

# NWAL Year 5 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 5 PROGRESS REPORT (JUNE 2020)**

**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 5 (modified) 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

During NWAL Year 5 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

The NWAL Project expanded its outreach to tribes in the Southwest, Great Basin, and Northern Rockies through our TCU partners including:

- Salish Kootenai College (SKC) on the Flathead Reservation in northwest Montana.
- Dine College and Navajo Technical University on the Navajo Nation
- Menominee College in Wisconsin
- Outreach to all 34 TCUs is led by NWAL partner, FALCON

## NWAL Year 5 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 5 accomplishments are listed below. A more detailed report will be posted on the NWAL website.

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 Coordination 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. This group continues to meet weekly (via Zoom). 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. Our team has been able to find solutions to urgent needs identified by our tribal partners including communities in need of food, hand sanitizer and cleaners, wood for home heating/cooking, hay for livestock, access to COVID-19 test kits, access to water testing for buildings left unoccupied, coordination of actions to get tribal farmers and ranchers relief from lease and fee payments, and many more issues. 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 the COVID-19 pandemic.

### Research, Data Collection & Analysis

- ***Water Resources & Economics:*** Co-PD Colby and her team of graduate students and colleagues focus on providing accessible, easy-to-understand material on water economics and management for tribal nations and their representatives. The material provided is designed to be useful to tribes considering participation in regional water management initiatives and water trading. 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.
- ***Climate adaptation webinars:*** Co-PD Kauneckis organized and delivered three webinars with the Institute for Tribal Environmental Professionals (ITEP) Tribal Climate Change Program, on climate adaptation and the tribes. Topics included: (1) Introduction to climate vulnerability assessments), [July 27, 2018, ~70 participants] (2) Why conduct a climate change vulnerability assessment) [Nov 1, 2018, ~ 60 participants, and (3) Learning from



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tribal climate adaptation plans [Jan 29, 2019, ~ 40 participants]. Generated Database of Native Reservation Vulnerability Characteristics, included tribal government type, economic diversity, water rights claims, population demographics, tribal climate adaptation plans, and others.

- **Collected information on water sources in Navajo/Hopi reservation areas** where there is not consistent access to safe water. Information includes publications, reports, and an inventory of web-based repositories that describe water sources (e.g., groundwater well, surface, spring). As much as possible, quality of water sources were also compiled. The goal is to use these resources to help evaluate long-term safe water sources by determining which sources are safe and which may be in need of treatment. Safe water for hygiene has become a critical resource during the Covid-19 pandemic. Washing hands is one of the most important ways to avoid sickness and spreading germs to others. Besides Covid-19, many diseases are spread by not washing hands with soap and clean, running water; hands could become contaminated or re-contaminated if using standing or otherwise unsafe water.
- **Extended/updated/automated climate data for tribes across western US.** Added the North American Drought Atlas for retrospective climate to contextualize present and future drought impacts. These were included in community workshops and public presentations. **Impacts** include community discussions about climate and drought resilience that integrate past examples of resilience, and broader discussions about Tribal food sovereignty.
- **Drought Management strategies:** Co-PD Curtis completed data collection and analysis on producer preferences for drought management strategies for forage, fresh produce, and livestock; an assessment of major crops and cost of production studies available for SW Indian Reservations; collected 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 2019 *Friends of UCOWR Award*, University Council on Water Resources (UCOWR) and 2019 *Area/Regional Impact Award*, National Indian Health Board.

## Tribal College Research, Education & Outreach

- **Created a New Faculty-Faculty Research Partnership (FFRP) program.** Upon successful completion and evaluation of the Aaniiih Nakoda College/Desert Research Institute (ANC/DRI) pilot project, an application was released to all 1994s in 2019, to implement additional FFRPs. A short list of applicants was reviewed and selections were made, but ultimately the selected 1994s chose to not proceed. By the end of 2019, upon careful reflection, it was understood that the FFRP pilot model requires a baseline of capacity that does not generally exist among the 1994 faculty and so represents a "cost of entry" barrier to participation in the FFRP. In early 2020, the NWAL team (PI McCarthy, Co-PD Phillips, Co-PD Collins), in consultation with a FALCON/TCU team of advisors (Dupuis, Litson, Caldwell, Chischilly), designed a new FFRP capacity building approach that would address the cost-of-entry barrier. It would provide regional and campus-based training workshops, as well as facilitate targeted collaborative projects



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between selected 1994s, DRI and other partners. (*Target audience: TCU faculty-student engagement*).

- **Continued to build relationship with Salish Kootenai College.** Co-PD Bocinsky worked to co-develop research, extension, and education projects with SKC faculty, and facilitate knowledge transfer to SKC faculty and CSKT land managers. He continued to mentor and advise SKC students in GIS and technical computing for environmental/agricultural analysis. Other NWAL activities at SKC include the mentoring of an undergraduate student in GIS and algebra, and the installation of a NWAL weather station for the community garden and SKC Forestry department. (*Target audience: TCU faculty/student engagement*).
- **Continued outreach efforts with all 1994 Tribal Colleges & Universities.** All research and extension output from the NWAL team is being used for tribal education and outreach. FALCON and Co-PD Collins have promoted the 1994/1862/FRTEP collaboration partnership model (NWAL model), through discussions with the NIFA FRTEP/1994 NPL (Erin Riley), at conferences and through outreach communications. (*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, a FRTEP/1994 survey of collaborative interests, and the identification of three pilot sites where 1994/FRTEP collaboration would be supported as potential best practice models (Michigan, Wisconsin and Arizona/Nevada). 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. There is also a commitment to hold a joint 1994/FRTEP annual conference in 2021. (*Target audience: TCU and FRTEP faculty*)
- **NWAL Graduate Students:** Co-PD Colby continued training and PD for graduate students is provided on an ongoing basis through project activities. Students receiving PD and training through NWAL activities in 2019-20 include Austin Walker (graduating December, 2020), Ryan Young (graduated May, 2019), Brian McGreal (graduating May, 2021) and Emily Joiner (graduating May, 2020). Co-PD Curtis mentored Alejandro Molano, MS thesis working title, "Cost and Returns to Drought Management Strategies in Southwest Indian Country" scheduled to graduate December 2020 and Emily Rice, Extension Intern, writing up fact sheets from research completed. Co-PD Edwards mentored graduate student Leslie Sanchez attended the NWAL Tribal Summit and the



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Workshop on Renewing Indigenous Economies, Hoover Institution at Stanford University.

- **Student Training:** Co-PD Cheif mentored 12 graduate 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.
- **Awards and Internships:** Project Researcher Fillmore was awarded an internship to research Indigenous community approaches to disturbed landscape restoration and climate resiliency with the Wildlife Society and the U.S. Forest Service Pacific Southwest Region for part of the summer of 2019.
- **Place-Based Education Teacher Workshops** (March & September 2019) - NWAL held a climate resilience workshop in March for students of Arizona's STAR School and identified a need for place-based modules for teaching subjects like climate resilience, energy supply, and agriculture that aligned with Arizona Science Standards.
  - In September 2019, Co-PD Collins with Bocinsky, Lutz, Chief, Teegerstrom, and McCarthy delivered a two-day workshop on place-based education at STAR School (Service to All Relations) in Leupp, AZ with the goal of helping teachers serving Navajo and Hopi students to develop science lesson plans that relate to the cultures and life experiences of Indigenous students. Fourteen teachers attended NWAL's September workshop, including K-12 and GED adult educators from the Hopi, Navajo, and Tohono O'odham communities of Arizona.
  - On day one, scientists shared key ideas from their fields (renewable energy, water quality, and paleo-climate), and then offered an immersive, hands-on demonstration of the subject matter. On day two, teachers and scientists worked through the place-based lesson plan template to create a lesson that each teacher could take home to use in his or her classroom. Some of the themes of the lesson plans that teachers created at the pilot workshop include: Water Quality Chemistry; Energy Efficiency through Comparing Light Bulbs; Can Our School's Energy Needs be Met by Solar Energy; and Water pH.
  - **Impacts** on participants included:
    - High confidence of 75% of teachers in creating lessons and activities that are relevant to current science topics in their region.
    - High confidence of 50% of teachers discussing connections between solar energy and their community
    - High confidence of 67% of teachers discussing connections between water quality and their community
    - High confidence of 58% of teachers discussing connections between drought and their community.
  - Following this workshop, the team proposed to expand this program to the USDA Women and Minorities in STEM program. The resulting award was announced in May 2020 entitled "Teaching Native Waters" will create a Community of Practice of educators in the four corners area serving Native American students and bolster their curriculum development and STEM skills.



## How have the results been disseminated to communities of interest?

### Outreach, Communication and Project Management

- **Project Communications:** NWAL Project communications included creating additional podcasts, maintaining an interactive website ([www.nativewaters-aridlands.com](http://www.nativewaters-aridlands.com)), and initiating a webinar series. NWAL Communications Lead (Fitzgerald) created an ArcGIS Storymap "COVID-19 in Indian Country" to document the activities of the NWAL COVID-19 Action Coordination Group  
at: <https://storymaps.arcgis.com/stories/336825e7c44a494ab24c72f67e02814a>
- **Youth Day:** *NWAL Youth Day: Science Career Panels at Pyramid Lake High School (PLHS).* 70 students participated in a series of career panels held on site at PLHS, led by Co-PDs Collins and Fillmore. The goal of the day was to highlight STEM career paths and talented individuals from the NWAL project who are involved in STEM in higher education, specifically Tribal Colleges and Universities. Panelists shared the story of their career path and passions (in lightning style format), and then answered students' questions and questions from the facilitator. Panelists included, Steve Chischilly (Professor, Navajo Technical University, NTU), Dalyna Hannah (undergraduate student at NTU), Lysie Dunn (Pyramid Lake High School counselor and former UNR student advisor), Dan Mosely (Director of Fisheries at Pyramid Lake), Maureen McCarthy (NWAL Project Director), Helen Fillmore (NWAL Research Scientist). An important **impact** from this panel was the initiation of a relationship between Pyramid Lake High School and Navajo Technical University for dual credit, distance learning options for PLHS students.
- **Regional Meeting:** *Participated in a regional meeting in support of the Missouri River Basin Drought Early Warning System in Billings, Montana, to facilitate project coordination between NWAL and the Missouri River and Columbia Basin DEWS.* **Impacts** include enhanced prioritization of Tribal needs in DEWS activities, and the coordination between the Tribes, TCUs and NWAL partners. The MT-TCU Climate Conference taking place during year 6 is a direct outcome of NWAL participation in this regional meeting.
- **Major Publication:** Co-PD Chief was invited guest editor for a special issue of the Journal of Contemporary Water Research & Education, entitled "Water in the Native World" (Issue 169 released in April 2020). Papers focus on water challenges facing tribes and highlight the contributions of Indigenous scientists, students and community members to addressing these challenges. This special issue is available for download at: [https://ucowr.org/wp-content/uploads/2020/05/JCWRE\\_169\\_Full\\_Issue.pdf](https://ucowr.org/wp-content/uploads/2020/05/JCWRE_169_Full_Issue.pdf)
- **Tribal community workshops:** Co-PD Edwards and graduate student Leslie Sanchez facilitated a discussion on tribal water right adjudication for agriculture with tribal leaders and water managers, extension agents, and researchers. Co-PD Singletary · Worked 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. Also identified topics specific to capacity building to support adaptation on reservation lands.
- **Maintained and enhanced the NWAL document library.** This online resource contains almost 700 documents on the topics of natural environment, paleo/archaeology history,



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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, examples of vulnerability assessments for tribes across the US, and summaries of existing water rights adjudications

- ***Tribal Water Rights Settlement Database:*** Co-PD Edwards and graduate student Leslie Sanchez completed an 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. There were eight different trips to work with reservation farmers regarding vegetable production; and two trips working with alfalfa hay crops and livestock reaching over 100 producers. Educational program topics include, crop varieties, soil analysis, climate conditions, government assistance programs, marketing and production recommendations, and agriculture sustainability of the farm and/or ranch. The NV FRTEP Team also led the effort for the 2019 Native Water Summit, and to conduct regional workshops to assist in facilitating tribe's agricultural sustainability plans.

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. For the 2019 NWAL Summit they developed a Native American Panel comprised of a mix of rancher farm managers and small producers to discuss any changes since the original panes in the previous 4 years. This panel of composed of FRTEP agents and 1994 extension personnel shared their insight to addressing food insecurities and the need for traditional foods. They discussed their successes, challenges, barriers, and solutions in developing and implementing programs for the different tribes and tribal communities. Due to COVID-19 restrictions they have redirected their efforts to develop webinars and virtual regional conference to reach tribes throughout the Intermountain West. These webinars will support mid to small size tribal farmers on crop selection, ranch management and conservation practices and their impacts on water management and marketing.

## Evaluation of Annual Native Water Tribal Summits 2015-2019:

Co-PD Singletary leads project evaluation for NWAL. NWAL's key outreach event is an annual Tribal summit where Tribal communities from across the US are the featured speakers to educate project researchers about successes and challenges in managing agricultural water resources at the farm unit and reservation scale.



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- **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 6 were documented in the NCE Request and Justification report submitted to USDA in Feb 2020 and approved in May 2020. Due to the impacts of the COVID-19 pandemic a major focus of the NWAL project will be on providing virtual outreach and support to our tribal partners to address ongoing agriculture challenges.

These activities include;

- **Conduct a series of regional resilient agriculture workshops with tribal communities in the Western US:** At the conclusion of the Fifth NWAL Tribal Summit in Oct 2019, the participants recommended that the NWAL team conduct focused topical climate-agriculture resiliency workshops would be held with tribal communities in the three study areas (Southwest, Great Basin, and Northern Rockies) in lieu of holding a sixth Tribal Summit. These workshops will be designed to build capacity among tribal college faculty and tribal resource managers to enhance water sustainability and agriculture resilience under a range of climate conditions projected for each of regions. Researchers and tribal partners will share insight and experiences and co-develop materials - based NWAL data and research findings and traditional knowledge and native wisdom shared throughout the NWAL project - to support place-based, reservation-specific climate, water, agriculture, and land-use adaptation planning and decision-making. FRTEP faculty at UNR and UA and FALCON faculty advisors at SKC, Dine College, and NTU will be instrumental in recruiting faculty and tribal community members to participate in these on-reservation workshops and tailoring the content to meet the needs of tribal communities in the region. Materials, workshop summaries, and lessons learned will be shared with other tribal communities in the project area and with tribal and non-tribal organizations outside the project team.
- **Create a Community of Practice (CoP) for Native K-12 Teachers:** Native teachers from Hopi, Navajo and other tribes in the Southwest (some of whom participated in from in the pilot teacher education workshop in Year 5) will participate in a series of three workshops during the year focused on co-developing and evaluating the effectiveness of



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place-based lesson plans that capture both western science and native wisdom understanding of climate change, water sustainability and quality, agriculture (crops and livestock) resilience on the landscape, and renewable energy generation and use. Materials and evaluations from the CoP will inform future work to expand STEM education among Native teachers.

- **Advance TCU capacity building:** NWAL researchers and TCU faculty advisors will 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.
- **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 publically accessible on GitHub for use by the research community and tribal partners.
- **Expand multimedia communications:** A webinar series will be organized to share NWAL research, Extension, and education initiatives with tribal and non-tribal communities inside and outside the study area. These webinars will provide opportunities to broaden the exchange ideas and findings from NWAL with other USDA project teams, Native American federal agency programs, and tribal communities across the U.S. and abroad. NWAL graphics arts team will also produce written reports and online tools that help tribal partners access and utilized project information.
- **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 6-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**

There were two major changes and impacts to the NWAL project during Year 5. First, we lost our dear colleague and Co-Project Director, Beverly Ramsey. Beverly passed away in March 2020 and had been Co-PD from DRI. The NWAL Key Personnel from DRI are Alex Lutz (water quality and knowledge portal lead researcher), Meghan Collins (education coordinator), and Kyle Bocinsky (climate coordinator). Alex, Meghan, and Kyle are integral to NWAL and will continue to execute the DRI subaward during NWAL Year 6.

The second major impact resulted from the COVID-19 pandemic. During Year 5 all of the academic institutions (1862 and 1994) closed in March 2020 and transitioned to on-line education. 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 particularly on the Hopi Tribe and Navajo Nation. 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.

The Navajo Nation has been particularly hard hit with COVID-19 cases and deaths. As of today (28 June 2020) cases are also increasing significantly on the Hopi Tribe, San Carlos Apache, Pyramid Lake Paiute Tribe, CSKT Flathead Reservation, Cheyenne River Sioux Tribe, and others, and Walker River Paiute Tribe reported its first case this past week. We anticipate continued impacts and challenges from the COVID-19 pandemic during NWAL Year 6. Our NWAL team is collectively committed to continuing to work with our tribal partners virtually, and when possible, in-person under COVID social distancing guidelines. This will require us to rely more extensively on Zoom and other video-conferencing platforms for meetings, workshops, and focus groups. It will also require us to work with our tribal communities to address immediate and urgent needs resulting from COVID-19 health impacts, agriculture productivity challenges, and other economic disruptions due to mandatory shutdowns. To that end, we appreciate the understanding of USDA-NIFA National Program Leaders as we reassess any impacts to both deliverables and Year 6 budgets.

Specific impacts and adjustments that will be made are:

- ***Postponement of MT-TCU Climate Conference -- All Climate is Local: Co-developing 'multiple ways of knowing' to enhance resilience of tribal agroecosystems to droughts, floods, and rising temperatures***
  - Due to restrictions on travel and large group gatherings, this Climate Conference will be postponed, and considerations are being taken to adapt the format for distance knowledge-transfer approaches.



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- This conference was developed to co-develop outreach products based on NWAL and other AFRI-funded projects with TCU Extension faculty from the seven TCUs in Montana.
- Support for this event was proposed in a separate Conference Grant to NIFA AFRI-Agroecosystems in early April 2020. If funded, the NWAL leaders (McCarthy, Bocinsky, and Dupuis) will amend plans for the conference so it can be held virtually and through webinars and hybrid workshops.
- **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).
  - Three workshops were planned to engage teachers from regional Tribal communities in the community of practice at the Crow Canyon Archaeological Center in Cortez, CO. These workshops will be redesigned to be held in a virtual format and build capacity by addressing COVID response and recovery challenges for educators and education systems.
  - A preliminary needs assessment of educators serving Native students: In the weeks following COVID-19 shutdowns, project personnel communicated with educators serving Native students across Nevada and Arizona to understand impacts to classes. The information provided by teachers will help to shape the adapted approach to the Community of Practice.
- **Realignment of Building water security in northern Arizona -- Workshops for water security education and outreach in Hopi and Navajo communities**
  - Due to restrictions on travel and large group gatherings and emergent needs of FRTEP agents on the ground in Indian Country, materials and resources being developed for in-person water security workshops are being folded in to our collaborative efforts with AZ, NM, and NV FRTEP agents. The expanded effort has been proposed in the COVID-19 Rapid Response Toolkit for Tribal Extension Agents initiative, proposed to NIFA COVID-19 CARE Initiative in April 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 FALCO Faculty-faculty Research Partnership (FFRP) planning was underway in early 2020, the program was disrupted by COVID-19 pandemic school closures. This required us to develop a recalibrated at-distance approach that will provide training and facilitate collaboration through a virtual knowledge-sharing and collaborative platform called the Technical Assistance Framework (TAF). The TAF will provide seed funding to rapidly deploy innovative 1994 extension approaches in response to COVID-19, share those innovations with the 1994s community, and scale-up best practices. It will also foster collaboration among the 1994s, FRTEP, DRI and others. The TAF concept was proposed in an application to the NIFA COVID-19 CARE Initiative in Apr 2020.
- **Travel canceled:** Co-PD Chief was unable to travel and conduct outreach activities due to COVID-19. The outreach is being revised to remote platform in FY 2020. The CO-



# Native Waters on Arid Lands

INFEWS workshop, which actively engages NWAL partners, "Indigenous Co-Innovation of Food, Energy & Water Systems" is now a virtual workshop. The training we were supposed to do with Dine' College is now virtual and we are developing training tools that can be completed remotely. In the spring and early summer of 2020, NWAL Researchers Fillmore and Singletary had planned to work with several nearby Tribes to offer in-person trainings based on the results of their research and the synthesis of climate data and information resources identified as being prioritized needs by these stakeholders. Being unable to carry these out these activities as planned, they have pivoted towards developing written Extension curriculum with virtual workshops to carry out objectives. Additional travel impacts are anticipated for other NWAL team members and tribal partners. Budget adjustments will be made, accordingly.

## 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	2.5	0.5	2.5	0.2	5.7
Professional	1.2	0	0	0	1.2
Technical	0.4	0	0	0	0.4
Administrative	0	0	0	0	0
Other	0.3	0	0	0	0.3
Computed Total	4.4	0.5	2.5	0.2	7.6

### Student Count by Classification of Instructional Programs (CIP) Code

Undergraduate	Graduate	Post-Doctorate	CIP Code
3	3	1	01.00 Agriculture, General.
	1		03.02 Natural Resources Management and Policy.

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