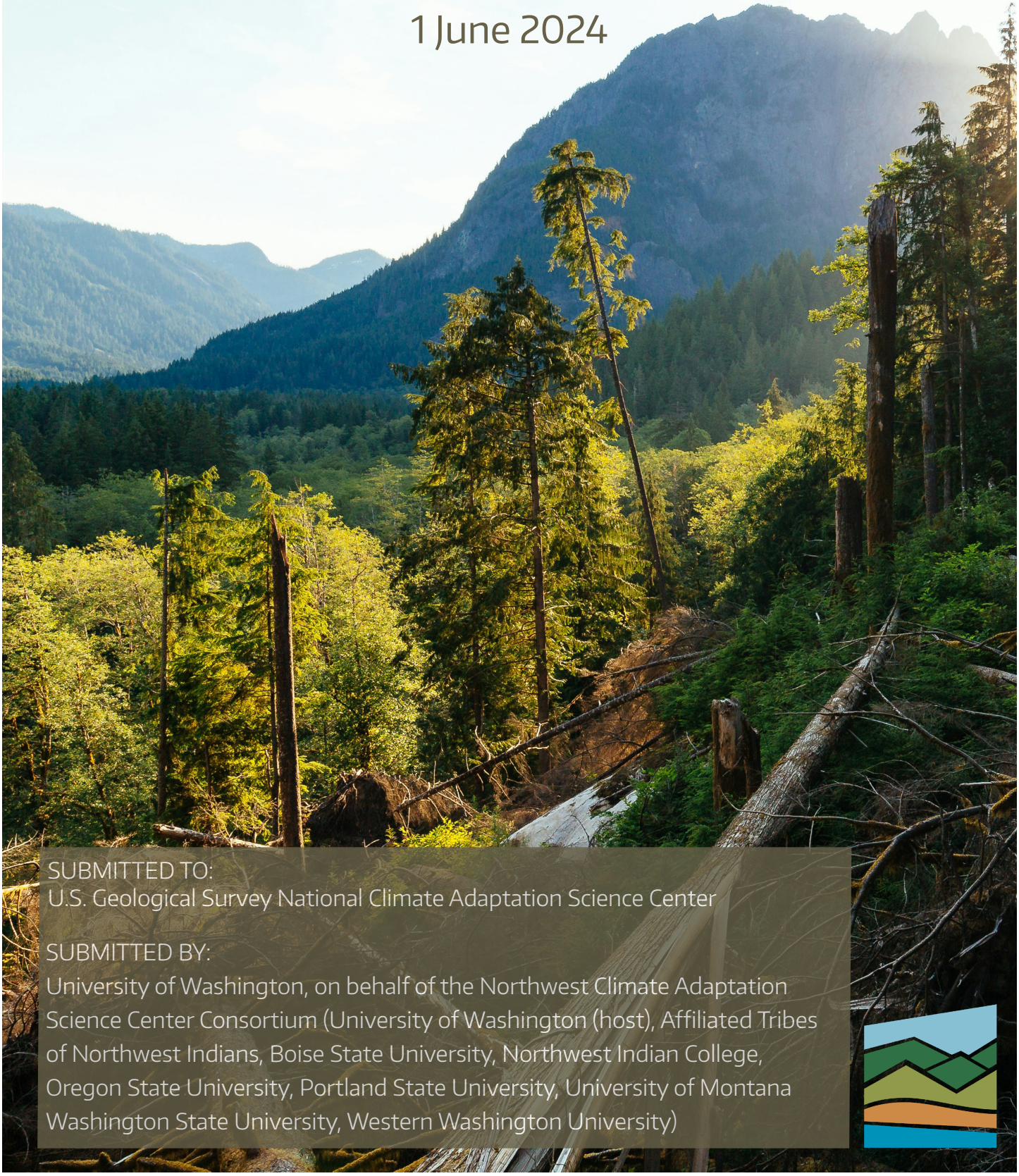
Northwest Climate Adaptation Science Center Cycle 2, Year 1 Annual Report

1 June 2024



SUBMITTED TO:
U.S. Geological Survey National Climate Adaptation Science Center

SUBMITTED BY:
University of Washington, on behalf of the Northwest Climate Adaptation Science Center Consortium (University of Washington (host), Affiliated Tribes of Northwest Indians, Boise State University, Northwest Indian College, Oregon State University, Portland State University, University of Montana Washington State University, Western Washington University)

ADMINISTRATIVE

AWARD RECIPIENT

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PROJECT TITLE

Northwest Climate Adaptation Science Center: Host, Cycle 2

AWARD AGREEMENT NUMBER

G23AC00517

REPORT DATE

1 June 2024

REPORTING PERIOD

August 1, 2023 – July 31, 2024

PURPOSE AND OBJECTIVES

This report provides a summary of activities completed by the Northwest Climate Adaptation Science Center's Consortium during the first year of its second hosting cycle, which will be referred to as "Year 1" throughout the remainder of this report. The Consortium completed the agreed-upon deliverables for its first year, which are described throughout this report and include accomplishments in science; education, training and capacity-building; and communications. In Year, the NW CASC Consortium:

- Expanded its reach by adding the Affiliated Tribes of Northwest Indians (ATNI), Northwest Indian College (NWIC), and Portland State University (PSU) as new Consortium partners, adding four new Consortium Co-PIs to its Consortium Leadership Team;
- Organized and hosted a 1.5-day, in-person Consortium Leadership Team retreat to onboard new members and strengthen existing relationships, followed by a 1.5-day, in-person NW CASC team retreat to connect and conduct planning and team-building activities;
- Funded ten research projects in support of the NW CASC's *Science Agenda*, involving NW CASC Research Fellows and a diverse suite of partners from federal, state and Tribal resource management agencies;
- Provided ten NW CASC Research Fellows with actionable science skills through a capacity-building curriculum developed and coordinated by the University Host;

- Developed and delivered an interactive fall workshop and spring webinar garnering over 280 registrants and adding to the portfolio of its actionable science skills-building webinars;
- Launched the first application process for its new Faculty Fellowship program through consultation with the Consortium Leadership Team and by gathering feedback during two input sessions with prospective fellows;
- Held three, virtual information sessions for NW CASC programming: a welcome call for 2023-24 Research Fellows and advisors, an information session for the 2024-25 Research Fellowship application process, and an information session for the 2025 Faculty Fellowship application process;
- Organized visits to new Consortium partners ATNI, NWIC and PSU, which included seminar presentations to Consortium faculty, staff and students, as well as one-on-one visits with faculty, staff and students;
- Initiated the process for hiring a Research Scientist to coordinate the NW CASC Actionable Science Deep Dives; and
- Strengthened cross-CASC collaborations through participating in the implementation of the Climate Adaptation Postdoctoral Fellows Program and participating in regular network-wide meetings of the CASC University Directors and Deputy/Assistant Directors and communications staff.

ORGANIZATION

The NW CASC Consortium is led by a Consortium Leadership Team (CLT) composed of the University Director, Deputy Director and Co-PIs from each of the Consortium universities (Tables 1 and 2). The CLT collaboratively selects Research Fellowship projects in consultation with the NW CASC USGS Director and oversees award and sub-award administration. The CLT meets roughly every other month by video conferences convened by the University Director and is in frequent contact regarding Consortium operations, strategic opportunities and Consortium-member specific management issues. The University Director and Deputy Director oversee, manage and supervise NW CASC-funded (“core”) personnel at the University of Washington (Table 1).

Table 1. Individuals funded by the NW CASC USGS award at the host institution (UW) and sub-award institutions. Projected FTEs relative to 12 months unless noted.

INSTITUTION	PERSONNEL
Core NW CASC Personnel – Oversee and complete NW CASC consortium activities.	
University of Washington	Meade Krosby (University Director, 0.28 FTE), Scott Kalafatis (Deputy University Director, 0.92 FTE) Darcy Widmayer (Communications Manager, 0.83 FTE), Sarah Lindner (Awards Manager, 0.42 FTE), Jenny Dettmann (Program Coordinator, 0.34 FTE)
NW CASC Research Fellows (Consortium partner universities) – Selected through a competitive process to conduct research that aligns with NW CASC science priorities (NW CASC fellows at UW are listed in Table 3). Note: Reported FTEs reflect total support provided by the NW CASC, including support projected for summer/fall 2024.	
Western Washington University	Alicia McGrew (0.5 FTE for 7 months)
Washington State University	Edwin Jacobo (0.5 FTE for 6 months)
University of Montana	Caroline Bean (0.5 FTE for 6 months), Jared Grummer (1 FTE for 5 months)
Boise State University	Will Loftin (0.5 FTE for 5 months), Helina Alvarez (0.5 FTE for 5 months)
Oregon State University	Haley Hudson (0.5 FTE for 9 months)

NW CASC Consortium Leadership Team (Consortium Co-PIs) – Provide strategic leadership, act as NW CASC liaisons to consortium institutions and administer sub-awards.	
Western Washington University	John Rybczyk (1 FTE for 2 weeks)
Washington State University	Jan Boll (1 FTE for 1 week), Julie Padowski (1 FTE for 1 week)
University of Montana	Solomon Dobrowski (1 FTE for 2 weeks)
Portland State University	Paul Loikith (1 FTE for 2 weeks)
Oregon State University	Selina Heppell (1 FTE for 2 weeks)
Northwest Indian College	Emma Norman (1 FTE for 1 weeks)
Boise State University	Kendra Kaiser (1 FTE for 1 week), Kelly Hopping (1 FTE for 1 week)
Affiliated Tribes of Northwest Indians	Chas Jones (.06 FTE for 12 months)

Table 2. Contributed service not funded by award: NW CASC Fellow Advisors.

NW CASC Research Fellow Advisors – Advise NW CASC fellows on research projects, support administration and compliance of award.	
University of Washington	Joshua Griffin, Brian Harvey, Takato Imaizumi
Western Washington University	Angela Strecker
Washington State University	Jeff Manning
University of Montana	Laurie Yung, Gordon Luikart
Oregon State University	Francis Chan
Boise State University	Libby Lunstrum, Megan Cattau

Table 3. Leveraged support from other resources.

INSTITUTION	PERSONNEL
NW CASC Research Fellows – Selected through a competitive process to conduct research that aligns with NW CASC science priorities (fellows at consortium universities listed in Table 1). *Note:* Reported FTEs reflect total support provided by the NW CASC, including support projected for summer/fall 2024.	
University of Washington	Michael Buck (0.5 FTE for 9 months), Madison Laughlin (0.5 FTE for 9 months), Christine Nolan (0.5 FTE for 6 months)

RESULTS

PARTNERSHIPS

The NW CASC's goal is to respond to high-priority natural and cultural resource management challenges and foster substantive, sustained engagement between scientists and managers. During Year 1, the Consortium focused on enhancing partnerships between the NW CASC and NW CASC external partners; between the NW CASC and host institution programs; and between the NW CASC and other federal programs.

NW CASC EXTERNAL PARTNERS. **NW CASC Advisory Committee:** During Year 1, NW CASC personnel continued to participate in the USGS-organized NW CASC Advisory Committee meetings, which provide an opportunity to build new and deepen existing relationships with both the agencies and individuals represented on the Committee. At the Committee's 2024 meeting in Vancouver, Washington, NW CASC University Director Krosby and Deputy Director Kalafatis presented an overview of the Consortium's updated partners and programs for the new host agreement.

HOST INSTITUTION PROGRAMS. **Climate Impacts Group:** During Year 1, the NW CASC continued its partnership with the Climate Impacts Group at the University of Washington. The NW CASC provides Climate Impacts Group staff with information about NW CASC activities, products and funding opportunities for distribution to their scientific partners and stakeholders. In turn, Climate Impacts Group personnel deliver insights about regional science needs to NW CASC leadership. **Doris Duke Conservation Scholars Program (DDCSP):** The NW CASC partners with the DDCSP to support climate adaptation internships with DOI-relevant partners (e.g., state natural resource management agencies, Tribes) for students and recent graduates from underrepresented groups. In Year 1, NW CASC-supported interns worked with the Swinomish, Tulalip and Quinault Tribes to support their climate adaptation efforts.

OTHER FEDERAL PROGRAMS. **NOAA Climate Adaptation Partnership (CAP) Program:** During Year 1, the NW CASC maintained its strong linkage with the Northwest Climate Resilience Collaborative (NCRC), through NW CASC University Director Krosby's participation as NCRC Co-PI. In addition, NW CASC University Deputy Director, Scott Kalafatis, continued his ongoing collaboration with the Great Lakes Integrated Sciences and Assessments.

SCIENCE

NW CASC FELLOWS' RESEARCH. In Year 1, the University Consortium finished supporting ten research projects that began in Year 6 and began funding ten new research projects. These 20 projects collectively supported each of the six Management Priorities and two of the Human Dimensions Goals identified in the *NW CASC Science Agenda (2018-2023)*. Science highlights for the new, in-progress projects funded in Year 1 include:

Exploring the Intersection of Settler Colonialism and Climate Change on the Fort Hall Bottoms. *NW CASC Science Agenda Priorities: 1.1.1., 2.1.2., Human Dimensions Goal 2. Interim Research Highlights:* A NW CASC Research Fellow is using qualitative, quantitative and Indigenous methods to chart and analyze how histories of colonial settlement (e.g., the removal of Native communities onto reservations, the rise of cattle ranching, and the damming of river systems) and climate change have impacted and continue to impact water quality and quantity in the Bottoms. Analysis of 32 interviews and focus groups has identified critical intersections between colonial settlement and climate change as well as implications for the Shoshone-Bannock Tribes.

Resisting, Accepting, and Directing Trade-Offs: How do Resource Practitioners Navigate Ethical Dimensions of Land Management Decisions Within the Resist-Accept-Direct Framework? *NW CASC Science Agenda Priorities: Human Dimensions Goals 1 and 2. Interim Research Highlights:* As natural resource managers navigate the Resist-Accept-Direct (RAD) Framework, trade-offs involving noneconomic and difficult-to-evaluate values, such as cultural identity, are likely to emerge regardless of which pathway is chosen. A NW CASC Research Fellow is conducting a series of multi-stakeholder workshops to examine Tribal and community engagement around RAD, to better understand engagement processes that will lead to more durable and equitable decisions that integrate a wide range of values and types of expertise. This project is also analyzing the political power of those who identify and give voice to certain trade-offs and how power influences which trade-offs are avoided or ignored.

Restoring the Relationship: Human Dimensions and Climate Resilience Strategy for Managing Pacific Lamprey Fisheries in the Columbia River. *NW CASC Science Agenda Priorities: 1, 2, 6, Human Dimensions, 2021 Deep Dive (Understanding and Responding to Climate-Induced Impacts on Stream Permanence in the Northwestern U.S.). Interim Research Highlights:* A NW CASC Research Fellow is working with the Oregon Department of Fish and Wildlife, Columbia River Intertribal Fish Commission and ATNI to understand the ecological and cultural significance of Pacific lamprey passage over the Bonneville Dam. This project uses a combination of Traditional Ecological Knowledge, fisheries science policy recommendations, and climate modeling to ask how climate change might affect Pacific lamprey passage at the Bonneville and Dalles dams along the mainstem Columbia River, and how these changes will combine with other stream-level climate impacts to affect Tribal harvesting at culturally significant sites on Columbia River tributaries.

Conserving Native Montana Trout Populations by Identifying Environmental and Biological Factors Promoting the Spread of Invasive Trout. *NW CASC Science Agenda Priorities: 1.2.3., 1.3.3., 3.1.2. Interim Research Highlights:* Rainbow trout, an invasive species that has been widely introduced across the globe for angling, threatens the long-term persistence of native Westslope cutthroat trout via hybridization that is being exacerbated by climate change. A NW CASC Research Fellow is analyzing genetic monitoring data from northwestern Montana that spans 40 years and developing a predictive model to identify streams most likely to be invaded in the near future so they can be managed to support the persistence of native trout.

Understanding Low Oxygen Zones and Ocean Acidification in Puget Sound to Inform Tribal Resource Management. *NW CASC Science Agenda Priorities: 1.2.3., 2.2.2., 6.1.2. Interim Research Highlights:* A NW CASC Research Fellow is collaborating with the Tulalip Tribe Shellfish Program to investigate climate change stressors to marine resources using a novel ocean observing system. This project is supporting the Tribe's management of marine resources through establishing thresholds for hypoxia tolerance in Dungeness crab within Puget Sound and enabling mapping of spatial and temporal hypoxia and exposure to ocean acidification. The project is also identifying hotspots and refuges of exposure to low dissolved oxygen.

Migrating in a Warming World: Thermal and Fire Refugia for Migratory Birds en Route. *NW CASC Science Agenda Priorities: 2.1.3. Interim Research Highlights:* During migration, birds are particularly vulnerable to temperature extremes and habitat degradation caused by wildfires. A NW CASC Research Fellow is completing bird surveys and collecting habitat data to understand the role riparian vegetation plays as climate and fire refugia for migratory birds along their migratory routes.

Built-in Resilience? Understanding Conifer Seed and Cone Availability After Wildfire in Northwestern Cascadia. *NW CASC Science Agenda Priorities: 4.1.1., 4.1.2., 2018 Deep Dive (Managing Western Washington Wildfire Risk in a Changing Climate), 2020 Deep Dive (Managing Post-fire Vegetation Change in a Warming Climate). Interim Research Highlights:* A NW CASC Research Fellow is comparing seed and cone abundance across a gradient of burn severity to test fire-induced stress crop as a mechanism of forest resilience to large and stand-replacing wildfire in the northwestern Cascades. This project has established a long-term monitoring plot network within the 2022 Bolt Creek fire across a burn severity gradient to collect data on seed volume, composition and post-fire conifer regeneration. This data will help identify potential mechanisms of post-fire conifer seed availability, contributing to understanding of post-fire regeneration far from a live seed source.

Modeling the Distribution of a Rare Idaho Native, the Cassia Crossbill, with Climate Change Implications. *NW CASC Science Agenda Priorities: 2.1.5., 2.2.1., 2.2.2. Interim Research Highlights:* Idaho's only endemic bird, the Cassia crossbill (*Loxia sinesciuris*), is at risk of extinction due to climate change. A NW CASC Research Fellow is creating a habitat suitability model using a combination of remotely sensed and in situ field measurements, which will be used to inform an adaptive management plan for this at-risk species. This project has discovered new areas where Cassia crossbills had never been recorded, uncovered new information about their habitat, and deployed long-term thermologgers to investigate and model the microclimate of the forest within the crossbill's range.

Back to the Future: Using Historical Data to Forecast Climate Change and Species Invasion Scenarios for Lake Whatcom, Washington. *NW CASC Science Agenda Priorities: 1.2.3, 3.1.3. Interim Research Highlights:* Forecasting future susceptibility to climate change and species invasions requires understanding historical relationships between climate, water quality and biological communities. A NW CASC Research Fellow is leveraging long-term monitoring datasets to explore historical relationships among abiotic and biotic variables, forecast water temperature changes, and explore potential climate impacts on focal native and invasive species. The results from this project will be used by project partners in informing management decisions, particularly as they revise the climate adaptation component of the Lake Whatcom Management Program's 2025-2029 work plan.

Understanding the Genetic and Molecular Mechanisms Behind Eelgrass Flowering to Inform Restoration Efforts. *NW CASC Science Agenda Priorities: 1.2.3., 2.1.1., 2.1.5. Interim Research Highlights:* A NW CASC Fellow is developing a mechanistic understanding of the gene-environment interactions that regulate the onset of eelgrass flowering, which are currently largely unknown. Using plants grown in controlled conditions, this project is characterizing florigen gene expression patterns in different natural thermal and tidal height conditions and determining the specific effects of temperature. These new findings can help link environmental cues to timing of flowering and enable prediction of how climate change and warming environments will affect eelgrass reproduction, which can help inform eelgrass restoration efforts.

CAPACITY BUILDING

The NW CASC aims to build a community of practice of researchers and managers engaged in climate adaptation-oriented work and to foster their leadership in science-based resource management. Efforts in Year 1 were designed to advance novel research and promote the use of existing knowledge in support of climate adaptation decision making. To enhance researchers' proficiency in co-producing knowledge, the Consortium facilitated professional development opportunities in the form of four education, training and capacity-building activities, described below.

NW CASC FELLOWS PROGRAM. In Year 1, the University Consortium supported ten Research Fellows, selected through a competitive process in Year 6. Fellows represented six of the seven Consortium universities (PSU was not yet part of the Consortium in Year 6); their research, described in the Science section above, spans all four Northwest states (WA, ID, MT, OR). All 2023-2024 participated in a University of Washington graduate seminar, *The Theory and Practice of Linking Knowledge with Action to Address Modern Environmental Challenges*. During the seminar, the fellows learn key theories and best practices for producing actionable science. They also met with practitioners from academic, government and non-government entities working on actionable science to ground their learning in real-world, applied contexts. Fellows participated in monthly video cohort training calls covering topics including career pathways, building networks for co-production, communicating science to policy makers and journalists, developing compelling scientific presentations and other activities.

ACTIONABLE SCIENCE WEBINAR SERIES. The University Consortium continued to develop and deliver actionable science skills-building webinars (one in fall 2023 and one in spring 2024) to help build regional capacity for generating and applying actionable climate science. In Year 6, the University Consortium initiated a webinar series on *Navigating a Collaborative Research Career in Academia* to support those in academia trying to pursue actionable science. The first webinar — held in Year 6 — featured MW CASC Consortium Director Jessica Hellmann and addressed potential changes in institutional tenure and promotion policies. It was titled, "Transforming Academic Promotion to Encourage Science That Serves Society — and Surviving in the Academic System as an Action Scientist."

Fall 2023: CV ReWorkshop: Updating Your CV to Contextualize Your Contributions to Societally Engaged Research

Participants of the summer 2023 webinar were enthusiastic about having a follow-up workshop to practice implementing the narrative CV elements discussed. The Consortium planned a Fall 2023 webinar in which participants broke into small groups and walked through prompts to practice incorporating narrative elements that highlight meaningful, contextual information about their contributions in societally engaged research. This webinar featured a mix of quiet work time as well as time for discussion to give participants an opportunity to network with each other in addition to reworking parts of their CVs.

Spring 2024: Early Career Reflections from the Climate Adaptation Field: Landing and Navigating Jobs After Graduate School

This webinar featured three NW CASC Research Fellowship alumni who recently navigated the job market and landed positions in the Northwest related to climate adaptation across a range of sectors. Current NW CASC Research Fellows submitted prompts for the panelists, who shared insights about what led them into their current positions, the tradeoffs they've experienced in their sectors, opportunities to develop actionable science with partners and the direct and indirect ways in which their organizations are supporting climate adaptation.

COMMUNICATIONS

During Year 1, the NW CASC University Consortium communications program maintained its robust communications channels, while building processes and products to support its new programs. As with Cycle 1, the NW CASC communications program invested strongly in both internal and external communications. With its distributed Consortium and USGS team, its internal communications are necessary for supporting an efficient and effective Center, while its external communications are used to promote its science and opportunities and support its external partnerships.

COMMUNICATIONS CHANNELS & PRODUCTS. Website Updates: Added new website content while keeping the NW CASC website up to date with the Center's most-recent projects, publications, webinars and announcements. Revised select webpages to reflect new Consortium members and added pages for its Faculty Fellowship Program and Northwest Regional Invasive Species and Climate Change Network to reflect its growing portfolio of programs. **Newsletter:** Distributed five issues of the *NW CASC Connections* electronic newsletter, sent every other month, to connect NW CASC audiences with NW CASC science, products, opportunities and resources. **Actionable Science Webinars:** Hosted a fall actionable science skills-building workshop*, Updating Your CV to Contextualize Your Contributions to Societally Engaged Research*, as well as a spring 2023 webinar *Early Career Reflections from the Climate Adaptation Field: Landing and Navigating Jobs After Graduate School*. **Informational Webinars:** Hosted annual fall welcome call for the new (2023-24) Research Fellows and advisors, as well as annual winter informational session for graduate students and postdocs interested in applying for the following year's (2024-25) Research Fellowship Program. Additionally, the NW CASC hosted three, new informational webinars in advance of launching its new Faculty Fellowship Program — two input sessions to collect feedback and help ensure this new program meets the needs of faculty in the NW CASC Consortium and an informational session about the application process. **Social Media:** In Year 1, the communications manager continued to share relevant announcements through Twitter to connect researchers in the NW CASC Consortium and other regional audiences with activities and opportunities within and outside of the network and to elevate the work of other CASCs. In Year 1, the communications manager built a stronger presence on LinkedIn by posting its opportunities and resources more frequently. In Year 1, the NW CASC Consortium posted or reposted content on LinkedIn twenty times and gained almost 370 followers.

COMMUNICATIONS SUPPORT. NW CASC Research Fellowship Program: Supported NW CASC Research Fellows by providing individual communications guidance; promoting their research through NW CASC channels; sharing relevant funding and training opportunities; and leading a cohort call about effective meeting planning and facilitation. **USGS-funded projects:** Supported USGS-funded research projects by attending project kick-off meetings to discuss project-specific communication opportunities and by sharing science spotlights on NW CASC research through the *NW CASC Connections* science through various channels.

Tribal Partners: Communications manager worked with the Natural Resource Specialist for the Bureau of Indian Affairs (BIA) Tribal Resilience Program to develop a success story about the jointly funded Swinomish Clam Garden project. This story was published on the Tribal Climate Resilience website, linked on its annual awards page, included in the BIA Office of Trust Services January newsletter, and featured in the *NW CASC Connections* newsletter. **Design:** In Year 1, the communications manager made strides in developing more efficient and modern design pieces (i.e., banners, fliers, lobbying materials) through working in Canva.

CASC NETWORK COMMUNICATIONS. USGS Highlights: Submitted routine highlights to inform USGS of upcoming, high-profile activities within the NW CASC network. **Climate Adaptation Insights Newsletter:** Provided regular submissions for consideration in the Climate Adaptation Insights newsletter. **CASC Network Communication Calls:** Communications manager attended calls every other month to stay informed of activities and connect with communications staff across the network.

EVALUATION. Conducted evaluation of communications channels and efforts, including the NW CASC website, Twitter, newsletter and webinars.

OUTREACH

PUBLICATIONS

Publications featuring NW CASC-funded research by NW CASC Consortium Leadership Team members (*), Research Fellows (+), and CAP Fellows (#) include:

PEER-REVIEWED

Agne, M.C.+, J.B. Fontaine, N.J. Enright, S.M. Bisbing, and B.J. Harvey. 2023. Rapid fuel recovery after stand-replacing fire in closed-cone pine forests and implications for short-interval severe reburns. Forest Ecology and Management 545:121263.

Askerooth, R.+, R.S. Mostow, P. Ruggiero, F. Barreto, and S.D. Hacker. 2024. A novel hybrid beachgrass is invading U.S. Pacific Northwest dunes with potential ecosystem consequences. Ecosphere 15(4): e4830.

Davis, K.T., M. Wynecoop, M.A. Rozance, **K.B. Swensen+**, **D.S. Lyons+**, **C. Dohrn+**, and **M. Krosby***. 2024. Centering socioecological connections to collaboratively manage post-fire vegetation shifts. Frontiers in Ecology and the Environment e2739.

Fales, R.J.+, B.L. Weigel, E. Carrington, H.D. Berry, and M.N. Dethier. 2023. Interactive effects of temperature and nitrogen on the physiology of kelps (Nereocystis luetkeana and Saccharina latissima). Frontiers in Marine Science 10:1281104.

Greenler, S.K.+, F.K. Lake, W. Tripp, K. McCovey, A. Tripp, L.G. Hillman, C.J. Dunn, S.J. Prichard, P.F. Hessburg, W.H. Harling, and J.D. Bailey. 2024. Blending Indigenous and western science: Quantifying cultural burning impacts in Karuk Aboriginal Territory. Ecological Applications e2973.

Hoecker, T.J.#, S.A. Parks, **M. Krosby***, and **S.Z. Dobrowski***. 2023. Widespread exposure to altered fire regimes under 2 °C warming is projected to transform conifer forests of the Western United States. Communications Earth & Environment 4:295.

Laughlin, M.M.+, L.K. Rangel-Parra, **J.E. Morris+**, D.C. Donato, J.S. Halofsky, and B.J. Harvey. 2023. Patterns and drivers of early conifer regeneration following stand-replacing wildfire in Pacific Northwest (USA) temperate maritime forests. Forest Ecology and Management 549:121491.

Zimmerman, O.+, T. Eison, R. Carey, and P.S. Levin. 2024. Addressing inequities and meeting needs of Indigenous communities in floodplain management. Frontiers in Climate 6:1306542

PEER-REVIEWED: IN PROCESS

Genzoli, L.+. Widespread anatoxin detected from attached cyanobacteria in the Klamath River and tributaries. Freshwater Science. In Review.

NON PEER-REVIEWED

Krosby, M.*, R. Hasert, **S. Kalafatis***, **R. Askerooth+**, K. Kuhn, K., and **O. Zimmerman+**. 2023. *Rising Seas and the Coastal Squeeze: Managing Inland Migration of Coastal Habitats in Response to Sea Level Rise.* Northwest Climate Adaptation Science Center, University of Washington, Seattle.

PRESENTATIONS

In Year 1, NW CASC Consortium personnel and researchers delivered over 20 presentations on NW CASC-funded research to diverse audiences including academic departments, academic society meetings, international and regional conferences, and non-profit organizations, including: Ecological Society of America Annual Meeting, International Fire Ecology and Management Congress, 2023 Northwest Climate Conference, The Wildlife Society Annual Conference, Oregon Cooperative Fish and Wildlife Research Unit Annual Cooperator Meeting, and The Nature Conservancy. Additionally, two webinars were given to broader Northwest audiences that included a mix of resource managers, researchers and students.

STAKEHOLDER ENGAGEMENT

Research supported by the NW CASC in Year 1 was conducted in close partnership with natural resource managers. Partner engagement was supported by the actionable science skills-building activities and cohort calls provided by the NW CASC Research Fellowship Program. In Year 1, the ten newly funded projects culminated in numerous project meetings and workshops led by the Research Fellows, specific to co-producing science with resource managers, stakeholders and other scientists from 25 agencies and organizations – a summary of these partners by type of organization is provided in Table 1.

Table 1. Summary of Research Fellowship Project Partners by Type

Type	Count	%
Academic	2	8
Federal-DOI	3	12
Federal-non DOI	2	8
Local	6	24
NGO	1	4
State	4	16
Tribal	7	28

Partnering organizations included Tribal, federal, state and county governments and NGOs, including: the Tulalip Tribes, Confederated Tribes and Bands of the Yakama Nation, Confederated Salish and Kootenai Tribes, Shoshone-Bannock Tribes, Salish Kootenai College, National Park Service, Bureau of Land Management, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, The Nature Conservancy and others.

Fellows communicated extensively with resource managers and other partners through regular meetings, organized workshops, presentations and consultations through one-on-one meetings, phone conversations and email communications. This collaboration with resource agencies has shaped research questions, methodologies and analysis and given fellows first-hand experience collaborating with resource managers outside their university setting.

OTHER PRODUCTS FROM NW CASC-FUNDED RESEARCH PROJECTS

During Year 1, in addition to peer-reviewed publications and reports, NW CASC Consortium-funded research projects also produced:

PRODUCTS. In collaboration with Yakama Nation Fisheries, a community ceremony was conducted to celebrate the first sustainable harvest of the Pacific lamprey in memory. Held at a traditional fishing site, the ceremony included a traditional lamprey cookout and was designed to reinforce the historic connection between the people of the Yakama Nation and the Pacific lamprey. As a part of this effort, an updated biological life cycle diagram of the Pacific lamprey was developed that incorporated traditional understanding of the significance of the Pacific lamprey for ecosystem health. An additional life cycle stage was included where, after its death, the Pacific lamprey gives new life to the ecosystem and the people of the Yakama Nation. This diagram was presented to the community at the ceremony to tell the story of the Pacific lamprey's cultural significance. **Research Project:** Restoring the Relationship: Human Dimensions and Climate Resilience Strategy for Managing Pacific Lamprey Fisheries in the Columbia River.

PRODUCTS. A dataset for the Tulalip Tribe Shellfish Department was developed that included variables for dissolved oxygen and temperature for seven sites from April to November. This dataset was developed using dissolved oxygen sensors, expertise and data analysis. This new data was aligned with the department's on-going monitoring work but enhanced their capacity beyond current resources and staff time. **Research Project:** Understanding Low Oxygen Zones and Ocean Acidification in Puget Sound to Inform Tribal Resource Management.

PRODUCTS. Maps describing locations of different degrees of burn in forests (i.e., scorched versus torched trees) to aid with targeting future management interventions informed by research findings about seed distribution following fires. The dataset concerning seed distribution related to areas of different degrees of burn was also provided to project partners. **Research Project:** Built-in Resilience? Understanding Conifer Seed and Cone Availability After Wildfire in Northwestern Cascadia.

PRODUCTS. A dataset of ten-minute, standardized point count surveys that were conducted to determine the abundance of Cassia crossbills and a dataset of vegetation surveys following the Integrated Monitoring in Bird Conservation Regions protocol was provided to external project partners. Maps based on this data were also developed to assist managers with planning microclimate thermologger deployment. **Research Project:** Modeling the Distribution of a Rare Idaho Native, the Cassia Crossbill, with Climate Change Implications.

PRODUCTS. A dataset of climate, air quality and water quality for Lake Whatcom was developed and shared with project partners. An R Markdown file including code, data wrangling decisions and critical context was also provided to project partners to support the use of this dataset. **Research Project:** Back to the Future: Using Historical Data to Forecast Climate Change and Species Invasion Scenarios for Lake Whatcom, Washington.

PRODUCTS. A predictive and adaptable landscape genetics model was developed for identifying which streams are most vulnerable to rainbow trout invasion under climate change in western Montana. Results from this model will also be summarized in a map that shows probabilities of rainbow trout invasion over the next 10-15 years in the North Fork Flathead River drainage and a list of "sentinel" streams to test for the early detection of rainbow trout invasion will also be shared with project partners. **Research Project:** Conserving Native Montana Trout Populations by Identifying Environmental and Biological Factors Promoting the Spread of Invasive Trout

CONGRESSIONAL OUTREACH

During Year 1, the NW CASC continued to participate in the cross-CASC effort to provide outreach and education to Congressional offices about the role and activities of the CASCs and the expressed science and capacity needs of CASC stakeholders regarding climate adaptation for natural and cultural resources.

CROSS-CASC CONTRIBUTIONS

In Year 1, the NW CASC collaborated with working groups across the CASC network on a range of initiatives. The NW CASC Communications Manager continued to participate in monthly cross-CASC communications calls.

The NW CASC University Director continued participating in monthly meetings of regional CASC university directors, monthly meetings for university directors and NCASC leadership, and quarterly meetings for all regional CASC university directors and deputy/assistant directors.

The NW CASC Deputy University Director continued participating in regional Deputy University Director calls and began participating in monthly national network calls for the Evaluation group and the Training, Education, and Extension Group (TrEEx) group. The Deputy Director also participated in discussions with USGS representatives exploring the CASC network's engagement in DEIAJ work and with representatives from the CASC Urban Symposium Planning Team.

NEXT STEPS

During Year 2 of the NW CASC award, we anticipate engaging in the following activities:

CENTER & CONSORTIUM OPERATIONS. The Consortium will continue regular meetings and communication among NW CASC University and USGS staff and with the NW CASC Consortium Leadership Team.

HOST INSTITUTION PROGRAMS. The NW CASC will continue to partner with the Doris Duke Conservation Scholars Program to support climate adaptation internships for undergraduate students and program alumni from underrepresented groups.

TRIBAL ENGAGEMENT. During Year 2, the Consortium will continue to work collaboratively to support Tribal adaptation work in the Northwest through our partnership with NWIC and ATNI and through engagement with Tribes across all Consortium programs.

SCIENCE FOR MANAGEMENT. Year 1 Consortium-funded science projects will be completed during summer/fall 2024. Year 2 Research Fellowship science projects have been identified and will begin during summer/fall 2024, while Faculty Fellowship science projects will be selected in summer 2024 and begin in January 2025. A new NW CASC Climate Adaptation Postdoctoral Fellow will be recruited in spring 2025 to begin work in the cross-CASC *Future of Species Range Shifts* postdoctoral cohort. We will scope, plan and implement the 2024-2025 *Deep Dive*, which will be focused on ecological impacts and potential adaptation responses for extreme heat events, with a focus on the 2021 Pacific Northwest heat dome.

NW CASC FELLOWS. Our eighth cohort of NW CASC fellows will begin cohort activities during fall 2024. This cohort includes five MS candidates, five PhD candidates and one postdoctoral fellow spread across six of the seven consortium universities. Fellows will participate in monthly cohort training calls, Actionable Science Skills-Building Webinars, the Actionable Science Graduate Seminar and the NW Climate Conference.

CAPACITY-BUILDING ACTIVITIES. During Year 2, the NW CASC will convene our 2024-2025 *Deep Dive* workshop. The *Deep Dive* workshop will synthesize the state of knowledge and enable participant co-development of an actionable science agenda for addressing the ecological impacts of extreme heat, with a focus on the 2021 PNW heat dome. During Year 2, we also anticipate hosting two series (fall/spring) of skills-building webinars.

COMMUNICATION. During Year 2, the NW CASC will continue to maintain internal communications and connect its audiences to NW CASC-funded science, resources and opportunities through up-to-date, clear and accessible communication channels. The communications manager will focus on improving the NW CASC website's searchability of NW CASC projects and publications and developing new pages that compile research products under climate adaptation topics. The communications manager will also help hire and onboard a communications ORISE Fellow and support new programs such as the Faculty Fellowship program. The communications program will continue to evaluate the efficacy of its new and existing communications efforts.

NATIONAL NETWORK. During Year 2, the NW CASC will continue to participate in CASC network university leadership collaborations. NW CASC leadership will continue to advise NCASC on development and implementation of the Climate Adaptation Postdoctoral Fellows Program through participation on the CAP fellows leadership committee. The NW CASC communications manager will participate in the monthly cross-CASC communications calls and the bimonthly network collaboration calls.

CONGRESSIONAL OUTREACH. During Year 2, the NW CASC will continue to participate in the cross-CASC effort to provide outreach and education to Congressional offices about the role and activities of the CASCs and the expressed science and capacity needs of CASC stakeholders regarding climate adaptation for natural and cultural resources.

APPENDIX: PRESENTATIONS

Formal presentations delivered by the NW CASC Consortium Leadership Team (*), Research Fellows (+), and NW CASC Fellow Advisors (#) include:

Buonanduci, M.S.+, D.C. Donato, J.S. Halofsky, M.C. Kennedy, and **B.J. Harvey#**. Dec 2023. *Harnessing spatial scaling relationships to inform expected future spatial patterns of burn severity across fire size distributions*. International Fire Ecology and Management Congress, Monterey, CA.

Greenler S.+, F. Lake, C. Dunn, S. Prichard, P. Hessburg, J. Bailey, W. Tripp, and W. Harling. Dec 2023. *Blending knowledge to quantify cultural burning spatial and temporal patterns on Karuk ancestral territory*. International Fire Ecology and Management Congress, Monterey, CA.

Hudson H.+, F. Chan, L. Rabins, and M. McHugh. Apr 2023. *Co-production for monitoring hypoxia in Puget Sound*. Oregon State University Biology Graduate Student Symposium, Corvallis, OR.

Hudson H.+, F. Chan, and K. Bosley. Nov 2023. *Hypoxia and the Puget Sound Dungeness crab fishery: How low is too low?* Coastal and Estuarine Research Federation Conference, Portland, OR.

Jantsch, S.+ Feb 2024. H*yporheic temperatures, cool-water refuge, and hope for chinook salmon.* AAAS Conference, Denver, CO.

Krosby, M.* Aug 2023. *Northwest Climate Adaptation Science Center: Coproducing actionable science to inform resource management in a changing climate*. Ecological Society of America annual meeting, Portland, OR.

Krosby, M.* Jan 2024. *Mobilizing actionable science (and scientists!) to support societal responses to climate change*. University of Washington School of Environmental and Forest Sciences, Seattle, WA.

Krosby, M.* Feb 2024. *CASC Consortia: Harnessing Regional Expertise for Climate Adaptation*. DOI Advisory Council on Climate Adaptation Science, Washington, DC.

Krosby, M.*, K. Kuhn, **Kalafatis, S.***, and R. Hasert. Oct 2023. *Rising seas and the coastal squeeze: managing inland migration of coastal habitats in response to sea level rise*. 2023 Northwest Climate Conference, virtual.

Laughlin, M.+, D. Donato, and J. Halofsky. Dec 2023. *Built-in resilience? Testing mechanisms of conifer seed availability within infrequent, stand-replacing fire regimes of the northwestern Cascades, USA.* 10th International Fire Ecology and Management Congress, Monterey, California.

Loftin, W.+ Mar 2024. *Inspired research to inform management of the cassia crossbill (Loxia sinesciuris), an Idaho endemic, with climate change in mind.* Chapter of Wildlife Society, Coeur D'Alene, ID.

Loftin, W.+ Apr 2024. *Inspired research to inform management of the cassia crossbill (Loxia sinesciuris), an Idaho endemic, with climate change in mind.* Boise State University Graduate Student Showcase, Boise, ID.

Nolan, C.+ Jun 2024. *Identification and characterization of flowering genes in Zostera marina*. 15th International Seagrass Biology Workshop and World Seagrass Conference, Naples, Italy.

Nolan, C.+ Nov 2023. *Uncovering molecular controls of flowering in Zostera marina.* Coastal & Estuarine Research Federation Meeting, Portland, OR.

Morris, J.+ Aug 2023. *Measuring and modeling post-fire forest trajectories in northwestern Cascadia*. Ecological Society of America Annual Meeting, Portland, OR.

Morris, J.+ Oct 2023. *How will forests recover following fire in northwestern Cascadia?* 2023 Northwest Climate Conference, virtual.

Rockweit, J.+ Nov 2023. *Changing fire regimes and nuanced impacts on a critically imperiled species.* The Wildlife Society Annual Conference, Louisville, KY.

Rockweit, J.+ Nov 2023. *Changing fire regimes and nuanced impacts on a critically imperiled species.* Oregon Cooperative Fish and Wildlife Research Unit Annual Cooperator Meeting, Corvallis, OR.

Vieira, S.+ Dec 2023. *Impact of seasonal-to-annual climate on post-fire regeneration of western larch*. International Fire Ecology and Management Congress, Monterey, CA.

Yegorova, S.+ Dec 2023. *Projecting climate-driven and fire-facilitated forest transitions for the state of Oregon*. International Fire Ecology and Management Congress, Monterey, CA.

Yegorova, S.+ Oct 2023. *Mapping climate-driven forest redistribution for the state of Oregon*. The Nature Conservancy, Portland, OR.