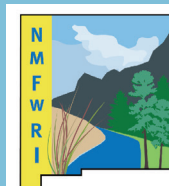# Annual Report
2020-2021

**New Mexico
Forest and Watershed
Restoration Institute**

New Mexico Highlands University

NEW MEXICO FOREST & WATERSHED RESTORATION INSTITUTE
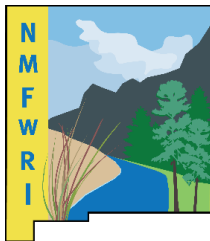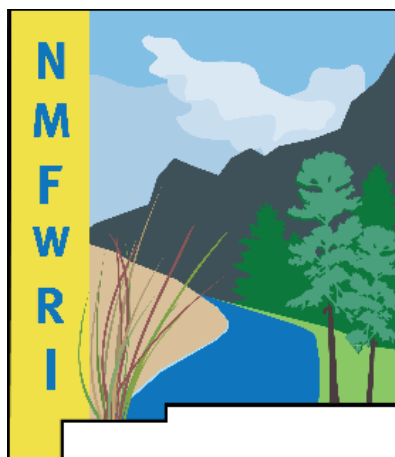
ANNUAL REPORT 2020–21

Covering the period October 2020 to December 2021

Dr. Kent Reid, Director
Oct. 2020 to Sep. 2021

Dr. Alan Barton, Director
Oct. 2021 to Dec. 2021

Report Prepared by:

Alan Barton, Collaboration Program Manager
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New Mexico Forest & Watershed Restoration Institute

Annual Report 2020–21

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"Water is already scarce in the Southwest, so every drop is a precious resource. People in the Southwest are particularly dependent on surface water supplies like Lake Mead, which are vulnerable to evaporation. Thus, even a small increase in temperature (which drives evaporation) or a decrease in precipitation in this already arid region can seriously threaten natural systems and society. Droughts also contribute to increased pest outbreaks and wildfires, both of which damage local economies."

– U.S. Environmental Protection Agency[1]

The first two decades of the 21st century have seen the Southwestern United States mired in persistent drought conditions, with increasing temperature and unusually dry weather. In 2020, New Mexico experienced its fifth hottest and fourth driest year on record, with statewide average temperatures that were 3.4° F above normal and average rainfall that was 5.22 inches below normal.[2] And 2021 followed suit, with temperatures that were 2.6° F above normal, the seventh hottest year on record, and rainfall that was 1.55 inches below normal.[3] Increasingly extreme weather conditions amplify the risk of uncharacteristic, high intensity wildfires, such as those that have garnered national and international attention in recent years.

Looking back, New Mexico kicked off the 21st century with just such a wildfire. From May through July, 2000, the Cerro Grande Fire blazed in the Jemez Mountains west of Santa Fe, engulfing over 47,000 acres and numerous houses in the Los Alamos area. At the time, it was the largest and most destructive wildfire in the state's history.[4] Two decades later, New Mexicans have not forgotten about the Cerro Grande Fire, and have seen several large and destructive wildfires since then.[5]

Congress responded to the risk posed by these wildfires by creating the New Mexico Forest & Watershed Restoration Institute (FWRI)[6] in 2004, and also authorized two sister institutes in Colorado and Arizona. Together, these are known as the Southwest Ecological

A dry acequia (irrigation ditch) near the Sandia Mountains was a sign of the ongoing drought in New Mexico in 2020-21. Photo by Dr. Alan Barton

Restoration Institutes (SWERI).[7] In the SWERI authorizing legislation[8] Congress charged the FWRI and the SWERI with five specific duties:

(1) develop, conduct research on, transfer, promote, and monitor restoration-based hazardous fuel reduction treatments to reduce the risk of severe wildfires and improve the health of dry forest and woodland ecosystems in the interior West;

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[1]*U.S. Environmental Protection Agency. A Closer Look: Temperature and Drought in the Southwest.* https://www.epa.gov/climate-indicators/southwest. [2]*National Weather Service. (2021, Jan. 21). 2020 Annual Climate Summary: Overview. Albuquerque, NM: Weather Forecast Office.* https://www.weather.gov/media/abq/Briefings/Annual2020.pdf. [3]*National Weather Service. (2022, Jan. 12). 2021 Annual Climate Summary: Overview. Albuquerque, NM: Weather Forecast Office.* https://www.weather.gov/media/abq/Briefings/Annual2021.pdf. [4]*Webb, M. Diana, and Carpenter, Kelly. (2001, Mar. 26). The Cerro Grande Fire, Los Alamos, New Mexico. Los Alamos, NM: Los Alamos National Laboratory.* https://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-01-1630 [5]*Wyland, Scott. (2020, May 10). Cerro Grande Fire remains burned into New Mexico's memory 20 years later. Santa Fe New Mexican.* https://www.santafenewmexican.com/news/local_news/cerro-grande-fire-remains-burned-into-new-mexicos-memory-20-years-later/article_190f6252-896c-11ea-8ab4-ee78b330ac4e3.html. [6]See https://nmfwri.org/. [7]The SWERI partners include the Colorado Forest Restoration Institute, located at Colorado State University in Fort Collins, CO, and the Ecological Restoration Institute, located at Northern Arizona University in Flagstaff, AZ. See https://sweri.eri.nau.edu/. [8]Southwest Forest Health and Wildfire Prevention Act, Pub. L. No. 108-317, 118 Stat. 1204 (Oct. 5, 2004), codified at 16 U.S.C. §§ 6701 to 6707 (2020). See https://www.congress.gov/108/plaws/publ317/ PLAW-108publ317.pdf.

(2) synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuel reduction treatments on a landscape scale using an adaptive ecosystem management framework;

(3) translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuel reduction treatments;

(4) assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuel reduction treatments; and

(5) provide peer-reviewed annual reports.

The FWRI is located on the campus of New Mexico Highlands University (NMHU) in Las Vegas, NM.[9] The overall goal of the FWRI is to promote adaptive-management-based practices that reduce the risk of catastrophic wildfire and that enhance ecosystem health and function in New Mexico and the Intermountain West.

Staff at the FWRI work to carry out the organizational mission: "To provide technical assistance and practical knowledge in forest and woodland restoration to reduce the threat of catastrophic wildfire and restore healthy and sustainable forested ecosystems and restoration-based economies."

As noted, preparing an annual report is one of the duties specified in the SWERI legislation. This report highlights the accomplishments of the FWRI staff from the Fall of 2020 to the Winter of 2021.[10]

Overview

The period covered in this report saw the FWRI accomplish a lot despite significant challenges posed by the extended drought as well as the on-going COVID-19 pandemic. With increasing support from Congress and continued support from the State of New Mexico, the FWRI expanded its programs and staffing, branching into new areas to offer additional long-term support to affected entities in New Mexico. The Monitoring, GIS and Collaboration programs were able to adapt their operations to changing conditions and, along with our key partners, continued to provide information and assistance to communities as well as federal, state and tribal agencies.

The expansion of the FWRI's programs created advantages as the Institute increased its capacity, but also required more attention to internal organizational and operational issues within the FWRI. The Institute started the 2021 federal fiscal year with four core programs. These programs are:

- The **Geographic Information Systems ("GIS") Program**, which supports field work by FWRI staff and partners, and produces maps for planning and presentation purposes;

- The **Ecological Monitoring Program**, which collects data on forested ecosystems to assess the effectiveness of treatments that reduce wildfire risk and improve forest health;

- The **Collaboration Program**, which works with collaborative groups and networks to promote cross-boundary partnerships and to build capacity to work together effectively;

- The **Restoration Treatment Protocols Program**, which carries out training in forest treatments and promotes reintroduction of a natural wildfire return interval.

Over the 15 months covered in this report, the FWRI added two new programs. One program, **Conservation and Restoration Education**, supports workforce development and advances New Mexico's capacity in forest restoration skills, offering STEM education[11] programs for youth and college students. The **Special Programs** unit takes on temporary or new projects and develops them into potential long-term collaborations.

The FWRI also added two new Coordinators during 2020-21. The Coordinator for **Education and Outreach** works with partners and affected entities, including pueblos and tribes, on restoration education. The Coordinator for **Public Information and Communication**, a new position in December 2021, will promote the FWRI's work through mass media and help program staff develop reports on their work. The growth in programs and staffing has been made possible by additional federal funding from Congress, and is among the most notable features of this period in the FWRI's history.

These accomplishments were especially significant given the challenging conditions that the FWRI, part-

ners, and affected entities faced throughout this period. In addition to an extended drought, the COVID-19 pandemic loomed over the work of the FWRI during the 2020-21 period. When COVID-related closures started in March, 2020, many people expected them to last for a short period of time, and the FWRI staff expected to be back in the office at full capacity by the summer of 2020. Beginning in March, the staff transitioned easily to remote work, relying on email and videoconferencing for communications. However, HU remained closed to all students and visitors and most faculty and staff through the summer and Fall Semester of 2020. Only employees designated as essential could work on campus, with everyone else working remotely from home.

Staff and students in the FWRI Monitoring Program were designated as essential at the beginning of the summer, and carried out field work to collect monitoring data throughout the summer. This important work

NMFWRI staff adjusted to the Covid-19 pandemic. Photo by Katie Withnall

was necessary to maintain time-series data on forest treatments. The work was difficult due to transportation restrictions, and to many stresses brought on by the pandemic. Yet the crew responded admirably and faced every challenge with professionalism to ensure on-going data collection continued with minimal interruptions.

As the COVID pandemic dragged on, FWRI staff adapted well to the changing and uncertain conditions and directives. Most staff continued working from home throughout 2021, and developed Institute policies to guide remote and hybrid work. Weekly staff meetings on the Zoom videoconferencing platform allowed staff to coordinate their work and keep abreast of all activities.

Monitoring staff worked in the offices during the winter months to organize data collected during field work, and conducted field work during the summer of 2021. While working in the office and the field, the Monitoring crews followed COVID-safe protocols and complied with all state and university policies and regulations, including travel restrictions. This meant altering some of their ordinary practices. Overall the COVID pandemic has impacted the work of everyone at the FWRI, just as it has in workplaces across the country.

Despite working mostly from home, staff in the Collaboration, GIS, Conservation Education, and Restoration Treatment programs, as well as Outreach coordinators, were able to continue their work, relying on videoconferencing for outreach to the public and to partners.

Collaborative groups around New Mexico modified their activities, with some—especially those based in rural areas—suspending their operations and others meeting regularly on videoconferencing platforms. FWRI Collaboration staff continued to participate actively in collaborative meetings, and also advanced work with collaborative networks such as the Western Collaborative Conservation Network and the Southwest Collaboratives Support Network.

Likewise, with schools meeting online, it was necessary to modify FWRI educational programs, field days, and outreach activities, adapting to changing norms in schools. GIS staff continued to maintain the New Mexico Vegetation Treatment Geodatabase, and offered training and mapping support to partners and affected entities. And the Restoration Treatment Program produced reports on treatment protocols.

Toward the end of 2021, the FWRI and SWERI partners' capacity increased further with the news that the three Institutes would receive funding from the Infrastructure Investment and Jobs Act ("IIJA").[12] The Act charges the SWERI with expanding the Vegetation Treatment Database, one of the FWRI's signature projects, into a national geodatabase of forest restoration treatments, and also to utilize this database to advance partnerships and promote restoration knowledge, and to assess treatment effectiveness through research using the database.

These accomplishments are described in more detail in the remainder of this report.

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[12]Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429, 1098-99 (Nov. 15, 2021). See https://www.congress.gov/bill/117th-congress/house-bill/3684/text.

A few of FWRI's accomplishments in 2020-21:

Provided hands-on, standards aligned science emersions and guest presentations to 986 K-12 students from 18 northern New Mexico schools.
Page 24

Established a remote sensing monitoring protocol.
Page 9

Provided field experience to several NMHU undergraduate and graduate students.
Page 13

Completed five drone/UAS mapping projects for partners.
Page 6

Added a total of 1,346 new projects to the Vegetation Treatment Geodatabase, including 893 projects added to the historical treatment projects feature layer and 458 projects added to the completed treatment projects layer.
Page 5

Created an ArcGIS Story Map of Pritzlaff Ranch.
Page 7

Helped organize the Southwest Collaboratives Support Network and set up the website for the group.
Page 18

Monitored 170 plots across 2,993 acres despite challenges of COVID-19 restrictions.
Page 12

Convened and facilitated Restoration Economy Discussion Group meetings.
Page 19

Analyzed the social and ecological impacts of the 20-year-old Collaborative Forest Restoration Program.
Page 13

Joined the Northern New Mexico Fuelwood Working Group to match resources with communities in need.
*Page 22*

GIS and Spatial Data Analysis plays an important role at FWRI. The program continues to represent an important center of restoration-based GIS, Remote Sensing, and GPS expertise in northern New Mexico. FWRI currently has on staff a GIS Program Manager, Patti Dappen, and a GIS Specialist, Katie Withnall. The Institute brings in other GIS help as needed, and our monitoring staff and students have strong GIS skills. Joe Zebrowski, our new Special Programs Coordinator, is part of our GIS team at FWRI.

New Mexico Vegetation Treatment Database

FWRI continues to maintain the statewide geospatial database of planned, in progress, completed, and historical watershed treatments, identifying private, state, tribal, and federal forest and woodland projects for all of New Mexico. The New Mexico Vegetation Treatments web application is available at http://www.vegetationtreatments.org/

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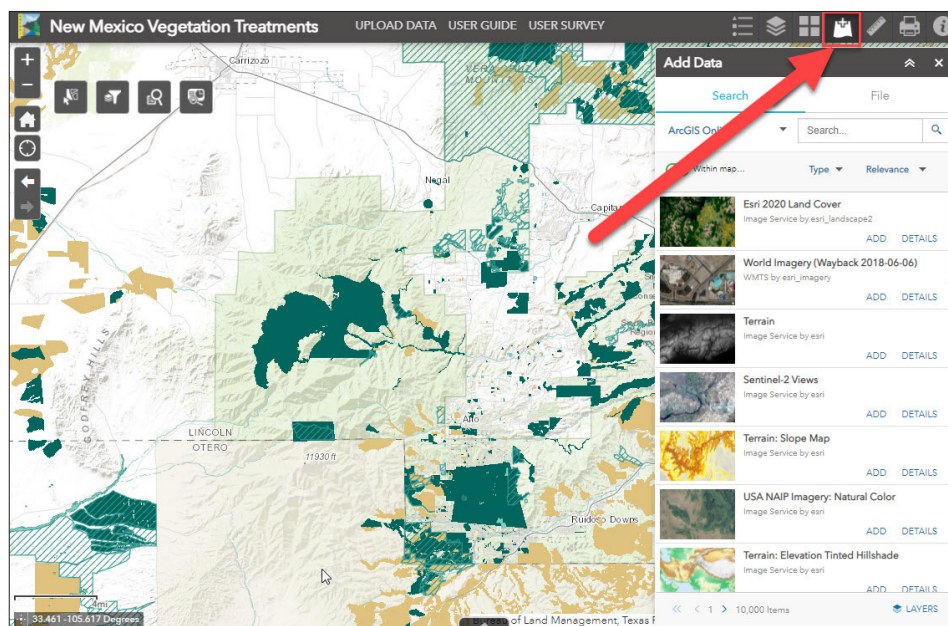
The maintenance of this database involves working collaboratively with, and receiving data from, NM State Forestry, U.S. Forest Service, BLM, Colorado State Forest Service, Greater Río Grande Watershed Alliance, tribal entities, the Greater Santa Fe Fireshed Coalition, and a host of other agencies. The collection houses over 50,000 projects. The data populates an integrated database, which is available as an interactive web application online.

New additions to the web interface this year include new tools such as employing the add layer button so that users can add personal or external data layers. Common layers that can be added include watershed boundaries and ESRI Living Atlas data layers.

From October 2020 to December 2021, a total of 1,346 new projects were added to the database, including 893 projects added to the historical treatment projects feature layer and 458 projects added to the completed treatment projects layer.

FWRI undertook outreach efforts to inform agencies and groups about the NM Vegetation Treatment geodatabase and the data Upload Tool. In March of 2021 FWRI presented a live webinar via zoom. The audience included more than ten people from various state agencies and nonprofits.

Quarterly updated versions of the geodatabase were distributed during this period to the user community. Currently the vegetation treatment database is incorporated into the New Mexico Forestry Division Shared Stewardship portal and quarterly updates are sent directly to them.

UAS (Drone) Projects

Our Unmanned Aerial Systems (UAS) Team was formed in 2018 to help bring high-end, mapping-grade UAS technology to the region. Our GIS team works with our vegetation monitoring team to capture vegetation changes on the landscape. In addition, our GIS team works with nonprofits and private landowners to help with environmental management and decision making. All members of our GIS Team are drone operators and hold FAA Part 107 Remote Pilot licenses. For two members, these licenses were renewed in April 2021.

**Micasense Red Edge MX Camera.
Image courtesy Sensefly**

New this year was the acquisition of Mica Sense Red Edge-MX Camera, a five-band multispectral sensor. It has a Single-band resolution or 1.2 MP, 1,280 x 960 px (4:3). The Multispectral bands include Blue (475 nm center, 20 nm bandwidth), Green (560 nm center, 20 nm bandwidth), Red (668 nm center, 10 nm bandwidth), Red edge (717 nm center, 10 nm bandwidth), and Near-IR (840 nm center, 40 nm bandwidth).

This camera, with the Red edge and Near-IR bands, will help detect changes in vegetation density and vegetation type. The camera will be used with smaller monitoring projects and along riparian corridors.

Our UAS this year worked to image and monitor vegetation projects continued throughout New Mexico. Projects completed this year included:

- **Pritzlaff Ranch,** San Ignacio NM, November 2020. UAS flight with Soda 3D camera of desired treatment stands for Forest Visualization project.

- **Fort Union Ranch**, November 2020. UAS flight with Soda 3D camera of Alluvial Fan deposition, Post-Monsoon Imagery with NMHU graduate student Meagen Larsen, for project "Developing an Effective Monitoring Strategy Using Photogrammetry and 3D Mapping to Measure the Impact of a Plug and Spread Composite Treatment in a Degraded Alluvial Fan in the Semi-Arid Grasslands of the Southwest": http://nmfwri.org/wp-content/uploads/2020/11/NMWRRI_2020_MLarson_NMHU_onepage_web.pdf

**Black Willow Ranch
Drone Flight and Web Map (https://arcg.is/1aDvqy) with NIR (left) and True Color (right) Composites.**

- **Black Willow Ranch** near Watrous, NM. September 21, 2021. UAS flight with Mica Sense Red Edge Camera. Riparian restoration pre-treatment flight in cooperation with Hermits Peak Watershed Restoration Alliance. True color and Color Infrared Webmap located: https://arcg.is/1aDvqy

- **Rio Abajo Restoration Area** near Belen, NM. November 16, 2021. UAS flight with Soda 3D camera eBeeX. Work in cooperation with GRGWA and Valencia SWCD. https://nmhu.maps.arcgis.com/apps/webappviewer/index.html?id=a67b86c9ff5e4109aad89fc51b35be16

- **Jemez Springs** NM, September 2021, DJI Mavic 2 Monument Canyon, drone video of stands for forest visualization project.

Virtual Desired Conditions Tours

We continue our work creating virtual desired conditions tours in forest restoration sites. Our goal is to bring these restoration areas more public exposure and reach more people through these virtual tours hosted on our website.

To create the experience of walking through a forest virtually, we employed different technologies. In the fall of 2020 we began using a Go Pro Camera for a higher resolution camera with 360-degree views. To host and navigate the images, we place them using Google Street View at https://www.google.com/streetview/.

**Go Pro 360 degree camera
Image courtesy © Future**

Our first location to visualize forests was The Pritzlaff Ranch, located near Las Vegas, in the Sangre de Cristo Mountains of northern New Mexico. The Pritzlaff Ranch has demonstration sites of three forest restoration techniques within three stands totaling about 10 acres. These sites were marked by Dr. Kent Reid and were thinned around the year 2008. These three treatment sites represent three different desired condition thinning techniques: remnant-based patch, northern goshawk, and genetics patch. A controlled burn was also introduced in the area soon afterwards. The GoPro camera was used to walk in each of these areas collecting photographs. Once collected, these images were stitched together and loaded onto Google Street view. See example image below.

Forest Visualization using 360-degree images incorporated into Google Street View.

In July 2021, the Forest Visualization Story Map of the Pritzlaff Ranch in northern New Mexico was published online. This Story Map helps to answer the question of what a northern New Mexico ponderosa pine forest should look like after restoration projects.

This Story Map highlights three different examples of the role restoration plays in achieving various desired conditions.

To view the Forest Visualization Story Map visit this website:

https://arcg.is/0nGG1X
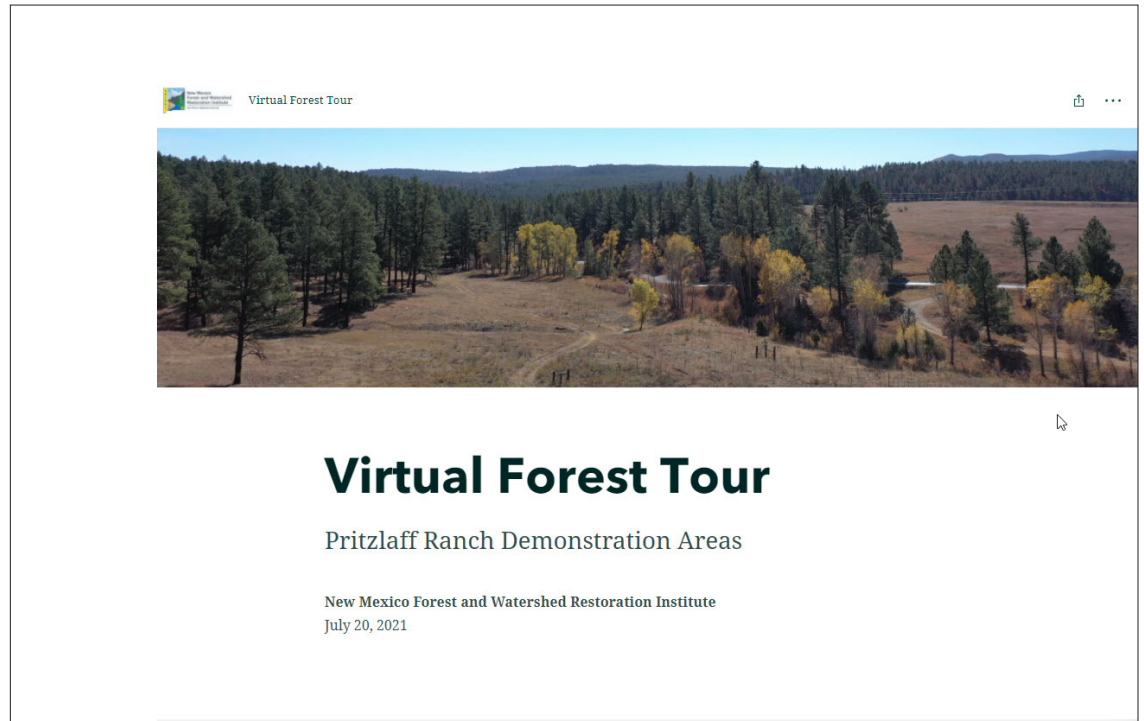
GIS Support to Stakeholders

NMHU / CREST GIS Support

The CREST project began in January 2020, when the NMHU forestry program joined two other forestry organizations in a partnership to improve forest management in New Mexico and the Southwest with the help of a $5-million grant from the National Science Foundation. The overall goal of the grant is to improve forest health and resiliency before and after forest fires. Another goal is to increase Highlands University student involvement in professional research and work in the forestry discipline, building the pipeline for new forest managers and researchers.

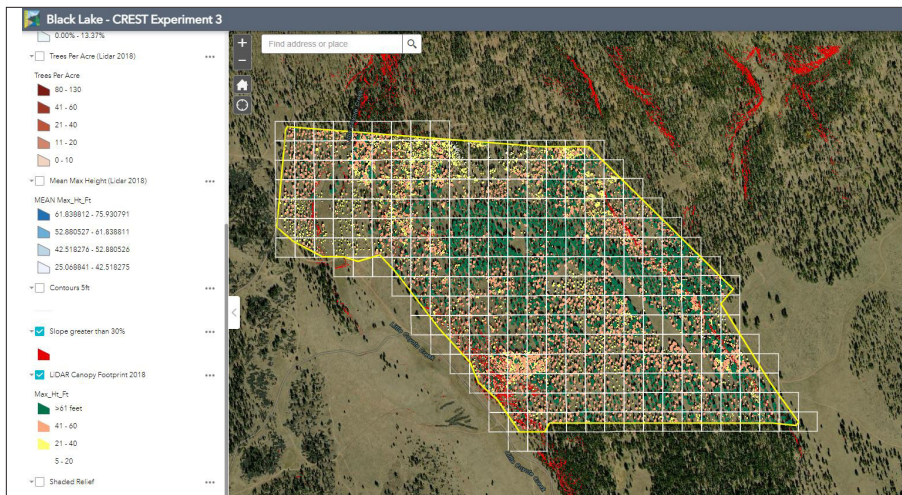**Black Lake / CREST web mapping application for Forest Assessments.**

In April 2021 our GIS Team began work to help facilitate the planning of one aspect of the CREST projects undertaken at NMHU. Our GIS Team developed a web mapping application for the Black Lake area near Angel Fire, NM. This location is owned, managed and has been thinned by the New Mexico State Land Office (SLO). To build a sample design and assess the current forest composition, LiDAR was used to map individual trees and calculate tree height. This information along with slope, forest density, percent tree canopy, aerial imagery, and other layers were assembled into a web mapping application. To view the webmap follow this link: https://arcg.is/G8viS

New Mexico State Land Office / Stand Boundary Creation Protocols

In the Fall of 2020, the SLO Surface Resources Division approached our GIS team with a request to help develop a sampling design for pre- and post-treatments sites using Remote Sensing Techniques. As the SLO is tasked with monitoring thousands of acres across the state, they were looking for a way to identify homogenous areas across the landscape that could be clustered and then identified as potential monitoring areas.

Pilot monitoring guides were assembled outlining the following steps:

1. Getting Satellite Images
2. Processing Satellite Images
3: Generating Monitoring Stands and Monitoring Plots
4. Using Avenza to load and view plot locations in the field.

These tutorials were used in house for training and monitoring planning.

Training for LiDAR Based Tools for Tree Crown and Height Estimation

Several web-based trainings were given to help assist the SLO's Surface Resources Division to estimate tree height mapping using LiDAR. These web-based trainings were done in the Fall of 2021.

As background, The US Forest Service, Pacific Northwest Region, Data Resources Management department has developed a Python tool using ArcMap 10.7.1 that identifies tree canopies and then estimates the number of tree stems.

For the training they were interested in identifying tree canopy for trees greater than 4.5 feet. The desired outcome was to estimate the number of matures trees to derive the number of Trees Per Acre (TPA). Within the modeling program, you can specify the threshold height, above which crowns will be identified. This value was set to 4 feet. Other factors can be modified to better represent canopy features such as a generalizing factor and minimum tree threshold sizes.
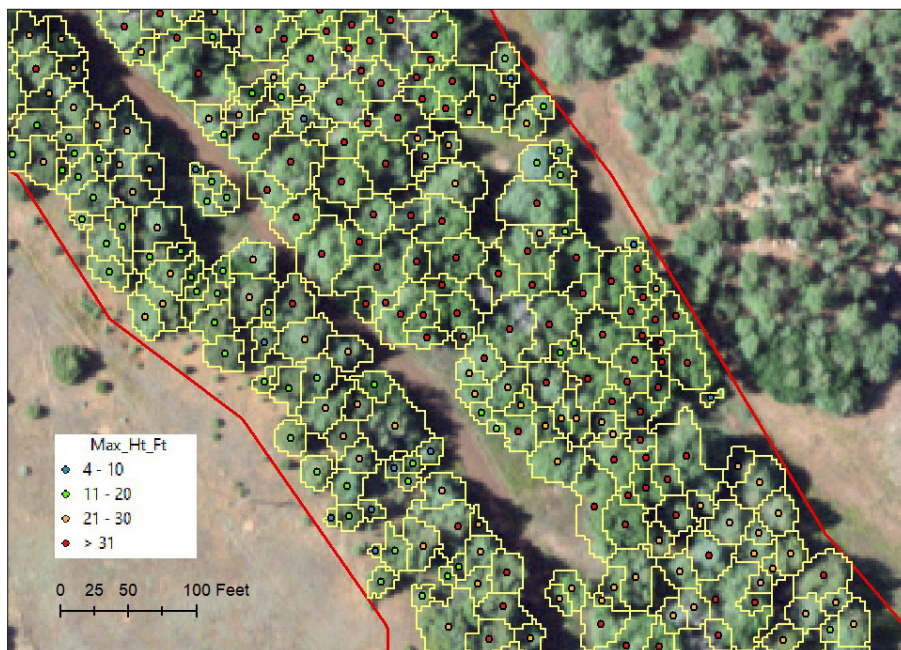
Tree Stems (individual trees with maximum height) estimated using Tree Crown Footprints.

Using the tree crown polygon layer, centroids were created in the centers of the tree crown footprints. Within the tree stem and canopy footprints, the attributes include maximum canopy height and mean height.

GRGWA GIS Support and Web Mapping Applications Updates

Due to the COVID-19 Pandemic, traditional GRGWA photo point monitoring was not possible as travel restrictions and safety issues limited the traditional field season. The GIS team helped provide Remote Sensing support to supplement traditional field monitoring methods. Pre-treatment assessments of riparian site using LiDAR (Light Detection and Ranging) and Aerial Imagery.

LiDAR and NAIP imagery were analyzed using eCognition software. An object-oriented classification system was used so that spectral characteristics as well as height above ground values of the vegetation could be incorporated into a robust classification system. LiDAR was also used to develop Vegetation Height Profiles for areas around the photo point locations.

GIS support for GRGWA includes field-based mapping support for the monitoring team and updates to the
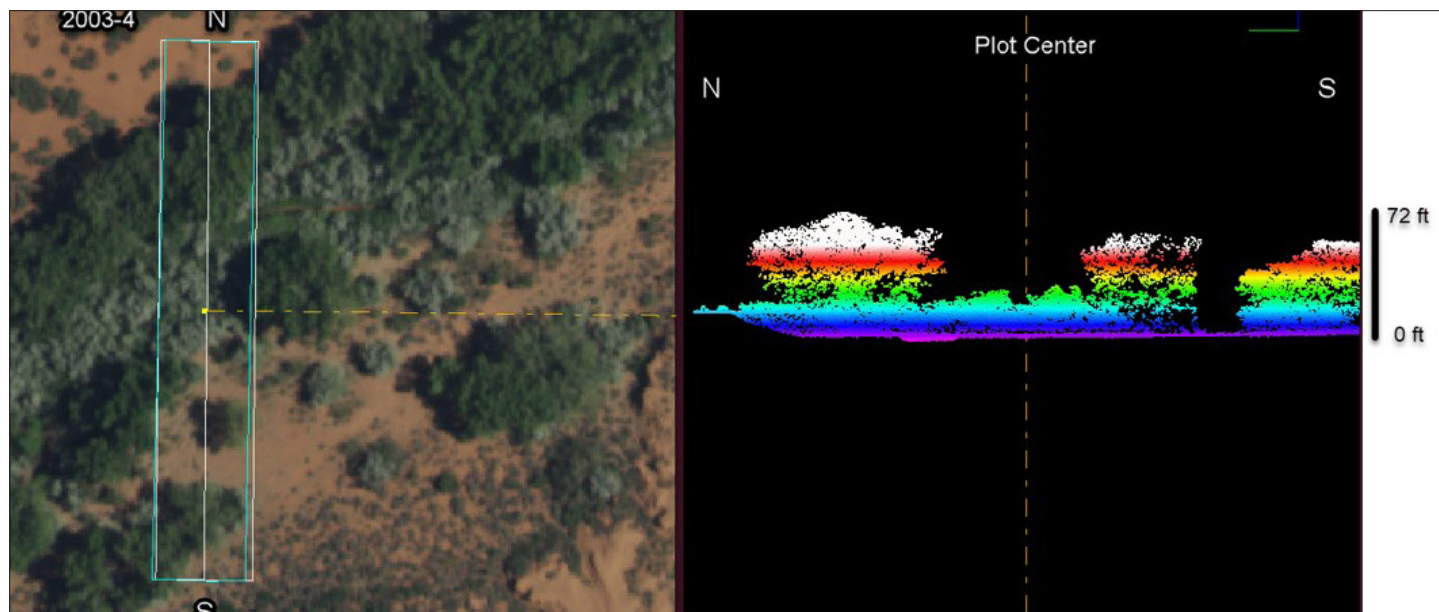
Example of LiDAR Profile at Rio Puerco Pre-Treatment Photo Point #2003-4

GRGWA online website. To support the multi-year monitoring going on with the Greater Rio Grande Watershed Alliance projects, we developed a web mapping application that continues to be maintained by FWRI. Data layers include project locations, photo point locations, base maps, and imagery.

This web map is located at https://arcg.is/yHPOW

The list of projects incorporating these Remote Sensing methods includes:

> 17-3 – Seboyeta Bibo Creek Moquino
> 17-26 – Glorieta
> 19-04 – Lagunitas Acequia

Place-based Collaboratives and CFRP – GIS Support

Mapping for Collaboration Webinar Series

Joe Zebrowski hosted a Mapping for Collaboration Webinar Series from January – March 2021. The goal of the webinar series was to explore ways to use maps to communicate collaborative efforts.

Topics covered included:
> 1. Online sources of free maps and geographic information
> 2. Web-based tools for creating and sharing maps
> 3. How collaboratives can share their activities
> 4. Accomplishments with ArcGIS Story Maps

This was a successful webinar series as maps are a proven way to bring partners around the table and identify areas and issues of common concern.

The webinar series included three training sessions:

January 27, 10:00 am – 11:30 am. Map and Geographic Information Sources. There is an enormous amount of free and high-quality geographic information available to anyone with an internet connection. This webinar examined a few of these, including the USGS National Map; state and local geographic information clearinghouses; and other publicly accessible sources such as Google Maps and ESRI's Living Atlas of the World. An ESRI Story Map was developed for this webinar: https://storymaps.arcgis.com/stories/fd413fd31b83494d8eaf96619d4ee338

February 24, 10:00 am – 11:30 am. Creating and Sharing Maps with Online Tools. There are many free or inexpensive web-based tools for creating and sharing maps. This session showcased a few common web mapping platforms, including the USGS National Map Advanced Viewer, Google Maps, and ESRI's ArcGIS Online. An ESRI Story Map was developed for this webinar: https://storymaps.arcgis.com/stories/a001f65811e64865aa39cf7f-c07c8e01

March 2021. Getting Started with ESRI's ArcGIS Story Maps. Story Maps are a compelling way for a collaborative to share its activities and accomplishments among its partners and with the public. This hands-on workshop showed participants how easy it is to tell your story with this powerful, web-based tool.

In addition to CFRP grantees, the GIS program has additional GIS mapping requests from watershed and other place-based collaborative groups. A common request is to develop and host web mapping applications. In using online mapping applications, collaborative groups can display project boundaries along with layers such as land ownership, vegetation treatments, and fire history, enabling these groups to have a better idea of areas to focus on for treatments or planning purposes. As in past years, the Institute will continue to host, maintain, and update online web mapping applications for the following collaborative groups on our website:

- The Magdalena Collaborative web map: https://arcg.is/1Srjmn
- Mountainair Collaborative web map: https://arcg.is/1aGeyK
- Otero Working group web map (requires ArcGIS login): https://arcg.is/jbu5j

Program Staff

Patti Dappen is the Institute's GIS Program Manager and has worked with the Institute since 2007. Dappen holds an FAA Remote Pilot License (UAS) and a Master of Applied Geography degree from New Mexico State University. She is an adjunct professor at New Mexico Highlands University.

Katie Withnall is a GIS Specialist and manages the Institute's NM Vegetation Treatment geodatabase. She has worked with the Institute for six years and holds a FAA Remote Pilot License. She has a Master of Environment and Development from King's College in London and a Bachelor of Arts degree in Geography from Humboldt State University.

GIS Technician Katie Withnall flies a drone to map a portion of the Sapello River near Las Vegas, New Mexico. Photo by Staci Matlock.

Field work

FWRI's monitoring staff between October 2020 – December 2021 included Ecological Monitoring Program Manager Kathryn Mahan, Crew Logistics Support/Assistant Manager Carmen Briones, and Monitoring and Data Technician Raymundo Melendez. NMHU student interns Louis Rymalowicz, Dorian Miranda and Gerardo Montijo continued their work through the summer 2021 field season. They were joined by NMHU students Faith Lovato and Desirre Herrera. Desirre stayed on through fall 2021 as a work-study student.

Measured projects included several Collaborative Forest Restoration Program (CFRP) projects at 5-years and 15-years post-treatment. The projects were located across the Carson, Cibola, Santa Fe, Lincoln, and Gila National Forests. The crew also continued work on the San Antonio Common Study under Rocky Mountain Research Station (RMRS) funding and provided three weeks of field labor for RMRS researchers.

Table 1: CFRP sites monitored between October 2020 and September 2021 (6)

Site Name	Land Manager	Acres	Forest Vegetation type(s)	Monitoring Classification	No. Plots Completed
28-05 Ensenada	Carson NF	260	Ponderosa pine	15-year-post-tx	19
01-05 Bluewater	Cibola NF	1500	PJ savannah/Ponderosa	15-year-post-tx	25
21-04 Sierra SWCD/Black Range	Gila NF	200	PJ/Ponderosa	15-year-post-tx	36
39-05 SBS II Cedar Creek	Lincoln NF	252	Ponderosa pine	15-year-post-tx	28
11-01 Monument Canyon	Santa Fe NF	230	Ponderosa pine	15-year-post-tx	10
12-13 Soil Value Added/David Canyon (Unit 1, 2, 3)	Cibola NF	551	Ponderosa pine	5-year-post-tx	52 (continued from 2020)

Collaboration and Funding

GRGWA

The Greater Rio Grande Watershed Alliance (GRGWA) is a collection of soil and water conservation districts, Pueblos, agencies, and other stakeholders in the watershed for the Middle Rio Grande working on landscape-scale watershed restoration, with a focus on non-native phreatophyte removal from the bosque. They use a variety of techniques including extraction, mastication, aerial, basal, foliar, and cut-stump herbicide applications, and plant-

Landscape of the 16-13 San Rafael GRGWA site near Grants, NM, 2021. Photo by Carmen Briones.

ing grass, trees, and shrubs. They follow community, statewide, and national management and conservation plans, and also seek to monitor the effectiveness of their restoration efforts. Our involvement with GRGWA has been supported with non-Forest Service funds.

We do most of the pre-treatment and post-treatment project monitoring, including publishing a monitoring guide (http://nmfwri.org/collaboration/greater-rio-grande-watershed-alliance/other-docs) and reports arranged by Soil and Water Conservation District (http://nmfwri.org/collaboration/greater-rio-grande-watershed-alliance/monitoring-reports).

Our website hosts an extensive collection of reports and repeat photographs (http://nmfwri.org/collaboration/greater-rio-grande-watershed-alliance/monitoring-reports/grgwa-resources), as well as a GRGWA Projects online map (http://nmfwri.org/collaboration/greater-rio-grande-watershed-alliance/grgwa-projects-online-map).

In Fall/Winter 2020, NMFWRI crews did not travel to GRGWA sites due to COVID-19 restrictions, however, we worked with the FWRI GIS Department to establish a remote-sensing monitoring protocol and completed pre-treatment reports for five proposed projects. In fall 2021, the crew were able to complete five-year post-treatment monitoring on 22 projects.

Outreach

In 2021, the FWRI monitoring department also provided first aid, safety, and forest monitoring protocol training to our own staff and crew as well as NMHU, Somos STEM (We Are Science, Technology, Engineering and Math) and NMHU Geology Program students. The department also held a staff retreat and set up Monday.com for improved transparency and communication across staff and programs.

CFRP Sustainability Analysis

FWRI was part of an effort to provide a comprehensive review of the CFRP. The Institute performed analyses of the ecological and social components of the CFRP, and Forest Stewards Guild analyzed the economic impact. For the ecological portion of the project, the monitoring team completed a detail analysis of the ecological impact of the CFRP up through 2019. The team looked at results from our pre-treatment, immediate post-treatment, 5-, 10-, and 15-years-post-treatment monitoring in piñon-juniper savannah, piñon-juniper/ponderosa pine transition, ponderosa pine, dry mixed-conifer and wet mixed-conifer forest types. We compared the monitoring metrics to the program objectives laid out in the source legislation. The report can be found at https://nmfwri.org/restoration-information/cfrp/

NMFWRI Field Crew members learn how to safely position an injured person in a wilderness first aid course held as part of their training near Las Vegas, New Mexico, 2021. Photo by Kathryn Mahan.

Database and Workflow Management

We have continued investigating options to manage our extensive fieldwork databases. We developed an Access database for use with GRGWA data. We also purchased a Juniper Mesa 3 rugged field tablet and field-tested it during the 2021 field season, along with a tablet-connected Geode GPS unit (replacing our Trimble GeoXT units). We continue to use FEAT/FIREMON's FFI but are interested in databases that would allow us to query across projects, more easily share files with other agencies, and access to models. In 2021, we were able to post a full-time Data Manager staff position for hire; the position was filled in January 2022.

Technical Support

FWRI was pleased to continue providing on-demand technical support regarding monitoring protocols, equipment, and data analysis methods to the Taos Soil and Water Conservation District. The Taos SWCD monitoring work included students from Taos High School and University of New Mexico working on CFRP and Río Grande Water Fund projects.

Top: San Cristobal Monitoring / gold sea of grasses. Right: Monitoring crew crawls through thick patch of willows to get to plot site. Photos by Carmen Briones.

Program Staff

Kathryn Mahan is the Ecological Monitoring Program Manager. She has a Master of Science in Natural Sciences with a concentration in Environmental Science and Management. She joined FWRI in 2014. She previously worked as an outdoor educator for the United World College Wilderness Program and the University of Wyoming, a biotechnician for the Las Vegas National Wildlife Refuge and as an independent natural resources consultant with organizations such as the Hermit's Peak Watershed Alliance. She has a background in wilderness and emergency medicine and firefighting.

Carmen Briones was Monitoring Crew Boss until August 2021 when she was promoted to Crew Logistics Support/Monitoring Assistant Manager. She earned a Bachelor of Science in Forestry and with a minor in Spanish from NMHU. She gained experience in Colorado nurseries and greenhouses before working at the Rio Mora Wildlife Refuge where she gained conservation and restoration skills.

Raymundo Melendez joined FWRI in 2018 as a Monitoring Technician. He was a crew supervisor during the 2021 summer field season and then was hired to assist in the FWRI Education and Outreach Program in the Fall. He earned a Bachelor of Science in Forestry with a minor in Wildland Fire at NMHU. He has experience as a timber technician with the U.S. Forest Service.

Alex Makowicki joined the FWRI in October 2021, as Monitoring Technician and Crew Boss. Makowicki's work focuses on monitoring in the riparian areas around the Rio Grande. He has a Bachelor of Science in Environmental Sciences from Walsh University.

Left: Landscape of 15-21 San Cristobal GRGWA site near Santa Fe, New Mexico, 2021. Photo by Carmen Briones.

Representatives from various organizations gather in the Gila National Forest for a training. Photo by Alan Barton.

Cross-boundary management of forests and watersheds requires landowners, managers and stakeholders to work together to coordinate their projects. Over the past two decades, collaboration has taken root in New Mexico as a strategy for managing resources on large landscapes across multiple property boundaries and jurisdictions, to address the increase in forest disturbances, including large, uncharacteristic wildfires and destructive outbreaks of insects and diseases. Collaborative groups bring together participants representing landowners, land managers, neighbors and stakeholders that have an interest in a specific landscape. They meet regularly to share information, understand each other's needs and interests, plan mutually beneficial projects, and stay updated on current policies and practices.

Participants in collaborative groups generally are volunteers, and their participation commonly is in addition to their job responsibilities. Some groups have the ability to hire a facilitator or coordinator who can take on basic tasks of convening, organizing, and running meetings and other group activities, and perhaps more advanced tasks such as preparing charters and other organizational documents, recruiting and sustaining membership, connecting with other groups and organizations, and organizing training activities. However, many collaborative groups lack the means to engage facilitation and rely on members to carry out the basic tasks of keeping the organization going. This is a significant burden to these groups' members.

In 2015, the FWRI initiated a Collaboration Program to promote collaborative practices and to support collaborative groups. Support ranges from attending and participating in collaborative meetings, to assisting with organizational tasks, to serving as facilitator. FWRI staff also participate in collaborative networks, taking on roles as convenors, facilitators and participants in organizations that link collaboratives together and provide resources to assist collaborative groups to work more efficiently and effectively. The primary functions of the Collaboration Program are to assist collaborative groups with tasks that are difficult for group members to carry out, to promote collaboration as an important aspect of adaptive ecosystem management, and to develop collaborative capacity among collaborative group participants.

Making Collaboration Work in Pandemic Times

Since early 2020, the COVID-19 pandemic has altered how Americans interact with each other in many ways. Traditionally, collaborative groups held face-to-face meetings and activities. With restrictions imposed by COVID, some collaborative groups continued their operations using videoconferencing platforms to meet, while other groups suspended or reduced their operations until the risks associated with the virus subsided. With the emergence of new variants, COVID continued to alter normal work operations throughout the period covered in this annual report.

Face-to-face meetings offer many advantages. Participants can meet people they do not know and converse informally during breaks to consider and coordinate common activities. Travel time to attend these meetings, an inconvenience to many, provides facilitators with an opportunity to prepare mentally on the way to meetings and to reflect on accomplishments on the drive back to the office. All of this is carried out in the way humans have been accustomed to interacting for many generations.

Virtual meetings also offer advantages. Inconveniences associated with travel are eliminated, and as they watch on their computer, participants can easily look up information in real time while a topic is being discussed. Virtual

meetings also present well-known downsides. It often is difficult for participants to join a conversation, working from home can lead to distractions and interruptions, and virtual meetings can be stacked back-to-back, producing "meeting fatigue" and reducing opportunities for reflection on each meeting. And, especially in rural areas, participants may lack the means to meet online effectively.
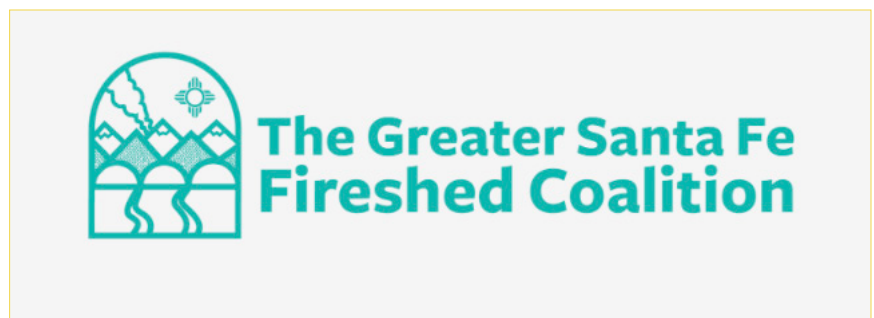
The changes brought about by the COVID-19 pandemic have given collaborative facilitators and coordinators plenty to think about. With the hope that COVID will subside in the near future, FWRI collaboration staff has started thinking through how virtual meetings have reshaped possibilities and constraints for collaborative groups.

Collaborative Groups

FWRI Collaboration Program staff promotes best practices in collaboration and works directly with collaborative groups around New Mexico in a variety of capacities: convenors, facilitators, coordinators, advisors and participants. The following four examples represent the type of work the FWRI does with collaborative groups.

Greater Santa Fe Fireshed Coalition

The Greater Santa Fe Fireshed Coalition (GSFFC) was founded in late 2015 and is based in Santa Fe. The focal landscape is the southern Sangre de Cristo Mountains to the east of Santa Fe, and includes the City of Santa Fe watershed, the source of about 40% of the city's water supply; the Hyde Memorial State Park, New Mexico's first state park; land owned and managed by the Pueblo of Tesuque, a key partner in the GSFFC; and land managed by the Santa Fe National Forest's Española and Pecos-Las Vegas Ranger Districts. The Pecos National Historic Site is located just to the east of the Greater Santa Fe Fireshed as well. The area within the Fireshed offers various recreational opportunities and is heavily used by residents and visitors. The FWRI has participated in the GSFFC since the beginning, and the Collaboration Program Manager wrote key organizational documents for the collaborative and chaired the group's Communications Committee for six years.

During the 2020-21 period, the GSFFC met regularly online, and continued its operations effectively. The collaborative completed a detailed strategy document, led by The Nature Conservancy, a key organizational partner. The FWRI is a signatory on this document and a committed partner in this organization. The GSFFC also has maintained a registry of fuel reduction and restoration treatments within its project area, and has collaborated with the FWRI's GIS Program to record these on the New Mexico Vegetation Treatment Geodatabase. See the geodatabase at https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping/ .

Magdalena Collaborative

The Cibola National Forest in central New Mexico has encouraged collaborative groups in each of its ranger districts. The Magdalena Collaborative brings together stakeholders with an interest in the Magdalena Ranger District and surrounding landscapes in Socorro and Catron Counties. The Magdalena Collaborative was started in 2018, and FWRI staff have been the collaborative's facilitators, coordinating with the Forest Service and community leaders in Magdalena and Socorro. The ongoing COVID-19 pandemic slowed the progress of the Magdalena Collaborative, as meetings took place by conference call or videoconference, and were held semi-annually. Nevertheless, these meetings kept residents and stakeholders updated on natural resource issues in central New Mexico and projects in the Magdalena Ranger District. Representatives from the Forest Service informed the collaborative about the Great American Outdoors Act and kept members informed on the Cibola National Forest Plan Revision process; a biologist from the Fish and Wildlife Service updated members on their annual wolf count; collaborative members weighed in on the Magdalena District's Travel Management Plan; and members heard a presentation on the New Mexico Forest Action Plan and Shared Stewardship Portal.

Mountainair Collaborative

The Mountainair Collaborative is the Cibola National Forest's collaborative group in the Mountainair Ranger District. The Mountainair Collaborative formed in 2017, and the FWRI has played a key role in convening, coordinating and facilitating collaborative meetings. Like other rural collaborative groups, the global COVID-19 pandemic disrupted the progress of the Mountainair Collaborative's work, as the organization did not meet in 2020. However, the collaborative met twice in 2021 by videoconference, with good attendance at both meetings. At these meetings, members were updated on the progress of the Cibola National Forest's plan revision; the Shared Stewardship initiative, which identifies the East Mountains as one of ten priority landscapes in the state; recreation fees on federal lands; and seminars sponsored by collaborative networks and the SWERI. Participants also shared information about their own organizations and projects.

Estancia Basin Watershed Health, Restoration and Monitoring Committee

The Estancia Basin Watershed Health, Restoration and Monitoring Committee (Estancia Basin Group) is one of New Mexico's oldest collaborations, dating back to the early 2000s. The Estancia Basin Group is a collaboration among four soil and water conservation districts, and regular participants include representatives from local government, the U.S. Forest Service, National Park Service, Natural Resources Conservation Service, New Mexico State Forestry Division, the Chilili Land Grant, and SWCA Consultants. The Estancia Basin Group has been very successful at acquiring funding to carry out forest treatments on both public and private lands in the Manzano Mountains. Representatives from the FWRI and HU have participated in this organization for many years, and the FWRI's Special Programs Manager has been the facilitator for this group for more than a decade.

Collaborative Networks

Networks have played an increasingly important role in providing support services for place-based collaboratives. Standing networks draw together representatives of collaboratives, or facilitators and coordinators of collaborative groups, who share information, ideas and strategies that keep collaborative groups updated on the larger context and opportunities that arise to improve their collaborations. The FWRI has taken a lead role in convening, facilitating and participating in the leadership of recently formed collaborative networks around New Mexico, the Southwest and states in the Western U.S.

Participants listen to presentations during the 2020 Western Collaborative Conservation Network Confluence in Ft. Collins, CO. Photo by Alan Barton.

Western Collaborative Conservation Network

Since 2018, the FWRI has worked with the Center for Collaborative Conservation (CCC) at Colorado State University (CSU) and collaboration advocates across the Intermountain West to advance networking strategies that build collaborative capacity and promote effective cooperative techniques. The FWRI played an instrumental role in forming and administering the Western Collaborative Conservation Network (WCCN), and in March 2020 this came to fruition with the formal rolling out of the WCCN at a regional convention that brought together about 125 collaborative participants in seven Western states. The FWRI has continued serving on the organization's leadership team and steering committee, as well as on topical committees that have advanced the work of the WCCN.

The WCCN has four standing committees that develop resources to support place-based collaborative groups around the West. The committees include the Awareness and Engagement Working Group; the Capacity Building Working Group; the Public Policy Working Group; and the Sustainable Funding Working Group. The WCCN planned a second Confluence, to be held in the Fall of 2021, but postponed this gathering for one year due to restrictions associated with the COVID-19 pandemic. The next Confluence is scheduled for the Fall of 2022, in

Montana.

Find out more at:
https://collaborativeconservation.org/western-collaborative-conservation-network/
https://www.facebook.com/WesternCollaborativeConservationNetwork/

Southwest Collaboratives Support Network

During 2019, FWRI staff met with two partner organizations in Colorado and Arizona to formulate plans for a southwestern network of collaborative groups. This came to fruition in 2020 with the formation of the Southwest Collaboratives Support Network (SWCSN), a loose-knit organization of collaborative facilitators and coordinators around the Southwest. The SWCSN originally met in a face-to-face organizational meeting in Santa Fe in February, 2020, just as the COVID-19 pandemic was beginning to affect public life in the U.S. After the initial meeting, the group agreed to meet monthly through videoconference to share experiences and discuss strategies for effective collaboration. SWCSN members also planned to hold annual face-to-face gatherings; however, an in-person workshop scheduled for October, 2021 was postponed due to the COVID-19 pandemic, and plans for a face-to-face get-together have been put on hold until group members believe it is safe for all members to once again travel and meet.

In 2020-21, SWCSN facilitators joined discussions on a variety of topics, including:

- Preparing and running effective videoconference meetings;
- Preparing charters, operational principles, communications plans, strategic plans and other organizational documents for collaborative groups;
- Considering what was learned during the COVID-19 pandemic and how facilitators might incorporate techniques learned into collaborative practice once collaboration returns to the traditional face-to-face approach;
- How collaboratives can work with elected officials and leaders in administrative agencies to sustain a mutually beneficial relationship, advance goals of the collaborative group, and continue engagement even with turnover in positions;
- Effective communications and engagement with Tribes in collaborative organizations:
- Strategies collaborative groups use to sustain leadership and to handle transitions in the life of a collaborative organization:
- How collaboratives address and deal with change in their organizations, and change that is caused by the environments in which collaborative groups operate;
- How collaboratives can increase their visibility in communities by documenting their collaborative work;
- Means of maintaining momentum and engagement in collaboration over the long term.

FWRI staff supported the SWCSN by convening and co-facilitating meetings, by actively working behind the scenes to improve the organization of this network, and by creating and maintaining a website for the organization.

See: https://www.swcollaboratives.org/

Restorative Economy Discussion Group

In June, 2020, a group of participants in the SWCSN formed an informal discussion group to explore ways in which collaborative groups can advance local economic development through collaboration. This group met regularly via videoconference for one year, carrying out peer-to-peer discussions on how to create local restorative economies. Participants heard from speakers engaged in projects designed to transform local economies, engaged in peer-to-peer discussions and studied models of sustainable economic development, including Kate Raworth's "doughnut economics" approach and Storm Cunningham's restoration economy. The FWRI Collaboration Program convened,

coordinated and facilitated monthly meetings of the Restoration Economy Discussion Group.

Connecting for Conservation—Santa Fe

With the support of Americorps-VISTA volunteers, the FWRI has worked to develop localized networks of collaborative groups. Adopting the Connecting for Conservation (C4C) model developed by the Mountain Studies Institute in Durango, Colorado, the FWRI has built the C4C-Santa Fe group. This informal network brought together representatives from several conservation collaboratives operating in or near Santa Fe, with the goal of assessing the needs of these collaborative groups. The network also provided information and resources to help the place-based collaborative groups operate more efficiently and smoothly, convening local leaders to connect Santa Fe's collaboratives with networks like the WCCN and the SWCSN. Tiering collaborative support networks requires communication, and the FWRI has created a communications network for the C4C-Santa Fe group that allows frequent updates on opportunities and resources.


Groups from the western U.S. and Canada on a tour of the Rio Mora National Wildlife Refuge. Photo by Alan Barton.

Collaborative Maps

New Mexico Collaborative Map

The New Mexico Collaborative Map was created and is maintained by FWRI staff. The map is available to the public on the FWRI website. Using a Story Map format, the NM Collaborative Map displays the forestry collaboratives and watershed groups operating in New Mexico. The map also shows organizations that offer services in support of collaboration. The NM Collaborative Map is updated periodically to maintain a current registry of New Mexico collaborations.
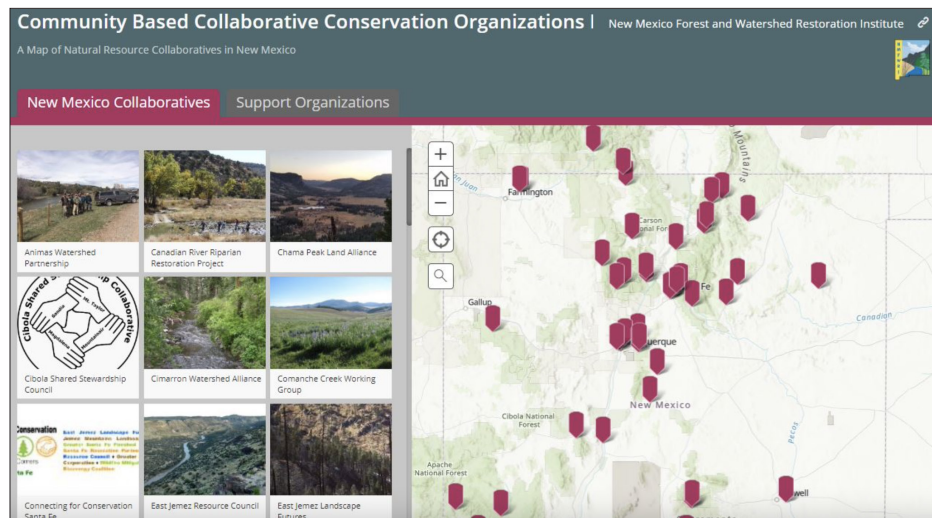
**The New Mexico Collaboratives Map provides information on collaborative groups and support organizations in the state.
See: https://nmfwri.org/collaboration/new-mexico-collaborations/**

Collaborative Conservation Mapping Project

The SWCSN initiated a project to create a regional map of collaborative groups in the southwestern U.S. A team from the SWCSN developed a questionnaire that collected information on each collaborative group, and this information is used to create a set of filters so that users can search the map and locate collaboratives with characteristics of interest. The WCCN joined the SWCSN and various other partners, and expanded the map to include states throughout the Intermountain West. More recent-

ly, the map has been expanded to include states along the West Coast, and now displays information on collaborative groups and support organizations in twelve western states. The USDA-ARS in Tucson, AZ hosts the Collaborative Conservation Map.

 See: https://findacollaborative.org

Collaborative Forest Restoration Program

 In 2021, New Mexico's Collaborative Forest Restoration Program (CFRP) celebrated its 20th anniversary. Since Congress authorized this program in 2001, the CFRP has provided funding to collaborative **forest** fuel reduction efforts around New Mexico, supporting planning and NEPA reviews, implementation of fuel reduction projects, and purchase of equipment for forest operators who support restoration. The Forest Service Region 3 Office requested that the FWRI carry out an evaluation of the CFRP on its 20th anniversary. The FWRI partnered with the Forest Stewards Guild on this project. FWRI staff have researched ecological and social impacts of the CFRP, while the Forest Stewards Guild has assessed the economic benefits of the CFRP. A report on these studies will be available in 2022.

Members of the Gila Area Watershed & Forest Restoration Collaborative at a meeting in Truth or Consequences, NM. Photo by Alan Barton.

Collaborative Support Materials

Papers and Presentations

- Alan W. Barton. "Addressing Catastrophic Wildfires Through a Sociological Lens: Applying Lessons from a Social Impact Assessment," Presentation at the Annual Meeting of the American Sociological Association, Virtual, August 6–10, 2021.

- Alan W. Barton. "Resilient Watersheds, Regenerative Economies: Incorporating Community Development in Conservation Collaboratives in the Southwest," Presentation at the Annual Meeting of the Community Development Society, Virtual, July 12–15, 2021.

- Alan W. Barton & Elliese Wright. "Networking Community-Based Conservation Collaboratives in the Western U.S. with Maps," Poster presented at the International Association for Society and Natural Resources Conference, Virtual, June 20–24, 2021.

- Alan W. Barton & Aaron Kimple. "The Southwest Collaboratives Support Network: Promoting Resilient, Restorative and Sustainable Community Development and the New Natural Resource Economy in Arizona, Colorado, New Mexico and Utah," Poster presented at the Society of American Foresters National Convention, Virtual, October 29–31, 2020.

Web Resources

 Southwest Collaboratives Support Network Website, https://www.swcollaboratives.org/

 NMFWRI, Community Based Collaborative Conservation Organizations in New Mexico, https://nmhu.maps.arcgis.com/apps/Shortlist/index.html?appid=bac35a49d16943e8972d8a64c09c591c

 Collaborative Conservation Mapping Project, Find A Collaborative Map, https://findacollaborative.org

Collaboration Program Staff

Dr. Alan Barton was hired as Collaboration Program Manager in July, 2015. He fulfilled that role until June, 2021. In July, 2021, Dr. Barton was named Assistant Director of the FWRI. He continued to manage the Collaboration Program in that position through the end of September, 2021. From October through December, Dr. Barton has served as Director of the FWRI, and the FWRI began to search for a new Collaboration Program Manager. Dr. Barton has worked closely with many collaborative groups and networks in New Mexico, and has co-facilitated the Southwest Collaboratives Support Network.

Elliese Wright joined the Collaboration Program as an AmeriCorps VISTA volunteer in July, 2020, after graduating with a degree in Environmental Sciences from Western Washington University. Wright served as Collaboration Specialist during her one-year VISTA service. Through the second half of 2020 and the first half of 2021, Wright worked to build a network of collaborative groups in the Santa Fe area and worked with collaborative groups to build their capacity. In July, 2021, she completed her VISTA service, and was hired by the FWRI as a full-time staff member, continuing her role as Collaboration Specialist. She continued her work with collaborative networks and served as facilitator for the Magdalena Collaborative.

Eleanore Mearns joined the FWRI in October, 2021 as an AmeriCorps VISTA volunteer. Mearns is a recent graduate of the University of Alaska, where she majored in Geography and developed an expertise in GIS. She relocated to New Mexico and began work in the Santa Fe area to assist collaborative groups in using GIS technologies to enhance their collaborative capacity.

Joe Zebrowski has worked for and with the FWRI since 2008. He spent five years as a GIS analyst in the early days of the FWRI, then went to work for HU's Natural Resources Department. As a faculty member and director of the Geospatial Applications in the Natural Sciences (GAINS) Lab, he continued to collaborate with the FWRI, and when he retired from HU in July, 2021, he returned to work at the FWRI as Special Programs Manager. Zebrowski has served as a facilitator for three collaborative groups for many years: the Estancia Basin Watershed Health, Restoration and Monitoring Committee; the Greater Rio Grande Watershed Alliance; and the Mountainair Collaborative.

The Education and Outreach program at FWRI works with land managers (Federal, State, Tribal, private), non-profit organizations, K-12 youth and educators, and undergraduate students at New Mexico Highlands University to support technical assistance and general public outreach on topics relating to forest and watershed ecology, land management, and fire ecology. The mission of this program is to engage diverse audiences in forest and watershed monitoring and restoration methods, and to provide support to the GIS, Monitoring, and Collaboration programs through coordination of community engagement efforts. In Fall 2020, Natalia Shaw was hired as the Education and Outreach Coordinator. In 2021, Raymundo Melendez, was hired as Education and Outreach Assistant.

Mora Middle School Students participate in a STEAMM Rally. (Science, Technology, Engineering, Art, Math). Photo by Natalia Shaw.

Partnerships and Network Building

The FWRI engages with several partners in order to create meaningful educational opportunities for stakeholders. In an effort to coordinate Tribal outreach activities across the Southwest, the Outreach program began meeting regularly with the Director of the Native American Forest and Rangeland Management Program of our sister institute, the Ecological Restoration Institute (ERI). Out of this relationship began preliminary planning for the Tribal Forestry Student Summit, which was then postponed to the Fall of 2022 as a safety precaution due to the COVID-19 pandemic. In addition, with the growing demand for fuelwood resources across the Southwest, the Wood for Life program was established in Arizona to match fuelwood from forest thinning projects with Native American communities, such as the Navajo Nation and Hopi, to supply the demand for fire wood after the closure of the Navajo Generating Station that provided free coal to these communities. To replicate this effort in New Mexico, the FWRI joined the Northern New Mexico Fuelwood Working Group to match fuelwood supplies with communities that have a demand for this resource. This group is a collaborative effort between Pueblo and Tribal Nations of New Mexico, State Forestry, U.S. Forest Service, the Bureau of Land Management, and several other local nonprofit conservation organizations. FWRI participated in monthly meetings to identify areas where the Institute could support this growing effort.

Middle school students in a STEM Showdown activity in 2020 at Storrie Lake, NM. FWRI file photo.

Outreach & Community Engagement

The FWRI Education and Outreach program presented on forest ecology, and topics surrounding forest health, to the third graders at Los Ninos Elementary. This presentation was organized when students were continuing to meet remotely, and hold classes online due to COVID-19. During this period, when student interaction, socialization, and outdoor learning was limited, it continued to be a goal of the FWRI to support K-12 educators and students and create meaningful educational opportunities. Students and teachers responded positively to the presentation and invited the FWRI to

Students in a STEM showdown learn about wetland plants. Photo by Raymundo Melendez

return. As schools began to transition to in-person learning, the FWRI Outreach program presented at the STEM Showdown, a month-long event at Storrie Lake State Park, hosted by the NMHU Conservation Science Center, which invited middle school and high school students from counties across Northern New Mexico to engage with local natural resource professionals, learn about different fields within the sciences, and learn about college and career opportunities. Before the approach of winter, the Education and Outreach program supported planning and presentation efforts for the STEAM Rally, hosted by NM MESA and NMHU Conservation Science Center. This event hosted middle school students from Mora, NM.

Inter-Institute Support

Education and Outreach program staff provided inter-institute support on projects lead by the GIS and Monitoring programs. This included writing and editing assistance on the GIS-led Virtual Forest Tour of the demonstration sites located at the Pritzlaff Ranch. Outreach staff are providing continued support to the development of the Forest Action Plan Monitoring Survey, led by the FWRI Monitoring program, as a secondary investigator. In order to coordinate education and outreach efforts, the Education and Outreach program met regularly with Shantini Ramakrishnan, Conservation and Restoration Education Program Manager, to assist in event planning and development of programming for middle school and high school students.

Program Staff

Natalia Shaw, the Education and Outreach Coordinator, has a background working with Tribal Nations on air quality and water resource monitoring programs. She previously worked for the Institute for the Tribal Environmental Professionals Environmental Education Outreach Program. As a researcher at Northern Arizona University, she developed a hydrologic model for tracking soil moisture in the Canyon de Chelly watershed in the Navajo Nation. She earned a Masters of Science in Environmental Science and Policy from NAU and a Bachelor of Science in Environmental Science from the University of Redlands.

Natalia Shaw, far right, works with Northern New Mexicostudents during a STEM Showdown in 2021. Photo by Raymundo Melendez.

Raymundo Melendez joined the Education and Outreach program as Education and Outreach Assistant in the Fall of 2021. Melendez worked with the FWRI monitoring program from 2018 until he was hired help with the expanding Education and Outreach program.

To support continued opportunities for NMHU students, the Education and Outreach program plans to develop a student internship position that will be open to undergraduate or graduate students at Highlands University.

The Conservation and Restoration Education Program at NMFWRI includes the Conservation Science Center (CSC), and is a new component to the New Mexico Forest and Watershed Restoration Institute. This program expands the Institute's work to include workforce development and recruitment into science and natural resource careers, focusing on five target areas:

- **Enhancing youth capacity** and interest in participating in Science, Technology, Engineering and Math (STEM) education and natural resource careers.
- **Building and strengthening pathways in STEM,** through placed-based, experiential outdoor learning for K-12 students.
- **Creating student cohorts** and resources in higher education, designed to increase participation and retention among STEM majors, particularly among students of color.
- **Developing culturally responsive** education and curriculum, and strategies for establishing science identity and a sense of belonging in STEM among students of color.
- **Designing holistic community engagement strategie**s that integrate access to federal/state/private working lands, with professional networks of STEM employers, New Mexicans in STEM mentors and role models, and the next generation of land stewards and conservationists.

K-12 Projects

The Conservation Science Center provided a variety of STEM projects from July 2020 to December 2021, focused on providing opportunities to underserved communities in Northern New Mexico.

- **Science, Technology, Engineering, Art, Mathematics Go (STEAMgo)** – These are Next Generation Science Standards (NGSS)-aligned modules, designed to be delivered in classrooms by teachers. The first set of modules were customized for remote learning and included individualized supplies for students. Teacher Guides included student worksheets, quizzes, and lesson extensions, while Student Guides were customized to grade level, included embedded links to enhance interactivity, and elevated minority voices in STEM through stories that focused on teenage leaders, women, and other under-represented groups. The project served 370 middle school and high school participants in Fall 2020 – Spring 2021 from Las Vegas, Espanola, Mora, Ojo Caliente, Santa Fe, Ribera, and Santa Rosa. The project also provided supplies to 110 high school participants from Las Vegas for in-person, hands-on lessons.

Introducing K-12 students to a variety of activities in science, technology, math and science is part of the STEM programming by the Conservation Science Center. FWRI file photo.

- **Classroom Connections** – This project by Albuquerque-based Explora, connects STEM professionals with grade schoolers. In December 2020, the Conservation Science Center gave a talk about "Science Jobs!" to 58 fourth graders from Puesta Del Sol Elementary School.

- **STEAMM (Science, Technology, Engineering, Art, Math and Music) Middle School Camp** – This project was CSC's first in-person engagement, following Covid-19 lockdown that ended July 1. The 3-day camp in July served more than a dozen 6-8th graders from Las Vegas schools and the village of Anton Chico, and provided leadership development for four NMHU science students community partners included NM State Parks/Coyote Creek State Park, Impact Outdoors, Mora Hatchery, Hermit's Peak Watershed Alliance, and community members, Brenda Ortega (Music and Spanish) and Mary Miller (NMHU art student). Two NMHU School of Education students also received credit/hours for leading and/or observing lessons.

• The **Tribal Youth Environmental Summer Camp (TYESC)** annual camp is hosted by the Eight Northern Indian Pueblos Council. In July 2021, Joe Zebrowski, FWRI Special Programs Manager, developed a 1-hour GIS lesson for the one-day virtual camp, and NMHU recruitment office showcased the NMHU experience.

• **STEM Showdown 2021** was hosted at Storrie Lake State Park and 352 middle and high school students from Las Vegas, Mora, Santa Fe, Española, Ojo Caliente, Ribera and Santa Rosa were served across 12 programmatic days. This was a joint event with NM MESA, and was supported by Luna Community College, Riversource, Tierra y Montes SWCD, NM State Parks, US Forest Service, NM Game & Fish, NRCS, NM Environment Department, and the Hermit's Peak Watershed Alliance.

Outdoor, hands-on learning is key to many of the workshops offered to K-12 students through FWRI's Conservation and Restoration Education Program and the Conservation Science Center. FWRI file photo.

• **ChemXchange** began as an appeal from a Mesa Vista High School teacher to increase chemistry competencies among juniors. CSC set up a near-peer exchange led by the NMHU ChemClub. Fifteen juniors participated in September 2021 (States of Matter), and 23 juniors participated the November 2021 exchange (Endothermic and Exothermic Reactions). Fifteen undergraduates led the exchange, including introductory lectures and lab experiments, while modeling and embodying leadership in chemistry.

• **STEAM Rally** is a NM MESA-initiated event. FWRI led two days of engagement at the Gene Torres Golf course, on Nov 4, 2021, for 16 Mora high schoolers and on Nov. 18 for 17 Mora middle schoolers.

Undergraduate-Graduate Student Support

Alliance for Minority Participation (AMP) is a NSF-funded project that facilitates research experiences and mentorship for STEM undergraduates. New Mexico Highlands University is sub-grantee on this New Mexico State University-led program, and CSC manager Shantini Ramakrishnan serves as the Institutional Coordinator on this grant. To ensure that students have access to research experiences, CSC established citizen science long-term monitoring projects on private working lands and mentored and co-advised a biology junior in Fall 2021, on a water quality monitoring project in the lower Mora River.

Somos STEM (We are STEM) is a NSF-funded project that engages students in culturally-informed, place- and community-based participation in STEM, through Course-based Undergraduate Research Experiences (CURE) in 1000- and 2000-level courses, Summer Science Challenge Academy (targeting 1st year students transitioning to their sophomore year), and 8-week summer internship projects with local STEM employers/mentors. FWRI staff member Joe Zebrowski serves as a co-PI and Shantini Ramakrishnan serves as senior personnel on this grant. CSC activities included: supporting a one-week Summer 2021 Academy for Leadership & Teaching in Conservation Science (May 2021) with 5 undergraduate and graduate students; co-developing 4 CUREs with 4 undergraduates (Summer 2021); completed Culturally Responsive STEM Teaching in Hispanic Serving Institutions mini course (Spring 2021), CURE Institute's Undergraduate Research at Scale: What if the treatment is a CURE? workshop (Fall 2021); supported CUREs in field labs for the Forestry (Spring 2021: Humans & Ecosystems/FOR1010, Terrestrial Ecology/FOR2020) and Biology (Fall 2021: Ecology & Evolution/BIOL2620) departments.

Climate Change Corps – Leadership in Forestry Training (CCC-LIFT) is a US Department of Agriculture-funded project in partnership with the University of New Mexico-Taos campus. NMHU is a sub-grantee, tasked to facilitate transfer of pre-science diploma students to NMHU for completion and mentorship of their 4-year degree, primarily in Forestry, and Natural Resources Management, and Conservation Management. CSC manager Shantini Ramakrishnan serves as an assistant coordinator on this grant.

Internships & Research Mentorship

• CSC served as an internship mentor for one senior and one graduate student in the biology program funded through ARMAS (Achieving in Research, Math and Science); and one Forestry junior and a Geology senior funded through a USDA Water Resources grant (Summer 2021).
• CSC sourced funding to offer the Graduate Scholars Program, providing research stipends to 3 graduate students, one each from the Forestry, Biology and NRM departments (Fall 2020).

CSC-hosted workshops/trainings for students
• USA jobs resume workshops with US Fish & Wildlife Service (February 2021)
• Refining Your Interview Skills with US Forest Service, National Park Service, US Fish & Wildlife Service, and Defenders of Wildlife (March 2021)
• Is Graduate School Right for You? w/ graduate student panel from UNM, NMSU, NMHU (November 2021)

High school students learn surveying and monitoring techniques during a workshop hosted by FWRI's Conservation and Restoration Education Program. FWRI file photo.

Graduate Scholars Program

Funded stipend support for graduate students to gain research experience; Supported 3 students in geology, biology and forestry.

Student mentorship & CSC cohort building

Established CSC distribution list for internships, jobs, scholarships, webinars, and conferences. Mentored and supported 12 students in resume/scholarship/job application reviews and edits, provided recommendation letters and served as references, responded to questions and needs about jobs, classes, majors and graduate school, and job interview preparation.

Work studies and Internships

Students from Mora, Las Vegas, Española and Mesa Vista participated in outdoor workshops coordinated by the Conservation Science Center. FWRI file photo.

As part of the ongoing effort to support NMHU science students, CSC had one work study student and helped provide four internships.

CSC Guest Lectures

• "The Power of Place: The Immersive Learning Experiences at Rio Mora Conservation Area" – HU Homecoming (October 2020)
• Disease Ecology, Biology, graduate class – guest lecture on plague dynamics in rodent populations (November 2020)
• "STEM..inizing: my journey in STEM" for BIOL 6890 Advanced Ecology (February 2021)
• Conservation Club Fossil Fuel's Action Day (October 2021)

STEM Student Pathways: Listed are CSC-led programs or ones that have CSC involvement, except those in italics, which are managed by partners. In 2021, connectivity in these pathways was strengthened.

7th - 8th grade	9th - 12th grade	College 1st year	Sophomore	Junior	Senior	Graduate Students
STEM Showdown STEM Rally STEAMgo STEAM Camp	STEM Showdown STEM Rally STEAMgo Summer Field Experience	CURE AMP/Prep Summer Academy	CURE AMP/Prep SomosSTEM Internships USDA *STEMfast*	AMP/URS FWRI USDA SomosSTEM Leader *STEMfast* *External Internship* CCC-LIFT	AMP/URS CCC-LIFT Post-Bacc Conservation Fellowship	CCC-LIFT *CREST*

Private Landowner Engagement

CSC increased access and collaboration with landowners in Fort Union, Sapello, Valmora, Villanueva, Collins Lake Ranch in Cleveland and Rolling Hills Ranch in Dilia. These interactions increased opportunities for NMHU students and interns to gain experience with restoration projects and studies.

Partnership Cultivation and Growth

In 2021, CSC expanded professional/student networks, leveraged opportunities for students, explored funding streams, and developed projects for future collaboration. Among the partnerships was one with **PlanetWomen. org**, which led to student scholarships for a conservation conference, and inclusion of a NMHU student in the Colorado River Project (pairs up female pilots with female story tellers in the Colorado River basin). Other partnership efforts included:

- **Institute for Integrative Conservation**, William & Mary in a collaboration to develop initiatives centered on racial equity in STEM (December 2020 - ongoing).
- **Ikh Nart Nature Preserve in Mongolia** sent a delegation to visit New Mexico and CSC supported a tour of arid-lands restoration techniques and approaches (Dec 2021).
- **Pueblo of Pojoaque** – Supported bison roundup and herd demographics summary, collared two bison, collecting hair samples for CURE and identified animals for annual tribal harvests.

Grants & Fundraising

CSC wrote more than a dozen grants and was awarded eight. The largest of these was a USDA Non-Land Grant Colleges of Agriculture (NLGCA) three-year grant of $299,868 to strengthen pathways between community colleges (Luna CC, Santa Fe CC, CC of Denver) and NMHU. Other grants were awarded to CSC from Noah's Ark, McCune Charitable Foundation, New Cycle, Las Vegas Community Foundation, LANL Foundation and Santa Fe Community Foundation.

Staff

Shantini Ramakrishnan is the FWRI's Conservation and Restoration Education Program Manager and the founder of the Conservation Science Center at the Institute. She has worked in Northern New Mexico since 2012. She earned a Master of Science in Life Science with a concentration in biology from New Mexico Highlands University and a Bachelor of Science in Zoology from Southern Illinois University.
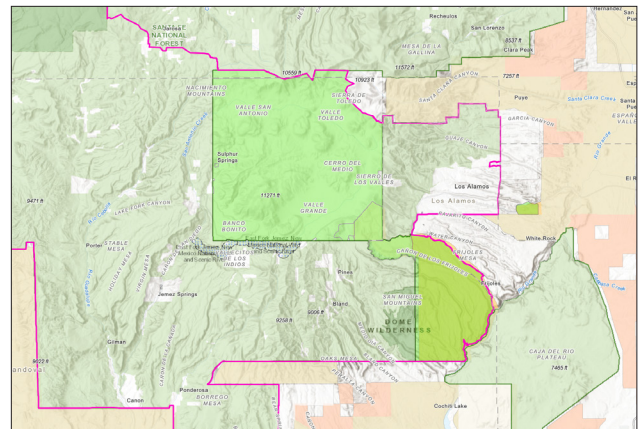
In August 2021, **Joe Zebrowski** was hired as Special Programs Manager, a new position responsible for investigating emerging projects and program areas related to the FWRI mission. In this capacity, he brought in the following externally funded initiates:

Rio Grande Riparian Area five years after treatment. Photo by Joe Zebrowski

• Meeting facilitation and geographic information systems support to the Estancia Basin Watershed Health Restoration and Monitoring (EBWHRM) Project. This project, funded by the NM Water Trust Board and managed by the Claunch-Pinto Soil and Water Conservation District, in collaboration with three other districts and other partners, seeks to improve watershed health along the eastern face of the Manzano Mountains. Projects focus on fuel-reduction thinning projects on non-federal lands, in close coordination with the U.S. Forest Service's efforts in the Mountainair Ranger District of the Cibola National Forest. This project also supports the Mountainair Collaborative, an effort centered on the Mountainair Ranger District, which seeks to improve USFS community engagement in the area.

• National Park Service Jemez Mountains outdoor recreation asset mapping. This project, funded by the National Park Service – Rivers, Trails, and Conservation Assistance program (NPS-RTCA), is a collaboration with Western New Mexico University that is creating an interactive map of outdoor recreation facilities in the Jemez Mountains area, centered on the Valles Caldera National Preserve. This work is also intended to form the basis for estabilshing an outdoor receration oriented collaborative in this area.

• Meeting facilitation, project management, and geographic information systems support to the Greater Rio Grande Watershed Alliance (GRGWA). This project is funded by the NM Water Trust Board and managed by the Claunch-Pinto Soil and Water Conservation District, in collaboration with nine other districts and other partners seeks to improve watershed health in the upper Rio Grande watershed. Projects focus on non-native phreatophyte treatments. NMFWRI provides monitoring support and serves on the technical committee that reviews candidate treatment projects.

The Jemez Recreation Map was funded by the National Park Service - Rivers, Trails and Conservation Assistance Program. Map by Western New Mexico University and Joe Zebrowski.

• Jemez Mountains unmanaged dispersed recreation surveys,. This project, funded through the USFS Santa Fe National Forest seeks to map the locations and survey conditions at the numerous dispersed and unmanaged recreation sites along road corridors in the Jemez Ranger District. These sites can be damaging to watershed and riparian zone health and are a potential source of wildfire ignitions. The start of this project is pending an agreement being processed by the USFS.

Left: Post-fire landscape in the Manzano Mountains. Photo by Joe Zebrowski.

The FWRI works with a variety of agencies and organizations around New Mexico and beyond to carry out its important work in forest and watershed restoration. The FWRI is most closely tied to two institutional alliances, one with the other two Southwest Ecological Restoration Institutes (SWERIs) and one with the academic Forestry Department at HU and a forestry research lab operated by New Mexico State University (NMSU). The FWRI also collaborates with public and private partnering organizations that share similar goals. Work with our institutional alliances and partners is directed toward affected entities, which are defined in the SWERI Act as land managers, stakeholders, concerned citizens and the States of the Interior West, including political subdivisions of the states.[1] In New Mexico, political subdivisions include counties; incorporated cities, towns and villages; districts such as soil and water conservation districts, or drainage, conservancy, irrigation, water and sanitation districts; mutual domestic or public water cooperative associations; acequias or community ditch associations; community land grants or mercedes recognized by state legislation, including pueblos[2] and other governmental entities recognized by the State of New Mexico.

Institutional Alliances

The FWRI has two principal institutional alliances, the Southwest Ecological Restoration Institutes (SWERI) and the Forest Restoration Triangle (FORT).

SWERI

The FWRI was created as part of the SWERI alliance; however, for many years, the three sister institutes created by the SWERI Act operated mostly independently. The institutes did collaborate occasionally, notably on a workshop in 2014, and directors also met annually to file their work plans with the Forest Service. In addition, individual staff members at the institutes collaborated on specific projects. However, interinstitutional collaboration was relatively rare.

Leaders from the three SWERI institutes pause for a photo during a retreat in Flagstaff in October 2021.
Photo by Melanie Colavito, ERI

In recent years, the SWERIs have worked to increase cross-SWERI collaborations, partnerships and relationships. Starting in 2018, the SWERI directors and a limited number of staff began meeting annually in the Fall for leadership retreats. The first meeting was held at Highlands University in New Mexico, then the next year the leadership met at Colorado State University (CSU) in Fort Collins, CO. The COVID-19 pandemic prevented a leadership team meeting in 2020.

In October 2021, the leadership team retreats resumed at Northern Arizona University (NAU) in Flagstaff, AZ. The Ecological Restoration Institute (ERI) hosted a two-day meeting with 20 staff members from the three institutes in attendance. The meeting included discussions on potential collaborations, a get-together in a local park, and a field trip to visit a demonstration plot operated by the ERI.

At the Arizona meeting, participants expressed support for greater inter-institutional collaboration across the SWERIs. Shortly after the meetings, discussion groups formed on various topics, portending greater SWERI collaborations in the future. Representatives from the three Institutes also began to meet monthly in a Coordination Call held by videoconference, to keep each other abreast of developments at each Institute and to coordinate projects of interest to all three SWERIs. The Directors of the three Institutes also began meeting regularly every other week to plan and coordinate actions and administration for the three Institutes.

[1] Southwest Forest Health and Wildfire Prevention Act of 2004, Pub. L. No. 108-317, 118 Stat. 1204 (Oct. 5, 2004), § 4(2).
[2] New Mexico's 23 pueblos are recognized as sovereign tribal entities, but historically also were recognized as land grants, which enjoy special status in New Mexico as political subdivisions.

In addition, a team of SWERI staff from the three institutes began meeting regularly to plan a second cross-boundary workshop to be held in Fort Collins in March 2022.[3] The workshop would build on the successful event held in Albuquerque in 2020.[4]

The SWERI and the U.S. Forest Service produce an assessment and review of the SWERI program every five years, as required in the SWERI Act. The most recent report covered the period 2015 to 2019. Contractors interviewed SWERI personnel, partners and affected entities, and compiled a report that demonstrated Review reports are available at https://sweri.eri.nau.edu/2-5-year-reviews/.

FORT

One of thousands of Ponderosa pine seedlings grown at the NMSU John T. Harrington Forest Research Center in Mora. Photo courtesy New Mexico State University

The Forest Restoration Triangle (FORT), is a partnership with the academic Forestry Department at New Mexico Highlands University and NMSU's John T. Harrington Forestry Research Center (JTH Center), located in Mora, NM. The FORT alliance was created in 2018 through a Memorandum of Understanding signed by the three partnering entities. The FORT MOU creates a shared board, that serves as the advisory entity for the three FORT allies.

The NMHU Forestry Department offers a B.S. degree in Forestry, a B.A. degree in Conservation Management, and a M.S. degree in Natural Sciences. The department is chaired by Dr. Blanca Cespedes, Assistant Professor of Wildland Fire, and departmental faculty include Dr. Joshua Sloan, Associate Vice President of Academic Affairs for Forestry and the Reforestation Center; Dr. Tomasz B. Falkowski, Assistant Professor of Socioecological Restoration; Dr. Jennifer Klutsch, Assistant Professor of Forest Entomology and Pathology; Dr. Kyle J. Shaney, Assistant Professor of Wildlife Management and Ecology; Dr. Julie Tsatsaros, Visiting Professor of Aquatic Ecology and Water Science; Dr. James R. Biggs, Visiting Professor of Wildlife and Fire Ecology; Joseph P. Zebrowski, Instructor in Geographic Information Science; and Dr. Alan W. Barton, Lecturer in Law and Policy and Human Dimensions.

FWRI staff collaborate with NMHU Forestry faculty, and the FWRI provides hands-on learning opportunities for undergraduate and graduate students enrolled in the Forestry degree program. Forestry students work on the FWRI's monitoring crews, process monitoring data during the school year, and assist in the FWRI's outreach and community education projects.

Dr. Owen Burney is the Superintendent of the JTH Center and an Associate Professor at NMSU in the College of Agricultural, Consumer and Environmental Sciences. The mission of the JTH Center is "to advance the understanding of restoration activities on forested acres in New Mexico through multidisciplinary research, education, and stakeholder collaborations." Working with private, tribal, state and federal forest managers, staff at the JTH Center help to balance pre-fire preparations and post-fire recovery and rehabilitation. Challenges that accompany a changing climate, sustained drought, and large burn scars from high-intensity wildfires create complex research questions that the JTH Center address with studies carried out on their own forests and research plots in Mora, and in reforestation sites around

From left: Dr. Blanca Cespedes, assistant professor of Wildland Fire at NMHU, Dr. Own Burney, Superintendent of the JTH Center in Mora and former FWRI director Dr. Kent Reid in 2020. Photo courtesy Jane Moorman/NMSU.

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[3] In early 2022, the decision was made to postpone this workshop for one year, as travel and large group gatherings were still deemed unsafe due to COVID-19. The workshop committee continued planning efforts for a workshop to take place in the Spring of 2023.

[4] See https://sweri.eri.nau.edu/cross-boundary-workshop-wrap-up/.

New Mexico. In 2021, the JTH Center produced 138,000 tree seedlings, which were distributed to cooperating landowners and agencies.

The FORT Board consists of the Director of the FWRI, the Director of the JTH Center, and the Director of Forestry at NMHU, as well as members representing federal and state agencies, universities, pueblos and non-governmental organizations. As of November, 2021, the FORT Board members were: Alan Barton (FWRI Director), Owen Burney (JTH Center Director), Josh Sloan (NMHU Director of Forestry), Anne Bradley (The Nature Conservancy), Daniel Denipah (Santa Clara Pueblo), Eytan Krasilovsky (Forest Stewards Guild), Ellis Margolis (U.S. Geological Survey), Linda Nagel (Colorado State University), Lindsey Quam (New Mexico State Forestry Division) and Jim Youtz (U.S. Forest Service).

In 2019, the FORT received a Centers for Research Excellence in Science and Technology (CREST) Grant from the National Science Foundation (NSF). The NSF-CREST program aims to enhance research capacity at minority-serving institutions (MSI). An important goal of the NSF-CREST is to recruit students from minority groups that are underrepresented in universities to careers in scientific research. Dr. Kent Reid, Director of the FWRI, served as the principal investigator (PI) from its initiation until he retired at the beginning of October 2021, at which point the role of PI transferred to Josh Sloan. The CREST Grant will continue through December 2024.

For more information, see: https://www.nmhu.edu/department-of-forestry-2/forest-restoration-triangle/ https://www.nmhu.edu/5-million-grant-to-improve-forest-health-in-new-mexico-and-southwest/

In FY21, the JTH Center sought funding to expand their operations into a national-scale Reforestation Center, supported by the FORT alliance. NMSU and NMHU have worked with the New Mexico Legislature, foundations, businesses and partners to acquire funding to build the Reforestation Center. When completed, the Reforestation Center will be a source of seeds and seedlings to use in reforesting burned areas and reclaimed landscapes. There is a growing need for these resources as landscapes burned in megafires can take decades to recover or may be converted to non-forest ecosystems. The Reforestation Center also will be a great resource for information on tree planting and reforestation in New Mexico and around the West.

Partnerships

The FWRI leadership carefully considers all solicitations it receives for assistance, and the Institute is willing to work with many other entities on projects that advance the Institute's mission and goals. Moreover, one of the functions of the Special Programs Manager, a position created in the summer of 2021, is to seek out and evaluate potential projects. However, much of the work of the FWRI relies on close collaboration with partners. Partnerships are rooted in relationships that facilitate the FWRI's work by building social capital—trust, common norms, reciprocity, network connections, respect, support, social learning, and a shared community vision.[5] These partnerships enable efficient and effective collaborations by reducing transaction costs, misunderstandings, and disagreements, and by enhancing easy communication.

Through working together over many years, the FWRI has forged strong partnerships with state agencies, and particularly the New Mexico State Forestry Division; with federal agencies, including the U.S. Forest Service, the U.S. Fish & Wildlife Service, and the Bureau of Land Management; with soil and water conservation districts, including Claunch-Pinto, Edgewood, Valencia and Tierra y Montes, and the South Central Mountains RC&D; with non-governmental organizations, including The Nature Conservancy, the Forest Stewards Guild, the New Mexico Forest Industry Association, the New Mexico Rural Water Association, and the Mountain Studies Institute; with other academic institutions, including the University of New Mexico Biology Department, and Colorado State University's Center for Collaborative Conservation; with businesses, including SWCA Environmental Consultants, Restoration Solutions, and Southwest Decision Resources; and with tribes and pueblos, including Mescalero Apache, Alamo Navajo, Taos Pueblo, Isleta Pueblo, Pojoaque Pueblo and Tesuque Pueblo.

[5] Pretty, J. (2003). Social capital and the collective management of resources. Science, 302(5652), 1912–14; Coleman, K., & Stern, M. (2018). Exploring the functions of different forms of trust in collaborative natural resource management. Society & Natural Resources, 31(1), 21–38; Levesque, V. N., Calhoun, A. J. K., Bell, K. P., & Johnson, T. R. (2017). Turning contention into collaboration: Engaging power, trust, and learning in collaborative networks. Society & Natural Resources, 30(2), 245–60; Gitell, R. J., & Vidal, A. (1998). Community organizing: Building social capital as a development strategy. Thousand Oaks, CA: Sage Publications; Jones, N., Sophoulis, C. M., Iosifides, T., Botetzagias, I., & Evangelinos, K. (2009). The influence of social capital on environmental policy instruments. Environmental Politics, 18(4), 595–611.

New Mexico's Vegetation Treatment Geodatabase Goes Nationwide

Congress is funding a nationwide version of FWRI's Vegetation Treatment Geodatabase under the Bipartisan Infrastructure Law.
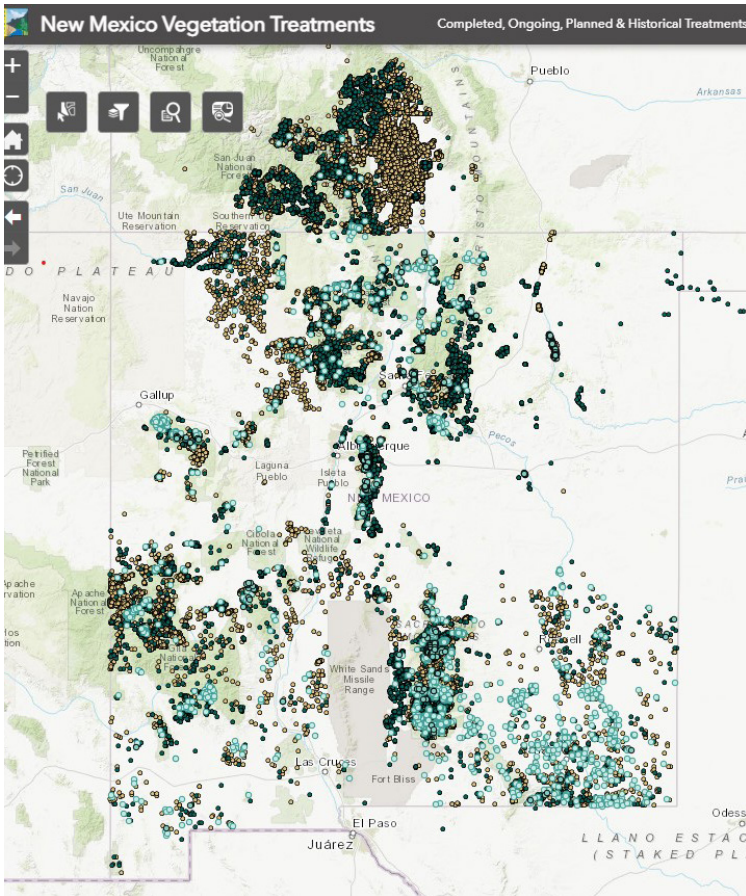
For the past several years, one of the FWRI's signature projects has been the Vegetation Treatment Geodatabase, described in the GIS Program section of this report. This popular decision-support tool displays historic, current and planned fuel reduction and restoration treatments around New Mexico. Landowners, managers and stakeholders can use the geodatabase to coordinate treatments, design controlled burns, plan responses to potential wildfires, and manage fires once they ignite. The geodatabase is widely used by New Mexico foresters, and FWRI GIS Program staff also have fielded calls from managers around the country interested in creating a similar map in their own states.

Congress took notice of the project and tapped the SWERIs to expand the New Mexico geodatabase to a national scale, as part of the $1.2 trillion Infrastructure Investment and Jobs Act (IIJA)[1], also known as the Bipartisan Infrastructure Law (BIL). Signed into law by President Joe Biden on November 15, 2021[2], the IIJA includes many provisions to improve the nation's infrastructure. Among these, Congress has dedicated over $5 billion to improving the management of the nation's public and private forestlands.

Section 40803(c)(8)[3] of the IIJA sends some of these funds to the FWRI and its SWERI partners to carry out infrastructure-related projects over the next five years. Including the SWERIs in the IIJA demonstrates the confidence that Congress has in the three Institutes and the reputation the SWERIs have built through their work with partners around the Southwest. IIJA funding supplements the SWERI's annual federal appropriations and expands the SWERI's capacity to carry out the projects that Congress defined in the Act.

The primary infrastructure project will be a nationwide geodatabase and publicly available map of vegetation treatments, modeled on the FWRI's Vegetation Treatment Geodatabase. The aim is to produce a geodatabase that is functional, useful and complete. The nationwide map will display vegetation treatments on federal lands, and, as data are available, on state, tribal and private lands as well. The map also will show the perimeters of all major wildfires. Additional projects specified in the IIJA for the SWERIs include assisting partners and affected entities in using the national geodatabase, and developing protocols for using the geodatabase to conduct research on forest treatment effectiveness.

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[1] Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429, 1098-99 (Nov. 15, 2021). See https://www.congress.gov/bill/117th-congress/house-bill/3684/text.

[2] The bill was passed by the House on July 1 and by the Senate on August 10. After differences were resolved, Congress passed the final bill on November 5, and sent it to the president for signature.

[3] Pages 1098-1099 of Statutes at Large, Volume 135, November 15, 2021, available at https://www.govinfo.gov/content/pkg/PLAW-117publ58/pdf/PLAW-117publ58.pdf.

In December 2021, the SWERIs jointly issued a briefing paper to share with policymakers and administrators, presenting preliminary plans for implementing the SWERI portion of the IIJA. The SWERIs will begin scoping the project in January 2022 and likely will begin hiring staff to carry out these projects in mid-2022.

The SWERI portion of the IIJA reads as follows:

SEC. 40803. WILDFIRE RISK REDUCTION

…

(c) ACTIVITIES.—Of the amounts made available under sub-section (a) for the period of fiscal years 2022 through 2026—

…

(8) $20,000,000 shall be made available to the Secretary of Agriculture to enter into an agreement with a Southwest Ecological Restoration Institute established under the Southwest Forest Health and Wildfire Prevention Act of 2004 (16 U.S.C. 6701 et seq.)—

(A) to compile and display existing data, including geographic data, for hazardous fuel reduction or wildfire prevention treatments undertaken by the Secretary of the Interior or the Secretary of Agriculture, including treatments undertaken with funding provided under this title;

(B) to compile and display existing data, including geographic data, for large wildfires, as defined by the National Wildfire Coordinating Group, that occur in the United States;

(C) to facilitate coordination and use of existing and future interagency fuel treatment data, including geographic data, for the purposes of—

(i) assessing and planning cross-boundary fuel treatments; and
(ii) monitoring the effects of treatments on wildfire outcomes and ecosystem restoration services, using the data compiled under subparagraphs (A) and (B);

(D) to publish a report every 5 years showing the extent to which treatments described in subparagraph (A) and previous wildfires affect the boundaries of wildfires, categorized by—

(i) Federal land management agency;
(ii) region of the United States; and
(iii) treatment type; and

(E) to carry out other related activities of a Southwest Ecological Restoration Institute, as authorized by the Southwest Forest Health and Wildfire Prevention Act of 2004 (16 U.S.C. 6701 et seq.);

Staffing Changes

New Leadership

FWRI Director Dr. Kent Reid retired at the beginning of October 2021. Dr. Reid was one of the first FWRI staff members, and worked continuously for the FWRI beginning in 2007 until his retirement. Dr. Reid served as Senior Forester during the early years of the FWRI, and twice served as Interim Director during transitions in leadership. In October 2013, Dr. Reid was named Director of the FWRI, and led the Institute through a period of growth. During his tenure, the FWRI solidified programs and capacity in Geospatial Information Systems, Monitoring, Collaboration, and Restoration Protocols. The FWRI added staff positions, increased its outreach to affected entities, and built closer collaboration with its SWERI partners. The FWRI also formalized its Forest Restoration Triangle (FORT) alliance with the NMHU Forestry Department and NMSU's John T. Harrington Forestry Research Center. Dr. Reid led the FORT partners in acquiring a National Science Foundation (NSF) Centers for Research Excellence in Science and Technology (CREST) grant, and served as Principal Investigator for this grant until his retirement.

Following a nationwide search, Dr. Alan Barton was selected as the new Director of the FWRI, and assumed this role on October 2, 2021. Dr. Barton joined the FWRI in July 2015 and served as Collaboration Program Manager and more recently as Assistant Director. As Director, Dr. Barton initiated a shared leadership approach, forming a Leadership Team that included program managers and coordinators. The Leadership Team met weekly from October through December, and initiated new policies to guide the growing Institute.

FWRI Leadership Team

Dr. Alan Barton, FWRI Director
Joe Zebrowski, Special Programs Manager
Patti Dappen, GIS Program Manager
Kathryn Mahan, Ecological Monitoring Program Manager
Shantini Ramakrishnan, Conservation and Restoration Education Program Manager
Natalia Shaw, Education and Outreach Coordinator
Staci Matlock, Public Information Specialist
Cesar Alvizo, Budget, Finance and Administration Manager

New Staff Members

The FWRI added several new staff members between October 2020 and December 2021.

Natalia Shaw joined the FWRI in October, 2020, as Education and Outreach Coordinator.

Shantini Ramakrishnan collaborated with the FWRI for several years representing the Rio Mora National Wildlife Refuge as Director of the Rio Mora Conservation Science Center. In August 2020, when the Denver Zoo pulled out of the Rio Mora Refuge, Ramakrishnan joined the staff at NMHU and brought the Conservation Science Center (CSC) under the university's umbrella, affiliated with the FWRI. In June 2021, she became the FWRI Conservation and Restoration Education Program Manager.

Elliese Wright joined the FWRI as Collaboration Specialist and a full-time staff member in July 2021.

Joe Zebrowski rejoined the FWRI as a staff member in August 2021, after retiring from the NMHU faculty.

Alex Makowicki joined the FWRI in October 2021, as Monitoring Technician and Crew Boss. Makowacki's work focuses on monitoring in the riparian areas around the Rio Grande. He has a B.S. in Environmental Sciences from Walsh University.

Eleanore Mearns joined the FWRI in October 2021, as an Americorps VISTA volunteer working with the Collaboration Program.

Staci Matlock started at the FWRI in December 2021. She has an extensive background with the mass media in New Mexico, and previously worked as a staff writer and editor for the Santa Fe New Mexican and the Taos News. Matlock is the Public Information Coordinator for the FWRI, and is responsible for public relations, document preparation and media relations. She attended the University of Arizona, earning a B.S. in Agriculture and an M.A. in Journalism.

FY21 Staffing

At the beginning of October 2020, the FWRI staff included:

Kent Reid, M.S., Ph.D., Director
Patti Dappen, M.A.G., GIS Program Manager
Kathryn Mahan, M.S., Monitoring Specialist
Alan Barton, M.S., J.D., Ph.D., Collaboration Program Manager
Cesar Alvizo, M.B.A., Budget & Finance Manager
Katie Withnall, M.Sc., GIS Specialist
Raymundo Melendez, B.S., Monitoring Technician/Field Crew Boss
Carmen Briones, B.S., Monitoring Technician/Field Crew Boss

Affiliated Staff:

Joe Zebrowski, M.S., HU Instructor in Natural Resources Management and
Director, Geospatial Applications in the Natural Sciences (GAINS) Lab

At the end of December 2021, the FWRI staff included:

Alan Barton, M.S., J.D., Ph.D., Director
Patti Dappen, M.A.G., GIS Program Manager
Kathryn Mahan, M.S., Ecological Monitoring Program Manager
Joe Zebrowski, M.S., Special Programs Manager
Shantini Ramakrishnan, M.S., Conservation & Restoration Education Program Manager
Cesar Alvizo, M.B.A., Budget & Finance Manager
Katie Withnall, M.S., GIS Specialist
Natalia Shaw, M.S., Education Outreach Coordinator
Staci Matlock, M.A., Public Information Specialist
Carmen Briones, B.S., Monitoring Program Assistant Manager & Crew Logistic Support
Alex Makowicki, B.S., Monitoring Technician and Crew Boss
Raymundo Melendez, B.S., Education and Outreach Assistant
Elliese Wright, B.S., Collaboration Specialist
Eleanore Mearns, B.S., Technology & Collaboration Technician, Americorps/VISTA Volunteer

FWRI Staff at Pritzlaff Ranch, September, 2021

FWRI Staff Retreat

In September, 2021, the FWRI held a staff retreat for two days at Pritzlaff Ranch near San Ignacio, NM. The Staff Retreat provided an opportunity to assess progress over the previous year, to set goals and plan activities for the coming year, and to engage in staff-building activities. With most of the FWRI staff working from home due to COVID restrictions, the retreat also was the first time staff members saw each other in person and worked face-to-face in many months.

FWRI Support to Highlands University

Courses Taught by FWRI Staff

FORS 3300 Natural Resource Law and Policy, Fall Semester 2020, by Dr. Alan Barton
FORS 3300 Natural Resource Law and Policy, Fall Semester 2021, by Dr. Alan Barton

Guest Lectures by FWRI Staff

FORS 5890 Applied Ecology and Environmental Restoration, "Law, Policy and Landscape Restoration," Fall Semester 2020, by Dr. Alan Barton

Sources of FWRI Funding

Core Funding

Federal Funding through U.S. Forest Service

Core funding for the FWRI comes from annual appropriations from Congress, as authorized in the Southwest Forest Health and Wildfire Prevention Act of 2004 (P.L. 108-317), the legislation that created the FWRI. Appropriated funds are allocated to the U.S. Forest Service (USFS) and distributed to the three SWERI Institutes via the USFS's Southwestern Region Office in Albuquerque, NM. Beginning in 2018, Congress has increased the annual appropriations to the SWERI and FWRI, which has permitted the Institutes to expand their staffing and programs, as well as the scope of the work they take on.

State Funding through New Mexico State Legislature

Core funding for the FWRI comes from appropriations from the New Mexico Legislature. The SWERI Charter, created by the Western Governor's Association and signed by the governors of the three states and the presidents of the three universities in June, 2005, commits the State of New Mexico to the SWERI partnership with the federal government. Funds from the N.M. Legislature are channeled through Highlands University ("HU"), the FWRI's home institution. The State of New Mexico classifies the FWRI as a Research and Public Service Project ("RPSP"), a category of funding to higher learning institutions in New Mexico to support temporary or on-going programs.

Additional Support

State In-Kind Support Through Highlands University

NMHU also provides substantial support to the FWRI through a reduced rate for overhead costs charged by the university. As specified in the SWERI Charter, NMHU agrees to provide the FWRI with facilities and administrative support, and providing these at a reduced cost represents a substantial contribution from the university to the success of the FWRI. In-kind support includes office and meeting space, maintenance, equipment, utilities, and services provided by the university, including human resources, financial services, administering grants and contracts, transportation, IT support, teamwork with other campus institutes and offices, and general administrative support through the Office of Academic Affairs.

Grants and Contracts

Greater Rio Grande Watershed Alliance

The Greater Rio Grande Watershed Alliance (GRGWA) is a collaboration that works to restore riparian and upland ecosystems in the landscape surrounding the Rio Grande. GRGWA partners include soil and water conservation districts, Pueblos, the Natural Resources Conservation Service ("NRCS"), and private consultants, along with the FWRI. The GRGWA Board funds projects carried out by the FWRI, including monitoring of their treatments and facilitating GRGWA meetings and collaborative processes.

USFS Rocky Mountain Research Station

The Rocky Mountain Research Station (RMRS) is one of five stations in the Research and Development arm of the USFS. The FWRI is conducting a multi-year monitoring project in the Jemez Mountains, with funding from the RMRS and the Jemez Ranger District of the Santa Fe National Forest (SFNF). The contract supports some summer work by FWRI Monitoring crews.

Education and Outreach

The FWRI educational, outreach and workforce development work is supported by grants and contracts with a variety of organizations, including the McCune Charitable Foundation, the NMHU Foundation, the Los Alamos National Laboratory (LANL) Community Partnerships, and the New Cycle Foundation.

<u>Contact</u>

For more information about this report:

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