulting graduates. The CSC-University and USGS should explore options for enhancing awareness of employment opportunities within USGS and in other agencies, including through internships, collaborative research, programs such as the federal Pathways program, and application processes for regular positions.

Area of Operation and Scope of Research

The expansive design of the CSC-University consortium should have resulted in a positive and discernable impact upon the ability of the NW CSC to effectively address the extensive issues reflective of its geography. The NW CSC includes partners from 11 state universities and three federal laboratories, yet it was clear that 8 of the 11 university partners were only marginally or inconsequentially involved in the NW CSC research program. The challenge to ensure a balance between geographic coverage and quality of research for each individual institution is complicated both by the extensive geographic scope of the CSCs and by limited funding. However, to enlist academic partners with no effective or even discernable involvement in the CSC is, at most, a waste of effort and, at worst, disingenuous. The SRT recognizes that there is no clear solution for this balance but recommends the following guidance:

Recommendations

- The CSC-University host, be it a single entity or consortium, must identify in the RFP how research support and associated activities in the representative geographical region of the operational area of the NW CSC will be provided most effectively. This research support should include an assessment of current science needs identified through NW CSC science planning documents, LCC science needs assessment, or other relevant compilations and a cross-tabulation of how the proposed host institutions will address those needs through existing areas of expertise or how they will develop a new capacity to address such defined needs.
- A core component of any consortium should be the linkage of faculty and graduate student activities among multiple host institutions. The applicant should describe specific linking actions that will be implemented, reported upon, and evaluated. These should be designed to engage students and faculty across institutions, with the result being to enhance cross-disciplinary learning, offer new collaboration opportunities, invite joint funding opportunities, and demonstrate efficient and effective use of unique capacities that each university brings to the consortium.
- The full geographic scope of the CSCs should in part be addressed through the engagement of the CSC-University with USGS scientists and laboratories throughout the CSC region.

Actionable Science

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 NW CSC and through its external grant funding. However, it was apparent that there were wide-ranging perspectives and a lack of common understanding of the role of the NW CSC as an instrument of actionable science or its role as a translator of science products into a form usable by resource managers. For example, it was stated by one of the host-university PIs that the original construct of the NW CSC did not suggest that they would be the translator of science, but that such a role would be more appropriate for the LCCs. This issue is also explored in the Web survey of science users and producers in the HDRU component of this evaluation report.

The 2015 ACCCNRS report to the Secretary of the Interior recommended that the CSCs conduct actionable science that "provides data, analyses, projections, or tools that can support decisions regarding the management of the risks and impacts of climate change. It is ideally co-produced by scientists and decision makers and creates rigorous and accessible products to meet the needs of stakeholders" (ACCCNRS 2015). While the NW CSC strategic plan, which was published in 2012 before the

ACCCNRS report, does not explicitly refer to either actionable science or coproduction, it implicitly does so in stating that "science conducted by the NW CSC will be focused on addressing the climate science needs of the LCCs, natural and cultural resource managers, tribes, and other stakeholders in the Pacific Northwest. Addressing these needs effectively and efficiently will require a collaborative approach to summon existing expertise in multiple scientific disciplines at different institutions." (Bisbal et al. 2012). Clearly, one important vehicle for describing the process of actionable science is the NW CSC Science Agenda. Furthermore, there is a critical role for the ESAC in contributing to and ensuring the identification, development, and implementation of actionable science.

Science Agenda

The NW CSC Science Agenda, as described in the FY11 annual report, was "developed by a USGS work team in consultation with the ESAC" (NW CSC 2012). The exact nature of this consultation is unclear, and later annual reports say simply that the agenda was "established by the ESAC." Further, the ESAC members who attended the Corvallis meeting of the SRT seemed unclear on their specific roles in establishing the NW CSC Science Agenda or annual priorities. Nonetheless, it is appropriate that the NW CSC identify how its research projects support the agenda.

The Science Agenda consists of seven broad themes, each with several subthemes (a total of 32). The ScienceBase Data Entry for Project Tracking and Highlighting (DEPTH) Web portal allows searching projects corresponding to each subtheme. The identification of and linkage to NW CSC Science Agenda subthemes is the responsibility of the PIs submitting proposals. The subthemes identified by PIs are then vetted and verified by the NW CSC research coordinator, who then also links the proposal/project with additional Science Agenda subthemes, as appropriate. Of the 51 NW CSC projects listed in the portal, 47 correspond to at least one subtheme and most to several (Appendix G). Each project description also lists the specific subthemes that the project addresses. The NW CSC is thus clearly making an effort to identify the linkages between projects and the Science Agenda.

In addition to continued efforts to identify each research projects role in responding to the Science Agenda subthemes, the actionability of projects should continue to be emphasized through the continued and expanded recruitment of research users to graduate student committees (if allowed by the university), as coauthors of proposals, and through other means of engaging research users in various phases of research project development, implementation, and completion. We recognize that this does currently take place in a number of projects. For example, NW CSC-supported student projects were presented for one morning session, and each included a regional agency or resource management partner. These projects were quite diverse and demonstrated an adequate scientific standard. It was commented that the design of these projects on the OSU side was modelled after the National Science Foundation's (NSF) Integrative Graduate Education and Research Traineeship (IGERT) program, which was quite successful in this regard. These projects were notable in that they all appeared to involve the management partner in a significant aspect of the project (design, execution, analysis, and dissemination). Expressions by those management partners present during the review were uniformly positive, indicating that these products were seen as satisfactory and were being delivered in an acceptable time frame. These projects were, however, relatively narrowly focused and of limited utility to a larger regional audience of natural resource managers.

Indeed, it was reported by USGS NW CSC director that a requirement for resource management involvement in funded projects has been standard operating procedure. Through a sample of 20 projects funded by the NW CSC from FY2011 through FY2014, nearly 400 unique managers and practitioners from 130 different federal and state agencies/bureaus/departments, tribes and tribal organizations, and NGOs participated. Resource managers were named in project proposals (121), letters of support (79), final reports (122), workshop attendees (206), and advisory committee members (25).

Continued encouragement and assistance to graduate students in establishing end-user involvement in projects would be beneficial, and it may be desirable to include statements recommending such in-

volvement in RFPs. As an example, the ecological drought RFP states that statements of interest will be evaluated in part (25%) on "how intended users...may apply the innovative technique(s) to lessen or adapt to the ecological impacts of drought" and 10% on "plans to actively engage with the intended users of the innovative approach, tool(s), or adaptation" (NW CSC 2015). The criteria for evaluation of full proposals includes 25% on management significance and engagement, with one subcriteria that the proposal "identifies the intended end users of the innovative tool or adaptation technique (e.g., resource managers and decision makers) and explains how the intended users will be meaningfully and regularly engaged in the planning and administration of the proposed project" (NW CSC 2015). This includes describing "any arrangements to include natural and cultural resource managers in the project design team" (NW CSC 2015). Such inclusion of end users on project design teams, graduate committees, and mechanisms are strongly encouraged. These requirements, assuming that similar ones appear in other RFPs, are laudable.

Such a requirement would also respond more fully to the ACCCNRS recommended practices for coproducing actionable science (Appendix IV, ACCNRS 2015). Guiding Principle #2, "Start with a decision that needs to be made" is particularly apt in this context. Continued exploration of employment of science coproduction, the processes involved, existing components, and relationship to the goal of actionable science is encouraged. This is an area of investigation in a number of CSCs, and also with NCCWSC. Broad cross-CSC community interaction would be beneficial.

The CSC-Federal and the CSC-University hosts have used, at various times, separate mechanisms for receiving advice on management and research priorities. One significant source of input used by the university hosts prior to full establishment of the CSC-Federal, was a CIRC-led effort in 2011 that included three intensive stakeholder workshops, one-on-one conversations, and discussions with LT, CIRC's advisory council, and ESAC. Of course, once fully established, the ESAC, through the science agenda, provides guidance to the CSC. Emphasizing and exploring mechanisms to enhance work towards an actionable science approach within the ESAC, as well as at the university and with other climate partners, is encouraged. Employing processes similar to the 2011 exercise or any one of a number of other approaches should be considered as future tools to build new dialogue among researchers and managers, develop better coproduction models or other approaches, and define more explicit goals and measures or actionability. The science is more likely to be both useful and used if it begins with a decision to be made rather than a deliverable to be produced. The leadership team should review the principles and practices as they develop future RFPs and graduate student projects to enhance the full utilization of the research products.

In general, it is clear that some projects have connections to resource management questions. However, the projects carried out and reported back do not appear to come full circle to the ESAC. The ESAC expressed that it was not clear to them how the questions they developed were being addressed and how project outcomes are being reported back to the ESAC. This appears to be an issue that could be resolved through how the ESAC is managed and/or how reporting of project outcomes is delivered to ESAC members. It seems that from the time the research agenda is developed to when projects and/or students are funded, there is no feedback mechanism to ground truth the relevance of the work to resource managers. Additionally, the two separate mechanisms for receiving advice on priorities do not seem conducive to the CSC functioning as one cohesive unit.

Relevance.—Despite the seemingly positive picture, there was the expressed perspective among the ESAC members and others involved in the focus group discussions that many NW CSC products were not meeting regional resource manager needs. Alternatively, ESAC members and others were simply not hearing about projects funded by the NW CSC that directly addressed the management questions that they raised in the priority setting exercises. Indeed, the HDRU survey found that only 36% of science users responded that they were involved in the identification of research questions. Furthermore, nearly 60% of the science users in the HDRU survey responded that lack of definition of the management issues was a barrier to the use of the NW CSC science products.

North Pacific Landcape Conservation Cooperative and Northwest Climate Science Center Joint Effort to Translate Research Findings into Management Guidance

An excellent example of how the CSC and LCC network can work synergistically was illustrated by two projects. The first was a 2012 Northwest Climate Science Center (NW CSC) project, "Marshes to Mudflats: Climate Change Effects Along a Latitudinal Gradient in the Pacific Northwest," with the lead investigator from the U.S. Geological Survey Western Ecological Research Center and co-leads from Oregon State University and University of California, Davis. This project examined the effects of sea-level rise (SLR) on coastal marshes in the Pacific Northwest and established the Coastal Ecosystem Response to Climate Change (CERCC) program, a network of sampling sites along the Pacific Northwest coastline, to help understand SLR impacts. In 2013, the North Pacific Land Conservation Cooperative (NPLCC) funded the project "Coastal Ecosystem Response to Climate Change (CERCC): disseminating climate science results to coastal managers for implementation in long-term planning." This second project supported NPLCC science communication and outreach by bringing the CERCC results to the managers by conducting in-person workshops in their communities, presenting initial results, identifying their climate science needs, and introducing a decision-support tool. The joint efforts of these projects and others by the NW CSC and partners led to a successful extension of science to wildlife refuge managers, which was specifically noted during the review as a clear example of how science can be translated into actionable guidance. This also highlighted the importance of work across partners where each brings unique contacts, funding, skills, and abilities, leading to a successful overall effort.

One of the state fish and wildlife managers involved in the review summarized this effectively by stating that "management decisions are not science decisions." Management decisions are a complex mixture of science, politics, and economic factors. Science information is one among many types of information utilized in the management decision-making process, yet it is frequently available in a format that that makes it difficult to interpret and apply. Research products need to be summarized and interpreted, rather than raw science products. Thus, the translation of science products into a management context is necessary.

Recommendations for NW CSC Actionability Measures

- The NW CSC should expand identification and characterization of the direct utility of research projects in support the Science Agenda and specific management-identified needs. Investigators should be required to explicitly reference project-agenda linkages in proposals.
- The actionability of projects should be enhanced by expanded recruitment of research users to graduate student committees, as coauthors of proposals, and other engagement in research project development.
- The actionability of the science funded should be strengthened by requiring, rather than implicitly encouraging, the inclusion of natural and cultural resource managers in project design teams.
- Knowledge of the degree of management involvement in research projects was uneven among partners. The review team received often contradictory messages regarding the success of management engagement. Project presentations and discussions with partners showcased well-designed engagement, but also some cases of surprising lack of awareness. Better documentation and communication of engagement and the resultant application and utility of research would help to address this challenge.
- The LT should review the ACCCNRS principles and practices as they develop future RFPs and graduate student projects.

NW CSC Request for Proposals—Federal

The USGS NW CSC director uses a wide variety of input on research project selection (e.g., ESAC guidance, NCCWSC priorities, complementary LCC project initiatives, etc.) but retains discretion on both project solicitation method (i.e., competitive or noncompetitive) and research priorities. Over the initial 5 years of the NW CSC (FY2011 through FY2015; Table 3), the total funds available to CSC-Federal was US$7,760,847. Of that amount, $6,061,515 (78%) was distributed for research through cooperative agreements, grants, interagency agreements, or internal USGS funds transfer. The SRT recognizes the emphasis placed by CSC-Federal on investing a high percentage of funds on research, as opposed to staff support or other options that certainly were available.

In FY2011, projects were identified and selected internally. Beginning in 2012, funds were allocated via biennial RFPs. Eligible applicants include members of the NW CSC consortium, USGS science centers, field stations, and laboratories, other federal agencies, and tribal governments. Proposals from consortium members must be submitted through OSU (the host university).

Projects funded by CSC-Federal ranged from $5,000 to $374,645 and ranged in duration from less than a month for an event to a maximum of 36 months, with most projects having a duration of 12 or 24 months. This relatively short time frame was suggested as not providing sufficient assurance of continued support to enable researchers and resource managers to build lasting working relationships and the longer-term research necessary to address complicated climate change-resource impact challenges. We recognize that funding duration limitations imposed upon the NW CSC are beyond their control. The National Climate Change and Wildlife Science Center should work with USGS to explore options for expanding funding flexibility.

The primary benefit of participating in the CSC consortium is the ability to respond to RFPs from the NW CSC. However, indirect costs at OSU for pass-through (46%), administrative time lags (through multiple institutions), and PI requirements (i.e., host-university lead Phil Mote as co-PI) reduce the utility of this funding source for consortium members. The requirement that non-OSU universities be subcontractors to OSU is an administrative obstacle for all involved. Only institutions that are members of the university partnership are eligible to apply for CSC funds, and then, once a project is awarded, funds must be administered through OSU, leading to inevitable delays and additional expenses. For example, one non-OSU investigator participating as part of the science producers panel discussion said that the subcontracting hassle had caused him or her to simply not even submit a proposal for a recent funding opportunity.

The RFPs have focused on a subset of priority needs identified by the ESAC; however, it is important to note that the ESAC priority list is very wide in scope. The 2014 RFP focused on

- Response of hydrologic systems to future climate;
- Threats to habitat connectivity and potential fragmentation;
- Changes in fire regimes;

Table 3. Funding for CSC-Federal projects for fiscal years (FY) 2011–2015.

Year project initiated	Number of funded projects	Total research dollars				
		FY11	FY12	FY13	FY14	FY15
FY2011	11	$776,122	$280,000			
FY2012	12		$1,206,143	$1,025,055		
FY2013	7			$286,658		
FY2014	13				$1,195,995	$1,030,768
FY2015	8				$5,000	$255,774

- Changes in phenology and related monitoring needs; and
- Vulnerability of species, populations, and ecosystems to climate.

Clearly, there is a balance between breadth of priority issues and depth. As a result, the NW CSC has not gained strong momentum on any one priority issue. The 2016 focus on drought is in response to this challenge.

Full proposals are evaluated on scientific merit, innovation, management significance and engagement, scientific expertise, and budget/work plan. Applicants are required to provide a detailed description of engagement with resource managers and decision makers and applicability of the findings or tools. To review the statements of interest and full proposals, the USGS NW CSC director establishes an independent review panel of federal and university climate science professionals. Because of the potential conflict of interest, the host university PI is not involved in the RFP development or review. The USGS NW CSC director makes the final determination of award recipients. Accountability and transparency mechanisms are important to avoid conflicts and ensure effective, efficient allocations of resources.

Finally, annual reports were written in a communications style directed towards a broad audience comprising NW CSC community and others who may have a general interest in climate change on natural and cultural resources. While this type of communication was valuable and useful for that general purpose, it was done at the expense of more detailed reports that would have allowed the SRT to track and understand research expenditures, matching funds, and overall allocation of research dollars with competing interests and research contributions. As part of determining the overall value added of the CSC-University to the entirety of the NW CSC as well as explicit mapping of products to strategic and annual work plan document, future RFPs, hosting agreements, and annual review expectations should mandate more explicit reporting of the financial details and annual work plan accomplishments.

Recommendations for NW CSC Request for Proposals Process

- The complicated process of managing CSC-Federal grants to NW CSC consortium partners through the host university is burdensome and costly and should be streamlined and allow for direct contracting from CSC-Federal to any qualified research partner.
- The extended period of time to complete the administrative process for pass-through projects from OSU to non-OSU researchers was reported to be an obstacle for some researchers to engage in submitting proposals to NW CSC requests for RFPs. This process needs to be evaluated to identify means for increasing efficiency of processing and funds transferal.
- A significant coordination challenge between USGS and host-university researchers is inherent in the architecture of the CSC model in that researchers who could contribute significantly to the development of science needs determinations should be kept distanced from the process due to perceived or potential conflicts of interest. This creates a fundamental obstacle in efforts to implement a more complete science coproduction model. The CSC should further explore how directed research, as compared with RFP development, could provide for more open dialogue and inclusion of researchers into science identification and coproduction efforts.

NW CSC Communication Services

NW CSC tools and products.—The NW CSC 2012–2016 communications strategy (NW CSC 2013a) maps communications products onto strategic objectives with broad indication of the target audience. The target audiences were identified as scientists; resource managers; legislators, policymakers, and administrators; and the general public. The diversity in audiences, thus, resulted in mapping that was relatively nonspecific. A particular challenge with this plan is that mapping of communications product to objective is many-to-one, where multiple products are all servicing one objective, but also many-to-many, where the same product was addressing multiple objectives and audiences. This makes it impossible to know how products are tailored or prioritized to specific audiences from the communications plan itself.

With regard to specific communications products, there were some clear strengths and weaknesses. The federal office operates a Web site, with planned consistent look and feel (i.e., branding) across the CSC network. The university host also operates a Web site, independent of the federal site. The UW is responsible for content, and the University of Idaho hosts the site. Web sites were typical of these types of activities, operating as bulletin boards with content intended for a wide range of audiences and relying on users to discover the information. The dual Web sites for the CSC, while providing for multiple sources of information, present a disjointed picture of the entirety of the CSC activities. To find specific products, unless the user knows the source of the information, the person must navigate through both Web sites. A single composite Web site, or even a single interface that maps to pages and content managed by the two parties, would present a more cohesive source of information for the audience.

Noteworthy as a positive development was the new NW CSC Story Map, a geospatial presentation of the center's science developed by the federal office and the UI Library and Northwest Knowledge Network. The federal office indicated that ScienceBase, the current USGS portal for stewardship of project results and data, could be difficult for communicating results to resource managers and was not an ideal system for data discovery. As a result, they worked intensively with PIs to develop the geospatial portal, NW CSC Story Map (www.nwclimatescience.org/story-map).

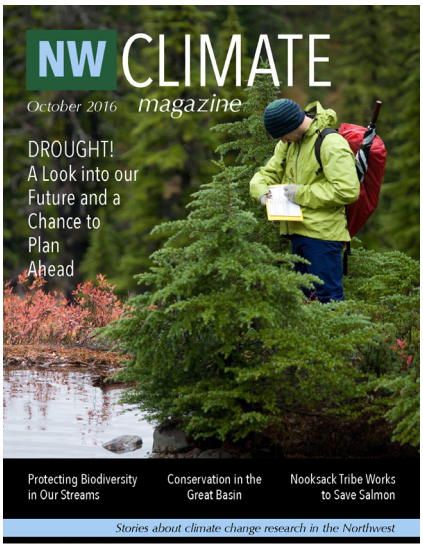
The NW CSC, with help from the ESAC, also built a database that allows users to search projects in ScienceBase by organization, project PI, keywords, or by NW CSC Science Agenda theme and subthemes. The database can be accessed through a Web portal known as DEPTH (Data Entry for Project Tracking and Highlighting; www.sciencebase.gov/depth/#).

The NW CSC also produces several stand-alone products for broadcasting information, including a glossy annual report and a climate magazine. In 2015, the center grew its communications program with three new products identified through ESAC engagement: the monthly *Northwest Climate Science Digest* (www.nwclimatescience.org/climate-science-digest), periodic email updates, and the annual *Northwest Climate Magazine* (www.nwclimatescience.org/nw-climate-magazine). *The Northwest Climate Science Digest* is a digest-style email update of scientific paper summaries, government reports, popular media stories, and upcoming events related to climate science and relevant to the Northwest. The NW CSC produces the digest in partnership with the North Pacific LCC, and it circulates to more than 6,000 recipients. For periodic updates, the NW CSC created newsletter-style emails featuring vignettes about NW CSC-funded projects and recent highlights. The annual *Northwest Climate Magazine* is produced jointly by the major university and federal partnerships (CIRC, North Pacific LCC) in the Northwest. The first issue in May 2015 included research stories about northwest communities that are successfully guiding conservation and efforts to build resilience. The issue received wide distribution, with more than 8,000 people receiving the magazine, 6,000 people reading it online, and more than 5,500 opening the PDF version.

The intensive communication of project results to users was not part of the review discussion, although it was reported that multimedia communication about projects has occurred via webinar.

The SRT noted that university communication efforts, while intensive, seemed to lack a clear consensus among all parties as to the intended audience. The host leader presenting the communication overview was not a trained communication specialist, and not surprisingly, their beliefs about what they were communicating about were not consistent with the products, and they seemed unable to engage in discussion about audience and content.

The NW CSC does engage in communication via social media, such as through Twitter (@NW_CSC), which as of September 1, 2016 has 941 followers and has produced 1,102 tweets. A Facebook page (Northwest Climate Science Center; @NWClimateScience) is also maintained and had more than 365 "likes" in early 2016. While this modest engagement through social media does address some audiences, the SRT concurs with the NW CSC staff that interaction via social media is a time- and resources-intensive commitment, and a systematic investment by the NW CSC would need to be carefully considered before undertaking a more significant social media outreach effort.



Northwest Climate Magazine

- Distributed to over 8,000 subscribers
- Over 6,000 read it online
- Additionally, over 5,500 opened the pdf.
- Twelve partner groups shared the magazine with their constituents
- Individual stories were featured in USGS Top Stories, university press releases, and popular media stories
- More than 2,300 people have subscribed to receive a second issue.

The SRT received no information from the university office that would allow us to gauge the degree to which the NW CSC was known across the 3 host campuses or the 11 partner campuses. This is diagnostic for the need for better communication within and among the project principals reach.

Defining audiences and the communications plan.—Addressing the question "Have NW CSC products addressed the needs of the user community?" requires acknowledgement that there are multiple audiences or product consumers with a diversity of needs and expectations. Consequently, the degree to which user needs have been met and the timeliness of product production may be different and require some unpacking. At points during the in-person review, the audience was identified as the broader community of managers; at other times, the audience was, broader still, the "interested general public." Once or twice, the only audience of significance was suggested to be the Secretary of the Interior. Finally, in discussing the communications plan, press releases were mentioned indicating that the regional media are sometimes the audience. Notably, the 2012–2016 communications strategy (NC CSC 2013a) prioritizes communications between scientists and resource managers. Secondary is "keeping legislators, policy makers and administrators informed." Finally, education of the general public would be addressed on an opportunistic basis. These varied statements presented to the SRT a lack of cohesive vision for communications and the need for refinement of the communications strategy. The inability to map audience onto product when audiences are changing for various products was a consistent challenge in the course of the review.

At some point in the future, when the corpus of products is greater, it is conceivable that this mapping could be accomplished with a more categorical prioritization. The relevant audiences appear to fall into the following broad categories: (1) Those directly involved in the coproduction of science products, of which there are two types, agency partners that participate in specific, CSC-funded research projects and management interests participating at strategic levels; and (2) those parties not explicitly involved in the coproduction process, which ranges from the ESAC, regional science providers and resource managers, to interested members of the public).

The fact that the audience is never explicitly maintained makes assessing communication and dissemination products nearly impossible. The review team recognizes the challenge in quantitatively assessing the impact of communication products, but also maintains that communications without specifically defined audiences and an understanding of both intent and utility is less than desirable. The NW CSC has done work to quantify simplistic measures, such as unique page visits and distribution of media (e.g.,

Northwest Climate Science Digest) and scoring of the value of various communications training activities at the Climate Boot Camp. Recent work by communications graduate fellow Diana Gergel is attempting to evaluate the *Northwest Climate Science Digest* and may provide additional insight. The project will attempt to determine if the digest is reaching the target audience and meeting the needs of that audience. The SRT recommends that more in-depth assessment of utility and value of the communications products is warranted. It is also recognized that other CSCs reviewed as part of this overall effort are attempting to address the challenge of communications in a variety of ways and have invested significant effort into building or working with recognized expertise. Collaboration and coordination among the CSCs on the communications challenges is strongly encouraged.

The communication plan is an electronic version of the "loading dock" model for science communication: push the information products out the door and put it on the loading dock, and the audience will pick it up if they are hungry and sophisticated enough (e.g., Cash et al. 2006; Feldman and Ingram 2009; Lindenfeld et al. 2012). In this case, the loading dock appears to be a little fresher because some of it is electronic—Web pages and social media—although only some, since a lot of resources appear to be going into an electronic magazine of unknown impact (circulation and impact are different things). This approach is familiar to the extent that one sees this pattern reflected in some of the weaker "broader impacts" statements when reviewing NSF proposals. Relying on the loading dock in this case is particularly disappointing in that much of the analysis work in critiquing this approach has been developed in the climate science sector (e.g., Cash et al. 2006; Feldman and Ingram 2009). So presumably the NW CSC principals could have been aware of the literature in their field.

The problem with the loading dock is that it is not adaptive, and clearly not coproduced, and this shows up in two ways. First, at the loading dock the communications products do not have user input, and second, there is no assessment of product performance in the target audience(s). Google analytics applied to Web page hits are not measures of user need nor of utility of product. More critically, key question to be addressed could include (1) the number of management decisions that have been made or influenced on the basis of products from the communications plan, or (2) the level of engagement of resource managers or members of the ESAC in the types and design of communications tools developed by the NW CSC and intended for their use. Certainly other questions could be formulated that address the effectiveness of NW CSC communications products in meeting the needs of the resource management community or any of the specific target audiences identified as a priority to the NW CSC.

Recommendations for NW CSC Communication Services

- It appears critical that the audience(s) needs to be more explicitly identified, or the spectrum of audiences prioritized. Given the current level of ambiguity in this regard, the mapping of audience to product should be done product by product.
- There must be some form of assessment of the value of communication products by the user community. This could be in the form of a knowledge utilization study targeting these external audience products (referenced above). In a knowledge utilization study, the real users are surveyed to see what science information products they are actually using. One could compare the utility of the communication plan products with all the other information products in circulation and provide a measure of justification that would dispense with these critiques. In so doing, one can assay user priorities for product format and provide some degree of adaptive design to the communications plan.
- Engage communications professionals in restructuring the NW CSC's approach to communications and dissemination. There are a number of professional organizations that are designed to help with science dissemination and communications (e.g. COMPASS [www.compassonline.org/]) and their insights should be accessed to redesign the communications plan for the NW CSC.
- A common set of statements reflected through all CSC products, essentially a branding effort, would

build a greater sense of commonality among the partners, students, and others involved in NW CSC efforts at all levels.

- NCCWSC and the CSC community should build collaborative approaches to developing communications tools, provide a common framework for any assessment of utility of CSC products, provide guidance in assessing effectiveness of communication efforts, and develop best practices for future work.

Capacity Building

The Capacity Building program evaluation component measures 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.

NW CSC Center Education and Training Services

The role of the NW CSC in developing a new generation of climate scientists.—There is an increasing disconnect between scientists and the public. In the area of climate change, this disconnect is large and poses a multitude of problems in addressing this issue. There is also a noteworthy science-management gap. Again, this gap is large in climate change and resource management decision making. Though there are many social, cultural, political, and economic factors that contribute to this disconnect, improved communication by scientists and coproduction of information with resource managers are highlighted as means to minimize the aforementioned barriers.

Training of the next generation of scientists and managers to address climate change is a priority of the CSCs and NCCWSC. In keeping with the national priority, a major objective of the NW CSC is to "promote broad participation and support education of diverse young scientists in the work of the NW CSC" with a focus on "deliver science-based knowledge and informal educational programs to the larger community, enabling people to make practical decisions" (Bisbal et al. 2012). The NW CSC education and training strategy (NW CSC 2013b) outlines five goals to meet the intent of the strategic plan. Goal 1 is to "provide education to prepare graduate research assistants and early career professionals for successful careers in climate science, climate education and communications, and natural and cultural resource management" (NW CSC 2013b).

The funding of graduate research assistants and their participation in Climate Boot Camp support Goal 1 of the NW CSC Education and Training Strategy. It is also the primary mechanism to achieve the broad NW CSC goal on education and training. In 2011, the NW CSC (as led by USGS, UI, UW, and USGS for this effort) initiated Climate Boot Camp. The program was modeled on the Dissertations Initiative for the Advancement of Climate Change Research.

Climate Boot Camp is a week-long program for competitively selected graduate students and early career scientists from all CSCs, Northwest universities, federal agencies, tribes, and NGOs. The curriculum focuses on communication of science, interdisciplinary collaboration and research, and management/decision making. The ESAC members are invited to attend the program to interact with fellows and colleagues. To date, 105 graduate fellows and early career scientists have participated in the Climate Boot Camp. In August 2015, the DOI Bureau of Indian Affairs announced that they were awarding a grant to the NW CSC, Affiliated Tribes of Northwest Indians, and United Southern and Eastern Tribes to launch a National Tribal Climate Camp in 2016.

Climate Boot Camp may not provide sufficient engagement with resource managers and decision makers to bridge the gap between research products and management decisions, but the SRT was impressed with this activity. Graduate fellows and agencies may benefit from a detailWhat is this? (e.g., USGS wetland fellow), brief stints in natural resource agencies, or temporary colocation in an agency. This is especially important as the majority of students will not pursue academic careers.

Also, in pursuit of Goal 1, the NW CSC has funded a total of 52 graduate student fellowships at the primary consortium partner institutions. The fellowship experience prepared students for careers in climate science, education, and outreach. Fellows attended Climate Boot Camp, participated as presenters and facilitators at the Northwest Climate Conference, and self-organized networking and collaboration via the Early Career Climate Network (established by fellows at the 2012 NW CSC Climate Boot Camp). The NW CSC has been supportive and engaged in the NW Climate Conference, and the SRT found that to be an excellent vehicle for outreach and engagement.

Other models are being or should be explored that may provide approaches for further graduate student and postdoctoral fellow integration of research and management. These include the NSF IGERT (www.igert.nsf), the Smith Fellows Program (www.smithfellows.org), and further collaboration with the USGS Cooperative Fish and Wildlife Research Units.

Recommendations for NW CSC Education and Training Services

- More engagement of partners (i.e., other natural resource partners) in the graduate process would be beneficial to students through building a more complete understanding of the science–management interface, constraints faced by resource managers, and the challenges of communicating and applying research products in a resource management agency environment.
- The NW CSC is in a position to broker agency internships and term appointments for students, but it would require a more active role than keeping lists of internships and lists of students. The emerging role of the NW CSC as a boundary organization is an authorizing environment for making and maintaining the professional network connections that would provide professional opportunities for engaged and qualified students. For example, the NW CSC could solicit and coordinate the funding from agency partners for paid internships and could provide a competitive process for selecting the interns. If the outreach to the Native American and indigenous communities is actionable (i.e., provides specific and directed opportunities for educational involvement), this is another venue to promote underrepresented and underserved groups.
- In the agriculture sector the land-grant universities have an obligation to provide an extension service to make the university research products accessible to the user community. The extension service takes the form of continuing education products (courses, webinars, workshops, etc.) that specifically target the user community. The NW CSC is poised to adopt the agricultural extension service as a model and target all these same managers with short courses, boot camps, seminar series, and other continuing education products related to regional climate impacts.

Partnerships

The Partnerships program evaluation component measures how well the NW CSC is working with partners beyond the principals associated with the NW 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, as well as 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 work is available from the NCCWSC. The material presented below are only those results relevant to the NW CSC.

Respondents

Fifty-three percent (n = 29) of the 62 total respondents (7 skipped or were excluded from this question) reported that they make decisions about natural resource policy, management, or programs as

part of their jobs. We refer to them as science users. Forty-three percent (n = 23) reported that they have produced climate adaptation science through an affiliation with the NW CSC, while 18% (n = 9) have produced climate adaptation science but never with such an affiliation. We refer to both of these groups as science producers (59%; n = 32). Twelve of the respondents (24%) were both science users and producers.

Respondents worked in one or more western states of the NW CSC. Three-quarters of the respondents (n = 38) worked all or part of the time in Oregon, while 60% (n = 31) worked in Washington and 44% (n = 23) worked in Idaho. Only 25% (n = 13) worked in Montana and 19% (n = 10) worked at least part of the time in other states, primarily in the West. One respondent noted that he or she works globally, and another reported working in British Columbia.

Most of the respondents (78%; n = 40) worked at the regional scale or across multiple states for some or all of their work, while 59% (n = 30) worked at the watershed scale and 57% (n = 29) at the state scale. A smaller percentage conducted all or some of their work at the local (39%; n = 20), national (27%; n = 14), or international scales (22%; n = 11).

The greatest proportion of respondents was affiliated with federal agencies (40%; n = 21), followed by universities (38%; n = 21). A few respondents were affiliated with state agencies (12%; n = 6), nonprofit organizations (10%; n = 5), local governments (2%; n = 1), tribal governments (2%; n = 1), or provincial governments (2%, n = 1).

Forty percent of respondents (n = 21) held research positions in their agency or organization, while somewhat less held leadership/administration positions (33%; n = 17). Few held policy (10%; n = 5) or operations (4%; n = 2) positions. Seven respondents wrote in a variety of other types of positions, including communications/outreach, education, technical support, science advisory, natural resource manager, and chaplain (note: this respondent was excluded from most of the survey questions because he or she reported that none of his or her work related to climate change).

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. Twenty-five nonrespondents from the NW CSC completed the questionnaire.

Response rate.—Response rate to the Web-based survey was 39% (n = 62) for the NW CSC. Respondents who reported that their work does not at all involve climate adaptation science, or management or policy related to climate change adaptation (n = 5), were excluded from our analysis as were those who reported that they had never heard of the CSC (n = 3).

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 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 (self-defined by respondents in the survey as those “making decisions about natural resource policy, management, or programs” as part of their job) 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 CSCs. Respondents included a greater proportion of individuals from federal agencies and universities.

Extent of Involvement with the NW CSC

Most of the respondents (81%; $n = 48$) reported that they have had at least some interest in or involvement with the NW CSC. Just 10% ($n = 6$) reported that they had no involvement but someone else in their agency or organization did, and another 3% ($n = 2$) had no interest or involvement.

Respondents reported a variety of forms of involvement with the CSC. The most common form of involvement (42%; $n = 20$) was being a CSC grant recipient, applicant, or partner on a grant, followed by a participant in a CSC training, webinar, workshop, or conference (35%; $n = 17$) or a resource manager or decision maker who has used the science produced by the CSC (35%; $n = 17$). Less commonly, respondents were involved as CSC SAC members (27%; $n = 13$) or university members affiliated with the CSC (21%; $n = 10$). Additionally, 15% ($n = 7$) reported that they were LCC Steering Committee members and 10% ($n = 5$) reported that they were LCC staff members. Only 6% ($n = 3$) were CSC-funded graduate students or postdoctoral fellows, and 4% ($n = 2$) were CSC-Federal staff. On average, respondents have been involved with the NW CSC for 3.5 years.

The respondents reported on their frequency of interaction with five types of CSC representatives (Figure 7). For their interactions with three of the types (CSC-Federal, university leads/PIs for the CSC, and CSC-affiliated researchers), the modal response was "up to a few times a year." The level of interaction respondents had with CSC-Federal staff and with university leads/PIs was comparable. For their

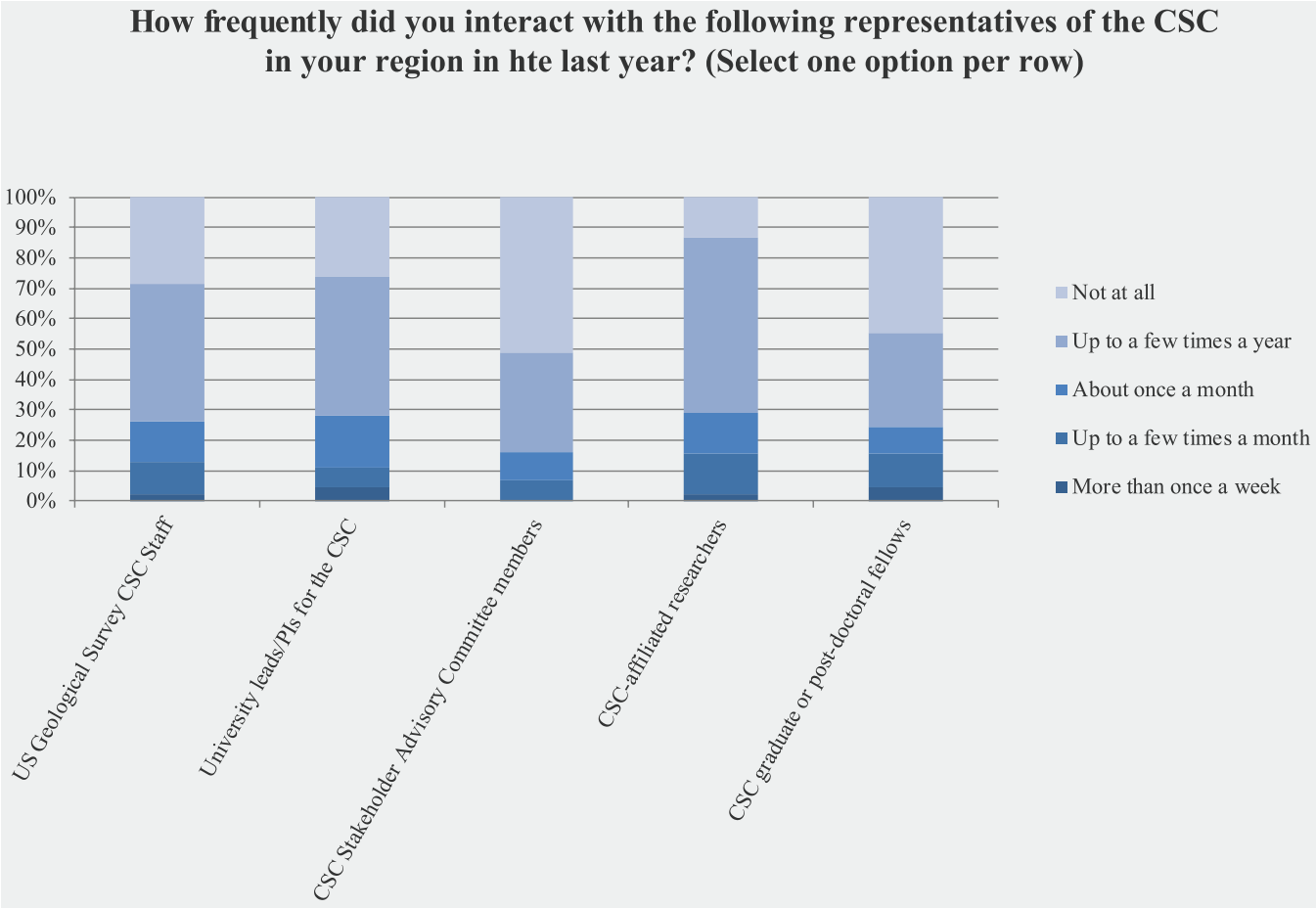


Figure 7. Responses to Cornell partnership survey regarding interaction with NW CSC staff. It should be noted that SAC members are not representative of the NW CSC, but rather reflect an interaction between a survey respondent and a person who, by nature of being an SAC member, would be expected to have substantial knowledge of the NW CSC and can provide input into the strategic direction of the NW CSC.

interaction with CSC graduate or postdoctoral fellows, the modal level was lower: 44% of respondents interacted with them not at all and 31% interacted with them up to a few times a year. For their interaction with CSC SAC members, the modal level of interaction was lowest: 51% of respondents interacted with them not at all and 33% interacted with them up to a few times a year. It should be noted that SAC members are not representative of the NW 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 NW CSC and can provide input into the strategic direction of the NW CSC.

Benefits of Involvement

The most important benefits of the CSC were "access to climate adaptation science" (65%; n = 31 describing as "important" or "very important"), "access to a broader network of people interested in climate adaptation science" (63%; n = 30), and "avenue to put climate adaptation science into the hands of decision makers" (63%; n = 30) (Figure 8). In contrast, the least important benefits were "justification for science I want to do" (important or very important to 23%; n = 11) and "training on climate adaptation science methods or findings" (29%; n = 14). Finally, in between the extremes, about half of the respondents found the benefits "source of funding for climate adaptation science" (48%; n = 23) and "means for learning about climate adaptation" (48%; n = 23) to be important or very important.

These results underscore the importance of the NW CSC as a vehicle for access and transferal of science, despite the fact that there are several other institutions in the Pacific Northwest that also provide such access. Furthermore, the results identify potential areas of growth, such as training in climate science application to resource management, where the NW CSC could expand its services. From an evaluative perspective, these findings may be useful as baseline data on measure of importance that can be used for future reassessments to determine if programmatic improvements have resulted in anticipated changes.

Limitations on Involvement

Most respondents (84%; n = 47) reported limits to their involvement with the CSC (Figure 9). The most common (55%; n = 31) limit was not having enough time, followed by not having enough funds (34%; n = 19). A smaller percentage of respondents reported limits that could be addressed by the CSC, including not being invited/being asked to be involved (16%; n = 9) or not knowing how to be involved (7%; n = 4). Other limits, which would be more of a challenge for the CSC to address, included it not being as high of a priority as other work for respondents (18%; n = 10) and not working on the same topics as the CSC (9%; n = 5). No respondents reported that they were limited by the CSC's science being irrelevant to their needs or not being interested in this work.

Some of these limitations are beyond the means of the NW CSC to address (e.g., funding). Barriers such as time limitations may be partially addressed by developing better means of engaging partners. Participation in meetings that require travel place stress on both time and financial resources. The NW CSC may be able to employ more remote methods of engaging partners in dialogues about research needs, findings, and training to provide for improve utilization of climate tools.

Is Climate Change Science Actionable?

Respondents shared their perceptions both of climate science in general and of the climate adaptation science produced by the CSC. With regard to climate adaptation science in general, more than half of respondents (60%; n = 33) agreed or strongly agreed that climate adaptation science in the Northwest is available to decision makers (Figure 10), but fewer respondents believed that various types of decision makers used the climate adaptation science to inform policies and management. The greatest number of respondents (57%; n = 31) believed that water managers used the science, followed by fish and wildlife managers (46%; n = 25) and land managers (44%; n = 24). The fewest number of respondents (27%; n =

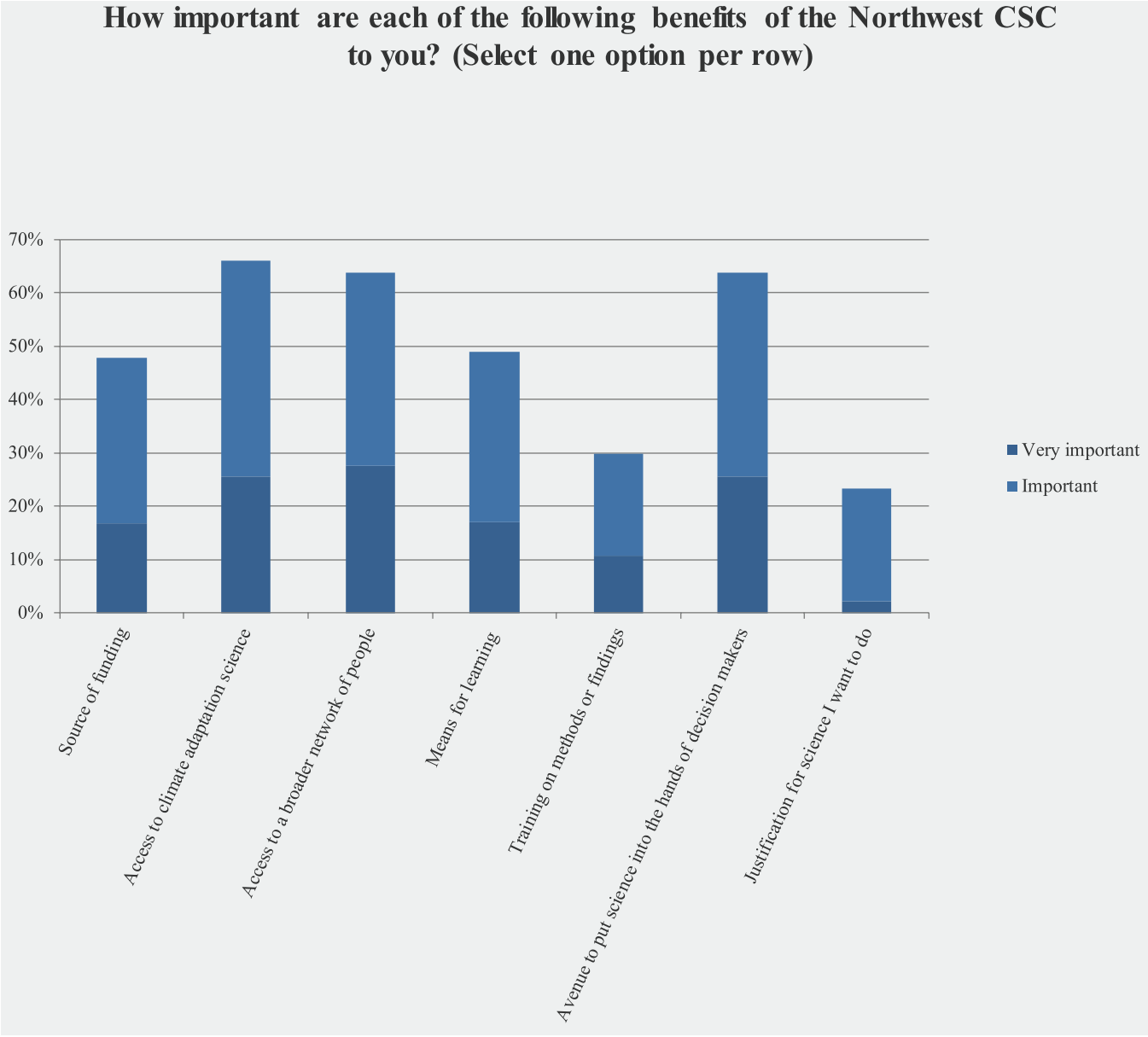


Figure 8. Responses to Cornell partnership survey regarding importance of Northwest CSC benefits to survey respondents. Note: text in items shortened for presentation in graph, and only "important" or "very important" responses are shown.

15) believed that policymakers used the science. More generally, about half of the respondents (48%; n = 26) felt that climate adaptation science does not influence actions taken by decision makers. Yet, about the same number of respondents (45%; n = 25) felt that the CSC has helped reduce this disconnect between what is known about climate adaptation and the actions taken by decision makers in the region.

These results provide a mixed message about utilization of NW CSC products. Practitioners would appear to be moderately well engaged, particularly at this relatively early stage of maturation of the NW CSC. As with previous metrics, this may provide a possible metric for future evaluation of the utilization of NW CSC products by practitioners. The relatively low utilization, or perceived utilization, by policymakers may be a result of the group simply not being a target of NW CSC products, lack of effective communications, or simply a mismatch of products. As with other aspects of the NW CSC a determination of target audience may clarify whether or not policymakers are even a relevant audience.

Northwest CSC produced science was perceived by the majority of the respondents (85%; n = 47) as

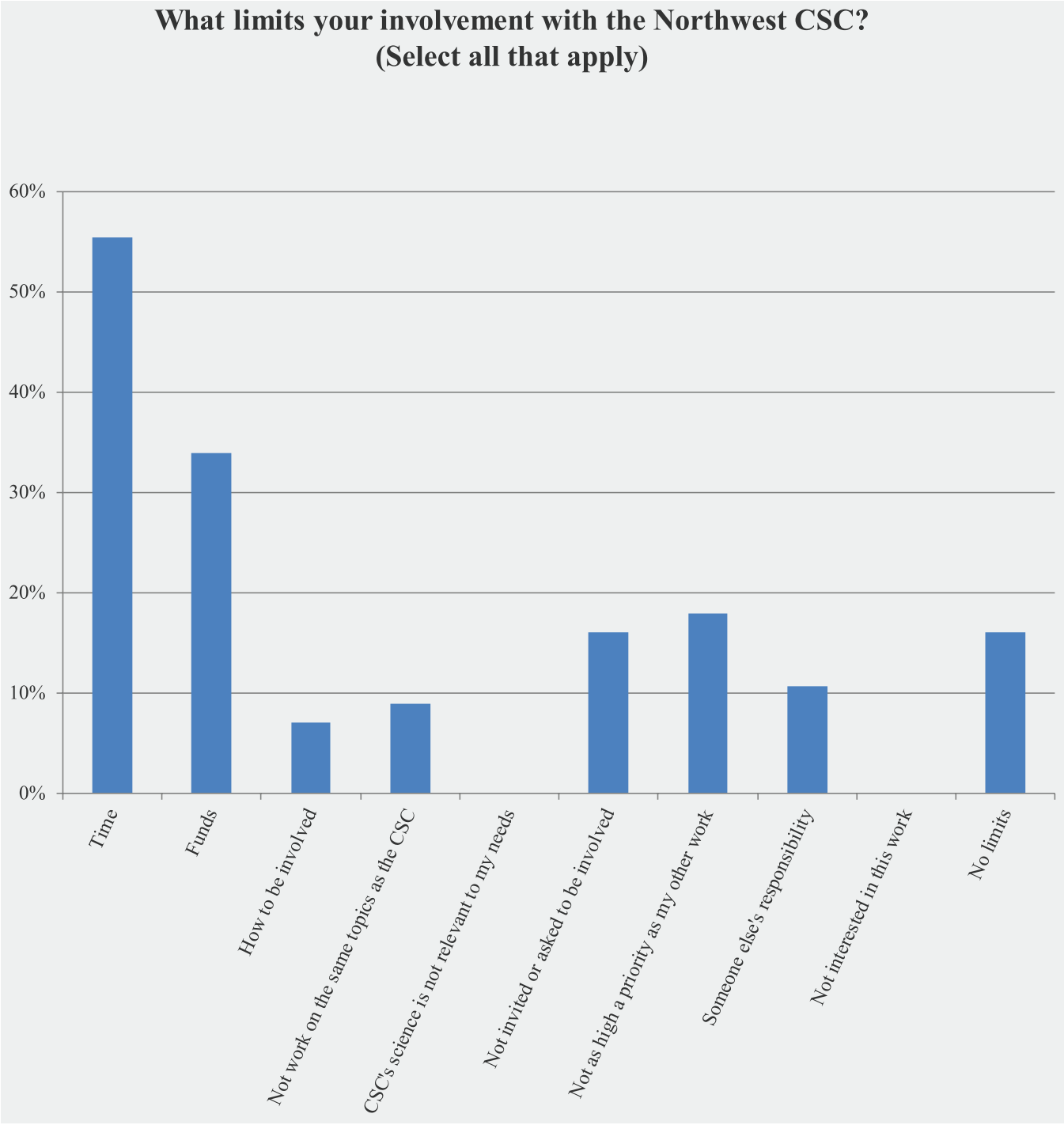


Figure 9. Responses to Cornell partnership survey regarding limitations to involvement in the Northwest Climate Service CSC. Note: text in items shortened for presentation in graph.

contributing to policy or management (Figure 11). Of those that did not agree, most reported that they were unfamiliar with the science (13%; n = 7). Respondents were also generally positive about other characteristics of the CSC science, finding it appropriate to inform decisions (75%; n = 47), high quality (85%; n = 47), and able to integrate well with other information (71%; n = 47). No respondents found the science to be biased, and only 5% (n = 3) respondents strongly or somewhat agreed that it was irrelevant to management. For all of these items, 12–18% of the respondents reported that they were unfamiliar with the science and did not respond on its characteristics.

Figure 10. Responses to Cornell partnership survey regarding utilization of NW CSC climate science products. Note: text in items shortened for presentation in graph.

Science Users' and Producers' Use of Climate Change Science

Of the 29 respondents who reported that they were science users, 71% (n = 20) reported that they or someone in their organization had used climate change science produced via sources from the NW CSC. Similarly, 70% (n = 19) reported that they or someone in their organization has used climate change science from sources not affiliated with the CSC.

The most common ways science user respondents reported using the NW CSC science were to inform management plans (56%; n = 15), training of conservation professionals about climate change and its impacts (56%; n = 15), management actions (52%; n = 14), or the public about climate change and its impacts (52%; n = 14). Less common ways science users reported using CSC science were to inform policy (30%; n = 8) and land-acquisition priorities (15%; n = 4).

Responses to this same question posed to science producers yielded a similar pattern of the most common and least common ways science was used but with a higher frequency of use reported for most ways science was used (Figure 12). The most common ways science producers reported using the science were to inform management plans (69%; n = 20), training of conservation professionals about climate change and its impacts (69%; n = 20), management actions (59%; n = 17), or the public about climate change and its impacts (72%; n = 21). Less common ways science-producer respondents reported using CSC science were to inform policy (38%; n = 11) and land-acquisition priorities (14%; n = 4).

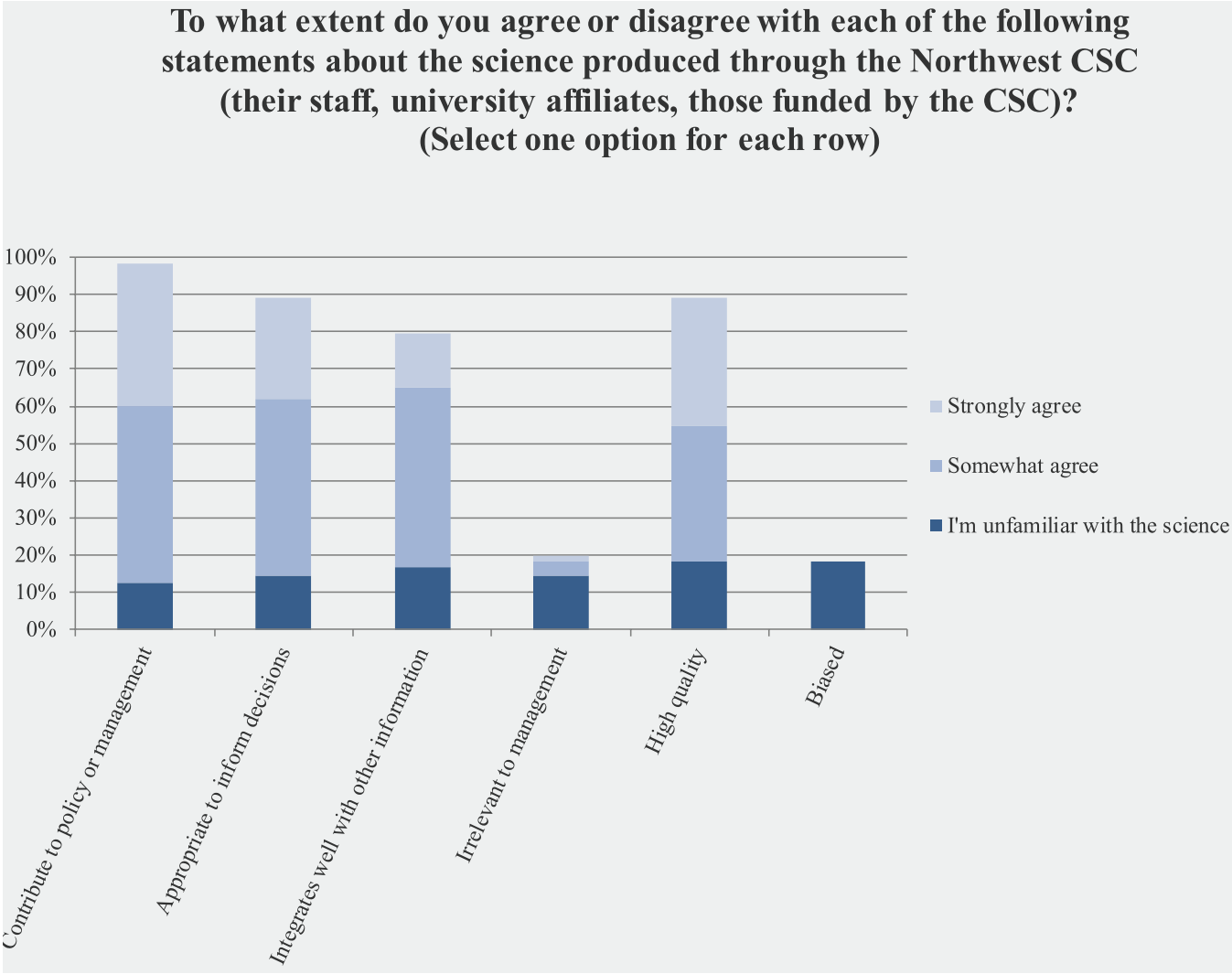


Figure 11. Responses to Cornell partnership survey characterizing contribution of Northwest CSC products to policy, management, as well as quality and biases of science products. Note: text in items shortened for presentation in graph, and only "strongly agree," "somewhat agree," or "I'm unfamiliar with the science" responses are shown.

Science users and producers differed in their perceptions of what limits the use of CSC science (Figure 13). In nearly all cases, more science producers than science users perceived limits (not specifically to them) to using CSC science to a moderate, large, or very large extent. Interestingly, the two factors that science users thought were bigger limitations on the use of science than did the science producers were lack of quality of the science (science users—7%; science producers—0%) and the science not being interdisciplinary enough (science users—38%; science producers—29%). Three of the most common limitations cited were the same for science users and producers: scientists not working closely with decision makers (science users—44%; science producers—86%), science not being communicated clearly (science users—41%; science producers—72%), and management issues not being defined clearly enough (science users—59%; science producers—66%). The latter was the most important factor from the perspective of the users. A majority of science producers (79%) also felt that the use of science was limited by decision makers not being aware of the science, while few science users (19%) agreed.

These findings validate some of the earlier observations by the SRT regarding effective engagement of the research community with the management agencies. A full review of the ESAC and options for modification may be one vehicle for addressing this issues. The next iteration of the CSC strategic plan, science plan, and operational plans done in a more inclusive manner may also address some of these

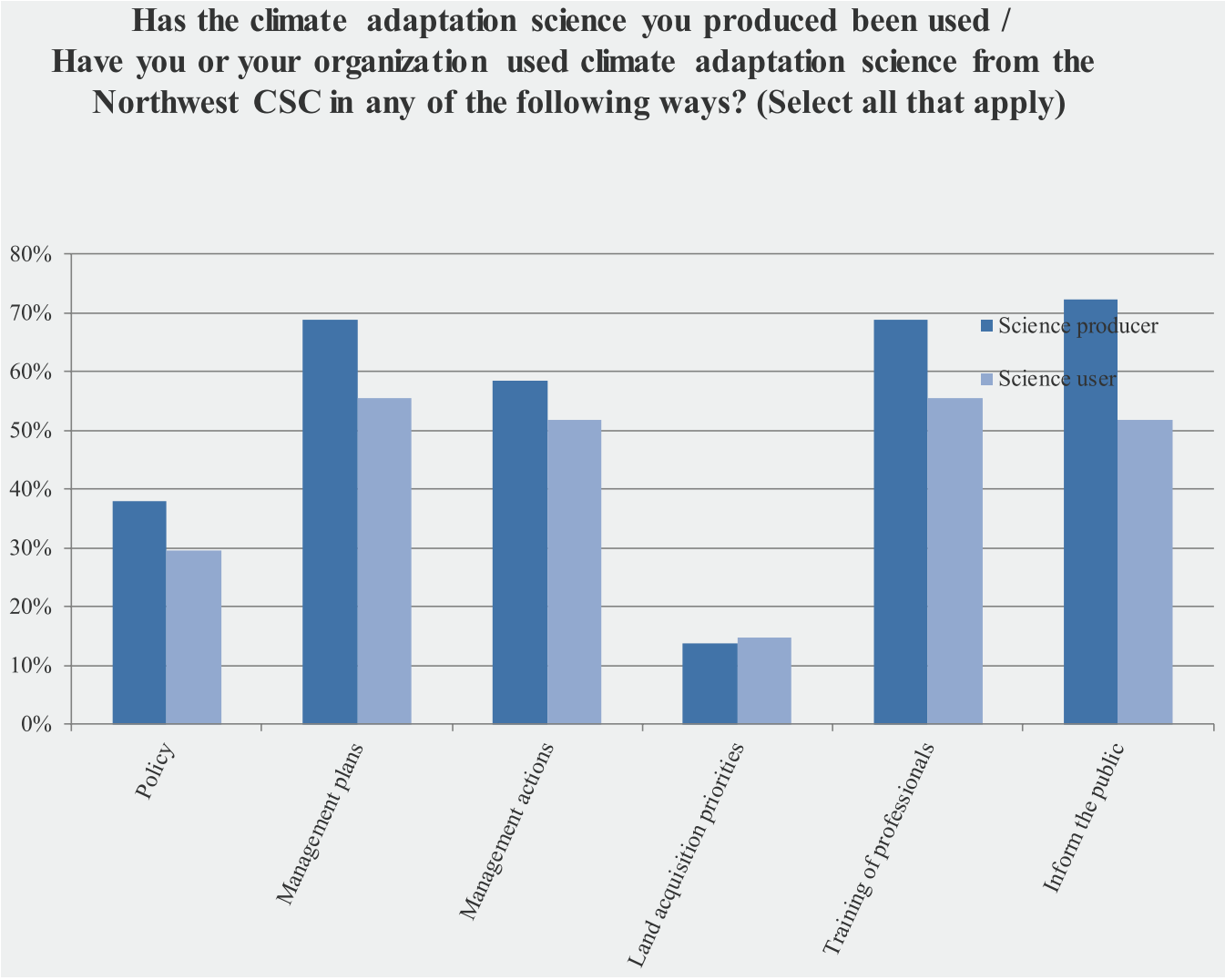


Figure 12. Responses to Cornell partnership survey regarding utilization of Northwest CSC science products. Note: text in items shortened for presentation in graph. Additionally, text varied slightly for science producers and users.

concerns. Such an exercise should also look broadly and better define roles among the various partner organizations (e.g. LCCs, CIRC, etc.). These groups may be positioned to better engage some segments of partners or to communicate results, and strategic partnerships could be beneficial to all parties. Finally, a review of the communications efforts of the NW CSC, with particular emphasis on audience clarification and communications tools used appropriate to the audiences, would likely improve these measures.

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 (96%; $n = 27$) and producers (90%; $n = 26$) expressed support for coproduction, indicating it was important or very important for climate adaptation scientists and natural resources decision makers to work together to produce science research.

While many of the science producers indicated experience in coproduction in various aspects of research projects, far fewer science users reported experience with each aspect (Figure 14). It should be noted that this question was asked in reference to the CSC specifically for users, but that specification was not made for producers. For both groups, the aspects with the most individuals reporting experience with

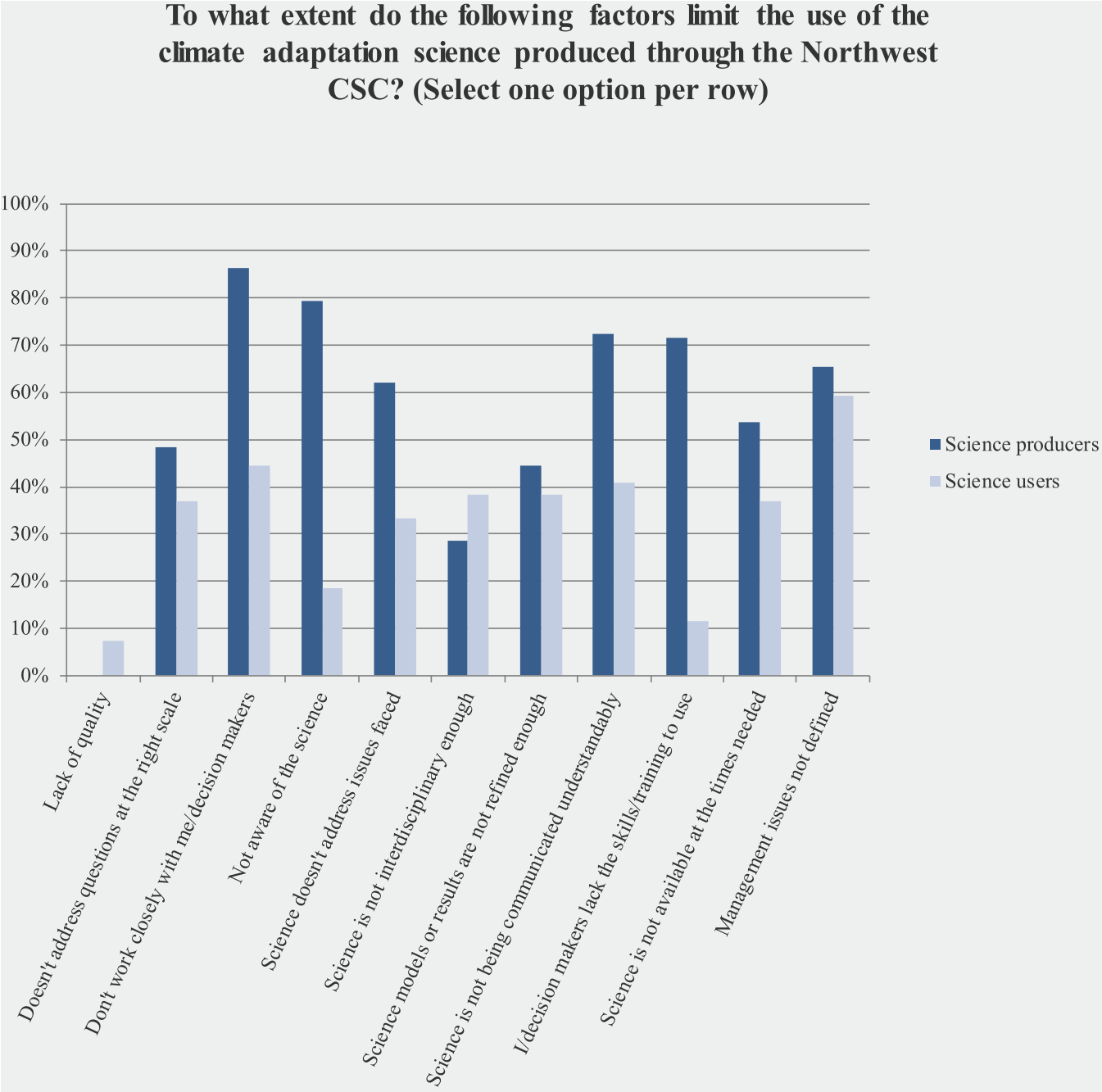


Figure 13. Responses to Cornell partnership survey regarding limitations to the use of Northwest Climate Science CSC products. Note: text in items shortened for presentation in graph, and only "to a moderate extent," "to a large extent," or "to a very large extent" responses are shown. Additionally, text varied slightly for science producers and users.

coproduction were similar: communicating results (science users—46%; science producers—97%), identifying research questions (science users—36%; science producers—93%), determining research priorities (science users—50%; science producers—79%), and applying results (science users—42%; science producers—68%). Both groups had the least experience with working together on analyzing data (science users—19%; science producers—37%).

Regarding science users' limitations to involvement in research, having different perspectives from scientists on what science is needed was the most common issue identified (54%; $n = 14$ agreed or strongly agreed), followed by scientists not reaching out to them to collaborate (42%; $n = 11$) and having different

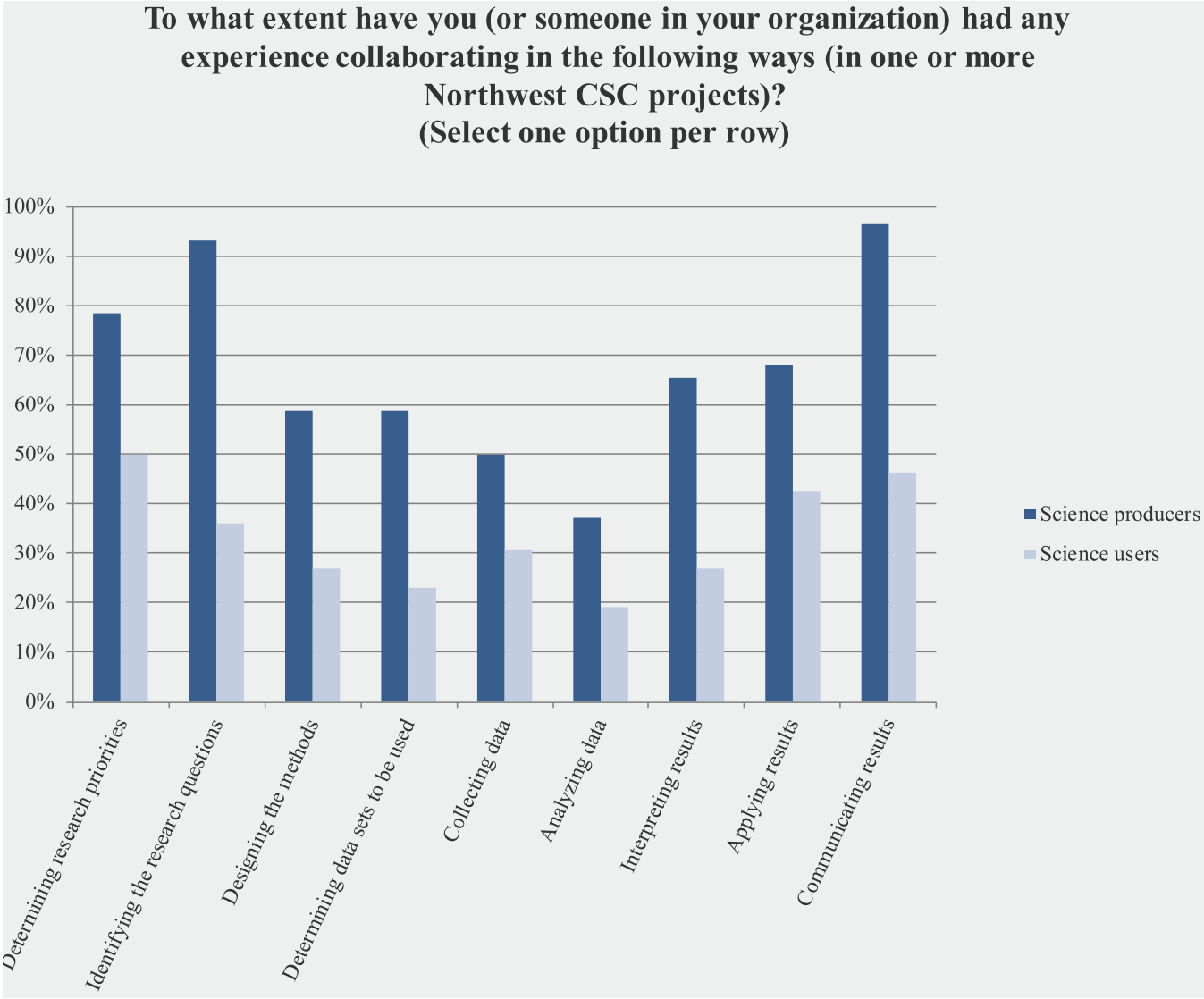


Figure 14. Responses to Cornell partnership survey regarding collaboration activities with the Northwest CSC. Note: text in items shortened for presentation in graph, and only "to a moderate extent," "to a large extent," or "to a very large extent" responses are shown. Additionally, the text of the question varied slightly for science producers and users (e.g., the users' version referencing "you or someone in your organization" and specifying a Northwest CSC project).

perspectives from scientists on how research projects should be conducted (35%; $n = 9$). Other factors were perceived to limit the involvement of smaller numbers of respondents: funders not being supportive of collaboration between scientists and science users (19%; $n = 5$), and scientists not being interested in listening to them (15%; $n = 4$). Notably, not having enough time was a limitation for few science users (31%; $n = 9$), although it had limited their involvement in the CSC (see above).

Perceptions of the Role of the NW CSC

The NW CSC has helped facilitate various connections, with most respondents reporting help making connections "to a moderate extent" (Figure 15). The most common connections reported were with climate adaptation science itself (56%; $n = 27$), professionals who might communicate climate adaptation science (50%; $n = 24$), climate adaptation scientists (49%; $n = 23$), and resources needed to conduct science (43%; $n = 20$). Considerably fewer respondents reported help in connecting with decision makers who might use science (20%; $n = 9$).

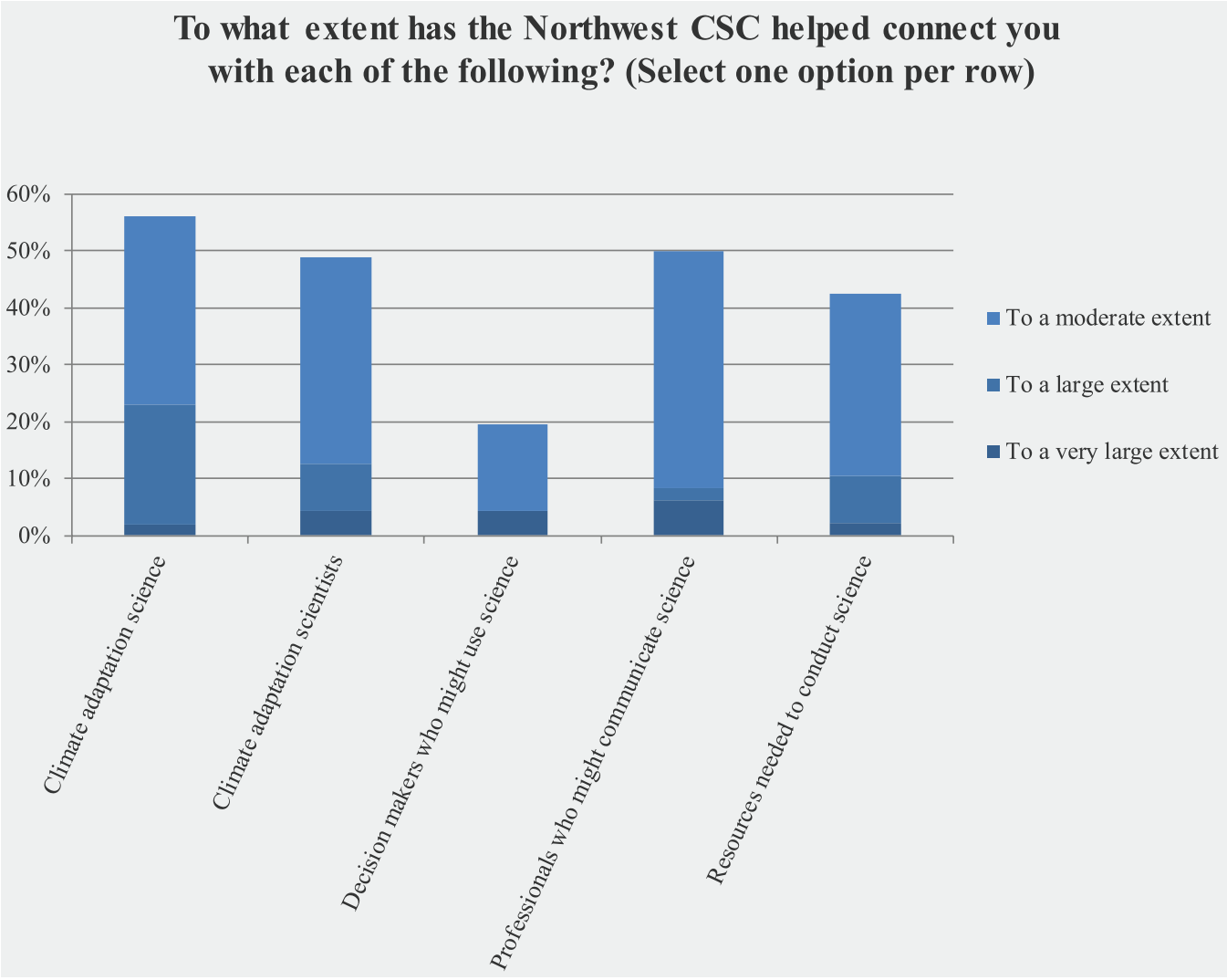


Figure 15. Responses to Cornell partnership survey regarding the establishment or enhancement of connections developed through or as a result of the Northwest CSC. Note: text in items shortened for presentation in graph, and only "to a moderate extent," "to a large extent," or "to a very large extent" responses are shown.

When evaluating the NW CSC's contributions, the greatest number of respondents agreed that it contributed to awareness of available science (73%; $n = 35$), communication between scientists and decision makers (65%; $n = 31$), interdisciplinary science (64%; $n = 30$), and collaboration between scientists (60%; $n = 29$; Figure 16). Although many respondents agreed that the CSC made interdisciplinary science contributions, the disciplines must not include social sciences because only 21% of respondents ($n = 10$) felt the CSC contributed to social science about climate adaptation issues. About half of the respondents indicated that the CSC contributed to relationship building among decision makers and alignment of science with needs of decision makers. Only a third indicated contributions to translating complex science for decision makers.

Summary of NW CSC Results

Respondents represented science users and science producers (both those affiliated with the CSC and those not so affiliated) and a variety of types of organizations and agencies and positions, with federal agencies and universities being most common. Most of the respondents had at least some interest in or involvement with the NW CSC. This involvement came in a variety of forms, with the most common

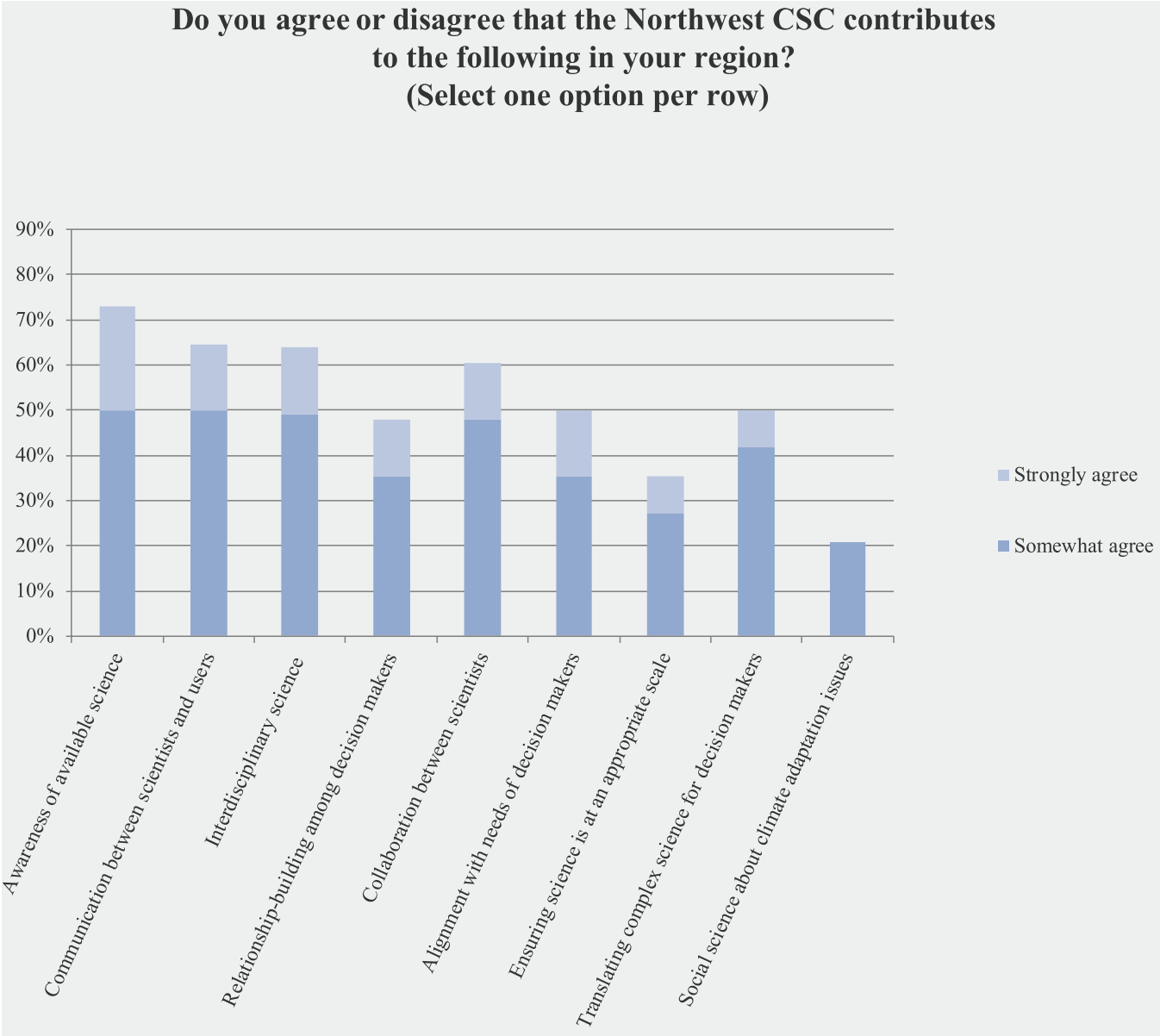


Figure 16. Responses to Cornell partnership survey regarding Northwest CSC contributions to a variety of potential benefits of the NW CSC. Note: text in items shortened for presentation in graph, and only "strongly agree" or "somewhat agree" responses are shown.

involvement being as a grant recipient, science user, or participant in a training, webinar, workshop, or conference. The level of interaction respondents had with NW CSC staff was comparable to that with university PIs.

The 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 are limited in their involvement with the CSC by a variety of factors, with the most common ones being time and funds.

More than half of the respondents felt that climate adaptation science in the Northwest is available to decision makers, but fewer of the respondents believed that various types of decision makers use the climate adaptation science to inform policies and management. When asked specifically about the science produced through the NW CSC, the majority of the respondents agreed it can contribute to policy or management. When asked specifically about the science produced through the CSC, respondents were also

generally positive about other characteristics of the 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 NW CSC science was used were to inform management plans, training of conservation professionals, management actions, and the public about climate change and its impacts. Science users and producers differed in their perceptions of what limits the use of CSC science. Science producers perceived issues to be more limiting than science users found them to be.

An overwhelming proportion of both science users and producers expressed support for coproduction. While many of the science producers indicated experience in coproduction in various phases of research projects, many fewer of the science users reported first-hand experience. Coproduction was more common in the early stages (setting priorities and identifying research questions) and late stages (interpreting, applying, and communicating results) of research than the middle stages. Science users reported that their involvement in coproduced research projects was most limited by scientists not reaching out to them to collaborate and different perspectives on what science is needed.

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

Concluding Comments

The overall observation of the review team was that the science being produced by the NW CSC is of high quality and has provided useful information for a variety of users. The SRT recognized, through presentations by researchers, comments by NW CSC partners, and a limited review of published material, that the researchers engaged in production of science through the NW CSC are doing work that is adding value to the knowledge of climate change impacts on natural resources in the region. In that context, the NW CSC has proven to be successful. The review team was also impressed by some key innovative projects of the NW CSC, such as the climate boot camp, as a key mechanism to engage graduate students with working professionals, to build a sense of community among the students across multiple universities, and to teach useful skills about climate communication and other topics. There were other examples of value-added efforts, such as key collaborations with the NPLCC and USGS Western Ecological Research Center that illustrated the possibilities that the NW CSC creates for linking science and management in a coproduction-type model.

The review team also recognized critical areas that need attention if the NW CSC is to fully meet its mission, and these topics are the responsibility of the USGS and the university hosts. For example, among these issues on the university side was the poor to almost nonexistent involvement of the other 11 members of the host-university consortium, the lack of a cohesive and targeted communications strategy, a noticeable lack of cohesion between the mission of the NW CSC and that of the university efforts, and missed opportunities by limited engagement of the Cooperative Fish and Wildlife Research Units and some other potential partners with a solid history of connections with resource management agencies. Similarly, it was clear that the ESAC as managed by the USGS is in need of redefinition and an improved management model. Members were disengaged, unclear about roles, and possibly mismatched for the roles that they were asked to play in the ESAC. Fundamentally, the NW CSC and the NCCWSC need to build a better mechanism to ensure compatibility in mission between the USGS CSC staff and the university hosts. The inherent differences in culture, internal evaluative and hence motivational structures, and other factors, while creating the possibility for creative approaches to science, also create tensions, lack of unity of vision, and mismatches between management-based research needs and the individual research interests of faculty.

The review team found that many of these issues can be resolved and strongly encourages the NW CSC and its partners to use the opportunity presented by the development of a new strategic plan, science

plan, and other related foundational documents to be a vehicle for introspection and recalibration. We encourage the NW CSC, through this process, to engage outside expertise in redesigning the relationship between the USGS and the university. We also strongly encourage the NW CSC to completely re-evaluate the ESAC role, structure, membership, and inclusion of the research community. This body is critical in building the partnerships essential to realizing the intimate linkage between the natural resources management community and the researchers in such a way as to advance coproduction and actionable science.

The NW CSC was built from scratch as one of the first three of eight CSCs nationwide and with no existing model upon which to design the staffing, administrative structure, relationships or research-management processes. Furthermore, there was no baseline of performance metrics upon which the NW CSC could orient its efforts to meet a predetermined benchmark for success. The review recognized this challenge and encourages the CSC network to engage in a structure exploration and dialogue to develop a common framework for performance while also recognizing the unique nature of each CSC and the environment, socially and ecologically, in which it works.

Acknowledgments

The review team would like to extend its sincere appreciation to the USGS NW CSC hosts and the university partners in providing critical support for this review. Drs. Gus Bisbal and Nicole DeCrappeo with the USGS were gracious with their time, intellect, and energy in helping the review team to schedule review activities and visits and identify participants for on-site discussions and the Web survey of partners. The host-university team, led by Dr. Phil Mote (OSU) with key partners Dr. Steven Daley-Laursen (University of Idaho) and Dr. Eric Salathe (University of Washington), wassimilarly generous with its time and resources throughout the entire review process. Dr. Mote arranged for meeting room space on the campus of OSU, engaged numerous faculty and graduate students for presentations and discussions, and invited critical university leadership to meet with the review team as part of illustrating the connection of the NW CSC with the host university. This was the first ever review of a CSC by an outside review team. As such, there was no pattern or history upon which to design and promulgate the review. We thank the USGS and university hosts for their patience, constructive criticism, and support of this review effort. We fully recognize that in less than 3 days on site, review of documents and reports, and various other discussions that the review cannot hope to fully understand the full nature and extent of the CSC through its 6 years of work. We can only hope that through the collective observations of the review team, the existing self-criticism of the NW CSC will be confirmed, some new observations will be added, and the NW CSC will find ways to continue to improve and better serve the natural resource conservation community of the Pacific Northwest.

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Appendix A
Northwest Climate Science Center Review Team Members

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Appendix B.
Northwest Climate Science Center Schedule of Activities

Wednesday, January 20, 2016

Time	Preparatory or on-site activity	Desired output
Day 1 – Morning Session	Introductions – SRT and hosts (CSC and university representatives	Goal is to develop a full understanding of the CSC structure, including federal and university components.
8:00–8:25	Gather for coffee get settled	
8:30–8:45	Welcomes Review Team Chair Jill Rolland Dean Roy Haggerty, OSU CSC Director Gus Bisbal	
8:45–9:15	Introductions of review team members, hosts, USGS staff, and guests. Review of the charge to the review team.	
9:15 – 10:30	Review of fundamental CSC strategic vision, planning, administrative structure. and 5-year status report. Presentations: • Introduction by CSC director and overview of CSC staff, structure, and brief history. Review of CSC strategic plan, work plans, funding history, and key accomplishments • Review of SAC or comparable structure—frequency of meetings, membership, summary of recommendations (presentation could be done by SAC chair or member) • Grant process overview	Develop a full understanding of the structure of the CSC, including core documents and key processes.
10:30–10:45	Break	
10:45–11:45	Introduction by university-host PI(s) – • Description of host agreement, accomplishments, integration of 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. • Description of climate change structures within the host institutions. This may include presentations by key entities, including their engagement with the CSC	Full understanidng of the host-university component of the CSC, including the primary hosts as well as other university partners.
11:45–noon	Lunch Break	
1:00–2:45	Establishment of the climate change science and conservation context of the CSC—selected presentations on significant climate change issues that	Understanding of the main drivers of science-

Wednesday, January 20, 2016 (continued)

Time	Preparatory or on-site activity	Desired output
	characterize the CSC operational area. Denise Lach, director of the School of Public Policy (OSU) Kathie Dello, associate director of OCCRI - regional engagement on identifying climate related risks Nicole DeCrappeo, Research Coordinator for the Northwest Climate Science Center (others TBD)	management needs that define that CSC and relevant other climate science providers. What is the context of the CSC with regard to the most significant conservation challenges?
2:45–3:00	Break	
3:00–4:30	CLOSED SESSION Review panel briefing and Q&A with USGS staff only. Concurrently, USGS-Reston staff (Janet Cushing and Robin O'Malley) will be meeting with Phil Mote, Steve Daley-Laursen, and Josh Foster in Strand 370.	
4:30–5:30	Review team only, closed session #1	

Thursday, January 21, 2016

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	CSC and host university research forum—exact order may not be reflected in the list below: Sihan Li, Lindsey Thurman - NW CSC fellows from OSU (15 minutes) Karen Thorne, USGS, NW CSC-funded investigator Kevin Buffington, NW CSC fellow from OSU (15) Josh Lawler, UW, NW CSC-funded investigator (10) Steven Daley Laursen, UI, on UI NW CSC fellows (10) Andrea Woodward, USGS (10) Eric Salathé, UW, on UW NW CSC fellows (10) Crystal Kolden*, UI, NW CSC-funded investigator (10) Dominique Bachelet, conservation biology, NW CSC-funded investigator (10) *Webex	Understanding of linkage between research projects and defined needs, levels of engagement, transferal of information, actionability pathway
10:00–10:15	Break	
10:15–noon	Partnership dialogue #1 (Cornell team)—science producers *Note that these two partnership dialogue sessions are for the invited panel participants, the Cornell facilitation team, and the science review team members only. We will politely ask others to respect the privacy of these discussions and take advantage of the free time to*	

Thursday, January 21, 2016 (continued)

Time	Preparatory or on-site activity	Desired output
	get a cup of coffee, find a place to catch up on e-mails, or take care of other business.	
Panelists:		
	Josh Lawler, in person Emilie Henderson, in person, OSU Andrea Woodward, in person Karen Thorne, in person Lisa Gaines, in person, OSU Doug Shinneman, webex, U Idaho Crystal Kolden, webex Susan Dickerson-Lange, webex Susan Capalbo, department head, applied economics Tiffany Sacra Garcia, professor, fisheries & wildlife Lindsey Thurman, Sihan Li, Kevin Buffington (fellows, who have also attended boot camp more than once)	
Noon–1:15	Lunch	
1:15–2:45	Partnership dialogue #2 (Cornell Team)—science users Primarily members of the Stakeholder Advisory Committee: David Jepsen, senior policy analyst, Oregon Department of Fish and Wildlife (ODFW) Lynn Helbrecht, Washington State Department of Ecology (Ecology) Don Sampson, Affiliated Tribes of Northwest Indians (ATNI) Laura Gephart, Columbia River Intertribal Fish Commission (CRITFC) Eliza Ghitis, Northwest Indian Fisheries Commission (NWIFC) David Redhorse, Bureau of Indian Affairs (BIA) Bryan Horsburgh, Bureau of Reclamation (Reclamation) Michael Cox, Environmental Protection Agency (EPA) Rick Kearney, Coordinator Great Basin LCC (GBLCC) John Mankowski, Coordinator, North Pacific LCC (NPLCC) Chris Lauver, National Park Service (NPS) Bea Van Horne, director, USDA HUBWhat is HUB? Stephen Zylstra, assistant regional director—science applications, U.S. Fish and Wildlife Service (USFWS)	
2:45–3:00	Break	
3:00–4:30	CLOSED SESSION Review team briefing and discussion with university/host	

Thursday, January 21, 2016 (continued)

Time	Preparatory or on-site activity	Desired output
	institution principle investigators and relevant other university partners only.	
	Concurrently, USGS-Reston staff (Janet Cushing and Robin O'Malley) will be meeting with Josh, Pat Hawk (director of the Office of Sponsored Research and Award Administration), and possibly someone else from Pat's office.	Review responses to submitted questions and information requests, open discussion of CSC.
4:30–5:30	Review team only, closed session #2	

Day 3 – Friday, January 22, 2016

Time	Preparatory or on-site activity	Desired output
8:00–8:15	Gather. Review day-2 notes and day-3 schedule of activities.	
8:15–9:45	Communications of CSC science (Eric Salathe et al.) CSC data management activities	
9:45–10:00	Break	
10:00–11:00	Review team closed, session #3	Identify key initial observations. Discuss writing assignments.
11:00–noon	Report out of review team to CSC/university hosts.	Open discussion and Q&A about initial observations. Develop list of follow-up items, responsibilities, and time lines. Draft report development, review, and finalization timeline.
Noon	Lunch and adjourn meetings.	
Afternoon option	Depending on travel schedules, review team could assemble for writing/work session.	

Appendix C
Partnership Effectiveness Focus Group Questions

Science Producers

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

Science Users

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

Appendix D
Executive Stakeholder Advisory Committee Members

Federal Agencies
Bonneville Power Administration
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
Environmental Protection Agency
Federal Highway Administration
National Oceanic and Atmospheric Administration
National Park Service
Natural Resources Conservation Service
U.S Forest Service
U.S. Army Corps of Engineers, Northwestern Division
U.S. Fish and Wildlife Service
U.S. Geological Survey

State Agencies
Idaho Department of Fish and Game
Montana Department of Natural Resources and Conservation
Oregon Department of Fish and Wildlife
Washington State Department of Ecology

Tribal Entities
Affiliated Tribes of Northwest Indians
Columbia River Intertribal Fish Commission
Northwest Indian Fisheries Commission

Landscape Conservation Cooperatives (LCCs)
Great Basin LCC
Great Northern LCC
North Pacific LCC

Appendix E
Northwest Climate Science Center Institution Partners

Table E.1. Northwest Climate Science Center-Funded Projects (2011–2015). Count of principle investigators by institution.

Institution	Total
Boise State University	1
Bureau of Land Management Idaho and Great Basin Restoration Initiative	1
Chilkoot Indian Association	1
Chugachmiut Tribal Consortium	1
Coeur d'Alene Tribe	1
Columbia River Inter-Tribal Fish Commission	1
Desert Research Institute	1
EcoAdapt	3
Oregon State University	14
Oregon Water Science Center	1
USGS Pacific Coastal Marine Science Center	1
Quartz Valley Indian Reservation	1
Swinomish Indian Tribal Community	2
Tribal Leadership Forum	2
University of California, Davis	1
University of Idaho	10
University of Montana	1
University of Washington	13
U.S. Fish and Wildlife Service	1
U.S. Forest Service Pacific Northwest Research Station	2
U.S. Geological Survey (USGS) Branch of Regional Research, Central Region	1
USGS Columbia River Research Laboratory	1
USGS Earth Resources Observation and Science Center	1
USGS Forest and Rangeland Ecosystem Science Center	7
USGS Fort Collins Science Center	1
USGS Northern Rocky Mountain Science Center	1
USGS Western Ecological Research Center	1
USGS Western Geographic Science Center	2
Washington Water Science Center	1
Yurok Tribe	1

Source: nccwsc.usgs.gov/display-csc/4f8c64d2e4b0546c0c397b46.

Note: Not all of these principle investigators received money directly from the Northwest Climate Science Center (NW CSC). Some (like EcoAdapt) were awarded money through subawards from Oregon State University. For the Chilkoot Indian Association and Chugachmiut Tribal Consortium, the NW CSC transferred funds to the North Pacific Landscape Conservation Cooperative/U.S. Fish and Wildlife Service, who then transferred funds to the tribal organizations.

Appendix F
Example Statement of Shared Interests Based Upon Cooperative Ecosystem Studies Unit Model

Note that additional editing is needed but the model specifying expectations for all involved parties is an essential approach. This document would be part of the Cooperative Agreement (CA) between the National Climate Change and Wildlife Science Center (NCCWSC) and the Climate Science Center host university (CSC-University). It is not intended to replace CA details regarding specific deliverables, but rather as a supplement to characterize the relationship intended to be developed among the CSC-University, the federal U.S. Geological Survey partners (CSC-Federal), and NCCWSC.

1. All parties associated with the Department of Interior (DOI) Climate Science Center (CSC) agree to work collaboratively, effectively, and efficiently to meet the mission and goals of NCCWSC and the individual CSC.
   a. 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.
   b. The mission of the DOI CSC 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.
   c. The mission of the host university is to …

The CSC-Federal agrees to

   d. Collaboratively conduct, with the CSC-University and partner institutions, a program of research, technical assistance, and education related to the CSC objectives to the extent allowed by each federal agencies' authorizing legislation;
   e. Provide administrative support for the Stakeholder Advisory Committee (SAC) to ensure that the SAC efficiently and effectively fulfills it roles as described in the SAC Terms of Reference docu ment;
   f. Allow federal agency employees to participate in the activities of the CSC-University and partner institutions, including serving on graduate committees and teaching courses, as appropriate, and as specifically determined in the CA.

2. The CSC-University agrees to
   a. Conduct, with participating federal agencies and partner institutions, a program of research, technical assistance, and education related to the CSC;
   b. Allow and encourage its faculty to engage in participating federal agencies' research, technical assistance, and education activities related to the CSC, as appropriate;
   c. Provide basic administrative and clerical support, as appropriate, and as described in the CA;
   d. Provide access for CSC-Federal-agency staff to campus facilities, including library, laboratories, and computer facilities, on the same basis or cost as other faculty members of the CSC-University to the maximum extent allowable under state laws and regulations;
   e. Provide suitable office space, furniture and laboratory space, utilities, computer network access, and basic telephone service for federal agency personnel to be located at the CSC-University, as appropriate and as specified in the CA;
   f. Offer educational and training opportunities to participating federal agency employees, in accordance with the respective policies of the federal agencies and the CSC-University;
   g. Encourage its students to participate in the activities of the CSC; and

h. Coordinate activities, as appropriate, with the partner institutions and develop administrative policies for such coordination.

3. Each partner institution agrees to
   a. Conduct, with participating federal agencies and the CSC-University, a program of research, technical assistance, and education related to the CSC objectives, and allow and encourage faculty to participate in the program, as appropriate;
   b. Offer educational and training opportunities to participating federal agency employees, as appropriate; and
   c. Encourage students and employees to participate in the activities of the CSC.
4. All federal agencies, the CSC-University, and partner institutions agree to
   a. Maintain the CSC closely following the mission and goals of the CSC and NCCWSC strategic plans, adapting key elements to local and regional needs, as appropriate; and
   b. Operate under a current multiyear strategic plan.

Appendix G
Actionability Measures

Table G.1. The Northwest Climate Science Center projects by Science Agenda subtheme, as listed in the DEPTH portal. For each subtheme, the example project is either (1) the first project that the portal lists for the subtheme, or (2) to avoid duplication of examples, the first project not previously included in the table. Several projects were nonetheless listed more than once because they were the only project responding to a subtheme. Potential users were identified where possible from the project abstract, or as noted from cooperators lists or final project reports when the abstract did not appear to provide sufficient information. *N* = projects from DEPTH; N/A = not applicable.

Subtheme	*N*	Example project	Potential users
1a	3	Integrated Scenarios of Climate, Hydrology, and Vegetation for the Northwest	General
1b	3	Changes to Watershed Vulnerability under Future Climates, Fire Regimes, and Population Pressures	Western JFSP wildlife fire consortia, Landscape Conservation Cooperative (LCC), and Climate Science Center communities
1c	2	Integrated Scenarios Tools: Improving the Accessibility of the Integrated Scenarios Data	Northwest natural and cultural resource managers; North Pacific LCC Northwest natural and cultural resource managers; North Pacific LCC as a specific example
1d	0	N/A	N/A
2a	12	An Interagency Collaboration to Develop and Evaluate New Strategies for Watershed Restoration Addressing Climate Change Impacts on Water and Ecosystems in the Great Basin	Ranchers and managers of public lands
2b	2	Marshes to Mudflats: Climate Change Effects Along a Latitudinal Gradient in the Pacific Northwest	Based on cooperator list, managers of coastal refuges in Washington, Oregon, and California
2c	0	N/A	N/A
2d	3	Climate Change and Peak Flows: Knowledge-to-Action to Help Managers Address Impacts on Streamflow Dynamics and Aquatic Habitat	Based on final report, Eugene Water and Electric Board, U.S. Forest Service (USFS), Pacific Northwest Research Station, U.S. Geological Survey Oregon Water Science Center, Oregon Department of Fish and Wildlife, and other watershed managers
2e	2	Sagebrush Ecosystems in a Changing Climate	Land managers involved in maintaining and restoring sagebrush ecosystems
2f	3	Rangewide Climate Vulnerability Assessment for Threatened Bull Trout	From final report, regional and local federal and state managers within the range of Bull Trout; examples include USFS, U.S. Fish and Wildlife Service (USFWS), and Burns Paiute Tribe
3a	18	Climate Change Avian Vulnerability	Conservation planners and natural

Table G.1. Continued.

Subtheme	*N*	Example project	Potential users
		Visualization and Analysis Tool for Land Managers: Expansion to Northwest Climate Science Center with Dynamic Vegetation Simulations	resource managers from nongovernmental organizations (NGOs) and state and federal agencies
3b	7	Climate Change Threats to Fish Habitat Connectivity: Growth and Predation	Stakeholders in the Methow River, including local politicians; federal, state and NGO resource managers; ranchers/farmers; and tribal representatives.
3c	6	Changes to Watershed Vulnerability under Future Climates, Fire Regimes, and Population Pressures	Land managers responsible for wildfire management systems
3d	5	Berry Risk Mapping and Modeling of Native and Exotic Defoliators in Alaska	Chugachmiut Tribal Consortium; Nathan Lojewski of the consortium was principal investigator
3e	0	N/A	N/A
3f	1	Climate Change Threats to Fish Habitat Connectivity: Growth and Predation [duplicate because only example for 3f]	Stakeholders in the Methow River, including local politicians; federal, state, and NGO resource managers; ranchers/farmers; and tribal representatives.
3g	5	Forest Management Tools to Maximize Snow Retention under Climate Change	Regional forest and water managers
4a	23	A Coupled (Ocean and Freshwater) Assessment of Climate Change Impacts on Pacific Lamprey and Pacific Eulachon	Regional Native American tribes
4b	11	Assessing Climate Change Effects on Natural and Cultural Resources of Significance to Northwest Tribes	Regional Native American tribes
4c	6	Climate-Change Vulnerability in the Pacific Northwest: A Comparison of Three Approaches	From final report, land and wildlife managers; for example, Idaho Fish and Game Department, USFS, and National Park Service (NPS)
4d	5	Identification and Laboratory Validation of Temperature Tolerance for Macroinvertebrates: Developing Vulnerability Prediction Tools	Managers of aquatic resources
4e	9	Can We Conserve Wetlands under a Changing Climate? Mapping Wetland Hydrology across an Ecoregion and Developing Climate Adaptation Recommendations	Managers involved in wetlands conservation
5a	0	N/A	N/A
5b	1	Identification and Laboratory Validation	Managers of aquatic resources

Table G.1. Continued.

Subtheme	*N*	Example project	Potential users
		of Temperature Tolerance for Macroinvertebrates: Developing Vulnerability Prediction Tools [duplicate because only example for 5b]	
5c	0	N/A	N/A
6a	3	Relations among Cheatgrass-Driven Fire, Climate, and Sensitive-Status Birds across the Great Basin	Land managers; for example, Bureau of Land Management (a cooperator)
6b	2	Toward Next Generation Downscaling for Hydrologic Prediction in the Pacific Northwest (Using Multivariate Adaptive Constructed Analogs – Variable Infiltration)	Water resource managers and planners
6c	9	Climate, Land Management and Future Wildlife Habitat in the Pacific Northwest	Natural resource managers, particularly those concerned with northern spotted owl and greater sage grouse
6d	3	Improving Understanding of Threats to Whitebark Pine in the Western US: Quantifying Climate Change Effects on Mountain Pine Beetle Outbreaks	From final report, land managers and and decision makers, USFWS, USFS, NPS. Project External Advisory Committee with agency and Natural Resources Defense Council representatives. Whitebark Pine Subcommittee of the Greater Yellowstone Coordinating Committee
6e	1	Schitsu'umsh Relationships with Their Dynamic Landscapes: Identifying, Managing and Applying Indigenous Knowledge and Praxis	Schitsu'umsh people (Coeur d'Alene Tribe of Idaho), potentially other tribal and nontribal communities
7a	1	Toward Next Generation Downscaling for Hydrologic Prediction in the Pacific Northwest (Using Multivariate Adaptive Constructed Analogs – Variable Infiltration) [duplicate because only example for 7a]	Water resource managers and planners
7b	44	Assessing Climate Change Vulnerability and Adaptation in the Great Basin: A Policy Perspective on Resource Managers and the Use of Science in Decision Making	Resource managers in the Great Basin