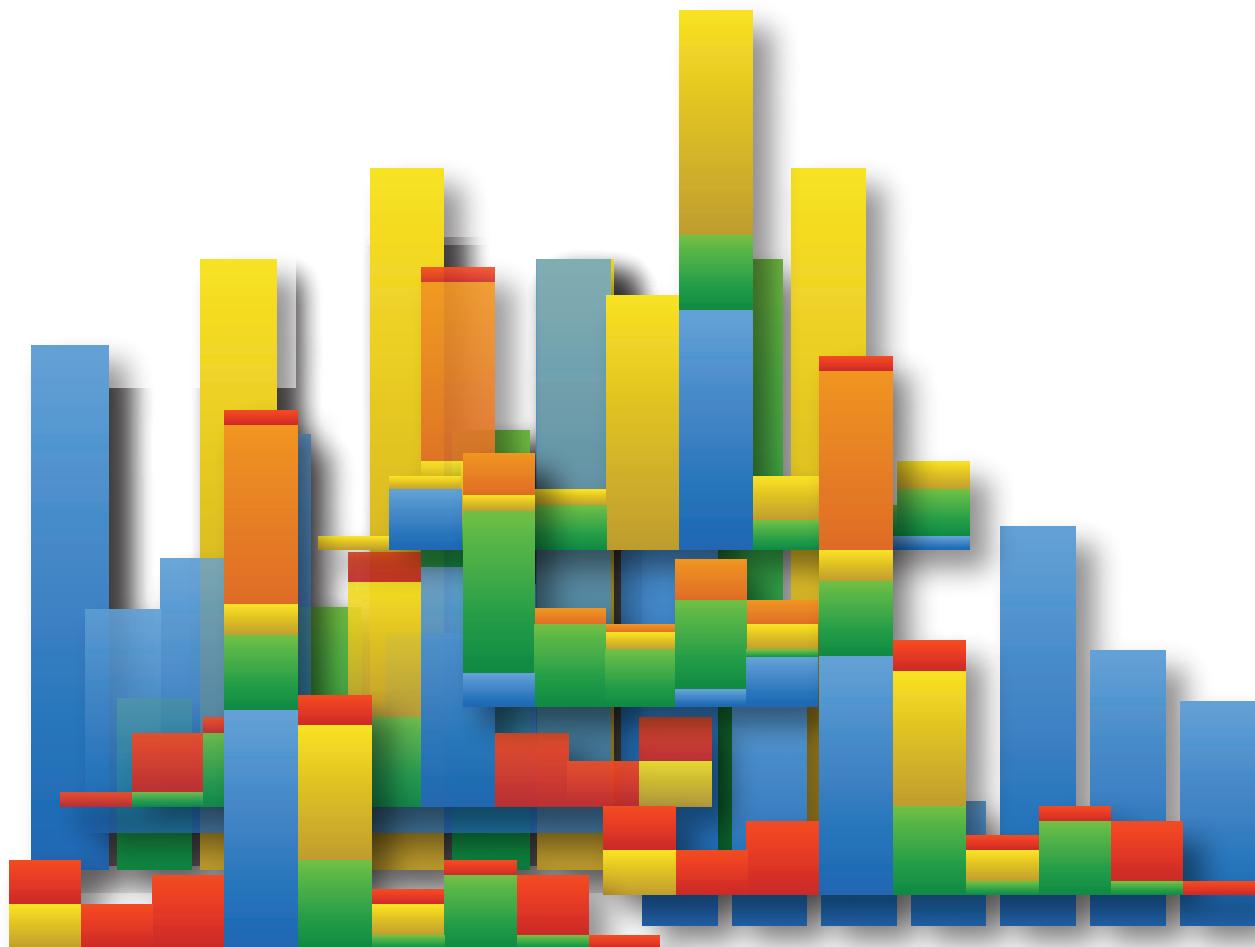


Training and Capacity Building Activities of Climate Adaptation Science Centers for the Benefit of Tribal and Indigenous Communities, 2010–2019



General Information Product 217

Cover. Graphic representation of activity, project, focus, and training data.

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By Tori Pfaeffle, Robin O’Malley, Aparna Bamzai-Dodson, and Stefan Tangen

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Training and Capacity Building Activities of Climate Adaptation Science Centers for the Benefit of Tribal and Indigenous Communities, 2010–2019

By Tori Pfaeffle,¹ Robin O’Malley,¹ Aparna Bamzai-Dodson,¹ and Stefan Tangen²

Abstract

Tribal nations and Indigenous communities are key collaborators on adaptation work within the Climate Adaptation Science Center (CASC) network. The centers have partnered with numerous Tribal and Indigenous communities on projects or activities to better understand the communities’ specific knowledge of and exposure to impacts of climate change, to increase or assist with capacity to support adaptation planning, and to identify and address climate science needs. Projects and activities generated in the various CASC regions have different Tribal and Indigenous stakeholders, climate change contexts, and training needs. Consequently, these projects and activities were neither implemented nor reported consistently throughout the network. Information and materials on the various projects and activities were gathered and are presented in the Tribal and Indigenous Projects Data Sheet (hereafter, Data Sheet) with the goals of reducing inconsistencies between CASCs and benefitting other agencies who plan to implement similar activities. The Data Sheet is complementary to this report, which provides a synthesis of the CASC-led climate-related, capacity-building activities for Tribes and Indigenous communities. The results described in this report provide an analysis of the categorization of projects, activities, and individual trainings to highlight detailed information on the various ways each CASC works with and supports Native and Indigenous communities.

Introduction

For Native communities across the United States, the natural resources of this land have long sustained their communities, traditional ways of life, and culture, thus creating a mutual relationship. Due to these close ties with land and water ecosystems, Tribal and Indigenous people and cultures are particularly vulnerable to climate change. The unique threats climate change poses to Tribal and Indigenous communities make

them key collaborators on adaptation work within the Climate Adaptation Science Center (CASC) network. The CASC network has made it a priority to engage with Native communities to (1) better understand their knowledge about climate change impacts; (2) enhance their capacities in adaptation planning; and (3) realize their climate science needs (U.S. Geological Survey, 2020). Through these partnerships, the CASCs have funded, organized, and participated in a variety of research projects, training workshops, conferences and summits, outreach activities, and stakeholder meetings. The report provides a synthesis of CASC-led climate-related capacity-building activities for Tribal and Indigenous communities, including results based on analysis of the information and categorization of activities and patterns and general conclusions. Detailed information on these activities is organized within the Tribal and Indigenous Projects Data Sheet (referred to as Data Sheet herein; Pfaeffle and O’Malley, 2019).

Purpose and Scope

The CASCs conducted numerous training and skills-development activities to support Tribal and Indigenous partners seeking to use scientific information and techniques to understand and respond to climate change impacts. However, these activities were often not consistently developed or implemented due to a variety of factors including Tribal and Indigenous stakeholders varying across the nation, regionally specific climate change contexts and training needs, the CASC network encouraging innovation, and the CASC regions pursuing different methods. The goals of this report are to identify relevant activities, develop a repository of related materials that could benefit other agencies seeking to implement similar activities, and assess content including strengths across the network and weaknesses in providing critical trainings.

The relevant information and materials are displayed in a Data Sheet which describes the training and capacity-building activities the CASC network has undertaken to support Tribes and Indigenous communities. The Data Sheet is intended to serve as (1) a single place where information regarding Tribal and Indigenous training and capacity-building activities can be stored; and (2) a searchable resource providing detailed

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information and resources on such activities, to both reduce inconsistencies between CASCs and enable CASCs to build upon the work done in previous projects. The purpose of this report is to provide information specifically on training and capacity-building activities and therefore is not meant to include all CASC efforts relating to Tribal and Indigenous communities. The type of activities likely to be excluded are those where scientific research and data collection are the primary goals, and there is little to no engagement with Tribal or Indigenous communities.

Methods

The information provided in the Data Sheet was collected through a variety of sources including the USGS ScienceBase Catalog, CASC's Project Explorer, individual CASC websites and newsletters, annual and 5-year review reports, and requests for additional or missing information from regional CASC staff and Tribal liaisons. Although a great deal of effort was made to gather and provide project information from a wide variety of sources, relevant information may still be missing from the Data Sheet.

Organization of the activities and information into the various categories is interpretive but has been done with the purpose of generating observable patterns and results about the activities provided across the network. The categories are consistent with the ways in which USGS and other climate-focused organizations categorize similar information or activities. Activities are primarily organized by their affiliated CASC and are then further broken down into several columns which display the following information: *Affiliation, Project Title, Project Purpose, Project Type, Level, Focus, Project Description, Partners, Participants/Focus groups, Date(s), Cost, Project Link(s), Resources/Training Materials, Event Details, Curriculum/Agendas, Outcomes, Evaluation and Feedback, and Notes*. Following the organization of activities in the Data Sheet, tables and figures were generated providing further details on the categorization of CASC activities and individual trainings. The tables and figures contained in this document present a breakdown of the categories included in the Data Sheet to highlight specific results.

Affiliation (Column A) identifies which regional or national CASC contributed to the activity through funding, knowledge support, or logistical support.

Project Title (Column B) indicates the title of the activity carried out.

Project Purpose (Column C) demonstrates the intended purpose or outcome of the activity. Purposes are grouped into four categories: (1) assessing science needs; (2) increasing capacity; (3) understanding impacts to food, water, and culturally important resources; and (4) incorporating traditional knowledge into adaptation planning. These categories are consistent with how USGS categorizes projects supporting Native and Indigenous community climate adaptation efforts as shown in the following descriptions (U.S. Geological Survey, 2018).

- **Assessing science needs:** Assessing the science needs of Tribal and Indigenous communities is the first step in developing and implementing effective climate-adaptation trainings. Several CASC activities focused on interviewing Native communities to identify their current capacity to adapt to climate impacts and to determine what science information is needed to build on this capacity.
- **Increasing capacity:** Supporting staff in assessing their vulnerability to climate change, providing trainings on climate science and available data resources, and teaching data-collection techniques allows Tribal and Indigenous communities to further contribute to quantifying changes occurring on the landscape.
- **Understanding impacts to food, water, and culturally important resources:** Assessing the impacts of climate change on culturally important resources allows Native communities to discern spatiotemporal shifts in these resources and to prioritize management activities.
- **Incorporating traditional knowledge into adaptation planning:** Working collaboratively with Native communities to use traditional and local knowledge by identifying priority issues for climate adaptation planning and focusing on the needs of the communities.

Project Type (column D) displays how activities were delivered to participants and includes five areas of categorization: (1) training (includes in person workshops and specific online trainings); (2) conference and summit; (3) online tools and resources (includes webinars, online resources, and online web platforms); (4) outreach (includes climate camps, interviews, and networking); and (5) research (community-based research and assessments).

Level (column E) categorizes activities by the type of participants and level of expertise required to participate. This includes four categories: (1) no prior expertise required; (2) requires substantial prior exposure to climate concepts or Traditional Ecological Knowledge (TEK); (3) oriented towards technical staff; and (4) targeted at youth. Activities categorized as “No prior expertise required” are open, but not limited to, participants who have little or basic knowledge of the concepts or information introduced by the activity. Activities that “Require substantial prior exposure to climate concepts or TEK” are targeted towards participants who either have significant prior exposure to the concepts or information or those considered research professionals in a specific area. The participants involved in activities “Oriented towards technical staff” are attempting to increase their skills and knowledge in particular areas to better perform their jobs. Activities “Targeted at youth” include participants who are considered college undergraduates or younger.

Focus (column F) describes the specific components involved in each activity using six areas of categorization: (1) basic climate literacy, (2) vulnerability assessment, (3) data

skills, (4) skills, (5) adaptation planning, and (6) research. Some categories are further broken down giving more detail on the specific type of activities.

- **Basic Climate Literacy:** The category includes the definitions for and distinction between climate mitigation and adaptation and resources for climate assessment and planning.
- **Vulnerability Assessment:** The category includes general how-to information, social strategies for undertaking climate work, components of vulnerability assessment, and actual hands-on work on a specific assessment.
- **Data Skills** The category includes highly technical skills related to climate adaptation planning and assessments applications.
- **[Other] Skills:** The category includes skills such as generating climate-smart writing, policy, communications, and research.
- **Adaptation Planning:** The category includes general how-to information, strategies for identifying adaptation options, social strategies for undertaking climate work, and actual hands-on work on a specific plan.
- **Research:** The category includes research that explicitly involves traditional ecological knowledge, such as interviews with elders and community-based research.

Project Description (column G) provides a general overview of the activity including the scope, goals, and outcomes.

Partners (column H) includes the names of specific institutions, organizations, and communities considered partners and provided staff, trainings, or resources to the activity.

Participants/Focus groups (column I) gives details on the intended audience of the activity's outcomes, as well as participants in specific events. This ranges from specific Tribes or Indigenous groups to targeted industry professionals (for example, resource managers).

Date(s) (Column J) of the activities range from 2012 to 2021; activities spanning multiple years fall under the fiscal year in which they began and when funds were allocated. Activities with reoccurring events such as conferences, summits, educational experiences, and camps are categorized by the year when the first event occurred.

Cost (column K) is included for activities receiving USGS CASC funding. For many activities, information on cost was unavailable or staff time was the main contribution, and no funds were allocated by the USGS CASCs.

Project Link (column L) includes a web page link for each activity if it exists.

Resources/Training Materials (column M) were either used during the activity or were products of the activity, including links to presentations and other training materials, journal articles, reports, videos and webinars, dashboards, and specific assessments and adaptation plans.

Event Details (column N) provides the name, date, and location of specific trainings, workshops, conferences, summits, and camps. Some events also include details such as a link to a specific web page or website.

Curriculum/Agendas (column O) includes information on event schedules and general topics along with links to specific agendas and curriculums followed.

Outcomes (column P) provides further details on products and results or general themes that emerged from research and assessments.

Evaluation and Feedback (column Q) gives details on any changes or adjustments made during the activities, feedback from participants, lessons learned, and suggestions for future efforts.

Based on analysis of the information presented in the *Level* and *Focus* columns of the Data Sheet, the individual trainings are presented in this report as three different types of training courses: Climate 101, Climate 201, and Technical training. “Climate 101” is made up of introductory trainings and is geared towards participants who have little or basic knowledge of the concepts or activities covered in the trainings. In some cases, these trainings may be prerequisites to more advanced trainings. “Climate 201” comprises advanced trainings targeted towards participants who have had significant prior exposure to, or knowledge of, the concepts or activities covered in the trainings, or those who have taken the “Climate 101” prerequisite. Rather than being categorized by participants’ prior knowledge or skills on a particular training topic, “Technical trainings” are oriented towards technical staff and teach (or increase) the knowledge and skills needed to successfully carry out their work. These trainings can vary from introductory to advanced levels and they do not have prerequisites.

Results

The results of this study described in this report are based on analysis of the information and categorization of projects and trainings throughout the various columns of the Data Sheet. The summary of results is broken down into three sections: (1) information on the categorization of projects, (2) information on training projects and individual trainings; and (3) project information by CASC. The Projects section of the Results presents a general overview of the projects included in the Data Sheet including the number of projects, how many projects were conducted per year, and the categorization of projects by purpose. The Training Projects and Individual Trainings section of the Results provides information about the projects categorized as trainings as well as the individual trainings found throughout the Data Sheet. This section discusses trainings in terms of their purpose, level, focus, and the years in which they were offered. The Project Information by CASC section of the Results gives details on the projects and individual trainings done by each CASC. In

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addition to detailed information on the individual trainings, this section includes the various ways in which each CASC works with and supports Native communities.

Projects

The Tribal and Indigenous Projects Data Sheet includes 84 activities, occurred during 2012–2019, and are categorized according to the CASC that initiated the activity (table 1) and the fiscal year in which they began (fig. 1). As figure 1 indicates, the highest number of activities occurred in 2019, with 20 activities, followed by 2018 and 2015, which both had 13 activities. With only four activities

Table 1. Number of activities in the Data Sheet initiated by each Climate Adaptation Science Center (CASC).

CASC	Projects
National	2
Alaska	5
Northwest	13
Southwest	7
North Central	5
South Central	19
Northeast	10
Southeast	7
Pacific Islands	16
Total	84

included in the Data Sheet, 2013 is the year with the lowest number of activities. Since 2012, there has been an overall increase in the number of CASC activities to support Tribal and Indigenous communities.

In the Project Purpose column of the Data Sheet, 49 activities are categorized as “increasing capacity,” and the most common Project Type within this category is training (20; fig. 2). Another major Project Purpose is “incorporating traditional knowledge into adaptation planning,” with 16 activities, with training (five) and outreach (five) as the most common Project Type within this group. Out of the four Project Purpose categories, “incorporating traditional knowledge into adaptation planning” is the only category with activities falling under all five of the different Project Types: training, conference/summit, online tools and resources, outreach, and research. Of the 12 activities categorized by Project Purpose as “assessing science needs,” the majority are research projects (six) and only four are considered trainings. The final Project Purpose category, “understanding impacts to food, water, and culturally important resources,” has only seven activities, with the most common Project Type in this group categorized as research projects (three). Activities which focus on highly technical scientific research and data collection (which often happens outside of local communities and therefore do not usually include a training component) have been excluded from the Data Sheet, which is a possible explanation of why the number of activities within this category is significantly lower than the other three categories. Such activities would likely be categorized by Project Purpose as “understanding impacts to food, water, and culturally important resources.”

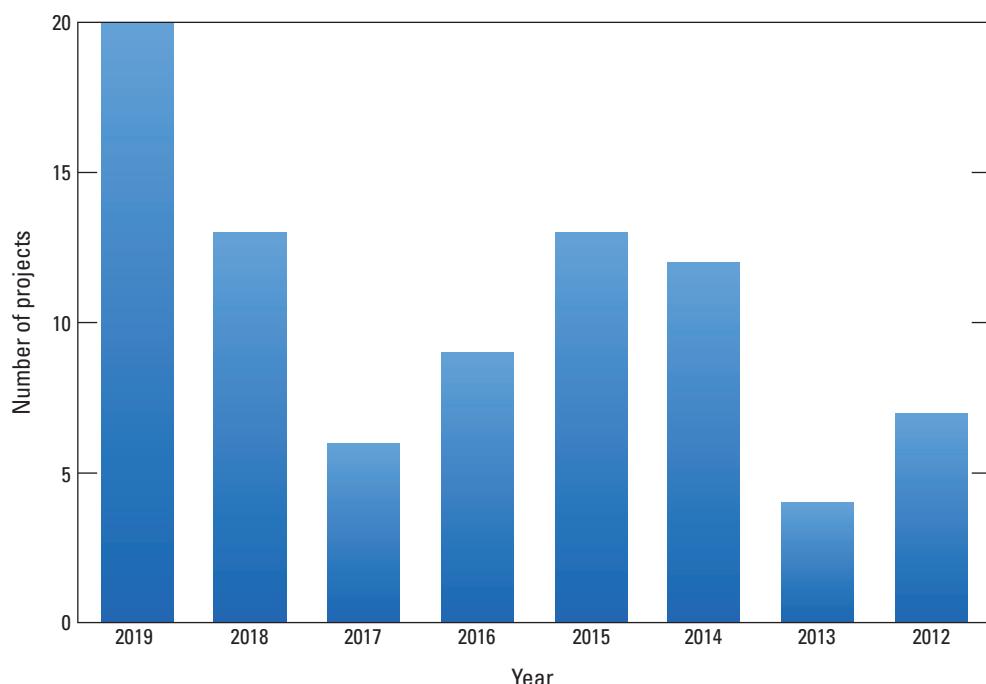


Figure 1. Number of activities initiated per year by Climate Adaptation Science Center (CASC).

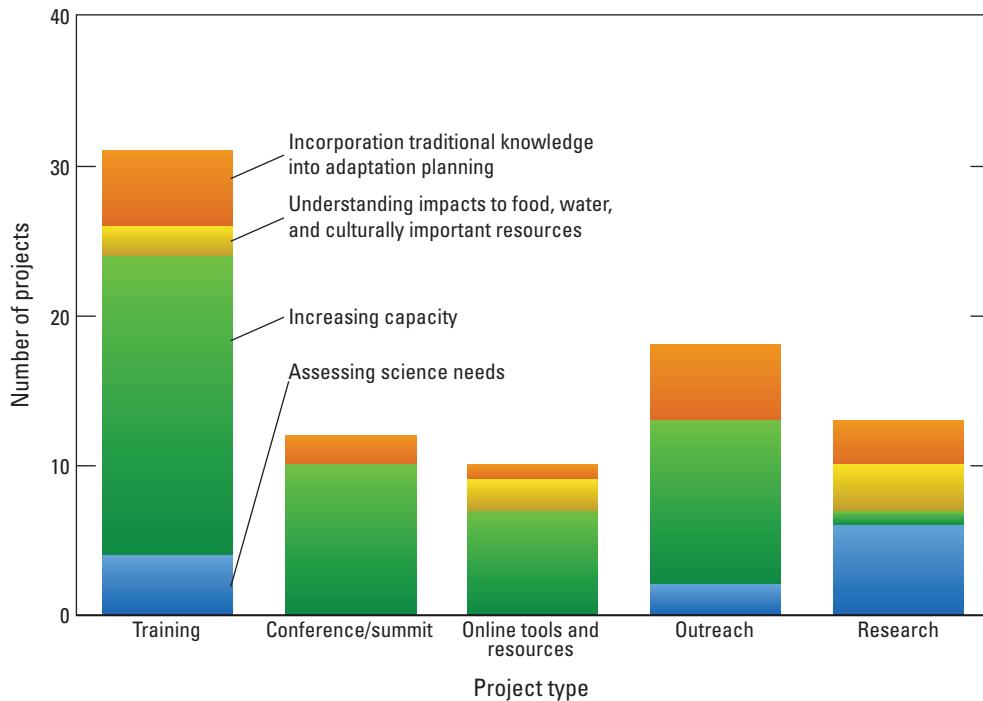


Figure 2. Project purpose by type.

Training Projects and Individual Trainings

The Project Type column categorizes 31 activities as trainings. While this is the total number of activities categorized as trainings by their Project Type, such activities often contain multiple training sessions. In some cases, activities not categorized as trainings do contain a training component, although it is not the activity's main contribution. To provide a more accurate analysis of training activities, the results are inclusive of the total number of individual trainings included in the Data Sheet in the Event Details column N, bringing the total number of individual trainings to 83 (table 2).

Table 2. Number of individual trainings by Climate Adaptation Science Center (CASC).

CASC	Trainings
National	1
Alaska	5
Northwest	6
Southwest	4
North Central	17
South Central	36
Northeast	5
Southeast	3
Pacific Islands	6
Total	83

The activity temporal information in figure 1 is restricted to fiscal year, because activities may have spanned multiple years, but information on individual trainings can be categorized by the year in which the specific training occurred (fig. 3). In the Data Sheet, the National CASC activity (row 4) titled, “Developing Adaptation Strategies for Recreational and Tribal Fisheries in the Upper Midwest,” is not included in figure 3, because specific trainings and dates could not be found. According to figure 3, the highest number of individual trainings occurred in 2019 (23), followed by 2015 (16). In 2016, there was a drop in the number of individual trainings offered, making it the year with the lowest number of trainings (five). Following the low in 2016, the number of trainings increased steadily throughout 2017 (eight) and 2018 (10), before a substantial increase in 2019.

The drop in the number of trainings in 2016—as well as the peaks in both 2015 and 2019—seems extreme but is generally consistent with the project data in figure 1. Possible explanations for this variability include a number of different factors such as overall project budgets, resources dedicated to other nonTribal and nonIndigenous projects, or a wide variety of other internal factors. Further explanation of such factors remains outside the scope of this project, but the conclusion that can be drawn from the data is, since 2016, there has been an overall increase in the number of trainings offered by the CASC network supporting Tribal and Indigenous communities.

Figure 4 shows 47 individual trainings categorized in the Project Purpose column of the Data Sheet as “increasing capacity,” which is the category with the highest number of

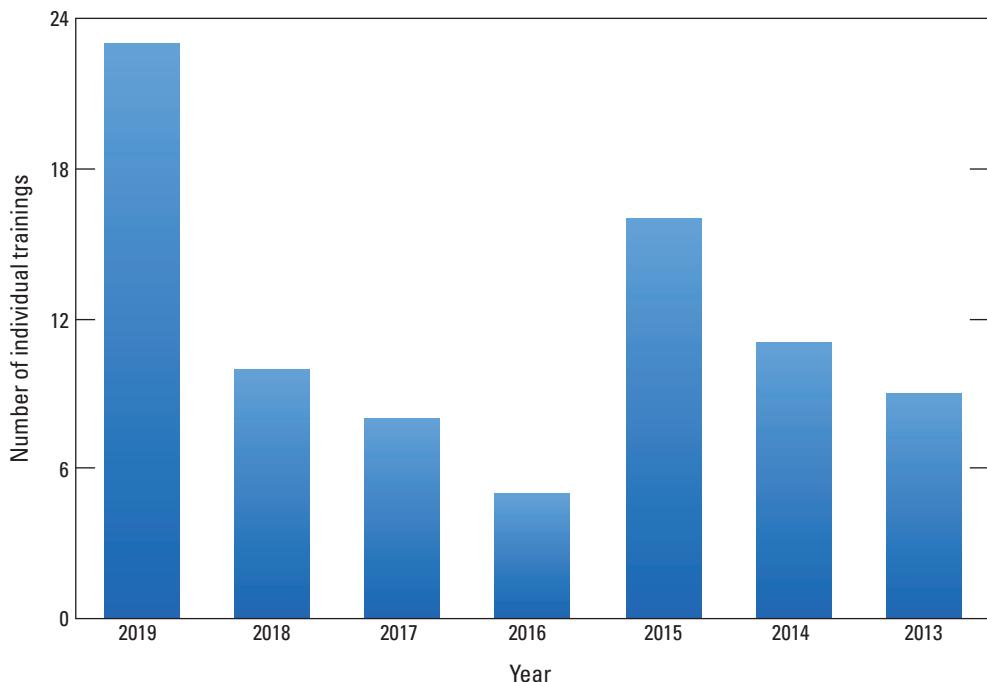


Figure 3. Individual trainings per year.

individual trainings. Individual trainings in this group tend to be categorized in the Focus column of the Data Sheet as data skills trainings, of which there are 16, followed by basic climate literacy (10), vulnerability assessment (eight), adaptation planning (six), and skills (seven) trainings. The category with the second highest number of individual trainings in the Project

Purpose column of the Data Sheet is “incorporating traditional knowledge into adaptation planning,” which has 21 individual trainings. This purpose is carried out through trainings grouped in the Focus column of the Data Sheet as adaptation planning (nine), basic climate literacy (five), skills (five), and vulnerability assessments (two). In the Project Purpose column of the

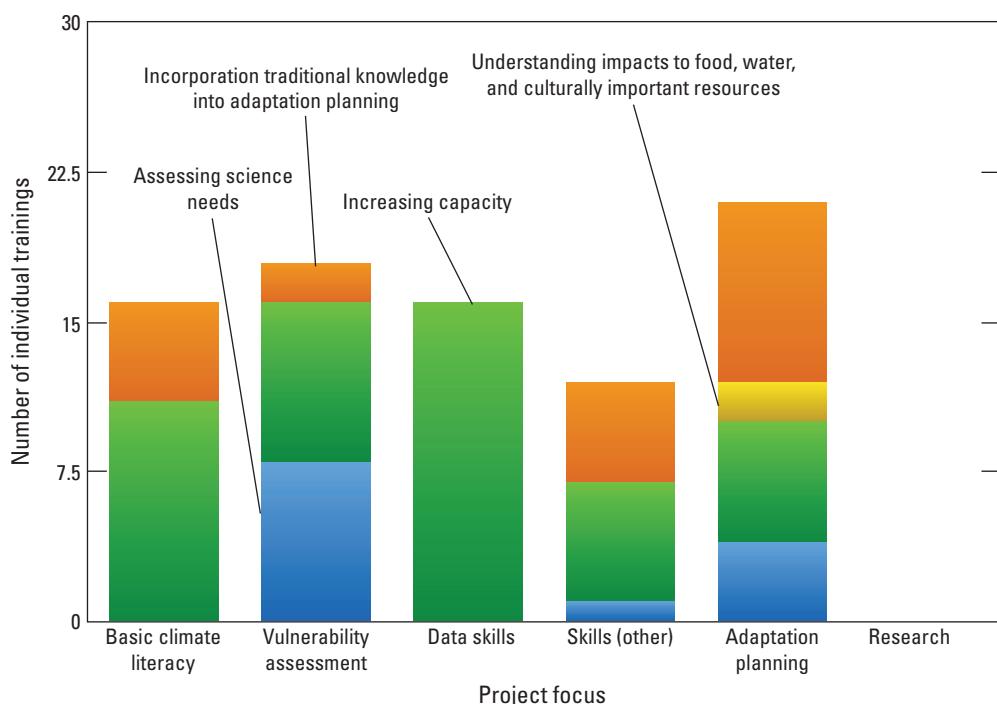


Figure 4. Project purpose by type and individual trainings.

Data Sheet, 13 individual trainings are categorized as “assessing science needs.” In the Focus column of the Data Sheet, the majority of these trainings can be categorized as vulnerability assessment trainings (eight), with the remaining five trainings dedicated to adaptation planning (four) and skills (one). The category with the lowest number of individual trainings in the Project Purpose column of the Data Sheet is “understanding impacts to food, water, and culturally important resources.” This category has just two trainings, both of which are grouped as adaptation planning trainings in the *Focus* column of the Data Sheet. The categorization of individual trainings by the type of participants and level of expertise required to participate in the various activities occurs in the Level column of the Data Sheet, where 22 of the individual trainings are categorized as “no prior expertise required,” 17 as “requires substantial prior exposure to climate concepts or TEK,” and the remaining 43 trainings as “oriented towards technical staff.”

Analysis of the Focus and Level columns of the Data Sheet for the individual trainings provides a breakdown of the trainings by the specific topics and their participant groups. These classifications enable these trainings and their related materials to be categorized as either “Climate 101,” “Climate 201,” or “Technical” training courses in both the Project Information by CASC and the Conclusion sections. The categorization of trainings found in these columns in the Data Sheet is displayed in figure 5. In the Focus column of the Data Sheet, there are 16 individual trainings categorized as basic climate literacy trainings. The topics covered in basic climate literacy trainings are: Introduction to climate, climate science, and components of physical climate systems; Climate change and external drivers; Climate models and projections;

Regionally specific drought histories and related online resources; Climate variability and change; and Resources for climate assessments and planning. In the Level column of the Data Sheet, all 16 of these trainings are categorized as “no prior expertise,” meaning the trainings were open to participants with little or basic knowledge of the concepts or activities covered in the training or workshop (fig. 5).

In the Focus column of the Data Sheet, there are 12 individual trainings categorized as [Other] Skills. Training topics and activities in this category include the following: Climate science grant writing, Communicating climate science in order to inform policy and action, Ethical research and coproduction, and Compliance with federal requirements to receive disaster relief assistance. When categorized by Level (fig. 5), seven of the skills trainings are “oriented towards technical staff,” and the remaining five trainings fall under the category “requires substantial prior exposure to climate concepts or TEK.”

There are 21 individual trainings in the Focus column of the Data Sheet categorized as adaptation planning, which is the group with the highest number of individual trainings. The topics and activities falling under adaptation planning are the following: Hands on work on a specific adaptation plan, Adaptation planning resources and general info on how to create an adaptation plan, Knowledge sharing and networking, Scenario planning, and Identification of specific concerns and strategies. These trainings are geared towards a much wider range of participants than any of the other training categories in the Level column of the Data Sheet, with six grouped as “no prior expertise,” seven as “requires substantial prior exposure to climate concepts or TEK”, and the remaining eight as “oriented towards technical staff” (fig. 5).

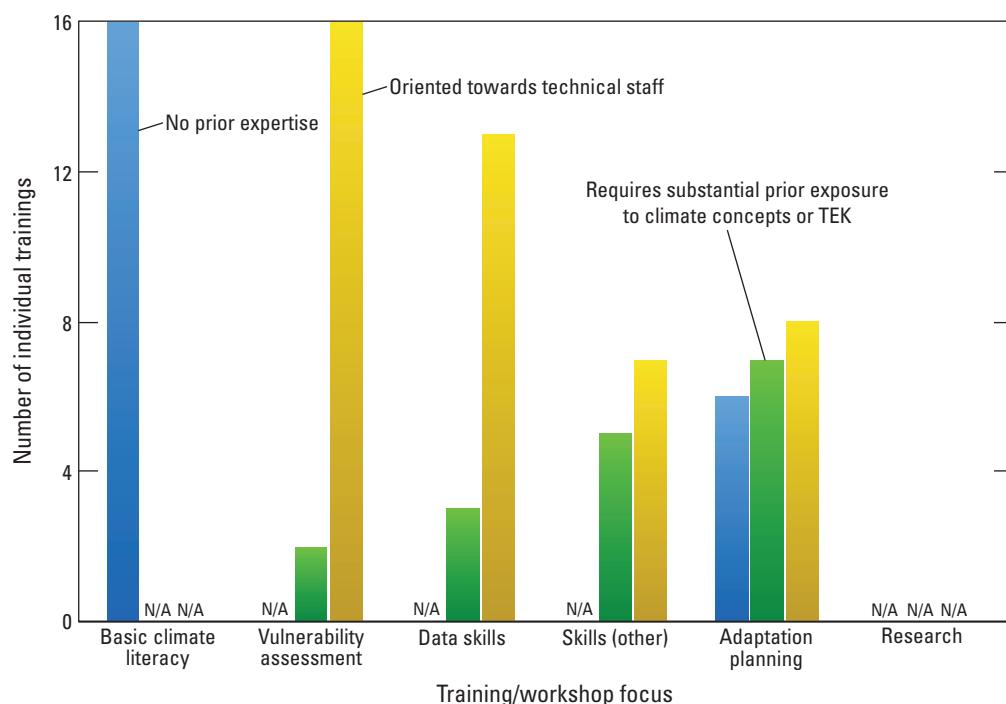


Figure 5. Level by training and workshop focus, individual trainings.

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In the Focus column of the Data Sheet, the second highest number of individual trainings belong to the vulnerability assessment category, which has a total number of 18 individual trainings. The topics and activities included in vulnerability assessment trainings are: Hands on work on specific assessment (including assessment of specific effects of climate change on Tribal and Indigenous communities, existing planning efforts and engagement in various levels of climate change planning, and policy and technical capacity as well as needs to address climate change); and Vulnerability assessment resources and information on how to complete a vulnerability assessment. Most vulnerability assessment trainings in the Level column of the Data Sheet are categorized as “oriented towards technical staff” (16), with only two trainings under the category “requires substantial prior exposure to climate concepts or TEK” (fig. 5).

There are 16 individual trainings in the Focus column of the Data Sheet categorized as data skills. The activities and topics covered in these trainings are highly technical and include the following: Collecting and generating data; Scenario planning and simulation modeling; Geographic information system (GIS) and geospatial training; Remote sensing; Methods, tools, data sources and climate products relevant to ecological forecasting, ecological modeling, species distribution modeling, and state-and-transition simulation modeling; and Mapping. In the Level column of the Data Sheet, most of the data skills trainings are grouped as “oriented towards technical staff” (13), with the remaining three grouped as “requires substantial prior exposure to climate concepts or TEK” (fig. 5).

There are no trainings with a Project Focus on research. The lack of trainings in this category can likely be explained by the tendency of research projects to include highly technical and scientific components to produce specific scientific data. Thus, a training component would generally fall outside the scope of professional research production. Additionally, there are no individual trainings in the Level column of the Data Sheet categorized as “targeted at youth.” Given the emphasis in Native and Indigenous communities on youth development, the lack of trainings in this category seems rather unusual and requires a deeper analysis of youth-related activities supported by the CASC network.

There are seven activities in the Level column of the Data Sheet falling under the category “targeted at youth,” even though there are no individual trainings in the Data Sheet specifically for a youth audience. The activities involving youth are most often grouped in the Project Type column of the Data Sheet as outreach (five) and include internships, camps, educational programs, and culturally relevant curriculum development. Of the remaining two activities, one falls into the conference category and one into the category of online tools and resources.

A few possible explanations exist for a general lack of activities and trainings targeting youth. First, for activities or trainings to be categorized in the Level column of the Data Sheet as “targeted at youth,” participants must be identified as college undergraduates or younger, making it the most specific

and limiting category. The other three categories in the Level column of the Data Sheet are inclusive of a much broader age range of participants, some of which may also be considered youth (undergraduates or younger). Therefore, it is likely youth are involved in activities and trainings not categorized as “targeted at youth,” because there are other participants who would not fall under this category taking part in the training (for example, graduate students, resource managers, researchers, Tribal elders).

Another possible explanation is many of the youth activities and outreach are not considered formal CASC trainings or projects, such as knowledge-sharing networks, after-school programs, or activities providing resources for youth. Finally, many of the activities and trainings included in columns other than “targeted at youth” may indirectly benefit youth by providing training and materials to educators and technical staff who then educate and provide activities for youth in their own communities. This could prove to be extremely beneficial in terms of increasing adaptation capacity in local communities as it allows the more general training and materials to be used and incorporated into place-based or culturally specific learning. See the Project Information by CASC section for more information on the outreach activities undertaken by each CASC to support Native youth.

Project Information by Climate Adaptation Science Center

This section of the results gives an overview of the activities and individual trainings undertaken by the National and Regional CASCs. Details are provided on the ways in which each individual center has been involved in capacity-building activities to support Tribal and Indigenous communities, the types of topics covered in the various trainings, and the partners who have been involved throughout activities.

National Climate Adaption Science Center

While the National CASC has only two activities included in the Data Sheet (table 1), it plays the roles of conducting research on cross-regional and national science priorities, serving as the national office for the CASC network, and providing management assistance to the regional CASCs. In addition to the two activities specified in the Data Sheet, the National CASC has also been involved as a partner in activities undertaken by regional CASCs. Of the two activities included, one is categorized in the Project Purpose column of the Data Sheet as “assessing science needs” and one as “increasing capacity” (fig. 2). In the Project Type column of the Data Sheet (table 3), the activities are grouped under training (one) and online tools and resources (one). Although one of the activities is grouped as a training project, there is no specific information on how many individual trainings are included in this project and when the trainings will occur. Regardless of the number of trainings, the events can be

categorized in the Focus column of the Data Sheet as adaptation planning trainings (hands-on work on specific plan) and in the Level column of the Data Sheet as “oriented towards technical staff.”

Alaska Climate Adaption Science Center

The size, remoteness, and geographic isolation of Alaska has made partnerships, collaboration, and knowledge sharing essential components of the research projects and capacity-building activities undertaken by the Alaska CASC. Additionally, the scarcity of long-term climate-science data throughout many parts of the state makes local or traditional knowledge and community observations an integral part of the research, assessments, and adaptation planning efforts supported by the CASC (Shasby and others, 2017). For this reason, the Alaska CASC collaborates with local partners and communities to link climate research, resource management, and community resilience in the context of localized climate impacts (Shasby and others, 2017). Education, outreach, and community involvement are all crucial elements to carrying out an effective science plan in Alaska.

Throughout these trainings and projects, the Alaska CASC has routinely collaborated and leveraged resources (including data and equipment) with other Federal agencies, universities, and Tribal communities and organizations (specifically, the Columbia River Inter-Tribal Fish Commission, Chugachmiut Tribal Consortium, Chilkoot Indian Association, and Quartz Valley Indian Reservation). Additional partners include the Northwest CASC, North Pacific Landscape Conservation Cooperative, Alaska Center for Climate and Arctic Policy, and a number of local community partners (Alaska Native Tribal Health Consortium, Arctic Village Traditional Council, Gwichyaa Zhee Gwich'in Tribal Council, Venetie Village Council, and Aleutian Pribilof Islands Association).

As shown in table 1, the Alaska CASC has five activities included in the Data Sheet, with three of the activities categorized in the Project Purpose column of the Data Sheet as “incorporating traditional knowledge into adaptation planning” (fig. 2). In the Project Type column of the Data Sheet, three activities are categorized as research projects, one as outreach, and one as training (table 3). All five of the activities include individual trainings (table 2), four of which are grouped in the Focus column of the Data Sheet as adaptation planning and one which is classified as a vulnerability assessment (fig. 6). In the Level and Focus column of the Data Sheets (fig. 7), four of the trainings are categorized as “no prior expertise” (Level) and adaptation planning (Focus) and the one remaining training is categorized as “oriented towards technical staff” (Level) and vulnerability assessment (Focus). Based on this information, the Alaska CASC has offered mostly “Climate 101” trainings for adaptation planning with the exception of one “Technical training” for vulnerability assessments. In table 4, which shows the number of individual trainings offered by each CASC per year, four of the trainings offered by the Alaska CASC occurred in 2019 and one occurred in 2016, showing an increase in the number of trainings through time.

The Alaska CASC has one activity included in the Data Sheet categorized as “targeted at youth” in the Level column of the Data Sheet (row 9). This activity set out to enhance collaboration in the Klamath Basin through Tribal youth internships to increase the Basin’s future capacity to respond to climate change by engaging Tribal youth. Even with only one activity included in the Data Sheet, the center has been involved in supporting training, research, and education programs targeted towards Native and non-Native undergraduate and graduate students, postdoctoral students, and early career professionals (Shasby and others, 2017).

Table 3. Project type by Climate Adaptation Science Center (CASC).

[—, no trainings provided]

CASC	Training	Conference and (or) summit	Online resources and tools	Outreach	Research	Total projects
National	1	—	1	—	—	2
Alaska	1	—	—	1	3	5
Northwest	1	3	3	2	4	13
Southwest	3	—	—	4	—	7
North Central	3	—	—	1	1	5
South Central	14	2	2	1	—	19
Northeast	2	4	—	4	—	10
Southeast	2	1	2	1	1	7
Pacific Islands	4	2	2	4	4	16
Total	31	12	10	18	13	84

Northwest Climate Adaptation Science Center

With 13 activities, the Northwest CASC has the third highest number of activities included in the data sheet (table 1). Most of the activities in the Project Purpose column of the Data Sheet are categorized either as “increasing capacity” (five) or “incorporating Indigenous knowledge into adaptation planning” (five), and they are carried out through involvement in a variety of capacity-building activities (fig. 2). The Northwest CASC is one of only three CASCs having activities in all five of the categories included in table 3 or the Project Type column of the Data Sheet, the most common being research (four), followed by online resources and tools (three), conference/summit (three), outreach (two), and training (one). Some of the most frequent Northwest CASC partnerships seen throughout the Data Sheet are with the Affiliated Tribes of Northwest Indians, North Pacific Landscape Conservation Cooperative, Alaska CASC, National CASC and a number of different Tribes and Tribal organizations, including Swinomish Indian Tribal Community, Institute for Tribal Environmental Professionals, Pacific Northwest Tribal Climate Change Network, Institute for Tribal Government, Tribal Leadership Forum (Rolland and others, 2016).

Although the Northwest CASC has only one training project categorized in Project Purpose, there are six individual trainings included in the Data Sheet as shown in table 2. In the Focus column of the Data Sheet, five trainings are categorized as vulnerability assessments and one as adaptation planning (fig. 6). Looking at a combination of Level (fig. 7) and Focus, four of the trainings categorized as “oriented towards technical

staff” (Level) are also grouped as vulnerability assessments and adaptation planning (Focus), and the remaining two trainings fall into the categories of “requires substantial prior exposure to climate concepts or TEK” (Level) and vulnerability assessment (Focus). Therefore, the trainings offered by the Northwest CASC are “Climate 201” trainings for vulnerability assessments and “Technical trainings” for vulnerability assessments or adaptation planning. Table 4 shows the highest number of trainings occurred in 2018, with three trainings. Of the remaining three, two occurred in 2013 and one in 2019.

The Northwest CASC does not have activities in the Level column of the Data Sheet categorized as “targeted at youth,” but it is included as a partner under the Alaska CASC project (row 9). Even though the center does not have any projects or trainings in this category, the Northwest CASC provides training and support for early career climate scientists, graduate students, and postdoctoral researchers through the many science projects it funds. Additionally, the CASC presented a compilation of education and training activities and plans for development of a priority education and training agenda to the National CASC Education and Training Working Group for incorporation.

Southwest Climate Adaption Science Center

In addition to complex and highly variable climatic, ecological, and hydrologic systems in the Southwest CASC region, there is a general lack of available funding and resources to adequately support adaptation planning for the large number of Tribes across their landholdings in the Southwest, making this

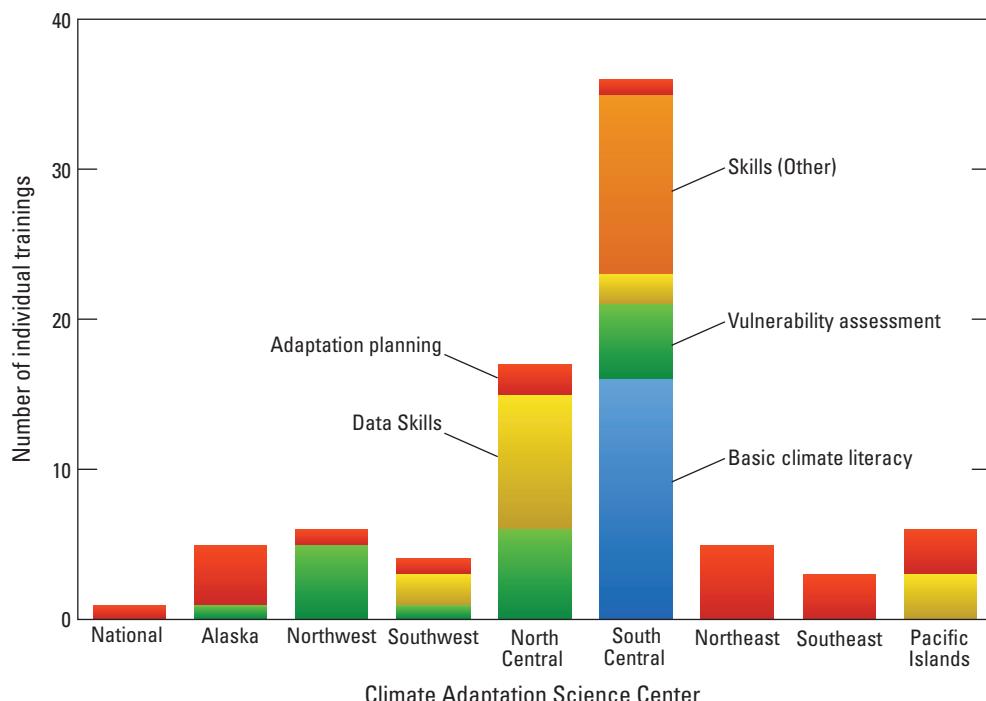


Figure 6. Focus of individual trainings.

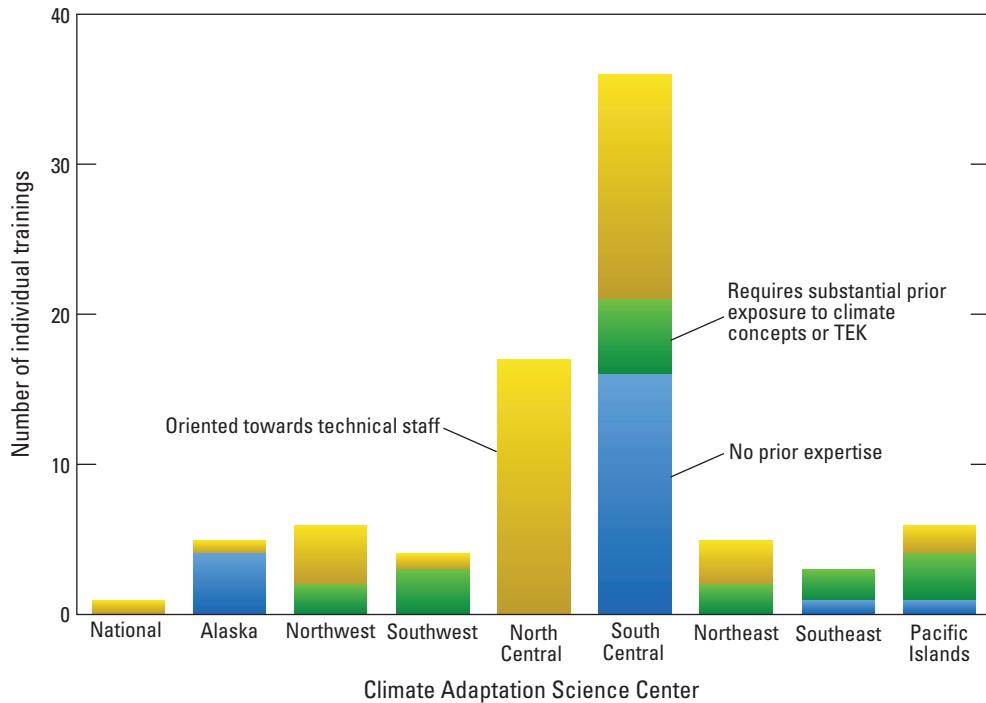


Figure 7. Level of individual trainings by Climate Adaptation Science Center.

Table 4. Trainings offered per year by Climate Adaptation Science Center (CASC).

[—, no trainings provided]

CASC	2019	2018	2017	2016	2015	2014	2013	Trainings
National	—	—	—	—	—	—	—	—
Alaska	4	—	—	1	—	—	—	5
Northwest	1	3	—	—	—	—	2	6
Southwest	1	—	—	—	2	—	1	4
North Central	2	2	4	1	6	2	—	17
South Central	4	4	4	2	7	9	6	36
Northeast	4	—	—	—	1	—	—	5
Southeast	2	1	—	—	—	—	—	3
Pacific Islands	5	—	—	1	—	—	—	6
Total	23	10	8	5	16	11	9	82

a priority area for the Southwest CASC (Redsteer and others, 2013). Through its involvement in climate change assessments, scenario planning activities and trainings, and support for adaptation planning, the Southwest CASC has taken on the initiative to increase the capacity of Tribal communities and organizations in the region. Additionally, the Southwest CASC has leveraged resources through the establishment of strong partnerships with the Native Nations Climate Adaptation Program, the Center for Climate Adaptation Science and Solutions, Native Nations Climate Adaptation Program, Institute for Tribal Environmental Professionals, and regional Tribes (Leenhouts and others, 2017).

The Southwest CASC has seven activities included in the Data Sheet (table 1), of which three are categorized as “increasing capacity” in the Project Purpose column of the Data Sheet (table 3). In the Project Type column of the Data Sheet and table 3, these activities are categorized as outreach (four) and training (three). Among the seven activities, there have been four individual trainings (table 4) which are grouped in the Focus category and displayed in figure 6 as data skills (two), vulnerability assessments (one), and adaptation planning (one). In the Level (fig. 7) and Focus column of the Data Sheets, three of the trainings are categorized

as “requires substantial prior exposure to climate concepts or TEK” (Level) and adaptation planning and data skills (Focus), and one training is categorized as “oriented towards technical staff” (Level) and vulnerability assessment (Focus). Based on this information, the Southwest CASC has offered a mix of “Climate 201” trainings for adaptation planning or data skills and “Technical trainings” for vulnerability assessments. As shown in table 4, one of the trainings occurred in 2013, two in 2015, and one in 2019. Lastly, one activity in the Level column of the Data Sheet was “targeted at youth,” a Tribal Climate Change Action Camp to provide youth with training, tools, and support to work with their own communities on local climate change concerns.

North Central Climate Adaptation Science Center

An emphasis on developing relationships and applying social science expertise has profoundly influenced the North Central CASC’s success in terms of partnerships, especially those with Tribal stakeholders in the region (Shipp and others, 2017). Partnerships included in the Data Sheet include the National Conservation Training Center, AmericaView, Institute for Tribal Environmental Professionals, National Drought Mitigation Center, and the Shoshone and Arapaho Tribes Office of the Tribal Water Engineer. Established relationships beyond those included in the Data Sheet are with the Intertribal Council on Utility Policy, Inter-Tribal Buffalo Council, Wind River Reservation, Haskell Indian Nations University, Indigenous Peoples Climate Change Working Group, and Rising Voices: Collaborative Science with Indigenous Knowledge for Climate Solutions.

The North Central CASC has five activities included in the Data Sheet (table 1). In the Project Purpose column of the Data Sheet, four of the activities are categorized as “increasing capacity” (fig. 2). Under the Project Type column of the Data Sheet, activities are categorized as training (three), followed by outreach (one), and research (one) (table 3). Even with a low number of activities, the North Central CASC has the second highest number of individual trainings (17) included in the Data Sheet, following the South Central CASC (table 2). In figure 6, a high number of trainings in the Focus column of the Data Sheet are categorized as data skills (nine), followed by vulnerability assessments (six) and adaptation planning (two). In the Level (fig. 7) and Focus columns of the Data Sheet, all 17 individual trainings are categorized as “oriented towards technical staff” (Level) and data skills, vulnerability assessment, or adaptation planning (Focus). Therefore, all the trainings are considered “Technical trainings” for either data skills, vulnerability assessments, or adaptation planning, making North Central the center with the highest number of “Technical trainings.” According to table 4, the North Central CASC has offered trainings every year except for 2013, with the most trainings (six) having been offered in 2015 and the least trainings (one) offered in 2016.

South Central Climate Adaptation Science Center

The South Central CASC has prioritized working with Tribes and is the only center in the network with sovereign Tribal nations included in their consortium. Additionally, in as early as 2014, the center published a Tribal Engagement Strategy outlining the framework for building partnerships between Tribes and scientists and increasing capacity in climate-related areas through trainings and outreach activities (Andrews and others, 2014). Through involvement in numerous training and skill-development activities, the South Central CASC has proven to be a useful resource for Tribes and Tribal organizations, not only in their region, but in other regions as well (Bumgarner and others, 2018).

The South Central CASC has the highest number of activities (19) included in the Data Sheet (table 1) and also has a long record of offering Tribal trainings. In both the Project Purpose and Project Type column of the Data Sheet, the number of activities in the categories “increasing capacity” (fig. 2) and training (table 3) are higher than any other CASC, with 16 grouped in the Project Purpose column of the Data Sheet as “increasing capacity” and 14 in the Project Type column of the Data Sheet as training. The remaining five activities in table 3 or the Project Type column of the Data Sheet are split between the categories of conference/summit (two), online tools and resources (two), and outreach (one). There are 36 individual trainings included in the Data Sheet for the South Central CASC (table 2) because they were either funded by the USGS South Central CASC or instruction was provided directly by the South Central CASC team.

When grouped in the Focus column of the Data Sheet, most individual trainings carried out by the South Central CASC are categorized as basic climate literacy (16) or skills (12) trainings (fig. 6). The high number of trainings within these categories is unique, because the South Central CASC is the only center having individual trainings in either of these categories. Of the remaining eight trainings, five are categorized as vulnerability assessments, two as data skills, and one as adaptation planning. The categorization of individual trainings in the Level (fig. 7) and Focus columns of the Data Sheet are varied, with 16 of the trainings grouped as “requires no prior expertise” (Level) and either basic climate literacy or skills trainings (Focus), 15 trainings grouped as “oriented towards technical staff” (Level) and adaptation planning, [other] skills, data skills, and vulnerability assessments (Focus), and the remaining five trainings are grouped as “requires substantial prior exposure to climate concepts or TEK” (Level) and skills (Focus). This makes the South Central CASC one of only two centers to offer a full range of “Climate 101” (for basic climate literacy), “Climate 201” (for skills), and “Technical” (for adaptation planning, skills, data skills, or vulnerability assessments) training courses.

In table 4, the South Central CASC is also the only center having trainings every year from 2013 to 2019. The highest number of trainings were offered in 2014 (nine), 2015 (seven),

and 2013 (six), and the lowest number was offered in 2016 (two). While this seems to indicate the number of trainings is declining each year, there are some possible explanations for why this may be. First, some of the more recent trainings following 2015 may not have been included when information was collected for inclusion in the Data Sheet. Second, many of the earlier trainings found in the ScienceBase Catalog or provided by the South Central CASC team utilize a “train the trainers” model and include shareable resources, allowing organizations or communities to use them to conduct their own trainings which would not be captured in the Data Sheet.

The South Central CASC has one activity categorized as “targeted at youth” in the Level column of the Data Sheet (row 46), a Tribal College Conference Series on Climate Change, where selected Tribal leaders from north-central Oklahoma were invited to discuss their nations’ resource-management plans and to provide information on their plans for resource protection. Beyond this single activity, an essential part of the South Central CASC’s *Tribal Engagement Strategy* is conducting Tribal youth outreach programs and activities promoting Native scientists in climate-related fields and building capacity in the next generation of Tribal staff (Andrews and others, 2014). From 2013 to 2016, the South Central CASC team conducted 24 Tribal youth outreach activities and mentored about 16 Native undergraduate and graduate students (South Central Climate Adaptation Science Center, 2016). The information needed to include these activities in the Data Sheet could not be located, or these activities were not classifiable as a specific project or training. Despite the exclusion of these activities, it should be noted the South Central CASC has dedicated significant time and resources to engaging Native youth in climate-related activities.

Northeast Climate Adaptation Science Center

The Northeast CASC has been involved in a number of networking and knowledge-sharing activities, conducted a number of site visits with Tribal nations in the U.S. Northeast region in order to gather input on local effects of issues related to climate change (for the purpose of community-based scenario planning), and helped to build a network which provides tools and resources for Indigenous peoples and scientists to work together to address climate-related issues (French and others, 2018). These activities all contribute to increasing the adaptive capacity of Tribes in the region by connecting Tribal partners and resources, identifying Tribal research needs and priorities, and providing technical support in the design and implementation of research projects and climate adaptation planning efforts (French and others, 2018). Additionally, the Northeast CASC has a strong record of partnerships with Federal, State, local, and Tribal programs in the region. Some of its most frequent partners are the Southeast CASC, regional Landscape Conservation Cooperatives, Northeast Association of Fish and Wildlife Agencies, Midwest Fish and Wildlife Association, and various Tribes throughout the region. Additionally, there are two Tribal liaisons for the Northeast

CASC, one of which is affiliated with the United South and Eastern Tribes and the other with the College of Menominee Nation Sustainable Development Institute, making these two organizations and institutions frequent partners.

As displayed in table 1, the Northeast CASC has 10 activities included in the Data Sheet, five of which are categorized in the Project Purpose column of the Data Sheet as “increasing capacity” (fig. 2). The most common categorization of activities in the Project Type column of the Data Sheet is conference/summit (four) and outreach (four), and the remaining two are trainings (table 3). Table 2 shows five individual trainings, all of which are grouped under the project Focus column of the Data Sheet as adaptation planning (fig. 6). There are three trainings categorized in the Level (fig. 7) and Focus column of the Data Sheet as “oriented towards technical staff” (Level) and adaptation planning (Focus), and two trainings categorized as “requires substantial prior exposure to climate concepts or TEK” (Level) and adaptation planning (Focus). This means the Northeast CASC has offered both “Climate 201” and “Technical” trainings for adaptation planning. One training was offered in 2015 and four in 2019, showing an increase in the number of individual trainings through time (table 4).

The Northeast CASC has two activities included in the Data Sheet categorized as “targeted at youth” in the Level column of the Data Sheet (rows 63 and 65). The first activity is the Indigenous Planning Summer Institute, which is a week-long educational camp for Indigenous students who are interested in careers in Indigenous planning and learning on Indigenous lands and with other Indigenous persons. The second activity is the Native Youth in Science Camp, which is a 4-week-long youth program focused on environmental science and designed to provide exposure to traditional knowledge of land stewardship. The camp is run by the Mashpee Wampanoag Tribe’s Natural Resources and Education Department.

Southeast Climate Adaptation Science Center

Due to the large geographic scope of the Southeast CASC region, many of the capacity-building activities and training opportunities are carried out through virtual presentations, online resources, in-person visits, and place-based learning experiences (Rice and others, 2017). This has also made the establishment of strong partnerships an extremely important part of supporting Tribal and Indigenous communities in the region. Frequent partners include the Northeast CASC, United South and Eastern Tribes, Institute for Tribal Environmental Professionals, and various Tribes and Indigenous communities throughout the region.

The Southeast CASC has seven activities included in the Data Sheet (table 1), the majority of which are categorized as “increasing capacity” (five) in the Project Purpose column of the Data Sheet (fig. 2). As shown in table 3, the categorization of activities in the Project Type column of the Data Sheet is split between training (two), online resources and tools (two), conference/summit (one), outreach (one) and research (one). Table 2 shows three individual trainings, all of which are

categorized in the Focus column as adaptation planning (fig. 6) and are grouped in the Level column of the Data Sheet, either as “requires no prior expertise” (one) or “requires substantial prior exposure to climate concepts or TEK” (two) (fig. 7). Therefore, the Southeast CASC has offered both “Climate 101” and “Climate 201” trainings for adaptation planning. As can be seen in table 4, two of the trainings were offered in 2019 and one in 2018, showing an increase in the number of individual trainings in recent years.

Pacific Islands Climate Adaption Science Center

The Pacific Islands CASC has been involved in a variety of capacity-building activities, including research, webinars, trainings, conference forums, and assessments for future research and places a large emphasis on providing technical assistance for natural resource managers through geographic information system and remote sensing workshops (Biedron and others, 2018). A large portion of activities carried out by the Pacific Islands CASC are part of the Manager Climate Corps (MCC), a capacity-building program designed to connect a variety of user groups, including natural resource managers, researchers, community leaders and graduate students, through networking opportunities and coproduced research. This program is a crucial component to building local adaptive capacity through (1) supporting and developing long-term trust, (2) building on existing in-person professional networks, (3) coproducing knowledge, and (4) developing and valuing multiple ways of knowing (Biedron and others, 2018). Many projects undertaken by the Pacific Islands CASC are targeted towards natural resource and land managers, and while many of these managers are Indigenous, associated trainings and workshops do not specifically target Indigenous people.

The Pacific Islands CASC has the second highest number of activities included in the Data Sheet (16; table 1). The Pacific Islands CASC is the center with the second highest number of activities categorized in the Project Purpose column as “increasing capacity” (nine; fig. 2). The most common categorization of activities under the Project Type column of the Data Sheet are outreach, training, and research; there are four activities in each category (table 3). The remaining activities are grouped as conference/summit (two) and online resources and tools (two). There are six individual trainings (table 2), three of which are categorized as data skills in the Focus column and three as adaptation planning (fig. 6). In the Level (fig. 7) and Focus columns of the Data Sheet, one training is grouped as “no prior expertise” (Level) and adaptation planning (Focus), two of the trainings are “oriented towards technical staff” (Level) and data skills (Focus), and the remaining three trainings are classified as “requires substantial prior exposure to climate concepts or TEK” (Level) under data skills or adaptation planning (Focus). Based on this information, the Pacific Islands CASC is one of two centers to have offered a mix of “Climate 101” (for adaptation planning), “Climate 201” (for data skills or adaptation planning), and “Technical trainings” (for data skills).

The Pacific Islands CASC has two activities included in the Data Sheet categorized as “targeted at youth” in the Level column of the Data Sheet (rows 87 and 93). The first activity, “Culturally Relevant Educational Resources and Lesson Plans on Climate Science in Guam,” aims to address a gap in the existing trainings by making culturally relevant lesson plans more available to practitioners in Guam. To ensure applicability, these plans are developed with local knowledge, Common Core State Standards, and the Guam Department of Education Content Standards in mind. The second activity, the GIS@CIS program/project, is an undergraduate program established to support capacity building within the universities in Guam and Micronesia by providing regular trainings, hosting geospatial data, and providing technical assistance. Additionally, this program supports the use of GIS technology in research and for application development related to climate change resilience.

Conclusions

Based on analysis of the data provided in the various columns and categories on the Tribal and Indigenous Projects Data Sheet, the Climate Adaptation Science Center (CASC) network has offered 22 “Climate 101” trainings, which cover the topics of basic climate literacy and adaptation planning. More specifically, “Climate 101” trainings for basic climate literacy include information on climate science and climate variability, regionally specific drought histories and related online resources, components of the physical climate system, climate change and external drivers, and climate models and projections. “Climate 101” trainings for adaptation planning include a general overview of how to plan for effects of climate change as well as strategies for identifying adaptation options. “Climate 101” trainings are considered introductory level courses, and, in some cases, may be prerequisites to the more advanced “Climate 201” trainings. The following centers in the CASC network have offered “Climate 101” trainings: Alaska, South Central, Southeast, and Pacific Islands. Of these 22 trainings, 16 were basic climate literacy trainings offered by the South Central CASC and six were adaptation planning trainings offered by the Alaska, Southeast, or Pacific Islands CASCs.

The 17 “Climate 201” trainings offered by the CASC network cover topics ranging from adaptation planning and skills to data skills and vulnerability assessments. The “Climate 201” trainings for adaptation planning include information on developing social strategies for undertaking climate work and strategies for identifying adaptation options. “Climate 201” trainings for skills cover topics of ethical research and coproduction, and “Climate 201” trainings for data skills include information on synthetic aperture radar and remote sensing. “Climate 201” trainings for vulnerability assessments are hands-on trainings including work on a specific assessment. The various “Climate 201” trainings have been offered by six of the centers including: Northwest, Southwest, South Central, Northeast, Southeast, and Pacific Islands.

There have been 44 “Technical trainings” offered on the topics of vulnerability assessments, skills, data skills, and adaptation planning. “Technical trainings” for adaptation planning provide information and resources on how to plan for the effects of climate change, strategies for identifying adaptation options, and hands-on work on a specific adaptation plan. “Technical trainings” for various skills (grouped under [other] in this report) give instruction on communicating climate science to inform policy and action; communicating and connecting with audiences on climate change; writing climate science grants; and complying with federal requirements to receive disaster relief assistance. “Technical trainings” for data skills give an overview of the various methods, tools, data sources, and climate products relevant to ecological forecasting; ecological modeling, species distribution modeling, and state-and-transition simulation modeling; geographic information system and remote sensing; and mapping cultural resources and challenges of mapping Tribal lands.

Additionally, these trainings sometimes include collecting and generating datasets for use in climate-change impact assessments. “Technical trainings” for vulnerability assessments include information on how to conduct a vulnerability assessment; the various components of an assessment; and actual work on a specific vulnerability assessment. Because “Technical trainings” are oriented towards technical staff in order teach or enhance the knowledge and skills necessary for carrying out their work, these trainings can vary from introductory to advanced levels and do not have prerequisites. These trainings have been offered by the National CASC and seven regional CASCs: National, Alaska, Northwest, Southwest, North Central, South Central, Northeast, Pacific Islands. The 44 “Technical trainings” include 16 vulnerability assessment trainings offered by the Alaska, Northwest, Southwest, North Central, or South Central CASCs; 13 data skills trainings offered by the North Central, South Central, or Pacific Islands CASCs; eight advanced adaptation planning trainings offered by the National, Northwest, North Central, South Central, or Northeast CASCs; and seven skills trainings offered by the South Central CASC.

For Native communities across the United States who are confronting the challenges of managing resources under a changing climate, the national and regional CASCs can, and have, served as capacity building partners. Tribal and Indigenous governments and organizations can work with the CASCs to develop and deliver training content to their staff and members, ranging from introductory “Climate 101” courses to “Technical trainings” developing specialized skills. CASCs can also support research activities, including the collection of data and the development of vulnerability assessments and adaptation plans. Continued partnerships building on the work described in this report will enhance the resilience of Native communities as they adapt to climate change.

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