

NWAL Year 6 Progress Report



**WATER FOR AGRICULTURE CHALLENGE AREA:
ENHANCING CLIMATE RESILIENCY AND AGRICULTURE
ON AMERICAN INDIAN LAND**



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**NATIVE WATERS ON ARID LANDS (NWAL)
YEAR 6 PROGRESS REPORT (JUNE 2021)**

Non-Technical Summary (original from project initiation)

American Indian farmers and ranchers provide an important economic base for rural areas in the Great Basin Desert and arid lands of the American Southwest. Sustaining agricultural production for ceremonial practices, sustenance, and trade is becoming more challenging for American Indian communities due to the scarcity of water resources, rapid change in ecosystem composition and health, and historic land tenure policy arrangements. Climatic change including reduced snowpack and rainfall and increased temperatures, combined with urban and industrial expansion in the American West is increasing demand for a dwindling supply of water from rivers, streams, and underground aquifers. Close cultural ties to natural resources, geographic remoteness, and economic challenges have led some to characterize American Indian agriculturalists as some of the most vulnerable to climate change.

Our project seeks to enhance the climate resiliency for agriculture on American Indian lands of the Great Basin Desert and Southwest by building the capacity within tribal communities to develop and implement reservation-wide plans, policies, and practices to support sustainable agriculture and water management. We will analyze past and future climate risks to traditional and production agriculture and test the feasibility of introducing innovative alternative agricultural practices and water management policies to enhance resiliency. We will accomplish this by harnessing the expertise of research and Extension faculty from 1862 Land Grant Universities (University of Nevada, Reno, Utah State University, and University of Arizona) in partnership with the First American Land-Grant Consortium of 1994 Tribal Colleges and Universities, researchers from the U.S. Geological and Desert Research Institute, and tribal community members from Nevada, Utah, Arizona, and New Mexico.

Our integrated team of research and Extension faculty will partner with American Indian water specialists, cultural advisors, agriculturalists, and educators to collaboratively develop climate scenarios and water supply projections for the tribal lands and surrounding arid areas. Tribal members and researchers will test the effectiveness of existing and future water infrastructure systems to optimize profits and production efficiencies under these climate scenarios. Researchers will study alternative water management policies being adapted worldwide in rural and agricultural areas and assess how these policies could improve climate resiliency in our area. Policy experts and tribal members will assess the efficacy of the federal government's "trust" land tenure system to support or impede tribal water management and agricultural sustainability under the climate scenarios. Researchers will create a set of time series of paleoecological data of tribal land ecosystems and correlate this with climate data to identify extreme events and periods of prolonged climatic change. Interviews with tribal members will be used to gather traditional knowledge about their community's response to these events and the impacts of these events on tribal culture and agricultural production. Knowledge generated and shared through this project will build understanding among tribal and non-tribal organizations about challenges and opportunities for sustaining tribal agriculture and cultural traditions in a changing climate.



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Major Goals (original from project initiation)

The **long-term goal** of this proposed project is to increase the climate resiliency of agricultural production on American Indian lands of the Great Basin region through collaborative generation and analysis of alternative policies, water plans, economic models, and agricultural practices.

Specific objectives to achieve the long-term goal of this project are:

- Increase climate resiliency of tribal communities in Great Basin Desert area
- Increase mutual understanding of traditional ecological knowledge among tribes and research communities
- Increase capacity of American Indian communities to sustainably manage agricultural water resources
- Increase capacity of tribal nations to sustain agricultural and cultural traditions
- Build/enhance tribal capacity to develop reservation-wide plans and policies to support sustainable agriculture and water management/use
- Strengthen 1862 & 1994 Land Grant institution research and Extension partnerships
- Harness FRTEP, 1862 & 1994 Land Grant institution human capital & infrastructure to address climate change issues on reservation lands

Year 6 Target Audience

NWAL outreach to our tribal partners relies on the integration of three critical activities.

- Academic research conducted with and in support of our tribal partners
- Federally-Recognized Tribal Extension (FRTEP) agents who are tribal members and live and work in their communities
- Tribal College & University (TCU) Extension Faculty and agents who engage students and faculty in support of tribal community agriculture and who participate in the FALCON network of TCUs to share experiences and best practices

NWAL Target Audiences reached:

- *Tribal Partner Engagement:* NWAL collaborating tribal organizations and tribal government officials and agencies
- *Federal and State Public Agency Engagement:* U.S. Bureau of Reclamation, U.S. Dept. of Agriculture, Bureau of Indian Affairs, U.S. EPA, Arizona Department of Water Resources, Central Arizona Project, Salt River Project, New Mexico Office of State Engineer, NM Interstate Stream Commission, NM State University, Lower Rio Grande Water Users Association, Colorado Water Conservation Board, Colorado Office State Engineer
- *Scientific Community & Water Stakeholders Engagement:* Arizona Farm Bureau, Arizona Cooperative Extension, Family Farm Alliance, The Nature Conservancy, Western Resource Advocates, Sonoran institute, ProNatura, Western Governors Association, Western States Water Council, National Audubon Society.

During NWAL Year 5-6 the AZ and NV FTREP Programs expanded their outreach to Tribes in the project area including:

- UA-FRTEP engaged Native American farmers, ranchers, natural resources managers and land managers from: Ak-Chin Indian Community, Colorado River Indian Tribes, Hualapai, Hopi Nation, Gila River Indian Community, Navajo Nation, Pascua Yaqui, Salt



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River Pima Indian Community, San Carlos Apache Nation, Tohono O'odham Nation and the White Mountain Apache Nation.

- NV-FRTEP engaged Native American farmers, ranchers, natural resources managers and land managers from: Duck Valley Shoshone-Paiute, Fallon-Shoshone, Pyramid Lake Paiute, Walker River Paiute, Washoe Tribe, and other through the Intertribal Council of Nevada

During Year 6 the NWAL Project expanded its outreach to tribes throughout the United States through the NWAL COVID-19 Action Working Group (COVID WG for short), which was started in March 2020 to address urgent issues related to the COVID-19 pandemic with Tribal communities and federal agency partners (USDA/OTR and NIFA, USFS, FEMA, HHS, CDC and others as needed). The COVID WG has transitioned to addressing urgent issues associated with the current extreme drought impacting the western US. It meets weekly on Zoom and has expanded to over 200 participants from across the US and Alaska with participants joining from FRTEP, 1994 TCU Extension, 1862 Extension, Ag Experiment Stations, Climate Adaptation Science Center (CASCs), USDA Climate Hubs, and many others.

NWAL Year 6 Accomplishments

What was accomplished under these goals? Accomplishments for the project objectives outlined above have been aggregated into four categories (Outreach, Communications & Project Management; Research, Data Collection & Analysis; Tribal College Research, Education & Outreach; and FRTEP Extension and Outreach). Outreach activities are reported below under dissemination of results to stakeholders. The accomplishments listed below represent the combined effort of many Co-PDs working together and with their respective research, Extension, and education tribal and non-tribal partners. Highlights of NWAL Year 6 accomplishments are listed below. A more detailed report will be posted on the NWAL website.

Impacts of COVID-19 Pandemic on NWAL programs: Due to COVID shutdowns and restrictions in 2020-2021, all in-person events including the NWAL Summit, workshops, training, etc. were canceled or moved virtually. NWAL participants did not travel during Year 6 of the project. We did conduct outreach with Tribal partners, faculty, and students, through Zoom and other on-line platforms, completed most research activities, and published results and outreach materials. All TCUs were closed to in-person education and outreach during most of NWAL Year 6. This presented significant challenges for Tribal Extension faculty and students involved in NWAL activities due to lack of available broadband connectivity to participate in virtual training, high levels of COVID illness and death among reservation communities, and severe economic disruptions.

Meeting COVID-19 Challenges: In March of 2020 the NWAL Team adapted to the COVID-19 pandemic by rapidly transitioning our in-person meetings, workshops, and focus groups to virtual platforms. We also established the NWAL COVID-19 Action Working Group to work with tribes from the Southwest, Great Basin, and Northern Rockies and Great Plains to identify and address urgent COVID-19 impacts in Indian Country. Participation has expanded to include 1994 and 1862 Tribal Extension agents from across the country and Alaska, and other 1862



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Extension and Agriculture Experiment Station partners, as well researchers and agency partners. By joining forces from the NWAL network of researchers, FRTEP agents, and TCU faculty, working directly with federal agencies, state and local organizations, and non-profit groups we have been able to address urgent COVID-related impacts in tribal communities. As the COVID crisis evolved, the COVID WG partnered with CDC, HHS, and others to provide information to Tribes to support COVID vaccine education through our newly created Facts Not Fear website: <https://factsnotfearcovid.com>

We have also partnered with the Intertribal Agriculture Council (IAC) to provide regular updates and guidance to the group on CARES Act and American Rescue Act relief funds for Tribal farmers and ranchers. During the Spring of 2021, the COVID crisis morphed into an extreme drought crisis with drought conditions worsening across the western US. Our COVID WG is now focusing on a wide range of topics related to drought impacts on water supplies and agriculture. The accomplishments of this group are a testament to the extensive outreach among diverse communities in Indian Country maintained by our FRTEP and TCU partners, the commitment of NWAL researchers to their knowledge and resources to solving real-world problems, and the dedication of our federal partners at USDA and other agencies who have working tirelessly to help us meet the rapidly evolving challenges created by both the COVID-19 pandemic and now the worst drought on record.

New funding for NWAL follow-on projects: Co-PDs and partners McCarthy, Emm and Hebb (UNR-Extension), Teegerstrom (UA), Bocinsky (U. Montana), Lutz (DRI), developed the COVID Toolkit Project that was funded in fall 2020 under USDA/NIFA COVID CARE program (Award 2020-68008-32762) called *NWAL Toolkit Project*. This new project is designed to make research and outreach products from NWAL available to FRTEP agents working in the field with Tribal farmers and ranchers. New resources are also being developed to support Tribal Extension agents in helping their communities deal with the impacts from the ongoing extreme drought. Co-PDs McCarthy, Bocinsky, and NWAL partner Virgil Dupuis (Tribal Extension Director, Salish Kootenai College) applied for and were awarded a USDA-NIFA Conference Grant (Award 2021-67019-33420), called *All Climate is Local*, to share NWAL climate, water and agriculture resources with other TCUs in the Crown of the Continent (MT, ND, SD, and NE). Both of these projects are ongoing and have been converted to be conducted virtually. Co-PD Collins (DRI), was awarded a NIFA Women and Minorities in Science (WAMS) grant (USDA WAMS 2020-02337), called *Teaching Native Waters*, to work with Native 6-12 teachers in the Four Corners region in translate NWAL climate and water research into place-based teaching modules that can be used in classroom.

Research, Data Collection & Analysis

- ***Water Resources & Economics:*** Co-PD Colby shared (virtually) accessible, easy-to-understand material on water economics and management for tribal nations and their representatives. These materials developed under NWAL are designed to be useful to tribes considering participation in regional water management initiatives and water trading that may help mitigate current and future drought impacts. Tribal governments around the western UA are exploring and implementing voluntary collaborative agreements to share water and water-supply risks, in partnership with federal and state

agencies, agriculture, cities and environmental stakeholders. These types of arrangements can be an effective approach to address water shortage threats in regional economies and can provide revenues to tribes. Co-PD Edwards and graduate student Sanchez constructed a 50-year dataset of land-use outcomes to evaluate tribal water settlements, demonstrating the ongoing gap between tribal water rights and on-reservation water use.

- **Climate adaptation:** Co-PDs McCarthy, Kauneckis, Chief, and Bocinsky shared NWAL research output on climate adaptation in Tribal communities during virtual conferences including the National Tribal & Indigenous Climate Conference (NTICC), the Global Conference on Science & the Environment, the Intertribal Agriculture Conference Annual Meeting.
- **Water sources and water quality:** Co-PD Lutz continued to build out the NWAL Knowledge Portal with resources and an inventory of web-based repositories related to water resources and water quality (e.g., groundwater well, surface, spring). These resources are being used to support drought mitigation training and outreach by our Tribal Extension agents and others. NWAL has partnered with UA and a local non-profit to implement rainwater harvesting with Tribal communities in Peach Springs, Arizona.
- **Climate data for Tribes.** Co-PD Bocinsky, augmented downscaled climate data for Tribes across the Intermountain West with updated information on drought conditions, seasonal weather and wildfire conditions, and resources available from the North American Drought Atlas, US Drought Monitor, and NOAA/NIDIS. He also trained Tribal partners on climate services available through the Montana Climate Office.
- **Drought Management strategies:** Co-PD Curtis completed and shared data analysis on producer preferences for drought management strategies for forage, fresh produce, and livestock; published an assessment of major crops and cost of production studies available for SW Indian Reservations; and analyzed and published data on barriers and impediments to climate change mitigation in agriculture; and conducted production studies and risk analysis of drought on crops.
- **Awards:** Co-PD Chief awarded *U. Arizona Extension Faculty of the Year*.

Tribal College Research, Education & Outreach

- **Faculty-Faculty Research Partnership (FFRP) program.** Upon successful completion and evaluation of the Aaniiih Nakoda College/Desert Research Institute (ANC/DRI) pilot project, a FFRP was implemented with Navajo Technical University (NTU), DRI, and FALCON. Phase I of the project is a desk-top evaluation of stream “health” in the San Juan River system that crosses the state lines of Colorado, New Mexico, Utah and Arizona and flows through tribal lands. Biological indices will be calculated using these benthic invertebrate following the guidance of each states’ regulatory agencies, and the results will be compared to evaluate how the sites would be classified in terms of “impairment” by each state’s biocriteria method. Phase II of this project will include a field study of stream “health” in the San Juan River system. More specifically, in-stream biosurveys will be conducted at the previously studied sites on Navajo lands, as well as additional sites near state boundaries which were included in the 2016 agency monitoring programs. Sampling and analysis methodologies used by each of the state and tribal jurisdictions will be followed. The results will be interpreted to look for temporal trends

in terms of post-spill “recovery”, and additional differences in how sites might be classified in terms of “impairment” with this enhanced sampling program.

- **Developed a sharable and adaptable Water Resources in a Warming World course.** FALCON, in partnership with USDA NIFA and the DRI developed a “Water Resources in a Warming World” course. This course is designed with stackable, plug-and-play modules that can be incorporated into existing environmental, water or climate change related courses; or as a standalone 3-credit undergraduate course. It can also be easily adapted for extension community education and/or continuing education units. It will be portable into any standard distance learning platform. The course can be offered as part of a degree program, certificate program, and/or as a special topics course. Additional resources may include a train-the-trainer course to help TCU instructors deliver the material, guest lecturers that can deliver the material at-distance, or adjunct professors who can teach the full course at-distance. The curriculum can be found at: <https://nativewaters-aridlands.com/teacher-resources/water-resources-in-a-warming-world/>.
- **Promote understanding and appreciation of Native Waters in the Missouri River watershed.** Nueta Hidatsa Sahnish College (NHSC), tribally chartered by the Three Affiliated Tribes of the Fort Berthold Reservation in New Town, North Dakota, in collaboration with DRI and FALCON secured a NIFA Tribal College Research Grant Program award of \$220,000 for the following project objectives: 1) Develop and test a method by which TCU students can compile comprehensive information about past and present importance of the Missouri River and associated valued resources to their community; 2) Develop and test a method by which TCU students can quantify Missouri River economic benefits in their community (e.g. irrigation, drinking water, fisheries, recreation, flood control, etc.); 3) Develop and test a method by which TCU students can summarize current Tribal Water Programs and relate those to the Pick-Sloan program. (e.g. tribal water policies, river monitoring, climate resilience / flood control planning, assertion of water rights, river access, etc.); 4) Provide additional Student Research opportunities at NHSC; 5) Share tested methods among all 15 TCUs in the watershed; and 6) Host workshop with interested TCUs in the Missouri River watershed to consider formation of a consortium to find ways to pursue common goals and research interests.
- **Expanded relationship with Salish Kootenai College (SKC).** Through a follow-on grant from USDA-NIFA for *All Climate is Local*, SKC is the hub institution for a series of on-line webinars with the other 16 TCUs from the Crown of the Continent region (MT, ND, SD, NE) to share climate, water, drought impact resources in the context of traditional ecological knowledge to build resources and capacity among the 1994 Extension to enhance climate and agriculture adaptation and resilience. (*Target audience: TCU faculty/student engagement*).
- **Outreach to 1994 TCUs and FRTEP.** The 1994 TCU Extension network and the 1862 FRTEP network are all included in COVID WG weekly Zoom calls. In collaboration, with NIFA National Program Leader for Tribal Programs (Erin Riley), we hosted two workshops to foster collaboration among 1862 and 1994 Tribal Extension programs. (*Target audience: TCU and FTEP faculty*).

What opportunities for training and professional development has the project provided?

NWAL Year 5 Training and Professional Development:

- **Creating synergy among 1994s and FRTEP.** An exciting outcome of the NWAL project has been increased trust and collaboration among FALCON, the 1994s and FRTEP. NWAL brought these groups together five years ago and over the course of the project strong trusting relationships have developed. Recently, with new 1994 eligibility in the FRTEP competitive grant program (2018 Farm Bill), there has been a strong push to encourage more collaboration among 1994 and FRTEP programs. Ongoing discussions led to a one-day 1994/FRTEP strategic planning session on March 24, 2020 and two additional workshops in Dec 2020 and Jan 2021. This effort has also linked with, and leveraged funding from, the Native American Agriculture Fund (NAAF) which distributes Keepseagle settlement funds for Native American agriculture outreach. NAAF grant applications will incentivize 1994/FRTEP collaboration. A joint 1994/FRTEP annual conference will be held in Kansas City in Oct 2021. (*Target audience: TCU and FRTEP faculty*)
- **NWAL Graduate Students:** CO-PD Chief's graduate student, E. Schuyler Chew defended his dissertation entitled, "A collaborative investigation of climate change adaptation for the Pyramid Lake Paiute Tribe" on July 28, 2020. Although Schuyler Chew completed his PhD, he continues to work on NWAL as a research analyst and is working on a manuscript entitled "*Collaboration with the Pyramid Lake Paiute Tribe through Decolonizing Participatory Climate Action Research*" which will be submitted to a Special Issue: Collaborative Management, Environmental Caretaking and Sustainable Livelihoods in September. Under the direction of Co-PD Edwards, graduate student Leslie Sanchez completed a Graduate Research Fellowship at the Property and Environment Research Center.
- **Complementary Student Training:** Co-PD Chief mentored graduate and undergraduate students in Food, Energy and Water Security in Indigenous communities. Students are trained to be culturally sensitive and to work with tribal college students. Students at Dine College have also been trained to operate off-grid water treatment systems.
- **Community of Practice (CoP) for Native K-12 Teachers:** Our team created synergies between NWAL and the Teaching Native Waters program, which is a community of practice that develops and hosts place-based virtual professional development for middle and high school educators serving Native students (USDA WAMS 2020-02337). This work quickly pivoted in spring 2020 to address the needs of educators and students that were multiplied by the COVID-19 pandemic. Content experts on the NWAL team were integrated into Teaching Native Waters supported content experts in soil and ancient farming practices (Bocinsky), water quality and effects of mining (Chief), general water quality (Lutz), and leadership (McCarthy). In total, NWAL experts served as part of three six-week professional development modules, engaging a total of 45 educators.
 - **Impacts:** Confidence of educators with subject matter from evaluation;
 - High confidence of participants (83%) to share standards-based practices related to scientific argumentation with their students.

- High to fairly high confidence of participants (78%) teaching about climate change and phenomenon-based questions with their students.
- Fairly high confidence of teachers (50%) adapting generalized lesson plans to local and community contexts.

How have the results been disseminated to communities of interest?

Outreach, Communication and Project Management

- **Project Communications:** NWAL Project communications included a significant expansion of the sharing of information and resources on our website (www.nativewaters-aridlands.com) and adding new on-line resources including:
 - Native Waters on Arid Lands website – <https://nativewaters-aridlands.com>
 - The NWAL project website documents the work of the team through a blog with up-to-date project news, links to resources, and links to new NWAL follow-up projects including the COVID-19 Working Group, Facts Not Fear, Teaching Native Waters, and the COVID19 Toolkit projects.
 - Stakeholders reached: Since July 1, 2020, the NWAL website has been visited by 5,257 unique users (12,296 pageviews).
 - Facts Not Fear website - <https://factsnotfearcovid.com/>
 - “Facts Not Fear” is a website and information campaign developed by NWAL’s COVID-19 Working Group to supply Tribal members and Tribal Extension Experts across Indian Country with accurate information and educational resources about the COVID-19 vaccines. The website contains answers to questions that were gathered from our project partners during weekly calls organized by the COVID-19 Working Group, vaccine information for tribal youth, mental health resources for tribal farmers, and other resources aimed at tribal communities.
 - A video tour of Facts Not Fear, an online suite of resources for Tribal members related to the COVID-19 vaccine, was created and distributed to 30-40 educators serving Native students who are involved in the Teaching Native Waters program.
 - Stakeholders reached: Since launching in February 2021, this website has been visited by 613 users (2,880 pageviews).
 - COVID-19 in Indian Country Storymap – <https://nativewaters-aridlands.com/covid19>
 - In March 2020, the NWAL team began hosting weekly video conference calls with Tribal leaders, Federally Recognized Tribal Extension Program (FRTEP) agents, and Tribal Colleges & Universities (TCUs) faculty from across the intermountain west to collect information about the impacts of COVID-19 on tribal farmers, ranchers, and communities and to identify actions that our team or our federal sponsors can take to help lessen the impacts of the pandemic. This website documents the work of NWAL’s COVID-19 Working Group from March 2020 to the present, including

scientists and community members, and students lead and are involved in addressing the challenges. Download at <https://ucowr.org/journal/current-issue/> June 11-Rachell Ellis and Danielle Perry; June 17-Jani Ingram and Jonathan Credo; June 24-Catherine Propper and Marie Jones; July 1-Andrew Kozich; and July 8-Christine Martin. June 11-July 8, 2020. University of Arizona, Tucson, AZ.

- **Native Voices in STEM Fall Seminar Series 2020.** Joseph Brewer (Tsalagi/Oglala Lakota), U. of Kansas; Andrew Curley (Navajo), U. of Arizona; Kim TallBear (Sisseton-Wahpeton Oyate) U. of Alberta; Nonabah Lane (Navajo), Navajo Ethno-Agriculture. University of Arizona, Tucson, AZ.
- **Tribal community workshops:** Co-PD Edwards and graduate student Leslie Sanchez analyzed materials developed in workshop on tribal water right adjudication for agriculture with tribal leaders and water managers, extension agents, and researchers. Graduate student Sanchez was interviewed on the MIT podcast: Gender, Race, and Environmental Justice on the issues surrounding tribal water right settlements. Co-PD Singletary continued to work with Tribal nations to identify climate data and science information needs to support Tribal efforts to enhance the climate resilience of agricultural water resources and food systems on reservation lands and to build capacity building for climate-agriculture adaptation on reservation lands.
- **Maintained and enhanced the NWAL document library.** This online resource contains over 1000 documents on the topics of natural environment, paleo/archaeology history, water issues, agriculture, climate, law/policy, traditional knowledge, education/outreach, sustainability, and economics. Led by Co-PD Lutz with support from Co-PD Bocinsky and Shawn McCabe. **Impacts** include Tribal members and resource managers having more immediate access to "gray" literature related to Tribal land, including vulnerability assessments and summaries of existing water rights adjudications
- **Tribal Water Rights Settlement Database:** Co-PD Edwards and graduate student Leslie Sanchez completed analysis using the tribal water right settlement database, finding that while water scarcity drives tribal water right settlements, bargaining costs associated with large numbers of participants delay outcomes, and predicting that 1.1-1.6 million AF of water will be allocated to tribes in ongoing adjudications.

FRTEP Outreach Activities:

- Under Co-PD Emm, the UNR FRTEP team has been working with Nevada Tribes and assisting other tribes in the project area with creating the agriculture side of local food systems including research on Hoop House (season extension tool) designs that function under reservation climate conditions. This includes monitoring and production trips to the reservations to work with individual Indian producers to be able to grow their own food or grow enough to sell at a farmers' market and/or Community Service Agriculture (CSA) Program. Hoophouse designs, community engagement plans, and food production guidance were shared with other Tribes through the NWAL COVID WG.
- Under Co-PD Teegerstrom the UA-FRTEP team, engaged Native American farmers, ranchers, and natural resource and land managers from tribes in Arizona and New Mexico. During the COVID19 pandemic in 2020, this included providing urgently needed supplies including wood, food, and hand sanitizer to Hopi, Navajo and other

communities who were severely impacted from both the disease and shutdown of roads and services.

- Nevada and Arizona FRTEP teams have partnered to develop resources and training materials to help Tribal farmers and ranchers navigate through myriad of federal relief programs implemented during the COVID pandemic. These include training on applying for food and debt-relief assistance and completing the necessary tax forms after receipt of funds, accessing farm equipment from Native-owned retailers, and anticipating impacts to meat and hay prices due to the ongoing drought. These resources are shared regularly with Tribal partners and others during weekly Zoom calls of the NWAL COVID WG.

Evaluation of Annual Native Water Tribal Summits 2015-2019: Co-PD Singletary leads project evaluation for NWAL. During NWAL Years 1-5, a key outreach event was the annual NWAL Tribal Summits. The results of the Summit evaluation were published in NWAL Year 6. Key findings include,

- **2015-2019 Overall Summit Evaluation Results:** Data collected year over year demonstrate that annual Tribal summits effectively accomplish short-term impacts (e.g., knowledge gains and attitude changes) through providing opportunities for relationship-building, networking, information exchange, and communication. Summits also accomplish medium-term impacts (e.g., behavioral changes) as demonstrated by the approximately 20% increase in registrants from 2015-2018, regardless of changes in event location and venue. In 2019, we saw a 20% reduction in registrants which may be related to the chosen date for the Tribal Leadership Summit coinciding with several key meetings and conferences requiring Tribal participation such as the EPA Region 9 Tribal Operations Committee fall meeting. Results from evaluations of individual annual summits indicate that these events succeed in building capacity of all participants to assess and support climate adaptation planning and implementation on Tribal lands (e.g., long-term impact/outcome).

What do you plan to do during the next reporting period to accomplish the goals?

NWAL Activities for a No Cost Extension Year 7 were documented in the NCE Request and Justification report submitted to USDA in March 2021 and approved in April 2021. The NWAL Year 7 activities will be focused on expanding the outreach to Tribal communities throughout the Intermountain West and with others across the US to maximize the outcomes of the NWAL project. Due to ongoing COVID19 restrictions in some areas and uncertainty about future COVID waves in the fall and winter of 2021 and 2022, the majority of NWAL outreach will be provided virtually during NWAL Year 7. Due to the impacts of extreme drought and recording breaking heatwaves throughout the western US in 2021, the NWAL team share resources widely with Tribal partners across the country through the weekly Zoom calls with the NWAL COVID WG. These resources are posted weekly on the COVID WG Storymap at: <https://storymaps.arcgis.com/stories/336825e7c44a494ab24c72f67e02814a>

Other activities include,

- **Conduct a series of regional resilient agriculture webinars with TCUs from the Crown of the Continent:** The All Climate is Local project will share climate services, drought

mitigation actions, climate adaptation planning, and Traditional Ecological Knowledge with TCUs from across the Crown of the Continent (MT, ND, SD, and NE) in the Upper Columbia and Missouri River Basins. Co-PDs McCarthy, Bocinsky, and Dupuis will lead this effort with webinars scheduled to kick-off in late summer 2021. These are designed to translate NWAL research, education and Extension efforts into place-based, culturally-relevant materials help 1994 Extension faculty enhance climate-agriculture resilience in their communities and mitigate the impacts of extreme drought, heat, wildfires, and floods.

- ***Advance TCU capacity building:*** NWAL researchers and TCU faculty advisors will continue to co-develop place-based short-course materials for faculty and students that incorporates NWAL research on water sustainability, climate impacts, agriculture productivity, food sovereignty in the context of native community traditional practices. These materials will help TCU faculty and Extension agents to incorporate climate agriculture resilience in their course curriculum and outreach programs. This includes implementation of an FFRP with Navajo Technical University (NTU), DRI, and FALCON to evaluate stream “health” in the San Juan River system that crosses the state lines of Colorado, New Mexico, Utah and Arizona and flows through tribal lands.
- ***Expand online resource library for climate resilience on tribal lands:*** The NWAL Knowledge Portal will be extended, updated, and automated to include additional climate data, water resource data, tribal climate adaptation and resource management plans, water rights inventories, NWAL workshop materials, publications, and other relevant literature and resources for tribes across the western US. The Knowledge Portal will also preserve the digital legacy of NWAL. Code will be hosted and publicly accessible on GitHub for use by the research community and tribal partners.
- ***Expand multimedia communications:*** NWAL’s extensive on-line resource capacity will be expanded in accordance with Tribal needs and transitioned to be supported by DRI for long-term sustainability.
- ***Share findings and lessons learned:*** NWAL team members will complete technical and Extension publications and technical reports and present findings at professional conferences, annual meetings for FALCON and FRETEP, topic national and international meetings, and ITEP conferences including the first annual National Tribal & Indigenous Climate Conference in Aug 2020.
- ***Project Evaluation:*** Workshops and other project meetings with tribal partners will be evaluated to assess short- and medium-term outcomes including knowledge gains and attitude changes as reflected in post-event evaluations. A retrospective evaluation will involve an e-survey to measure medium-term and anticipated long-term outcomes of the 7-year project. These may include knowledge and action around tribal climate policy and/or reservation-wide planning and action.

Year 5 Changes/Problems and Challenges to be Addressed in Year 6

The major impact resulted from the COVID-19 pandemic. During Year 6 all of the academic institutions (1862 and 1994) closed in March 2020 and transitioned to on-line education through spring 2021. Many of the tribes in our region were (and many remain) under stay-at-home orders with only essential personnel able to perform duties. The UA and UNR FRTEP agents continued to work from home, most on their home reservations, but providing service to their farmers,

ranchers and communities became very challenge due to the inability to hold in-person meetings, limited computer and internet access in many of the communities, and a lack of running water and electricity in many homes. The UA College of Agriculture and private foundations did provide some resources to put up mobile hotspots for temporary broadband access in some reservation communities, but on-line connectivity remains a challenge.

With COVID vaccination rates in Tribal communities above the national average in many areas, most reservations are opening up to in-person education and community events. However, with uncertainty about potential next waves of the virus in the fall and winter of 2021 and 2022, NWAL will retain the option to conduct outreach activities virtually or in hybrid (in-person/virtual). The use of virtual communication platforms have also allowed the NWAL team to engage more communities from around the country through the NWAL COVID WG and other virtual events.

Specific impacts and adjustments that will be made are:

- ***Delay of All Climate is Local: Co-developing 'multiple ways of knowing' to enhance resilience of tribal agroecosystems to droughts, floods, and rising temperatures:*** Due to all TCUs remaining closed during the spring of 2021, the *All Climate is Local* team decided to delay the kick-off the webinar series until late summer/fall of 2021. All activities will be conducted virtually.
- ***Transition of Place-based Lesson Plan Workshops -- Building a Community of Practice:*** This effort will be jointly funded by NWAL and a new grant from USDA-WAMS (awarded in May 2020) will continue virtually in 2021-2022.
- ***Realignment of Building water security in northern Arizona -- Workshops for water security education and outreach in Hopi and Navajo communities:*** Materials and resources are being developed for water security workshops are being folded in to our collaborative efforts with AZ, NM, and NV FRTEP agents and will be implemented through the COVID Toolkit Project (funded in 2020).
- ***Postponement of publication of the carbon sequestration and trench composting report:*** Due to Covid-19, project personnel Scott Goode and Anna Eichner are delayed in delivering their report on carbon sequestration and trench composting, but plan to deliver it during summer 2020.
- ***FALCON/TCU Impacts:*** As FALCON Faculty-faculty Research Partnership (FFRP) planning was underway in early 2020, the program was disrupted by COVID-19 pandemic school closures. This effort has been restructured to be a partnership with DRI, FALCON, and NTU and will be conducted virtually.
- ***Travel canceled:*** All NWAL travel was canceled or postponed during NWAL Year 6 due to COVID restrictions. Most activities will remain virtual during Year 7 with limited travel for specific events including the joint FALCON/FFRTEP meeting in Kansas City in Oct 2021.
- ***Co-PD Relocation:*** Co-PD Bocinsky relocated in Jan 2021 from DRI and Crow Canyon Archeological Center to the Montana Climate Office (MCO) at the U. Montana, WA Frank College of Forestry and Conservation. Dr. Bocinisky is now Climate Extension Director for the MCO and continues his NWAL duties from this position.

Participants
Actual FTE's for this Reporting Period

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	2.2	0.5	1.0	0	3.7
Professional	1.0	0	0	0	1.0
Technical	0.4	0	0	0	0.4
Administrative	0	0	0	0	0
Other	0.3	0	0	0	0.3
Computed Total	3.9	0.5	1.0	0	5.4

Student Count by Classification of Instructional Programs (CIP) Code

Undergraduate	Graduate	Post-Doctorate	CIP Code
2	1		01.00 Agriculture, General.
	1		03.02 Natural Resources Management and Policy.

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