



# Northwest Climate Science Center Annual Report 2016

## Message from the NW CSC

The pages in this Annual Report highlight some of our many accomplishments during the federal fiscal year 2016 (FY16). More importantly, these successes punctuate the thriving evolution of our growth since our infancy as a Center. The release of this Annual Report coincides with the completion of the original 2010 agreement between the U.S. Government, Oregon State University, University of Idaho, and University of Washington to jointly build the Northwest Climate Science Center (NW CSC) from the ground up (see Appendix 1). For the last six years our priority has been to provide quality services to the Northwest community as it responds to environmental change. With news of persistent drought, devastating fires, and profound ecological shifts now prominent in every newspaper, our focus has been to recognize urgent priorities, innovate our products, seize partnership opportunities, and contribute to long term resilience. The quality and diversity of science products we helped sponsor not only enhance our collective understanding of the intricacies of climate change, but also strengthen management interventions that improve adaptive capacity. Our efforts continue to nurture a growing generation of early career professionals to secure the continuity of our legacy. We experiment with creative approaches for the delivery of climate data and we offer a multitude of communication products to reach all segments of our diverse audience. We capitalize on the many opportunities to work with our partners in academia, government, tribes, and citizen groups, to launch joint ventures that benefit the region as a whole. Finding the way during the past six years has not been always easy, but we've blazed a trail with steady and lasting steps. Our commitment to providing a suite of professional quality services to the Northwest is stronger than ever. And as our evolution continues, we look forward with enthusiasm to the next chapter of the NW CSC.



*Members of the NW CSC Leadership Team (from left): Gustavo Bisbal, USGS; Rich Ferrero, USGS; Philip Mote, Oregon State University; Steve Daley-Laursen, University of Idaho; and Eric Salathé Jr., University of Washington, Bothell.*

## 2016 Highlights

- Helped organize the first-ever national [Tribal Climate Camp](#).
- University Director Philip Mote and colleagues from other CSCs organized and hosted the 5th meeting of the CSC network, in Stevenson, WA Sept 26-28, 2016.
- Created [Story Maps](#) to make project data more accessible for our stakeholders.
- Supported [16 NW CSC Graduate Fellows](#) in FY16.
- Organized the most highly rated [Climate Boot Camp](#) to date, which provided training to 25 Graduate Fellows and early-career professionals.
- Distributed the second issue of [Northwest Climate Magazine](#) to approximately 10,000 recipients.
- Created an fully searchable online database for the [Northwest Climate Science Digest](#).
- Congratulated [Nicole DeCrappeo](#) who was promoted from Research Coordinator to Deputy Director of the NW CSC.
- Welcomed [Rich Ferrero](#), USGS Northwest Regional Director, newest member of the NW CSC Leadership Team and Chair of the [Stakeholder Advisory Committee](#).

# Producing Actionable Science

**Supporting actionable climate science** that is co-produced by scientists and Northwest resource managers is a mission that drives all of the NW CSC's research activities. The actionable science co-development process we endorse and sponsor is one in which scientists and managers: 1) discuss a management priority that needs to be addressed, 2) collaboratively decide on a scientific strategy to help inform decisions around that priority, 3) converse regularly and meaningfully throughout the venture, and 4) generate information and create products that are tailor-made to meet the managers' needs.

While every step along this path can be challenging, many scientists and managers are successful at navigating the path together and producing actionable products. Broadly speaking, our Department of the Interior (DOI) mandate focuses our science on the impacts of climate change on fish, wildlife, ecosystems, and tribal resources. We work closely with managers and decision makers in DOI bureaus, other federal agencies, state natural resource management departments, and tribes and intertribal organizations to identify management priorities and guide our science

directions. We also work closely with other climate change and landscape-level oriented organizations to leverage resources and make our science useful to stakeholders such as forest managers, ranchers, growers, and local conservation groups. Below are short descriptions of five projects that were completed in FY16.

In FY16, the NW CSC devoted \$1.4M to projects that will help resource managers adapt to or lessen the impacts of climate change on species, habitats, and ecosystems (see Appendix 2). Each project will have active participation from natural and cultural resource managers in the Northwest; all told, the FY16 suite of projects is poised to engage managers from over 30 different tribes, federal and state agencies, and non-profit organizations.

Additionally, six science projects reached completion in FY16. They ranged in focus from modeling future wildfire impacts on water availability to developing tools to visualize avian vulnerability to climate change. Descriptions of each of the six finished projects can be found below.



## Synthesizing the Science on Prescribed Burns

Lisa Gaines of Oregon State University and Rachel Gregg of EcoAdapt applied a rigorous review to the science of using prescribed burns as an adaptation action for Northwest forests. In this pilot [Available Science Assessment Project \(ASAP\)](#), Gaines and Gregg developed a process to evaluate evidence on adaptation actions, which includes interviews and workshops with scientists and resource managers, and systematic literature review. Not only did this pilot project synthesize the science on prescribed burns, it also validated an approach to evidence review that can help improve any number of local climate adaptation strategies.

## Managing forests to maximize snow retention under climate change

Climate change is causing earlier snowmelt, with consequences for ecosystems and community water supplies. If forests can be managed to retain snow longer, some environmental and financial impacts may be mitigated. Jessica Lundquist of the University of Washington and her team mapped climate-forest-snow interactions across the Northwest to help predict how forest change will affect snow duration in different locations. They tested their predictions against observations. [Their results are helping managers decide how to manage forests](#) in order to maximize snowpack into summer. Ultimately, their work will help provide more late-season water for hydropower, agriculture, and fish flows.

*Susan Dickerson-Lange*



## Visualizing Avian Vulnerability to Climate Change

Joshua Lawler of the University of Washington updated and expanded an [interactive, map-based website](#) that allows managers and planners to visualize projected changes in bird habitat at scales that range from sites to landscapes to the entire Northwest region. This online tool presents the most current projected changes in vegetation and bird species distributions for 30+ focal species. Lawler engaged conservation planners and natural resource managers throughout the stages of his project to ensure that ultimately the tool would be useful for them.



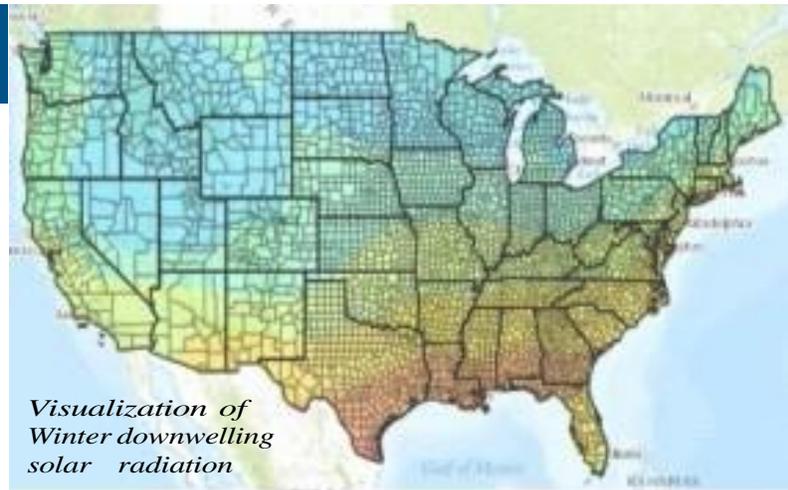
## Conserving Connectivity in a Changing Climate

As the climate changes, species will likely adjust their geographic ranges to track shifting areas of climatic suitability. For this reason, [enhancing habitat connectivity](#) is a key strategy for increasing biological resilience to climate change. Meade Krosby of the University of Washington brought together scientists and land managers to tailor science syntheses for those seeking to manage connectivity. Resulting data syntheses and visualization tools are helping managers conserve important corridors for 12 plant and animal species across a large, transboundary region of British Columbia and Washington State.



## Improving Accessibility of the Integrated Scenarios Data

The Integrated Scenarios project describes in detail projected changes in climate, hydrology and vegetation for the Northwest. That project's datasets comprise over 20TB of data available in netCDF format. Unfortunately, the size and format of these datasets posed barriers to access for many users. John Abatzoglou and Katherine Hegewisch of the University of Idaho helped make the datasets more accessible by providing the project results with a [user-friendly online interface](#). The website provides a repository of information about the different models and products, a data portal, and visualizations from the modeling efforts.



## Modeling Future Wildfire Impacts to Forested Watersheds

Climate-driven increases in wildfire frequency and severity will impact watersheds and water availability across the American West. Jason Kreidler of the U.S. Geological Survey led a team to investigate [how wildfires will affect watersheds and water supply](#). To their surprise they found that three quarters of the watersheds modeled will likely have an increase in sedimentation of 10 percent, while one quarter could see a 100 percent increase in sedimentation by the year 2050. Understanding watershed vulnerabilities will help managers take proactive measures to protect future water supplies for our growing population.





## Education & Training

### Climate Boot Camp 2016 Focused on Place-Based Education

Each year the NW CSC hosts a week-long retreat known as [Climate Boot Camp](#) (CBC) to prepare the next generation of scientists, policy-makers and resource managers for the opportunities and challenges of climate change. In FY16, Climate Boot Camp drew 25 graduate students and early career professionals to the University of Idaho's McCall Field Campus. This diverse group was comprised of graduate student fellows from other regional DOI Climate Science Centers, the National Climate Science and Wildlife Center and the Western Water Assessment. Nez Perce Tribe, Quinault Indian Nation, Bureau of Reclamation and United States Geological Survey also sent staff members, along with Idaho Department of Fish and Game and Montana Department of Natural Resources and Conservation. This year's CBC attendees brought a range of research experience, including glaciology, botany, sociology, ecology and wildlife biology.

Guided by feedback from the FY15 evaluation, a program committee comprised of staff from Nez Perce Tribe, US Forest Service, McCall Outdoor Science School and graduate students from Idaho State University, University of Idaho and Shoshone Bannock Tribes were engaged to shape curriculum that reflected interactive, integrative and experiential pedagogy. The result was dynamic, place-based approach exploring themes of co-management and knowledge co-production through four case studies: water quality, water allocation, bull trout and camas. Specific skills in storytelling and narrative development were demonstrated by educators and offered for practice through community member interviews and podcast development. (See evaluation in Appendix 3.)

There are now 135 CBC alumni-fellows in the region and country, working in public sector positions, and conducting research in climate related fields.



Arwen Bird

### The First-Ever National Tribal Climate Camp Focused on Capacity-Building

The Affiliated Tribes of Northwest Indians (ATNI), Institute for Tribal Government (ITG) United South and Eastern Tribes (USET), and the Department of the Interior's Northwest Climate Science Center and Bureau of Indian Affairs collaborated to offer [The Tribal Climate Camp](#) (TTCC). TTCC supported teams of tribal leaders, climate change coordinators, planners, and program managers to build skills, gather information, and develop tribal policies needed to address climate change impacts. Delegate teams were drawn from six ATNI and USET member tribes and traveled to University of Idaho's McCall Field Campus for this week-long training. Members of the TTCC program committee shaped curricular elements that helped delegate teams develop climate adaptation plans for their tribes, including conducting vulnerability assessments, fundraising, and presenting to tribal councils. More information about the camp can be found [here](#).

# NW CSC Graduate Fellows

To date, 22 graduate students have received fellowships from the NW CSC. Currently the NW CSC funds 17 graduate student fellowships, including four at Oregon State University, nine at the University of Idaho and four at the University of Washington. Below are profiles of a few of the fellows supported in FY16. See Appendix 4 for the complete list.

## MOSS Fellows Contribute to Innovation

In its inaugural year, the collaboration between University of Idaho's McCall Field Campus, [McCall Outdoor Science School \(MOSS\)](#) and the Northwest Climate Science Center translated to exponential benefit to 2016 [Climate Boot Camp \(CBC\)](#) curriculum development and delivery. Through a nationally competitive process two MOSS Fellows, [Caitlin Rushlow](#) and [Ben Soderquist](#), were selected for a year-long residency to develop and deliver CBC, among other aspects of their fellowship.



**Caitlin Rushlow**

The result was a close collaboration between both fellows, their advisors at MOSS and NW CSC staff. "The instruction in science communication and place-based education I received at MOSS transformed my idea of what it means to be a scientist and do science," said Caitlin Rushlow. "It led us to design this year's CBC curriculum around

science identity, with the goal of bridging the barriers separating scientist from non-scientist."

The fellows' residency at MOSS was not only transformative for each of them, the fellowship provided innovation to CBC curriculum through the concepts and ideas presented. "Working with the NW CSC and MOSS was a great experience that challenged me to rethink science education and communication," said Ben Soderquist. "Helping develop the CBC curriculum allowed us to further explore our roles as researchers and science communicators in a meaningful way. Overall, the collaborative experiences we shared during the past year have left a lasting impression on my development as a scientist."



**Ben Soderquist**



## Ian Breckheimer University of Washington

[Ian Breckheimer](#) studies how plant communities are responding to climate change. His research, based in Mt. Rainier National Park, uses experiments and long-term observations to tease apart which locations in the park are the most sensitive and most resilient to climate change impacts. He does this by connecting observations from a large network of microclimate sensors to historical and contemporary plant surveys in the park. Using riparian plants as a model system, he also digs deeper into the ecological mechanisms driving sensitivity to climate using a set of reciprocal transplant and neighborhood manipulation experiments.

## Lindsey Thurman Oregon State University

[Lindsey Thurman](#) is investigating the capacity of amphibians in the Northwest to adapt to climate change. She works primarily in high elevation freshwater ecosystems, focusing on the Cascade Mountain Range metacommunity of pond-breeding amphibians. Lindsey examines how species interactions shape their adaptive capacity, ecological niche, and, ultimately, their footprint on the landscape. As she finishes her dissertation, she is planning to also produce a conservation assessment for high-elevation amphibian species and guide to management options for stakeholder groups like the National Park Service.



# Growing Our Communications Partnerships



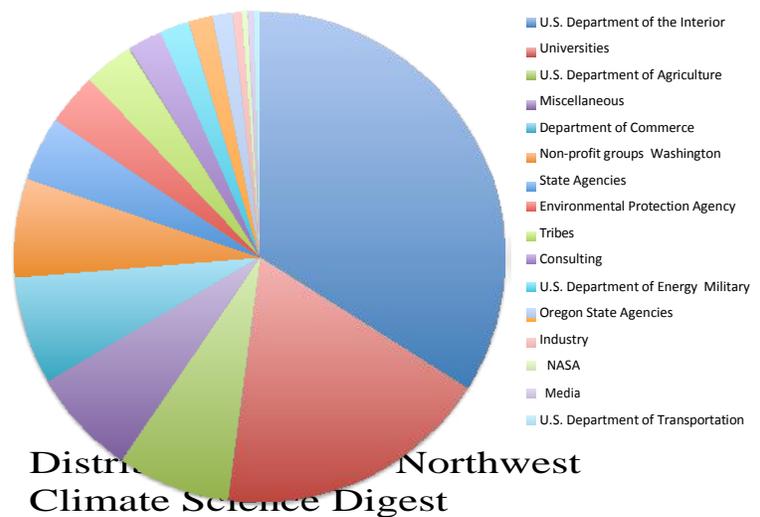
In FY16, the NW CSC strengthened its partnership with the three Landscape Conservation Cooperatives (LCCs) in the region by working with them to produce communication products for our shared target audiences. We invited the [Great Basin LCC](#) and the [Great Northern LCC](#) to contribute stories for the second issue of *Northwest Climate Magazine*, which we jointly produce with the [North Pacific LCC](#) and the NOAA's [Pacific Northwest Climate Impacts Research Consortium](#). Additionally, we worked with the North Pacific LCC to expand distribution of the [Northwest Climate Science Digest](#)- a monthly summary of scientific papers,

government reports, popular media stories and upcoming events related to climate science and relevant to the Northwest (see below).

The NW CSC also continued to maintain and expand its academic website and social media accounts, growing new website users by 55% and returning users by 90% from the same time last year, while adding 54% more Facebook likes and 36% more followers on twitter. We also helped provide communications training to graduate students through [Climate Boot Camp 2016](#), for the first time giving participants a chance to produce their own podcasts.

## Evaluating and Improving the Northwest Climate Digest

In FY16, the NW CSC partnered with [Diana Gergel](#) to evaluate and improve our [Northwest Climate Science Digest](#), a communication product of high value to stakeholders that we began co-producing with the North Pacific Landscape Conservation Cooperative in the fall of 2014. For Diana's capstone project, as part of the University of Washington's [Program on Climate Change](#), she was required to help communicate climate science and also evaluate the effectiveness of that communications effort. Since the fall of 2015, she has worked to improve the NW Climate Science Digest by helping us better understand who gets the digest, how they use it, and how we can tailor it to better meet their needs. In response to feedback that she obtained through targeted interviews, we created a fully-searchable online database for archived digests. During the time we've worked with Diana we've also increased our subscribers from about 4,500 to more than 8,400, and are seeing an additional 1,000-1,500 readers from forwards each month.



## Partnering with Northwest Tribes

Northwest Tribes may face special challenges in a changing climate because of their close connections to their ancestral and treaty lands. Some are strongly motivated to understand and adapt to climate change, especially as it relates to their water resources, culturally significant foods, and managed forests and rangelands. The NW CSC has worked with Northwest

Tribes to assess their technical capacity to address climate change. An important finding is that most tribes have limited resources to conduct vulnerability assessments and adequately plan for climate change impacts. In collaboration with the [Great Basin Landscape Conservation Cooperative](#), the NW CSC is funding the University of Washington [Climate](#)

[Impacts Group](#) to a) make the vulnerability assessment process more accessible to tribal staff, b) address the demand for climate data at the scale of tribal decision-making, and c) support the use of project products via workshops and a webinar, and by staffing a [Tribal Climate Technical Support Desk](#) to provide rapid response to relevant queries.

## Providing accessible and useable data products to scientists, resource managers, decision-makers, educators, students, and the general public

*I am told there are people who do not care for maps, and I find it hard to believe.*

-Robert Louis Stevenson

Throughout FY16, the NW CSC continued to receive data products from its funded projects ranging from photos of snow accumulation obtained from citizen scientists to anticipated distributions of birds across the Northwest. Each of these products and their accompanying metadata (i.e. descriptions of the data) have been made publically available in the USGS repository, ScienceBase.

In October 2015, the NW CSC released a 'story map,' titled [Northwest Climate Science Center Projects and Data Storefront](#). Story maps are a relatively new phenomenon in scientific communication. They use a combination of text, video, imagery, GIS, and other multimedia resources to tell a narrative about a research project. Given the natural emphasis in environmental or ecological topics on spatial characteristics, story maps introduce a means to imbue spatial data with context and narrative.

The NW CSC story map gives us an opportunity to elevate data products received from investigators. Data products are usually spreadsheets, large text files, or spatial data – all difficult to use without appropriate knowledge and tools. The story map allows us to share those data without burdening the user with knowledge of the intricacies of the data in order to understand what it shows. If a user requires more information they can dig deeper into the data.

Our story map focuses on projects that have produced spatially-explicit data, such as a project examining projected changes in habitat resulting from climate change for bird species in the Northwest, completed by Dr. Josh Lawler of the University of Washington in 2014 (shown in the background), to compare climate vulnerability assessment approaches. Maps from this project present the results of several methods for ranking the vulnerability of plant and animal species to climate change. Each ranking, once clicked, produces a different map, describing the relative stability or threat present across the spatial distribution of that plant or animal.

We anticipate adding to the story map in the next year, and continuing to explore ways to make our data available and usable by all our partners!

For more information contact: **Gustavo Bisbal**

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541-750-1020

or

**Philip Mote**

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pmote@coas.oregonstate.edu  
541-737-5694

or visit [www.nwclimatescience.org](http://www.nwclimatescience.org)

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# Appendix 1: Hosting Agreement Execution



Oregon State University (OSU) continued as the NW CSC host institution overseeing consortium and related project activities connected to the cooperative agreement and competitive awards, organizing events described below, and participating in network leadership. OSU ensured that FY16 “extension” funds were secured from USGS and distributed to University of Idaho and University of Washington to maintain education, training, and communications missions.

During 2015-16, OSU led an internal “self-evaluation” of university consortium research and management, and hosted an independent, 5-year, site review at OSU in January 2016. OSU also spearheaded development of a renewal proposal for 2017-2022 (submitted July 2016), better aligning research and educational missions. OSU continued to oversee and provide management support for competitive “pass-through” project grants to the region originally awarded in FY14, and helped prepare for new project grants that start in Fall 2016.

OSU again provided rigorous administrative, logistical, and curriculum support for successful Climate Boot Camp training in 2016, as in previous summers. Preparations for Climate Boot Camp 2017 began already during the 2016 Boot Camp.

OSU has led preparations to host the CSC National Meeting in September 2016, and several CSC-affiliated scientists serve on the program committee for the Northwest Climate Conference in November 2016. OSU continues an active role on the NW CSC Leadership Team, engaging with ESAC, serving on the *Northwest Climate Magazine* editorial board, advising governance of the North Pacific Landscape Conservation Cooperative, and serving as a resource on certain tribal matters.

## Appendix 2: Ten New Science Projects Funded in FY16

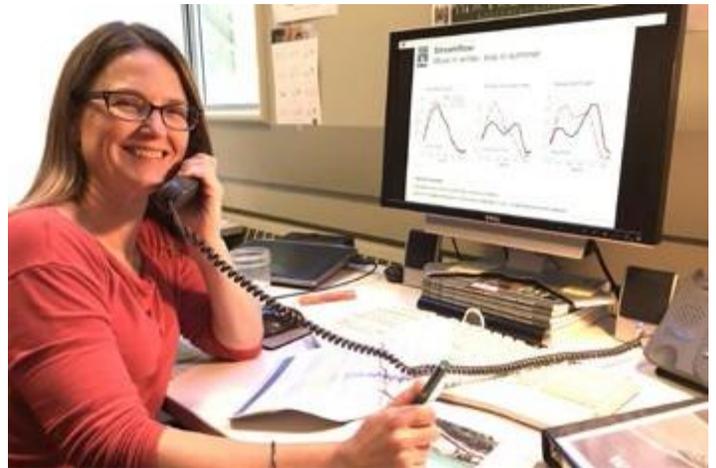
The Northwest Climate Science Center is proud to announce funding for ten new projects in Fiscal Year 2016. In total, these efforts represent a \$1.4 million investment to help natural resource managers and cultural stewards adapt to, or lessen the impacts of, climate change on species, habitats, and ecosystems. These projects will improve drought and climate change adaptation strategies by:

Examining the effectiveness of innovative management actions, like [relocating salmon](#) to colder habitats, [amending soils with biochar](#) to increase soil water holding capacity, and [managing urban tree canopies](#) to lower stream temperatures.



Providing conservation planning tools that identify resilient headwaters, drought tolerant trees, climate and drought refugia, and adaptation strategies for coastal estuary managers.

Building regional adaptation capacity by [streamlining the vulnerability assessment process](#) for tribes, evaluating and improving the production of [actionable science](#) in the region, and helping students and tribal members attend the seventh annual NW Climate Conference.



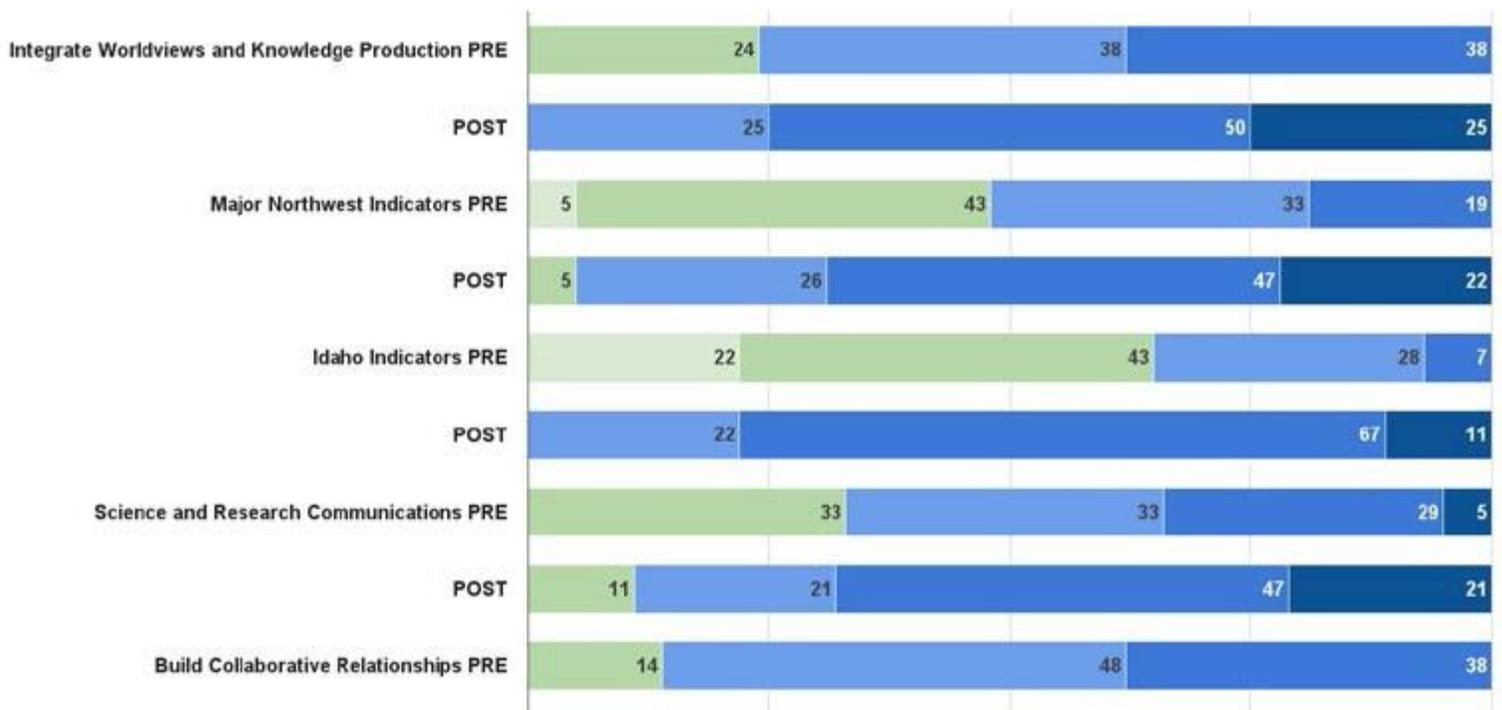
Each project will have active participation from natural and cultural resource managers in the Northwest, consistent with our commitment to the delivery of actionable science. All told, the suite of projects is poised to engage managers from over 30 different tribes, federal and state agencies, and non-profit organizations.

# Appendix 3: Achieving Understanding in 2016 Climate BootCamp Learning Areas

Essential understandings and objectives for the 2016 Climate Boot Camp (CBC) reflected the dual aims of a place-based and experiential learning environment. Respondents were asked to self-assess their understanding in five learning areas prior to and following the camp. These areas were as follows:

- How to integrate different worldviews and knowledge production into research and/or management decisions.
- Major indicators of climate change for water resources, freshwater fisheries, and native plants in the Northwest.
- Major indicators of climate change for water resources, freshwater fisheries, and native plants in Idaho.
- Theories and practices of science and research communications for diverse audiences.
- Ways to build relationships that foster collaboration and adaptive management.

Responses to the self-assessment demonstrate a progression toward substantial understanding for all five learning areas (see figure below). Respondents' understanding of Northwest climate change indicators demonstrates this shift, where 52% of respondents indicate an above average understanding prior to attending CBC, and none indicate substantial understanding. Following CBC, 95% of respondents indicated an above average understanding, with 22% indicating substantial understanding of Northwest indicators. For all five of the learning areas, the percentage of respondents indicating an above average or substantial understanding following CBC increased.



Percent respondent change in self-assessed understanding of five learning objectives. (PRE n = 21; POST n = 19)

# Appendix 4: NW CSC Graduate Fellowship Program



The NW CSC promotes broad participation in climate science by supporting the education of diverse young scientists through its [NW CSC Graduate Fellowship program](#). The NW CSC fellowship experience prepares students for careers in climate science, education and outreach. Fellows attend NW CSC [Climate Boot Camp](#), present and facilitate at the annual [Northwest Climate Conference](#), and network and collaborate via the self-organized [Early Career Climate Network](#), which was established by graduate fellows during the 2012 Climate Boot Camp.

To date, 22 graduate students have received fellowships from the NW CSC, to support work ranging in focus from evaluating the impacts of expanding ranges for invasive fish on native salmon to assessing likely climate impacts on transportation infrastructure. Currently the NW CSC funds 17 graduate student fellowships at its primary partner institutions, including four at Oregon State University, nine at the University of Idaho and four at the University of Washington. Click the links below for more information about students supported through the NW CSC's Graduate Fellowship program.

## NW CSC Graduate Fellows supported in FY16

### [Kathryn Baker](#)

Forest, Range & Fire Science  
Department  
*University of Idaho*

### [Ian Breckheimer](#)

Department of Biology  
*University of Washington*

### [Kevin Buffington](#)

Department of Fisheries & Wildlife  
*Oregon State University*

### [Diana Gergel](#)

Department of Civil &  
Environmental Engineering  
*University of Washington*

### [Isabel Guerrero](#)

Applied Economics  
*Oregon State University*

### [Jamie Jarolimek](#)

Fish and Wildlife Sciences  
*University of Idaho*

### [Sihan Li](#)

College of Earth, Ocean &  
Atmospheric Sciences  
*Oregon State University*

### [Harry Podschwit](#)

Quantitative Ecology and Resource  
Management  
*University of Washington*

### [Erika Sutherland](#)

Aquatic & Fishery Sciences  
*University of Washington*

### [Lindsey Thurman](#)

Department of Fisheries & Wildlife  
*Oregon State University*

### [Polly Buotte](#)

Environmental Science Program  
*University of Idaho*

### [Shana Hirsch](#)

Water Resources - IGERT Program  
*University of Idaho*

### [Daniel Matsche](#)

Geography Department  
*University of Idaho*

### [Ryan Niemeyer](#)

Water Resources - IGERT Program  
*University of Idaho*

### [Caitlin Rushlow](#)

Geosciences  
*Idaho State University*

### [Ben Soderquist](#)

Forest, Range & Fire Science  
Department  
*University of Idaho*