Aldo Leopold Wilderness Research Institute

2024 Annual Report

Chris Armatas, Stephanie Barron, Clare Boerigter, Kellie Carim, Kira Hefty, Olga Helmy, Teresa Hollingsworth, Sean Parks, Lauren Redmore, Jaclyn Fox Rushing, Kathy Zeller

Advancing Wilderness Stewardship Through Transformational Science

USDA Forest Service
Rocky Mountain Research Station

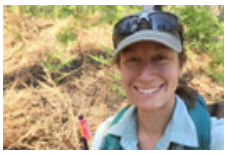
Our Team

Dr. Chris Armatas is a social scientist whose research focuses on wildlands management and planning.

Stephanie Barron is the ALWRI ORISE Social Science Research Fellow.

Clare Boerigter is the ALWRI ORISE Wilderness Fire Research Fellow.

Dr. Kellie Carim is an aquatic ecologist whose research focuses on fish and freshwater systems.



Dr. Kira Hefty a wildlife biologist whose research focuses on wildlife distribution modeling and land management trade-offs and consequences.

Olga Helmy is a science delivery specialist with a background in field biology who facilitates communication between research staff and managers-in-the-field.

Dr. Teresa Hollingsworth is ALWRI's acting director whose research focuses on disturbance effects on plant communities and ecosystems.

Dr. Jaclyn Fox Rushing is a social scientist whose research focuses on outdoor recreation, parks, and protected area management.

Dr. Sean Parks is a fire ecologist whose research focuses on historical and present day fire as a natural process.

Dr. Lauren Redmore is a social scientist whose work focuses on community-based conservation, shared stewardship and natural resource management, and program evaluation.

Dr. Kathy Zeller is a spatial ecologist whose research integrates the fields of landscape ecology, wildlife biology, landscape genetics, and biostatistics.

Acronyms

Acronyms and Abbreviations

ALWRI – Aldo Leopold Wilderness Research Institute (may also be referred to as Leopold Institute)
BLM – Bureau of Land Management
DOI – U.S. Department of the Interior
FWS – U.S. Fish and Wildlife Service
NGO – Non-Governmental Organization
NPS – National Park Service
NOAA – National Oceanic and Atmospheric Administration
NWPS – National Wilderness Preservation System
OMB – Office of Management and Budget
PoC – Point of Contact
R&D – USDA Forest Service, Research and Development
RMRS – Rocky Mountain Research Station
USDA – U.S. Department of Agriculture
USFS – USDA Forest Service
USGS – U.S. Geological Survey
WCM – Wilderness Character Monitoring
WSA – Wilderness Study Area
WSR – Wild and Scenic Rivers

Projects

RPA1 - Biodiversity Conservation: Develop an understanding the values, opportunities, and challenges for wilderness to support biodiversity conservation in an era of unprecedented change

1-1: Contributing to a Landscape Conservation Design for the Crown of the Continent Ecosystem

A multi-year study with the Crown of the Continent (COTC) Manager's Partnership to incorporate connectivity into a Landscape Conservation Design for the COTC ecosystem.

ALWRI personnel: Kathy Zeller

Partners: University of Montana, National Park Service, Fish and Wildlife Service, Bureau of Land Management

Location: Missoula, Montana to Banff, Alberta

Deliverables:

- Peer Review Publication: Corridor-based approach with spatial cross-validation reveals scale-dependent effects of geographic distance, human footprint and canopy cover on grizzly bear genetic connectivity
- Peer Review Publication: Measuring ecological connectivity with ecological distance and dynamic resistant kernels
- Manuscript (In peer review): Movement models reveal changing grizzly bear habitat use and functional connectivity in response to human disturbance in the southern Canadian Rocky Mountains

1-2: Modeling connectivity to inform national forest planning

To inform forest planning for the next 10-15 years, we are modeling structural connectivity for wildlife based on land cover classes across the continental United States, for each USFS Region, and for each USFS Unit.

ALWRI personnel: Kathy Zeller, Kira Hefty

Partners: National Wildlife Ecology Program, Lolo National Forest

Location: Continental United States

Deliverables:

- Web application to view and download connectivity outputs (in development)
- Manuscripts (In preparation for peer review)

1-3: Wilderness contributions to wildlife connectivity across the western United States

We are working to develop a seamless, online decision-making tool of past and current habitat and functional connectivity for multiple wildlife species in the western US.

ALWRI personnel: Kathy Zeller

Partners: BLM, Forest Service--Forest Inventory and Analysis and National Wildlife Ecology Program, Utah State University, non-profit organizations, state agencies, and Tribes

Location: Results will be relevant for management across the nation, but research is focused on the western United States

Deliverables:

- Functional connectivity models (in development)

Value-added tasks: Hired one-year postdoctoral researcher to incorporate more species into the study.

1-4: Quantifying the contribution of Wilderness to genetic viability of wildlife populations

We are examining the link between Wilderness and other protected areas and genetic diversity and modeling genetic diversity of hundreds of species across North America as a function of protected areas, protected area status (i.e. IUCN status 1a/b, 2, etc.), and other factors.

ALWRI personnel: Kellie Carim, Kathy Zeller (PoC)

Partners: The Wilderness Society

Location: North America

Progress: Completed analysis of genetics per protected area.

Deliverables: Manuscript (In preparation for peer review)

1-5: Assessing aquatic community assemblages in Wilderness and adjacent waterbodies with development of multi-species eDNA panel (Project completed)

This project focused on optimization of eDNA laboratory methods to accurately and rapidly assess aquatic species diversity and applied these new methods to understand distributions of economically and socially relevant aquatic species.

ALWRI personnel: Kellie Carim

Partners: North Sound Chapter of Trout Unlimited, U.S. Forest Service National Genomics Center for Wildlife and Fish Conservation

Location: Nooksack River basin, Washington, including the Stephen Mather Wilderness Area, Mount Baker Wilderness Area, North Cascades National Park

Deliverables:

- Peer review publication: The riverscape on a chip: High-throughput qPCR enables basin-wide fishery assessments

1-6: The role of Wilderness and Wild and Scenic Rivers in protecting diversity and persistence of bull trout

This project examines the role that Wilderness and Wild and Scenic Rivers play in the persistence, genetic diversity and life history of federally Threatened bull trout (*Salvelinus confluentus*).

ALWRI personnel: Kellie Carim

Partners: State and federal agencies including University of Idaho, Idaho Fish and Game, U.S. Forest Service National Genomics Center for Wildlife and Fish Conservation, U.S. Fish and Wildlife Service

Location: North and central Idaho- St. Joe Wild and Scenic River, Selway-Bitterroot Wilderness Area, Sawtooth Wilderness Area, Gospel Hump Wilderness Area (Panhandle, Salmon-Chalis, Nez Perce-Clearwater, and Sawtooth National Forests)

Progress:

- K. Carim served as member of St. Joe River Bull Trout Working Group (Idaho), and participated as a science advisor to managers in scenario planning for bull trout recovery efforts
- Completed surveys of lake dwelling bull trout populations (including several populations in wilderness areas)

1-7: Pyrodiversity and aquatic species distribution in Wilderness

This project uses remote sensed data and eDNA detection of aquatic species to assess the recovery of stream and riparian habitat following wildfire as well as the effects of wildfire on distributions of federally Threatened bull trout (*Salvelinus confluentus*) in the Bob Marshall Wilderness Area and Selway-Bitterroot Wilderness Area.

ALWRI personnel: Kellie Carim (PoC), Teresa Hollingsworth, Sean Parks

Partners: University of Montana

Location: Montana, Bob Marshall Wilderness Area (Flathead National Forest), additional sampling in the Selway-Bitterroot Wilderness Area (Lolo National Forest)

Progress:

- Master's student at University of Montana successfully defended research proposal
- Collection of field data (eDNA samples) completed
- Preliminary results presented at Arthur Carhart National Wilderness Training Center Spring national wilderness training (June 2024)

1-8: Current and projected distribution of lamprey species in Wilderness and Wild and Scenic Rivers

This project uses eDNA methods to determine distributions of Pacific lamprey (*Entosphenus tridentatus*) and lamprey in the genus *Occidentis* across Oregon, Washington and Idaho with particular emphasis on how Wilderness and Wild and Scenic Rivers may support these taxa.

ALWRI personnel: Kellie Carim

Partners: U. S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, as well as numerous additional partners at Tribal and local government natural resource agencies

Location: The scope of this work overlaps with over forty Wilderness areas and nearly twenty Wild and Scenic Rivers in Oregon, Washington, Idaho, and California

Progress:

- First year of monthly sampling completed in Puget Sound
- Collected and analyzed > 200 eDNA samples to assess distributions of *Occidentis*

Deliverables:

- Presentation: Hide and Seek, eDNA for Pacific Lamprey Conservation, Salish Kootenai College (March 2024) and Carleton College (May 2024)
- Project featured in High Country News: Saving the Pacific lamprey (March 2024)

1-9: Species diversity of freshwater lamprey in western North America and relevance to wild and scenic river Outstanding Remarkable Values

This project seeks to provide insights into the value of management units for freshwater species based on their respective life histories. We are using genetic analyses to understand relationships among species in the genus *Occidentis* across their range in North America.

ALWRI personnel: Kellie Carim

Partners: Willamette National Forest, Oregon Department of Fish and Game, Washington Department of Fish and Game, California Department of Fish and Wildlife, University of Manitoba, Canadian Museum of Nature, North Cascades National Park.

Location: The scope of this work overlaps with over forty Wilderness areas and nearly twenty Wild and Scenic Rivers in Oregon, Washington, Idaho, and California, as well as portions of Alaska and British Columbia

Progress:

- Tissue samples collected from Washington and submitted for genetic analysis

Deliverables:

- Peer Reviewed Publication: A revised taxonomy and estimate of species diversity for western North American *Lampetra*
- RMRS Science You Can Use in 5 Minutes: Don't judge a lamprey by its teeth: genetic analysis shows need to reconsider species classification, possibly influencing conservation decisions
- RMRS Science X Webinar: Gaining and losing *Lampetra* species through phylogenetic analysis
- Presented research at the 2024 Lamprey Information Exchange in Portland, OR (December 2024)

1-10: Local adaptation of westslope cutthroat trout to Wilderness and similarly protected areas (Project completed)

This project investigates local adaptation and inbreeding in westslope cutthroat populations, which are often used as source populations for reintroduction efforts outside of Wilderness and for stocking in Wilderness lakes for recreational fishing opportunities.

ALWRI personnel: Kellie Carim

Partners: University of Montana, MPG Ranch, Montana Fish Wildlife and Parks, Confederated Salish and Kootenai Tribes

Location: Montana (including Flathead, Lolo, and Lewis and Clark National Forests)

Deliverables:

- Manuscript (Submitted for publication in Evolutionary Applications, accepted for publication in FY25): Genomic insights into inbreeding and adaptive divergence of trout populations to inform genetic rescue.

1-12: Connectivity across the sagebrush biome

We are developing a connectivity model to identify the 'backbone' of sagebrush core areas that have high levels of connectivity across the biome and are developing a new range-wide landscape genetic connectivity model for sage grouse to support conservation and management actions to stem the loss of sagebrush.

ALWRI personnel: Kathy Zeller

Partners: USGS, FWS, BLM, The Nature Conservancy, Natural Resources Conservation Service, and many others

Location: Washington, Montana, Idaho, Oregon, Wyoming, North Dakota, South Dakota, California, Nevada, Utah, Colorado, Arizona

Deliverables:

- Peer Reviewed Publication: Well-connected core areas retain ecological integrity of sagebrush ecosystems amidst overall declines from 2001-2021
- White Paper: Sagebrush conservation design to proactively restore America's sagebrush biome
- Briefing Paper: Sagebrush conservation design special issue relevance to biome wide conservation efforts
- Manuscript (In preparation for peer review) on genetic connectivity for sage grouse

1-13: Understanding the impacts of invasive Northern Pike on native fish in the St. Joe Wild and Scenic River and homelands of the Coeur d'Alene Tribe of Indians

This project examines the distribution of invasive northern pike (*Esox lucius*) and the effects of northern pike predation on bull trout in the St. Joe Wild and Scenic River and Lake Coeur d'Alene.). The St. Joe River supports the last extant populations of bull trout in the Coeur d'Alene River basin.

ALWRI personnel: Kellie Carim

Partners: Coeur d'Alene Tribe of Indians, Panhandle National Forest, U.S. Fish and Wildlife Service

Loca on: St. Joe Wild and Scenic River and Lake Coeur d'Alene, Idaho (including Panhandle National Forest)

Progress:

- First year of eDNA samples collected in spring, summer, and fall to examine seasonal distribution of northern pike and bull trout in the lower St. Joe River
- First year of diet samples collected from northern pike in Lake Coeur d'Alene to assess predation on bull trout

1-14: Developing new protected area connectivity tools for natural resource management

We are using publicly available and updatable earth observation data to develop a decision support system (DSS) that can be used to identify priority areas for conservation and management. We are combining remotely sensed geospatial data with species observations and genetic data to quantify protected area contribution to habitat suitability and connectivity for a range of species. We will display these outputs will be displayed in the DSS and allow users to assess protected area connectivity and effectiveness for wide-ranging wildlife species, with the intent that the DSS will ultimately be able to be adapted for other species in other areas to help with protected area and wilderness management.

ALWRI personnel: Katherine Zeller

Partners: USFS International Programs and Northern Arizona University

Location: Global

Progress:

- We are preparing to test DSS and applicability to connectivity projects in the USA

1-15: Monitoring of bull trout in the North Fork Malheur Wild and Scenic River and headwater Wilderness areas

We are applying eDNA methods to assess the distribution and abundance of bull trout in the North Fork Malheur Wild and Scenic River where we are working to evaluate whether eDNA can be used as a proxy

for bull trout redd counts and seeking to understand the distribution of bull trout and nonnative trout species in two Wilderness areas.

ALWRI personnel: Kellie Carim

Partners: Oregon State University

Location: Oregon: Malheur River Wild and Scenic River, Strawberry Mountain Wilderness Area, Monument Rock Wilderness Area

Progress:

- Master's student at Oregon State University successfully defended thesis proposal
- Field work (eDNA sample collection) completed
- Coauthored presentation (delivered by master's student) at Oregon Chapter of the American Fisheries Society (March 2024) and *Salvelinus confluentus* Curiosity Society
- Project featured in Backcountry Hunters and Anglers Magazine (Summer 2024, p.26): eDNA

RPA2 - Climate Change and Disturbance: Improve knowledge about the impacts and consequences of climate change and climate-disturbance interactions, including wildland fire, relevant to wilderness stewardship

2-3: Ecosystem response to fire in Wilderness

We are evaluating the ecosystem response to fire across a broad bioclimatic and fire history gradient in the Selway-Bitterroot Wilderness (SBW) to determine how fire history and bioclimatic characteristics influence post-fire ecosystem trajectories, including the potential for enduring conversions to non-forest.

ALWRI personnel: Sean Parks

Partners: University of Montana

Location: Idaho, Montana

Deliverables:

- Peer Review Publication: The scientific value of fire in wilderness
- Peer Review Publication: Mesic mixed-conifer forests are resilient to both historical high-severity fire and contemporary reburns in the US Northern Rocky Mountains
- Peer Review Publication: Fire suppression makes wildfires more severe and accentuates impacts of climate change and fuel accumulation
- (In preparation for peer review): Fire effects on forest structure in the alpine treeline ecotone
- (In preparation for peer review): Climate change and fire alter biotic interactions and tree growth in treeline forests
- Book chapter in Wilderness Management (5th edition): Fire in wilderness ecosystems. Eds: Chad P. Dawson, John C. Hendee. 2025

2-5: Quantifying fire regime departures in western US Wilderness areas

We are seeking to define best practices for measuring pyrodiversity and for linking to characteristics of biodiversity. This project uses designated Wilderness, many with extensive fire history, as study areas to help quantify spatio-temporal variability (pyrodiversity) in fire patterns.

ALWRI personnel: Sean Parks

Partners: University of Montana

Location: WA, OR, CA, ID, MT, WY, NV, UT, CO, AZ, NM

Deliverables:

- Manuscript (In preparation for publication, link to preprint): Wildfires are burning less frequently and more severely in the western US: An integrative approach to calculating fire-regime departures

2-6: A complex assessment of fire history and Indigenous stewardship

We are working with a Montana State University graduate student from the Crow Nation to quantify long-term fire history through lake sediment coring at Axolotl Wilderness Study Area in the Gravelly Mountain Range in Southwest Montana, a region identified as communal hunting grounds for the Crow people. We are analyzing short-term fire history and vegetation patterns using tree-rings and repeat photography and seeking further opportunities for collaboration with Little Bighorn College and the Crow Tribe to document Indigenous use of this region.

ALWRI personnel: Chris Armatas, Teresa Hollingsworth (PoC), Sean Parks

Partners: Montana State University, BLM, Little Bighorn College, Crow Tribe

Location: Montana

Progress:

- We are finishing up our analysis of fire history in Axolotl Lakes WSA.

2-7: Effects of management, climate change, and disturbance on wildlife biodiversity

We are assessing multi-scale impacts of climate and forest management on biodiversity and socio-ecological resilience in the Lake Tahoe region of the Sierra Nevada Mountains. Specifically, we are quantifying impacts to biodiversity conservation, forest resilience, fire dynamics, carbon sequestration, wetland integrity, air quality, water security, fire-adapted biotic communities, differing economics, and social and cultural well-being.

ALWRI personnel: Kira Hefty, Kathy Zeller (PoC)

Partners: Tahoe-Central Sierra Initiative, Pacific Southwest Research Station

Location: California

Deliverables:

- Peer Review Publication: Managing for biodiversity: The effects of climate, management and natural disturbance on wildlife species richness
- Peer Review Publication: (in press, Landscape Ecology): Spatiotemporal Patterns of Diversity and Diversity-Stability Relationships as a Function of Compounding Disturbances and Forest Management

2-8: Will Wilderness provide the aquatic refuge we expect in a changing climate?

We will identify locations where displaced and novel stream environments are likely to occur, with a focus on the NWPS and Wild and Scenic Rivers. We will then build upon existing models to determine whether the NWPS is large and connected enough to provide refuge for species of conservation concern and cultural significance in future climate scenarios.

ALWRI personnel: Kellie Carim (PoC), Kira Hefty

Location: Washington, Oregon, Idaho, Montana

Progress: We are working with partners in the U.S. Forest Service Rocky Mountain Research Station Water and Watersheds Program s and are considering options for project study design. We expect to begin data analysis in 2025.

2-9: Quantifying trends in high severity fire in wilderness and non-wilderness in the western US

We are updating, through 2022, our previous study that demonstrated an 8-fold increase in annual area burned at high severity from 1985-2017 in western US forests. We are evaluating how trends may differ among forest types (e.g. dry forest, cold forest) and wilderness vs. non-wilderness.

ALWRI personnel: Sean Parks

Partners: RMRS Missoula Fire Sciences Lab, Western Colorado University.

Location: Western United States

Deliverables:

- Data analyses completed
- Manuscript (submitted): Intensifying fire season aridity portends ongoing expansion of severe wildfire in western US forests

RPA3 - Stewardship effectiveness: Examine the effects and effectiveness of wilderness stewardship decisions, including the potential for and effects of management interventions

3-1: Wildlife responses to recreation noise

Using novel technologies in natural habitats in the Bridger-Teton National Forest in Wyoming, we experimentally exposed mammal and bird species to recreation sounds to 1) assess mammal behavioral

and stress responses to recreation sounds, 2) estimate changes in mammal and bird use of areas, and 3) quantify changes in diversity. We are using our results to create maps showing the spatial impact of recreation sounds for different species.

ALWRI personnel: Kathy Zeller

Partners: RMRS scientists, Bridger Teton National Forest, University of Montana, Boise State University, American Museum of Natural History

Location: Wyoming

Deliverables:

- Peer Reviewed Publication: Experimental recreationist noise alters behavior and space use of wildlife
- Manuscript (in preparation for peer review) on bird responses to recreation noise
- RMRS Project Web Page: Recreation Noise
- Many (est. 10-20) popular media outlets featured results from this research project.

3-4: Developing a monitoring protocol for a wild and scenic river recreation ORV (Outstanding Remarkable Value)

We designed and supported the implementation of a visitor experience survey to support required monitoring of Wild and Scenic Rivers with outstandingly remarkable recreation value. This survey was conducted to support the visitor satisfaction monitoring requirements laid out in Fossil Creek Wild and Scenic River's Comprehensive River Management Plan (CRMP).

ALWRI personnel: Chris Armatas, Jaclyn Fox Rushing (PoC)

Partners: Managers from the Coconino National Forest and the Tonto National Forest, Arizona Conservation Corps, University of Montana

Location: Arizona, with nationwide implications

Progress:

- Data collection complete
- Analysis underway
- The unit plans to carry the approach forward, with their own resources, in subsequent monitoring periods.
- While Fossil Creek is the test site, the broader monitoring approach (to be published in a GTR), will serve the broader WSR and VUM communities.

3-5: Benefits, costs, and challenges of prescribed fire in Wilderness

We are assessing the benefits, costs, challenges, and barriers of implementing prescribed fire in Wilderness.

ALWRI personnel: Clare Boerigter, Sean Parks (PoC)

Partners: Western Colorado University; California State University, Chico; University of Wyoming; USFS Pacific Southwest Region

Location: Nationwide

Deliverables:

- Peer-reviewed publication: Untrammeling the wilderness: restoring natural conditions through the return of human-ignited fire
- Manuscript (In preparation for peer review): Guardians and gardeners: Managing wilderness for the 21st century
- RMRS News Release: Workshop synthesis paper describes value of prescribed fire in wilderness areas
- White Paper: Prescribed fire and U.S. wilderness areas: Barriers and opportunities for wilderness fire management in a time of change
- StoryMap: Wilderness and fire: Barriers and opportunities in a time of change
- StoryMap: Untrammeling the wilderness: restoring natural conditions through the return of human-ignited fire
- RMRS Science You Can Use in 5 Minutes: Prescribed fire and wilderness: Barriers and opportunities in a time of change
- RMRS Webinar: Prescribed Fire and Wilderness: Barriers and Opportunities in a Time of Change

3-6: The role of interventions to conserve aquatic biodiversity in protected areas

This project reviews the history of human activities that have caused declines of freshwater biodiversity and examines the role of interventions to promote freshwater biodiversity in protected areas through the lens of the RAD Framework.

ALWRI personnel: Kellie Carim (PoC), Kira Hefty

Partners: University of Montana

Location: Nationwide

Deliverables:

- K. Carim led a graduate student seminar at the University of Montana exploring the role of interventions to preserve freshwater biodiversity in protected areas
- Manuscript (in review): Conserving freshwater biodiversity in U. S. protected areas – Management intervention and the RAD Framework

3-7: Evaluating a Resist-Accept-Direct (RAD) framework to address climate change in Wilderness

Through this project, we are engaging interagency managers, partners and scientists to evaluate a RAD decision-making framework to use in wilderness management.

ALWRI personnel: Chris Armatas, Kellie Carim, Kira Hefty (PoC), Olga Helmy, Teresa Hollingsworth, Sean Parks, Lauren Redmore, Jaclyn Fox Rushing, Kathy Zeller

Partners: FWS, BLM, NPS, USDA FS, many others

Location: Isle Royale National Park (Michigan and Minnesota), Kofa National Wildlife Refuge (AZ), Cabeza Prieta National Wildlife Refuge (AZ), Black Ridge Canyons Wilderness Area (CO), USDA FS Regions 1, 2, 4, 5, and 6 (CA, CO, ID, MT, NV, OR, WA, WY)

Progress and Deliverables:

- Webinar: Untrammeled and Natural? Ecological Transformation in Wilderness
- Webinar: RAD Decisions in Rad Landscapes: Introducing the Isle Royale Case Study
- Manager Interaction: Resist-Accept-Direct: A framework for social-ecological decisions for wilderness in transformation
- Completed all interview and biological analyses for each case study
- Completed all workshops and embedded focus group data collection
- Completed all workshops and embedded focus group data collection

3-8: Black Ridge Canyons Wilderness (BLM) - Evaluating a RAD for climate change in Wilderness

We convened a team of subject-matter and local experts to describe plausible, diverse future ecological scenarios for amphibian populations in the Black Ridge Canyons Wilderness and used this information to guide and inform conversations with managers when generating and evaluating R-A-D alternatives during a 2-day workshop.

ALWRI personnel: Kira Hefty (PoC), Olga Helmy, Teresa Hollingsworth, Sean Parks, Jaclyn Fox Rushing

Partners: Bureau of Land Management

Location: CO

Progress:

- Interviewed BLM staff involved in managing McInnis Canyons National Conservation Area (including Black Ridge Canyons Wilderness) and key subject matter experts about their perceptions of climate change and its impact on native frogs and toads, and challenges and opportunities to manage changing native frog and toad habitat.
- Wrote the first biological science report for the BLM case study and delivered science results to project partners
- Planned and executed two workshop practice sessions to prepare for the BLM workshop
- Organized and completed the first workshop (including focus groups) of the project in Grand Junction, CO
- Used thematic qualitative analysis to analyze pre-workshop interviews and focus groups from the workshop.
- Both biological and social science findings were summarized and included in final report for the BLM.

3-9: Whitebark pine, range-wide wilderness assessment (USFS) - Evaluating RAD in Wilderness

The whitebark pine case study, which encompasses the range of whitebark pine on USFS lands, considers the role of Wilderness in promoting whitebark pine conservation into the future. We have completed a quantitative assessment on projected current and future distribution of whitebark pine under climate change, which we used to inform and evaluate R-A-D alternatives with managers during a 2-day workshop in January 2025, with a group that included national wilderness leads to regional and unit-level practitioners. Our research will help bring together various efforts across agencies to support interagency collaboration and decision-making for WBP conservation and restoration within and beyond Wilderness.

ALWRI personnel: Kira Hefty (PoC), Olga Helmy, Teresa Hollingsworth, Sean Parks, Jaclyn Fox Rushing

Partners: USDA FS

Location: USA Whitebark Pine Range (Washington, Oregon, Montana, Idaho, Wyoming, Nevada, California)

Progress:

- Interviewed Forest Service staff across the U.S. range of whitebark pine about their perceptions of climate change and its impact on whitebark pine, and challenges and opportunities to manage changing whitebark pine in wilderness.
- Used thematic qualitative analysis to analyze pre-workshop interviews.
- We have modeled and mapped the climatic suitability for whitebark pine (WBP) under reference period (1961-1990) and future (mid-21st century) climate conditions. To date, we have produced draft maps of WBP climate suitability under reference period and future climate. We are currently evaluating these draft results.
- Manuscript (in preparation and to be submitted in March 2025): Whitebark pine to experience 80% reduction in climatically suitable area in U.S. by mid-21st century under climate change: implications for restoration planning
- Planned and completed two-day workshop (including focus groups) held January 22-23 in Missoula, MT.

3-10: Sonoran pronghorn in Cabeza Prieta and Kofa NWR (FWS) - Evaluating RAD in Wilderness

We are applying the RAD (resist-accept-direct) framework to create a multi-perspective decision space regarding Sonoran pronghorn recovery efforts within and outside designated wilderness in southern Arizona. Using climate projections to predict how habitat for Sonoran pronghorn may shift in the future, we are considering how current management resist strategies under different climate scenarios may or may not remain effective for promoting pronghorn recovery efforts.

ALWRI personnel: ALWRI personnel: Kira Hefty (PoC), Teresa Hollingsworth, Sean Parks, Jaclyn Fox Rushing, Kathy Zeller

Partners: FWS

Location: AZ

Progress:

- Held the Sonoran Pronghorn Case Study two-day workshop for February 25-26, 2025, in Yuma, AZ, at the AZ Game and Fish Department office (Completed 2/26/25).
- We completed preliminary analyses on habitat suitability for Sonoran pronghorn and are evaluating how climate change will impact habitat and landscape connectivity.
- Interviewed Fish and Wildlife Service, AZ game and fish, and NPS staff about their perceptions of climate change and its impact on Sonoran pronghorn, and challenges and opportunities to manage changing Sonoran pronghorn habitat in wilderness.
- Used thematic qualitative analysis to analyze pre-workshop interviews.
- Manuscript (in preparation and to be submitted by May 2025): Ghosts of the desert: Impacts of management and climate on habitat suitability and connectivity of an endangered species

3-11: Developing Wilderness Stewardship Training Evaluations for Arthur Carhart National Wilderness Training Center (Project completed)

Together, ACNWTC and ALWRI staff co-produced a flexible pre/post training questionnaire to evaluate effectiveness across Carhart training offerings (e.g., national, regional, and topic-based wilderness trainings). This new evaluation process identified the effectiveness of each training by comparing pre and post levels of participant understanding and confidence in key topics.

ALWRI personnel: Jaclyn Fox Rushing

Partners: Arthur Carhart National Wilderness Training Center

Location: Nationwide

Deliverables:

- In late FY23 ALWRI and ANWTC staff co-produced an optional post-training questionnaire and piloted it after the Ely, NV Regional Wilderness Stewardship Training in October 2023.
- In FY24 we continued to develop, pilot, and refine questionnaires across diverse training offerings to ensure reliability and flexibility of the instruments.
- We delivered the data and a report to Carhart staff summarizing the instrument and results from the Regional Wilderness Stewardship Training in Ely, NV.
- We delivered to Carhart staff the data and the evaluation instrument for the Regional Wilderness Stewardship Training in Silver City, NM.
- This project has been completed. Moving forward, ANWTC staff will independently administer the evaluation with analysis support from ALWRI as needed.

3-12: Informing decisions to resist, accept, or direct post-fire vegetation transitions in western US landscapes

We are addressing key science gaps that limit application of the RAD framework, which provides guidance for making management decisions in an era of rapid environmental change, to managing post-fire environments. We have identified plausible future ecological scenarios of vegetation change and fire

regimes at management-relevant scales, determined where the different RAD strategies may be most successful for the NW and NC CASC regions.

ALWRI personnel: Sean Parks

Partners: Multiple partners from USFS including RMRS Missoula Fire Sciences Laboratory, NPS (Mt. Rainier, North Cascades, Yellowstone, and Rocky Mountain National Parks), BLM, University of Montana, and The Nature Conservancy.

Location: Forest and shrubland systems Western USA, Washington, Oregon, California, Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico

Deliverables:

- Webapp under development
- Manuscript (in preparation): Mapping vegetation shifts in western US protected areas under a warming climate

3-13: Isle Royale NP, RAD in Wilderness

We are evaluating use of the RAD (resist-accept-direct) framework to describe a multi-perspective decision space surrounding habitat management options responsive to forest composition change on Isle Royal and to highlight the ecological, social, and legal trade-offs and consequences of selecting resist, accept, or direct in space and time on Isle Royale. Model results and workshop discussion will also help inform a wildfire management plan revision NPS staff are currently engaging on.

ALWRI personnel: Clare Boerigter, Kira Hefty (PoC), Teresa Hollingsworth, Olga Helmy, Sean Parks, Jaclyn Fox Rushing

Partners: NPS Tribal partners from the Grand Portage band of Lake Superior Chippewa

Location: Michigan, Minnesota

Progress:

- We worked with the Director of Natural Resources for the Grand Portage Band of Lake Superior Chippewa and with RMRS Grants and Agreements staff to create and execute a data sharing agreement to ensure our research participants and partners from the Grand Portage Band have sovereignty over the data they share and the results they help produce. Though unfunded, this is the first agreement ALWRI has made to support Tribal data sovereignty.
- We completed our workshop with NPS and the Grand Portage Band of Lake Superior Chippewa, in Nov 2024.
- We completed our biological analysis of forest composition change (presented at the workshop above).
- Interviewed NPS and Grand Portage Band staff about their perceptions of climate change and its impact on key resources including boreal forests and challenges and opportunities to manage forest change in wilderness.
- Used thematic qualitative analysis to analyze interviews.

- We continue to update our biological modeling to incorporate management strategies that workshop participants generated during the workshop.
- Manuscript (in preparation to be submitted by June 2025): Shifting vegetation communities on Isle Royale: Socio-ecological implications and RAD solutions

3-15: Wilderness Character Monitoring: Looking Ahead

We will analyze wilderness character monitoring (WCM) data collected in Wilderness throughout the NWPS, to assess data quality and categories and, where possible, detect and assess trends. We will explore challenges encountered by each agency during monitoring. When appropriate, we will provide guidance for on-going monitoring by evaluating whether current data collection aligns with the intended goals of wilderness character monitoring.

ALWRI personnel: Kira Hefty

Partners: USDA FS, NPS, FWS, BLM

Location: Nationwide

Progress:

- Attended regular interagency wilderness character monitoring working group (IWCM) meetings
- Brainstormed research ideas given information gathered from managers
- Provided feedback to interagency wilderness character monitoring program leads on new WCM database

RPA4 – Expanding our understanding of wilderness relevance

4-1: Developing a visitor use survey to support wilderness stewardship planning

This project aims to provide social science support for visitor use management within Wilderness inside NPS units, using both quantitative and qualitative approaches. The quantitative element constitutes a survey instrument that can be applied in multiple NPS units over time, with slight variations depending on the context. The qualitative element includes interviews with organizations representing various communities, to understand barriers and perspectives related to visiting Everglades NP and other sites within the NPS.

ALWRI personnel: Chris Armatas (PoC), Jaclyn Fox Rushing

Partners: NPS, Everglades National Park, University of Montana

Location: Everglades National Park, Florida. North Cascades National Park, Washington

Deliverables:

- Peer review publication: Exploring underserved communities' perspectives on wilderness character in Everglades National Park
- Peer review publication: Negotiating constraints to recreation in Everglades national Park among underserved South Florida Residents

- Peer review publication: U.S. wilderness in the 21st century: A scoping review of wilderness visitor use management research from 2000 to 2020

4-2: Understanding trends in recreation and visitor use (Project completed)

This project focused on better understanding visitor perceptions and travel patterns in the Rattlesnake Wilderness and National Recreation Area and nearby city open space. We used a trends analysis to describe both current visitor perceptions and changes in those perceptions since data was collected in the early 1990s.

ALWRI personnel: Chris Armatas

Partners: UM, the USFS, and the City of Missoula

Location: Rattlesnake Wilderness Area, Montana

Deliverables:

- Peer review publication: The Effect of Place Attachment and Leisure Identity on Wildland Stewardship, Leisure Sciences
- Data Archive. Trends in Visitor Use, Rattlesnake Wilderness and National Recreation Area and nearby city open space. University of Montana, USFS, City of Missoula.

4-3: Developing a framework for user capacity determination for Wild and Scenic Rivers

This research aims to provide a framework for completing the policy (legal and administrative) mandated 'user capacity' determination for Wild and Scenic Rivers (WSR). This project provides an initial case study on the 'recreational' segment of the Main Salmon River and an example for the WSR management and planning community at large, while also meeting the immediate needs of the Salmon-Challis NF, who administers the Wild and Scenic Salmon River in Idaho.

ALWRI personnel: Chris Armatas

Partners: Forest Service NFS, University of Montana

Location: Salmon River (Idaho) WSR, Idaho

Deliverables:

- Final report near final; two data archives submitted.

4-4: Wilderness Condition Monitoring support

This project provides science support for monitoring of elements critical to wilderness stewardship. This research currently includes two projects: 1) campsite data set compilation and analysis for the Frank Church River of No Return Wilderness; 2) data set analysis and methodology consultation related to encounters in Sequoia and Kings Canyon National Parks.

ALWRI personnel: Chris Armatas

Partners: USDA FS, NPS

Location: Frank Church–River of No Return Wilderness Area, Idaho, Sequoia and Kings Canyon National Parks, California

Deliverables:

- Report for managers: A Review of Sequoia-Kings Canyon National Park Wilderness Solitude Monitoring

4-6: Examining Relevance of Wilderness in the California Desert (Project completed)

This qualitative project was based on semi-structured interviews with partner organizations of the BLM, managers, and visitors to wildland areas in two BLM Wilderness areas in Southern California (Mecca Hills and San Gorgonio) and aims to advance our understanding of issues related to access in wilderness.

ALWRI personnel: Chris Armatas, Jaclyn Fox Rushing (PoC)

Partners: BLM

Location: Mecca Hills Wilderness Area and San Gorgonio Wilderness Area, California

Deliverables:

- Report for managers and other partners: Examining relevance of wilderness in the California Desert
- Manuscript (In preparation for peer review): Wilderness relevance and roles community organizations and partners play in increasing wilderness relevance in the CA desert.

4-7: Exploring Wilderness heritage in South Carolina

This project seeks to advance an understanding of how Wilderness is meaningful to rural communities in Low and mid-country, South Carolina. By bridging oral histories with decades of landscape-level data, we are exploring questions around land use change to better understand changing relationships to Wilderness.

ALWRI personnel: Lauren Redmore

Partners: NPS, FWS

Location: Congaree National Park Wilderness Area, Cape Romain Wilderness Area, Francis Marion National Forest, South Carolina

Deliverables:

- Book Chapter (In review): Roots in the swamp: Narratives of relationships to wilderness
- Eight oral history interviews completed and in preparation for archiving

4-8: Examining hunting and fishing groups to increase retention in the outdoors

We are exploring and mapping the locations of hunting and fishing groups across five states in the Mountain Prairie region to better understand how mentoring through groups can improve retention in

outdoors sports. This project is the first step in a project aimed at understanding and improving wilderness access for local communities.

ALWRI personnel: Lauren Redmore

Partners: South Dakota State University

Location: Mountain Prairie Region: Montana, South Dakota, North Dakota, Wyoming, Colorado, Utah, Nebraska

Progress and Deliverables:

- Interactive map: Hunting and fishing groups in the Mountain-Prairie Region
- Hosted two community of practices with group leaders (in person and virtual)
- Shared findings at 6 conferences, including as keynote to Pheasant Fest, and through two FS R&D virtual events, including a ScienceX talk and a Science You Can Use webinar
- Developed two videos on hunting and fishing groups, including one video on overall project and one on the Community of Practice of group leaders (See project page).
- Created a handout to share findings on effective programming for building programming for hunting and fishing and shared with state fish and wildlife agency programming leaders
- Three manuscripts, in preparation
- Two MS theses and associated databases, archived at SDSU

4-9: Community science for more comprehensive wilderness stewardship

This project examines how citizen science opportunities can expand the definition of wilderness stewardship (beyond trail and weed management), as well as invite groups to engage in wilderness recreation and stewardship. We are examining how partnership-supported citizen science opportunities can expand the definition of wilderness stewardship and exploring how citizen science can establish meaningful relationships between community members and wilderness. This project is connected to project RPA 1-7 (Pyrodiversity and aquatic species distribution in Wilderness).

ALWRI personnel: Kellie Carim, Teresa Hollingsworth, Lauren Redmore (PoC), Jaclyn Fox Rushing

Partners: USDA FS, Bob Marshall Wilderness Foundation

Location: Bob Marshall Wilderness Area, Flathead National Forest, Montana

Progress:

- Completed interviews and identified the scope and scale of research outputs
- Supporting a SWS fellow to conduct literature reviews, data cleaning, and analysis around this project
- Presented work at a training facilitated by the Arthur Carhart National Wilderness Training Center, and at the annual Bob Marshall Wilderness Managers meeting.
- Report and manuscript (In preparation)

4-12: Understanding visitor experiences and travel patterns to support visitor use management in Curecanti National Recreation Area (CURE)

This project seeks to develop descriptive information about visitor use types, amounts, and patterns as well as perceptions of visitor experience on the high visitation Blue Mesa Reservoir and the adjacent Gunnison River at CURE. Limited data about visitor use and experience exist for Blue Mesa Reservoir and the adjacent Gunnison River. Understanding current conditions, experiences, and associated relationships regarding visitor use on Blue Mesa Reservoir and the adjacent Gunnison River is essential for park planning.

ALWRI personnel: Chris Armatas

Partners: University of Montana, NPS

Location: Curecanti National Recreation Area, Colorado

Progress and Deliverables:

- Data collection complete, and analysis ongoing.

4-13: Advancing understanding of manager and visitor perspectives of recreation allocation systems

This research aims to broadly understand manager and visitor perspectives on recreation allocation design, that is, the phase of management following the decision to limit use to a resource. Using our recently completed a literature review and results from a related qualitative study with public land managers on the topic of recreation allocation, we are entering the publication phase of the manager-oriented work and planning for a visitor-facing study.

ALWRI personnel: Chris Armatas

Partners: University of Montana, USDAFS WWSR

Location: Alpine Lakes Wilderness Area, Washington; Cleveland National Forest, California; and nationwide

Deliverables:

- Manuscript (in preparation for peer review): Visitor Perspectives, Preferences, and Behaviors concerning Recreation Allocation: A Systematic Review
- Manuscript (in preparation for peer review): Muddling through it: Analyzing public land manager perspectives on recreation allocation
- Interactive map: A Mosaic of Management: Exploring and Mapping Recreation Confinement in Parks and Protected Areas in Colorado
- Report for managers: Allocating Recreation with Fairness at the Forefront: A research-based planning and management handbook

4-14: Informing Boundary Waters Canoe Area and Wilderness (BWCAW) management with visitor experience and travel pattern data

This research aims to provide direct support to the Forest Plan amendment of the SNF focused on visitor use management in the BWCAW. The project supports SNF managers in two ways: 1) we are updating an existing travel model with new trip itineraries and 2) we are collecting evaluative data from visitors about their experience, including values, motivations, and management preferences. The survey is planned for this winter/spring, pending OMB approval.

ALWRI personnel: Chris Armatas

Partners: University of Montana, Superior National Forest, USDA Forest Service

Location: Boundary Waters Canoe Area Wilderness Area, Minnesota

Deliverables:

- Proposed survey undergoing the approval process.

4-15: Expanding our conceptualization of wildland recreation experiences

This research aims to understand if there is a pro-social view of wildland recreation that exists among wildland recreators in the state of Washington. Through an analysis of online trip reports, using machine learning models, this research aims to identify and better understand those perspectives that may convey pro-social views of wildland recreation.

ALWRI personnel: Chris Armatas

Partners: Pacific Northwest Region, Region 6, USDA Forest Service, University of Washington, Seattle, Washington

Location: Washington

Deliverables:

- Data analysis ongoing.

RPA5 - Shared Stewardship: Improve our understanding of co-production approaches and abilities to harmonize multiple knowledge systems towards more inclusive wilderness stewardship

Ext-CA2: Understanding global issues in natural resource governance and wilderness

This collaboration is part of a series of scholarly exchanges to benefit the stewardship and protection of our Earth's wildlands. This particular project has a component focused on China and a component that is Global in scale.

ALWRI personnel: Chris Armatas

Partners: Yunnan University, The WILD Foundation

Location: Global

Deliverables:

- Peer Reviewed Publication: Understanding stakeholder perceptions of environmental justice: A study of tourism in the Erhai Lake Basin, Yunnan Province, China
  Book Chapter: International wilderness in the twenty-first century: A global review. In Wilderness management, stewardship and protection of resources and values. Eds: Chad P. Dawson, John C. Hendee. 2025.

5-2: Shared stewardship for Wilderness management in Alaska

We are seeking to understand challenges and opportunities to adopting an "inhabited wilderness" management approach to Wilderness in Alaska through this developing project, broadly focused on exploring unique approaches to managing Wilderness in Alaska, particularly as it relates to ANILCA.

ALWRI personnel: Chris Armatas (PoC), Teresa Hollingsworth, Lauren Redmore

Partners: NPS: Wrangell-St. Elias and Denali NPs. Copper River-Ahtna Intertribal Resource Conservation District

Location: AK

Deliverables:

- We conducted interviews with 21 key informants, transcribed interviews, and are preparing write-ups to share back results with Alaska collaborators.
- Data analysis ongoing.

5-3: Expansion of scientific foundations and development of the M3P tool

We are building up an already established protocol for engaging the public during large-scale planning processes in two ways. First, we aim to expand the scientific foundation of the protocol through further publication of related work and applications. Second, we will work with partners to continue the development of the Mapping, Prioritization, and Public Participation (M3P) tool, which includes the integration of two existing public engagement approaches.

ALWRI personnel: Chris Armatas

Partners: PNW Research Station

Location: Mendocino National Forest, CA

Deliverables:

- Peer Reviewed Publication: A pragmatist ecological economics - Normative foundations and a framework for actionable knowledge

5-4: Exploring the relationship between federal land managers and non-governmental Partners: A study focused on national trail partnerships

ALWRI scientists will provide a research perspective for this project focused on understanding indicators of success for trail partnerships.

ALWRI personnel: Chris Armatas

Partners: Virginia Tech University, USFS, and NPS.

Location: Nationwide

Deliverables:

- Manuscript (in preparation for peer review) on trust in trail partnerships.

5-5: Developing and evaluating shared stewardship approaches in high-use wilderness areas

Alpine Lakes Collaborative (ALC) is a shared stewardship group focused on planning the future of a high use Wilderness area outside of Seattle. We are advancing understanding of collaborative arrangements between tribal entities and federal land managers and evaluating the ALC to understand what works (and what does not) for a collaborative, shared stewardship effort, with the intent to capture and communicate how transferable this approach might be to other Wilderness areas.

ALWRI personnel: Chris Armatas (PoC), Stephanie Barron, Lauren Redmore

Partners: University of Washington, USFS managers and planners, NGOs, Tribal Communities

Location: Alpine Lakes Wilderness Area, Washington

Progress and Deliverables:

- Conducted interviews and collected surveys from 35 members of the ALC
- Supported ongoing ALC efforts on governance, partnership and funding
- Developed a focus group approach to better understand Snoqualmie Tribal member connections with wilderness
- Advancing a video to share diverse perspectives on the Alpine Lakes Wilderness and the challenge of management
- Conducted a case study approach to learn more about US government efforts for federal-Tribal shared stewardship and co-management
- Conducted a literature review to understand the body of literature on federal-Tribal shared stewardship and co-management in the northwest region of the USA
- Data analysis ongoing.

5-6: A synthesis of desired conditions for visitor use management

This synthesis is a supplement to the desired conditions guidebook, created by the Interagency Visitor Use Management Council (IVUMC).

ALWRI personnel: Chris Armatas

Partners: USFS and NOAA.

Location: Nationwide

Deliverables:

- Peer review publication: Embracing the public participation process for developing desired conditions: building relationships for actionable knowledge

5-7: Coproduction of knowledge with the Shoshone-Bannock Tribes on Chinook salmon restoration

We are using eDNA sampling to monitor changes in Chinook salmon distributions in response to reintroduction efforts by the Shoshone-Bannock Tribes in their homelands across the Salmon River basin.

ALWRI personnel: Kellie Carim

Partners: Shoshone-Bannock Tribes

Location: Idaho: Frank Church–River of No Return Wilderness Area, Sawtooth Wilderness Area, Salmon River (Idaho) WSR

Progress:

- In addition to the data that has been collected, we are establishing a working group with USFS Researchers and Shoshone-Bannock Fisheries managers to strategize research and information needs with tribal input.

5-8: Coproduction of ALWRI science plan, delivery, and application (Project completed)

With the successful application of a structured social science process in support of ALWRI's science planning, we published work to highlight our innovative, co-production process; and advanced the effort from understanding thematic needs, to understanding the most effective way of delivering science to address those needs.

ALWRI personnel: Chris Armatas, Kellie Carim, Kira Hefty, Olga Helmy, Teresa Hollingsworth (PoC), Sean Parks, Lauren Redmore, Jaclyn Fox Rushing, Kathy Zeller

Partners:

Location: Nationwide

Deliverables:

- Peer review publication: The Future of Wilderness Research: A 10-Year Wilderness Science Strategic Plan for the Aldo Leopold Wilderness Research Institute
- Peer review publication: Reflecting on the co-production ideal through practice
- Peer review publication: Examining and strengthening the role of science in wilderness decision-making
- Archived data from Google jamboard data collection with wilderness managers

5-10: Federal-Tribal co-stewardship of Wild and Scenic Rivers

Using a comparative case study approach of shared stewardship between WSR staff and Tribes across two rivers in the continental US, we are exploring the Federal-Tribal Wild and Scenic River shared stewardship planning and practice, with a focus on how WSRs are accounting for and integrating Tribal treaty rights, Indigenous Traditional Ecological Knowledge, and Tribal values and outside perspectives.

ALWRI personnel: Kellie Carim, Lauren Redmore (PoC), Jaclyn Fox Rushing

Partners: Yavapai Apache Tribe

Location: Arizona, Missouri

Progress:

- Completed interviews
- Transcribed interviews
- Analyzed findings

5-11: Combining Indigenous Knowledge and western science to examine biodiversity loss and ecosystem health across Alaska Wildernesses

By combining Indigenous Knowledge with western science, we are examining aquatic biodiversity and ecosystem health in the Yukon and Koyukuk Rivers (including Innoko and Koyukuk Wilderness Areas).

ALWRI personnel: Kellie Carim (PoC), Teresa Hollingsworth

Partners: NPS, FWS, University of Alaska Fairbanks, State of Alaska

Location: Alaska: Innoko Wilderness Area, Koyukuk Wilderness Area, Yukon-Charley National Park

Progress: Completed background research on existing eDNA data, related to subsistence fisheries in AK, that has already been gathered by ADFG and researchers at Univ. of AK-Fairbanks.

5-12: Understanding Alaska Native perspectives on climate change impacts on Indigenous lifeways

We will use conservation photography and Indigenous knowledge methods to respectfully document, examine, and share Alaska Native perspectives of the impacts of climate change on federally designated protected areas, flora and fauna, and traditionally-associated Indigenous lifeways. We will also explore connections between people and place, and the ways that federally designated protected areas may support or hinder how Alaska Natives are adapting their lifeways in the face of climate change.

ALWRI personnel: Chris Armatas, Lauren Redmore (PoC)

Partners: Tanana Chief's Conference

Location: Alaska

Progress: Project is still in early stages of development.

5-13: Science communication for wilderness stewardship--Toolboxes for Wilderness Connect

Wilderness Connect's (wilderness.net) toolboxes are an important resource for wilderness managers. However, many of the toolboxes require updates. This project is an effort to extend the existing collaboration to collect, collate, and add new science-based content to the Wilderness Connect Toolboxes, and to use scientific best practices in developing, testing, and monitoring impacts and efficacy of science communication and professional resources delivered through Wilderness Connect.

ALWRI personnel: Lauren Redmore and Jaclyn Fox Rushing (PoC)

Partners: University of Montana, Arthur Carhart National Wilderness Training Center, FWS, BLM, NPS

Location: Nationwide

Progress: Project is still in early stages of development.