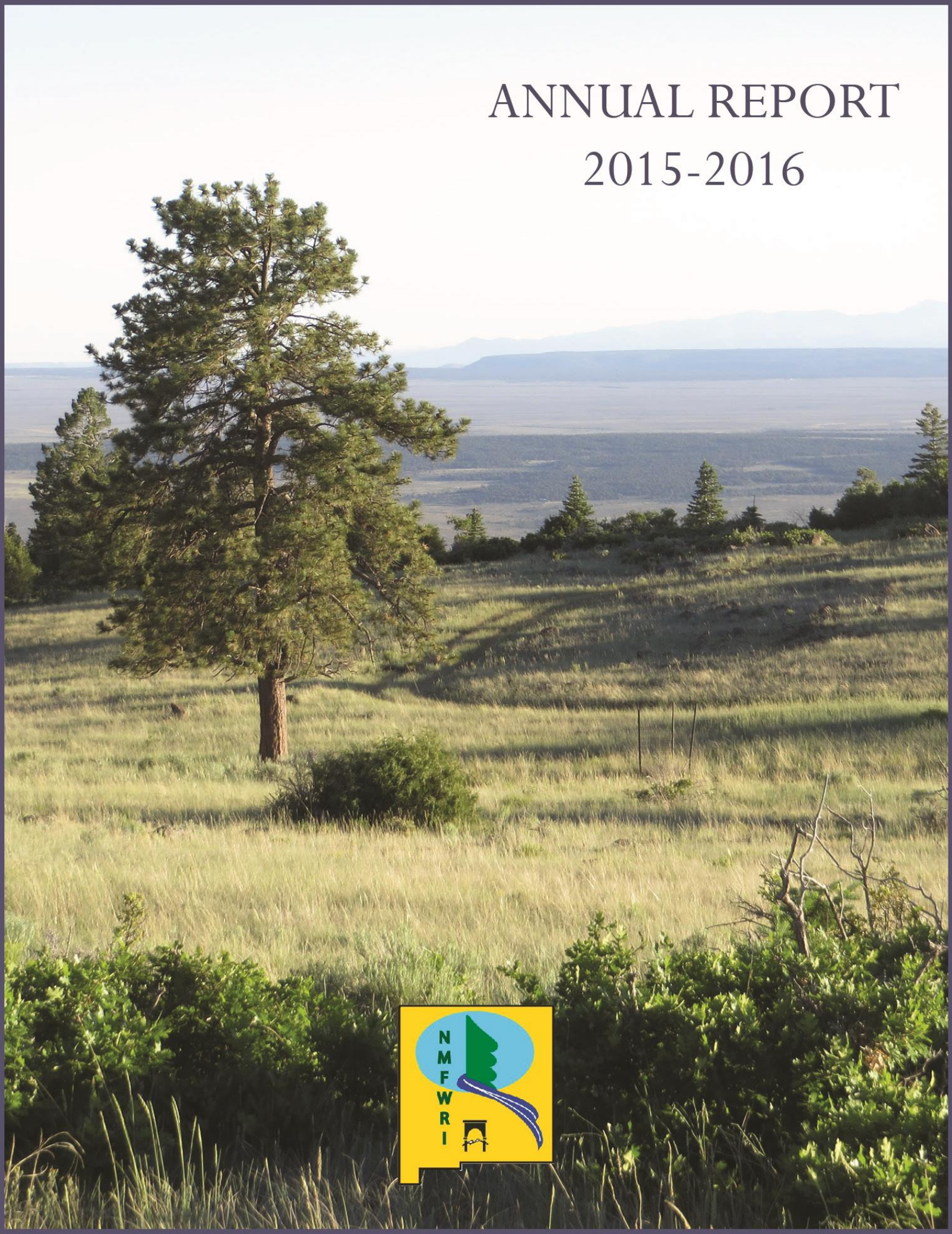
ANNUAL REPORT
2015-2016



New Mexico Forest and Watershed Restoration Institute Annual Report

2015-2016

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The New Mexico Forest and Watershed Restoration Institute (FWRI) exists to promote practices that reduce the risk of catastrophic wildfire and enhance ecosystem function. We pursue this through four program areas: the biology of restoration treatments, or which tree to cut and which to leave, with an emphasis on the need to burn treated areas; support from geographic information systems (GIS) to field work by FWRI and our partners, which usually involves maps; monitoring, or how to determine if treatments are effective, the subject which accounts for most of our partner's requests for technical assistance; and collaboration, something we have always done but now is backed up by a full-time staff member.

This report is organized into the four broad areas mentioned above: technical assistance in restoration protocols, GIS, monitoring, and watershed restoration partnerships. These areas are further subdivided as needed. An Appendix corresponding to our Forest Service work plan is included.

This report focuses on the period 1 October 2015 through 30 September 2016, with activities outside of that period mentioned as needed for context. This period was one of high activity for the Institute. Three new full-time staff members began work in mid-2015. Ms. Kathryn Mahan began in early June as a monitoring specialist, especially working on riparian areas treated under the Greater Rio Grande Watershed Alliance (GRGWA). Dr. Alan Barton began as the Collaboration Program manager in late July, and Dr. Rob Strahan began as the Restoration Monitoring Program Manager in August. Very little work was done by contractors during this period. In addition to the full-time staff, we employ Highlands' undergraduates as work-studies and to assist with summer field work.

TECHNICAL ASSISTANCE IN RESTORATION PROTOCOLS

In order to both mitigate the potential for catastrophic wildfire and restore natural watershed functions, the NMFWRI provides technical assistance with fuel treatments and restoration prescriptions, and technical assistance with Geographic Information Systems and mapping. These technical assistance efforts extend beyond individual land ownerships and jurisdictions.

Outreach in treatments and prescriptions

Workshops

In March 2016, NMFWRI joined with agencies operating in the Sacramento Mountains to begin planning workshops to explain and discuss the Forest Service's Desired Conditions as outlined in the RMRS publication GTR-310. Initial contacts included the City of Ruidoso, State Forestry-Capitan, ENMU-Ruidoso, the Lincoln National Forest, and Mescalero Apache Reservation. The Lincoln National Forest saw these workshops as fitting in with their on-going Forest Plan Revision, and became the major partner in the planning. Since the guidelines can be applied to any ownership, the workshops were open to all, including private landowners. The South Central Mountain RC&D became another important planning partner.

Planning continued throughout the summer and early fall, and the workshops were scheduled for late October 2016. Two workshops were held, both covering the same material and visiting the same forest stands. The first workshop emphasized the landscape-level benefits of forest

restoration, and the second emphasized stand-level protocols for workers in the woods. Each workshop started with a half-day of indoor presentation of background information, then moved outdoors. Presenters were from the Forest Service, Ecological Restoration Institute (ERI), FWRI, and the Fish and Wildlife Service. The afternoon of the first day was around Ruidoso, including dwarf mistletoe rehabilitation on the Mescalero Reservation. The second day was east and south of Cloudcroft. A total of 42 participants and 11 planners and presenters attended one or both sessions.

Statewide

In August 2016, the staff of the Interim Water and Natural Resources (WNR) Committee of the state legislature asked FWRI to organize a panel to report on forest restoration activities during the past year. After a delay related to the Legislature's Special Session, the Interim WNR hearing was held at Socorro in late October. Representatives from State Forestry, the Forest Service, Game & Fish, FWRI, The Nature Conservancy (TNC), and the Forestry Industry Association prepared a 40-minute formal presentation, then took questions for almost an hour.

GIS/SPATIAL DATA ANALYSIS

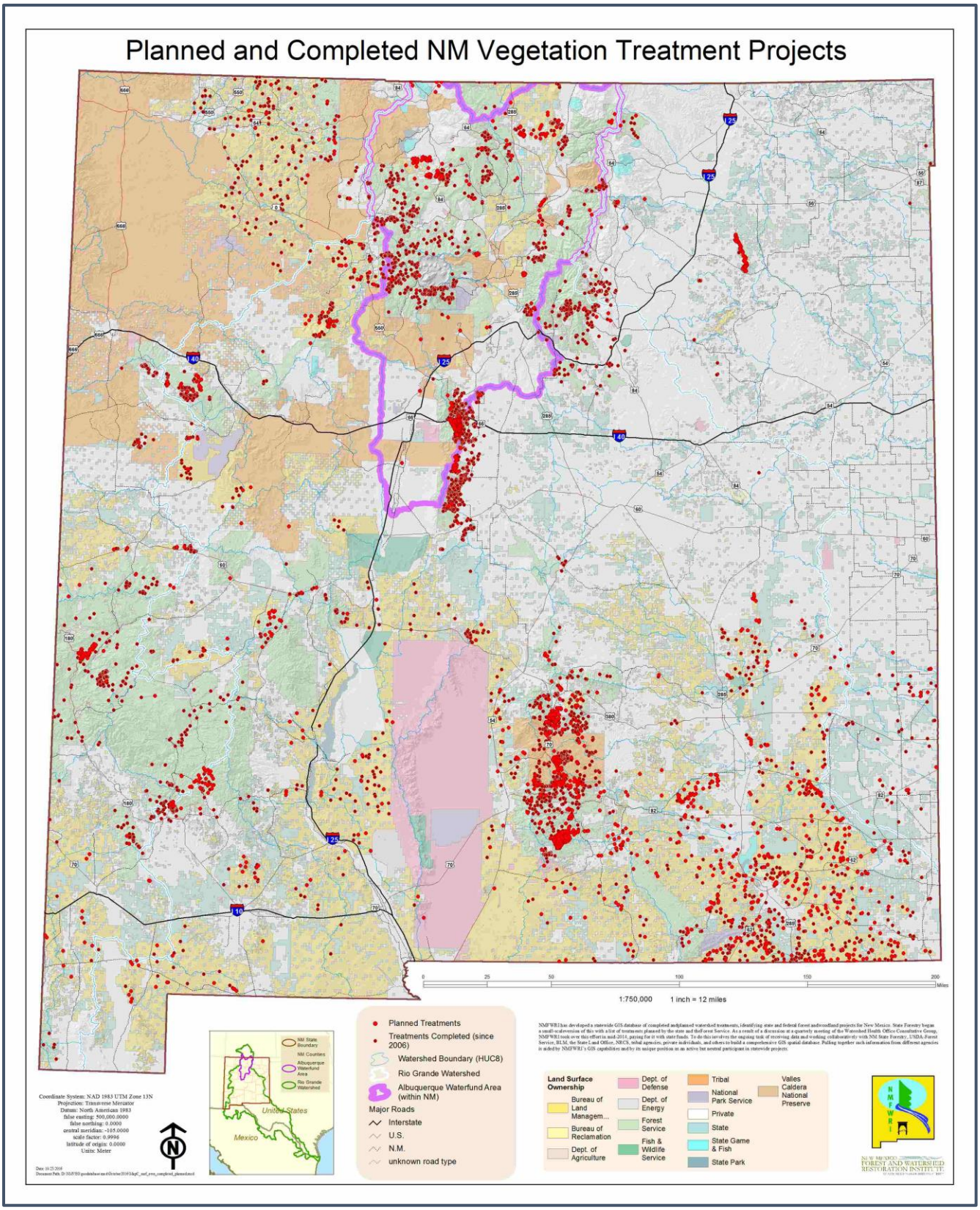
Highlands University is a center of restoration-based GIS and GPS expertise in northern New Mexico. FWRI currently has two part-time GIS specialists, brings in other GIS help as needed, and our monitoring staff and students have strong GIS skills. We continue our mutually beneficial relationship with Joe Zebrowski, the head of the Geospatial Applications in Natural Sciences (GAINS) Laboratory.

Vegetation treatment database

FWRI continued to develop the statewide geospatial database of planned watershed treatments, identifying planned private, state, tribal, and federal forest and woodland projects for all of New Mexico. Development of this database involved working collaboratively with and receiving data from NM State Forestry, USDA-Forest Service, BLM, the State Land Office, NRCS, and a host of other agencies. The collected data populates an integrated database.

The major milestone that occurred for this project was the distribution of versions of the database and map products associated with it. Versions of the database were posted for sharing and archived three times, each improved version replacing the previous. Most editing was related to refining the structure of the database, creating individual ID numbers for each record, populating fields, attempting to simplify problem areas (for example, removing duplicate records), and identifying problem areas within the database which needed attention (from source agents) to edit and complete the data wherever necessary. We also began to create summaries of field contents for each of the most important attributes in the database, in order to review results and help to direct future edits and refinements.

Related tasks were creating maps for public sharing, including posting the first version of a map of NM Vegetation Treatments data at ArcGIS Online, sharing the link with NMFWRI associates,



NM Vegetation Treatment map, fall 2016

testing to verify linking and sharing functions, and distributing update notices to our contact list. We also created a draft of a User's Guide to the NM Vegetation Treatments spatial database, and created 3-D Scenes at ArcGIS Online to improve public access to the NM Vegetation Treatments information.

An important question is the completeness of the data set, meaning complete in terms of including all necessary projects which ought to be included. We plan to incorporate a study for completeness into our federal FY17 work plan.

Rio Grande Water Fund and Opportunity Map

The Rio Grande Water Fund is a TNC program established to collect and distribute funds for watershed restoration, with the emphasis on protecting water supplies. It focuses almost exclusively on the Rio Grande Basin upstream of Albuquerque. The initial success of the Fund attracted attention of national and international organizations, who came together with the idea to link downstream users of Rio Grande water with upstream land managers. The resulting effort is called New Mexico Opportunity Mapping.

The New Mexico Opportunity Mapping is a collaborative project of agencies and NGO's to develop up-to-date, accessible information about forest and watershed restoration across New Mexico. The purpose of the Opportunity Mapping is to enable planners and managers from all jurisdictions to access data that can help them make decisions about how to invest or match their funds in a way that will complement past restoration work and achieve a larger-scale outcome.

The New Mexico Opportunity Map is being developed as an on-line database where any agency, organization, or partnership effort can enter information about their project. The results can be accessed at various scales by any user through the existing "All About Watersheds" portal that is hosted by FWRI and managed by State Forestry's Forest and Watershed Health Office. The database will be populated by FWRI, similarly to the Vegetation Treatment database. The Opportunity Map covers a wider geographic area, from the Gulf of Mexico to the Rio Grande's headwaters in Colorado, and has more of an emphasis on organization strength and planned treatments than does the Vegetation Treatment map.

The project is being developed in multiple phases. Some are complete and some are ideas for which the partners are seeking funding.

1. NM Vegetation Treatment Database. Developed by FWRI, this database has information about vegetation treatments planned and completed since 2005. *Status: database is completed and data are continually being updated.*
2. NM Landscape Unit Assessment Report Tool. This tool is in development to summarize existing data layers created by, and priorities established by, various agency sources and agency collaborative planning processes. *Status: a mock-up of the tool is under review, with completion dependent upon finding.*
3. Upload Tool for the Database. This tool is proposed in a pending grant application, so that new information can be added directly to the database or the NM Landscape Unit

Assessment Tool. *Status: a proposal is pending with FEMA; if funded the upload tool should be completed by July 2017.*

4. Download Tool for the Database. This tool is planned as the final phase of the project so that all users will be able to generate the maps and summary data they need to inform watershed planning and reporting. Item 2 is incorporated into this. *Status: a proposal is being developed so that funding can be secured for the download tool; ideal completion date is September 2017.*

GRGWA LiDAR Vegetation Mapping

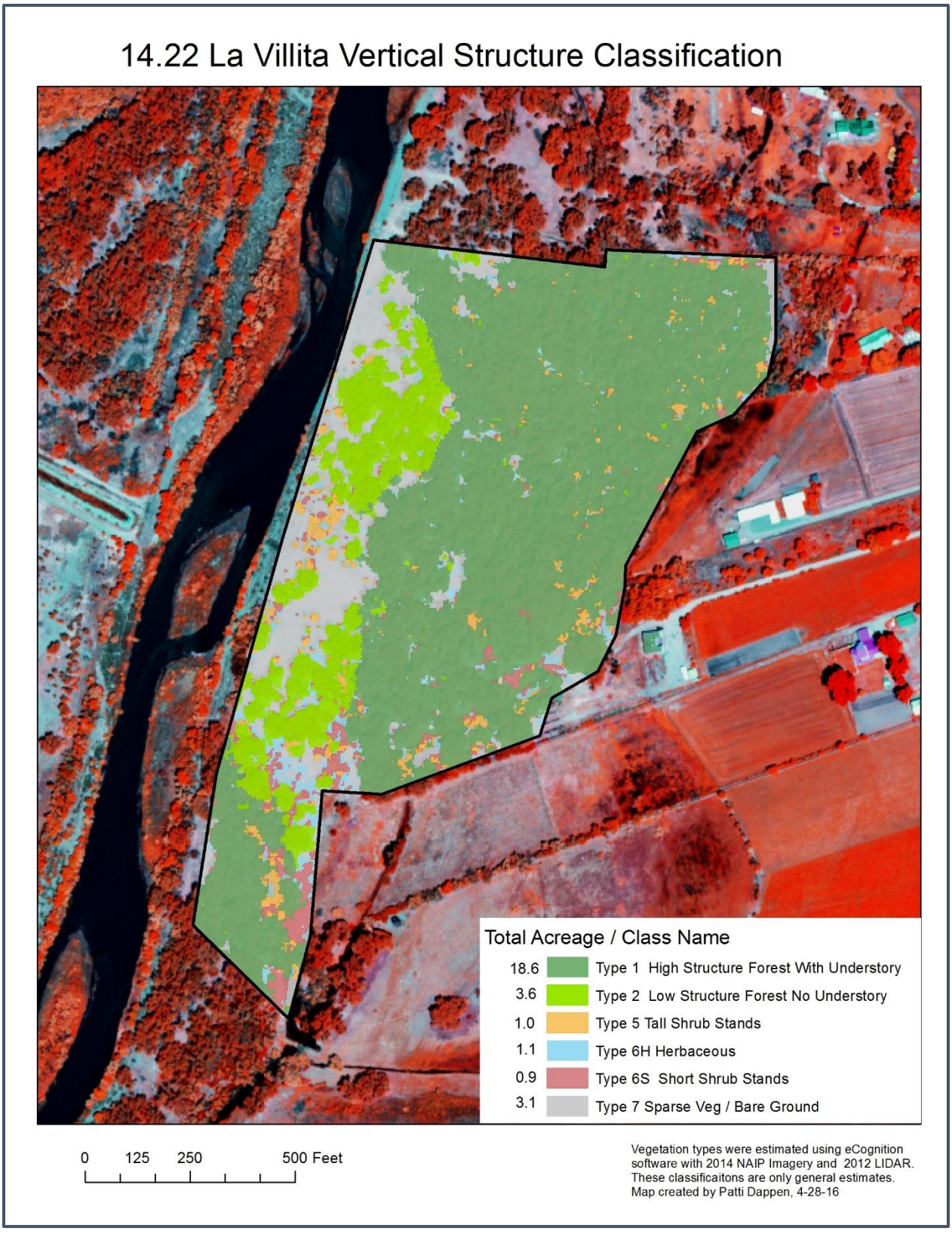
To help supplement monitoring of GRGWA (Greater Rio Grande Watershed Alliance) projects, LiDAR and aerial photography were used to develop vegetation maps for selected pre-treatment areas. LiDAR stands for light detecting and ranging. This detailed elevation data were used to estimate vegetation height and canopy characteristics. This information was especially useful in areas where pre-treatment monitoring had not taken place. Using the older LiDAR and aerial photography it was possible to assess the landscape even after a treatment had taken place.

Pre-Treatment Monitoring Assessments include using LiDAR to characterize vegetation before treatments would take place for pre-treatment monitoring reports. In areas without LiDAR, NDVI was use to characterize vegetation type. LiDAR, light detecting and ranging, elevation data were used to estimate vegetation height and canopy characteristics a supplement to field monitoring data for some GRGWA pre-treatment project sites.

GRGWA Pre-Treatment LiDAR/eCognition Vegetation Mapping Projects include:

14_05 Sandia
14_14 Rancho Las Lagunas
14_22 La Villita
15_03 Sandia
15_07 Baca
15_08 Ojo Caliente
15_12 Sceery Santa Fe
15_15 SE Grants / Grants
15-16 Rio Abajo
15_19 La Canova
15_20 Mt. Taylor

To perform the analysis, 2012 LIDAR was provided by Bureau of Reclamation (flown in February). One-foot 2014 NAIP (National Agriculture Imagery Program) imagery was acquired to get an estimate of vegetation extent. In order to classify vegetation, the LIDAR point cloud was filtered to isolate first returns and then LIDAR elevations were calculated to represent height above ground level (AGL). Next, the AGL point cloud was exported by height categories that correlate with the Hink and Ohmart height classes as modified for use in the NMRAM (2.0). These separate point clouds were then converted into separate digital surface models and exported as GeoTiffs.



La Villita LIDAR Vertical Structure Classification

Understory vegetation was classified first. Understory vegetation was classified using first returns of LIDAR elevations less than 15ft and 1-foot 2014 4-band ortho-imagery within eCognition. eCognition software is an object-based image classification system that allows for a semi-automated analysis of high resolution images. NDVI (Normalized Difference Vegetation Index) from the ortho-imagery was calculated and incorporated as a threshold to determine vegetation from dead or non-vegetative areas. The resulting classifications were combined into one image representing total understory vegetation.

The understory vegetation layer was then used as an input in the multiple story community classifications (Types 1 and 2). A digital surface model for all heights above ground was used to classify single-story Communities (Types 5, 6S, 6H, and 7). This classification incorporated height classes as well as NDVI to identify active vegetation. Once the vegetation was classified by height, the understory vegetation layer was used to identify whether each class had understory vegetation or not and was then classified accordingly. Total acreage were calculated for each vegetation class and hard copy maps were created for the GRGWA reports.

Image Ortho-Rectification and Photogrammetry for Rio Mora Wildlife Refuge

Aerial Imagery was flown for the Rio Mora Wildlife Refuge in the summer of 2015. This high resolution imagery (1-foot cell size) was flown and collected without being rectified. Without being rectified the imagery had little value and could not be used for any analysis. The image rectification work involved learning Leica Photogrammetry Suite software and collecting reference points for over 70 images.

2014 NAIP Imagery for Mora County was used to collect control points and a 10 meter digital elevation model from the National Elevation Dataset was used to terrain correct the imagery. Once the images were rectified they were mosaicked and compressed using Erdas Imagine software. These files were provided to Rio Mora and they are being used as part of their natural resource management work and is being used as a basemap for all of their field work activities. The work was done to build cooperation between the Institute and Rio Mora/ USFWS.

Other

GRGWA: Created and maintained a new spatial database of projects by the Greater Rio Grande Watershed Association. Work included updating project data in the GRGWA spatial database with new files, and responding to data request from GRGWA stakeholders.

Grant County Eco-Watershed Group: Supported work in Grant County by creating and providing maps for collaborative group meetings regarding forest treatments. The NM Vegetation Treatments spatial database has been displayed in Grant County Eco Watershed Group Maps since the time it first became useable. Tasks included creating, updating, uploading, delete, or managing maps and files available at the AllAboutWatersheds website, and distributing notifications about updates.

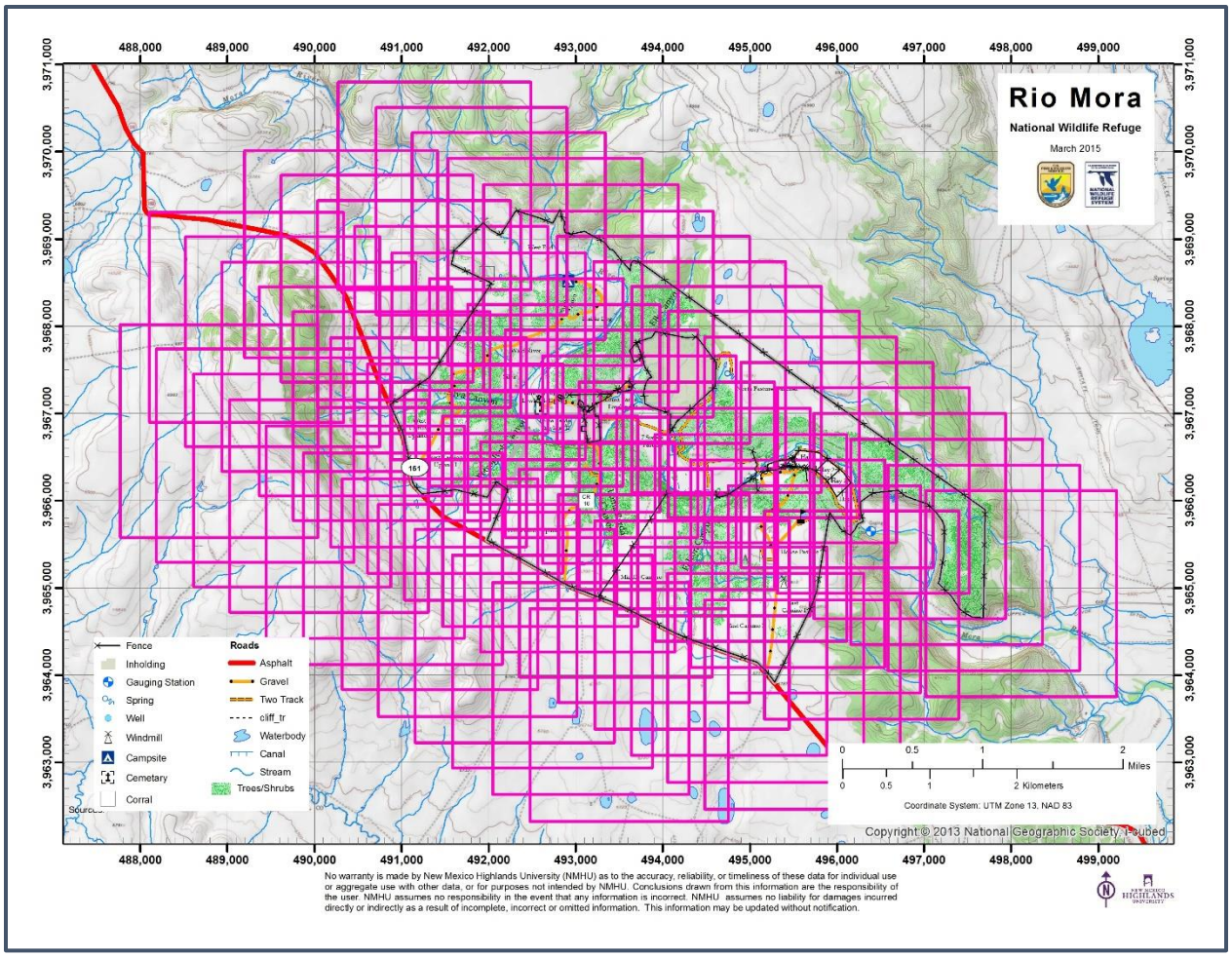


Image footprint of all images rectified for Rio Mora Wildlife Refuge.

Otero County Working Group: Supported work in Otero County by creating and providing maps for collaborative group meetings regarding forest treatments. The NM Vegetation Treatments spatial database has been displayed in Otero County Working Group maps since the time it first became useable. Work included creating and editing maps, receiving treatment data, reviewing treatment data with contacts on the Lincoln NF and in State Forestry, creating or editing focus area boundaries, creating new maps with hydrologic information. Surface hydrology information was posted on ArcGIS Online and displayed in a publicly accessible web map. Maps created for the Sacramento Summit meeting in May were also posted on ArcGIS Online.

Urban Tree Canopy Mapping. Began development of methodologies for urban tree canopy mapping April 2016 – June 2016 (ongoing). Extract Tree canopy and building footprints for city of Santa Fe using eCognition and LiDAR collected in 2015

MONITORING

Monitoring technical assistance for CFRP and other restoration projects.

Field work

The NMFWRI field monitoring crew for summer 2015 consisted of student intern crew leader Nathan Maestas and two crew members: 2nd-year student intern Christopher Martinez and our new Ecological Monitoring Specialist Kathryn Mahan. During the months of July and August, they spent three weeks in the field for post-treatment monitoring on Collaborative Forest Restoration Program (CFRP) projects in Santa Fe, Rowe Mesa and Ocate, and one week finishing pre-treatment monitoring at Guadalupe Mountain for the Bureau of Land Management (BLM). Both student interns stayed on with NMFWRI part-time once the university semester began; Nathan left the Institute upon his graduation in December. Their primary responsibilities were data entry and management.

2016 NMFWRI monitoring team (left to right): Christopher Martinez, Kathryn Mahan, Zane Jones

Our Ecological Monitoring Specialist spent the rest of her time in 2015 working with the Greater Rio Grande Watershed Alliance (GRGWA). FWRI's 2015 work with the GRGWA included pre-treatment monitoring for 15 GRGWA non-native phreatophyte removal projects and detailed reports.

Monitoring Plot at Cerro de la Olla, July 2016

Other reporting efforts during 2015 included a pre-treatment monitoring report for the Bureau of Land Management for Guadalupe Mountain (North), and five CFRP reports from our data backlog. Two NMHU student interns assisted with data entry from summer 2015 field work. A draft photo guide to Southwest fuel loading with down woody debris using NMFWRI's photos collected on various CFRP monitoring visits was also produced and distributed to various agencies for field-testing during the 2016 field season.

FWRI's 2016 field crew included Kathryn and two NMHU students with assistance from Rob Strahan as needed. Measured projects included Cerro de la Olla and Guadalupe Mountain (South) pre-treatment sites for the Bureau of Land Management; eight pre-treatment and four post-treatment visits for TNC in northern New Mexico and southern Colorado, one post-

treatment visit for Isleta/ David Canyon; one post-fire visit for the Village of Ruidoso; and five 10-year post-treatment visits on CFRPs across the state (Table 1).

Table 1: Sites monitored between May and August 2016

Site name (Project affiliation)	Acres	Forest vegetation type(s)	No. Plots
LaBrier #2 (TNC/CPLA)	15	Ponderosa pine w/ some aspen	1
Red Rabbit Ranch (TNC/CPLA)	20	Mixed conifer/aspen	3
Quinlan #1 (TNC/CPLA)	20	Mixed conifer/aspen	3
Rito de Agua Fria (TNC/CPLA)	20	Mixed conifer/aspen	3
Binkley (TNC/CPLA)	20	Mixed conifer/aspen	3
Rancho Lobo (TNC/CPLA)	100	Mixed conifer/aspen	7
Aspen (TNC/CPLA)	10	Aspen	1
Isleta (TNC/USFS)	200	Ponderosa pine/PJ	20
Moon mountain (State Land Office)	120	Ponderosa pine	12
Monument Canyon (CFRP: Santa Fe NF)	250	Ponderosa pine	10
Ensenada (CFRP: Carson NF)	260	Ponderosa pine	19
Bluewater (CFRP: Cibola NF)	1500	Piñon juniper	29
Sierra SWCD Black Range (CFRP: Gila NF)	200	Ponderosa pine	36
Cedar Creek (CFRP: Lincoln NF)	252	Ponderosa pine	28
Cerro de la Olla (BLM)	384	Piñon juniper	28
Guadalupe mountain (BLM)	280	Piñon juniper	29
TOTAL			232

One student intern remained with FWRI during the school term to do data entry and assist with 2016 GRGWA monitoring. To September 30, 14 pre-treatment and 5-year revisit projects had been monitored. CFRP and BLM reporting efforts are ongoing.

Other projects during this year included vegetation monitoring at the Rio Mora National Wildlife Refuge, participating in the New Mexico Environment Department (NMED)'s Canadian and Dry Cimarron New Mexico Rapid Assessment Method (NMRAM) advisory committee, developing an ArcPad-based protocol to analyze groups and openings in marked stands, and providing guest lectures and field training for the NMRAM for an NMHU Watershed Management class while collaborating with the City of Las Vegas on a Gallinas River assessment.

Collaboration/Funding

The FWRI was funded by TNC to establish a "Roving monitoring" team to monitor fuels and prescribed fire effects across three landscape and ownership boundaries:

1. Two plots on the El Salto Land Grant in Taos'
2. 21 plots for seven private landowners within the Chama Peak Land Alliance.
3. 20 monitoring plots on the Cibola national forest in the.

We worked across agencies to establish monitoring plots to understand effects of the Dog Head Fire.

NMFWRI worked with the High Plains Grassland Alliance (HPGA) to develop cost-effective guidelines for restoration and management of juniper encroached grasslands and savannahs in northern New Mexico. The HPGA represents over 200,000 acres of private ranchland in Northeastern New Mexico.

NMFWRI partnered with both HPGA landowners and the BLM to fund a landscape-scale treatment on approximately 1000+ acres of juniper encroached rangeland. The treatment areas will target mid to late successional savannah and woodland communities where tree density and canopy cover area currently outside of their natural range of variability. This project will provide much needed information concerning the economic and ecological effectiveness of different management strategies including mechanical thinning, prescribed fire and the role of planned grazing in plant community recovery.

WATERSHED RESTORATION PARTNERSHIPS

Collaboration has become a central theme in forest management in the Western United States. The emphasis placed on forest health and resiliency these days requires landowners to collaborate, working across property boundaries to restore forests and watersheds to conditions similar to those that existed before the strong emphasis during the twentieth century on harvesting timber and suppressing wildfires. Dr. Alan Barton was hired by the New Mexico Forest & Watershed Restoration Institute (NMFWRI) on July 20, 2015 to coordinate the Institute's outreach to collaborative groups, to facilitate many of the social dimensions that are an inherent part of forest management in the twenty-first century.

FWRI is engaged directly with a variety of collaborative groups, some well-established and some in their formation stages. These groups included community-based organizations that brought together landowners to work to improve environmental conditions in nearby forests; agency-based collaboratives that brought representatives from state, federal and tribal land management agencies, local governments and fire departments, representatives from other public institutions including state universities, and non-profit environmental organizations; and mixed collaboratives that included agency personnel, environmental organization representatives, and local landowners.

Collaborative groups FWRI are involved with include:

(1) NM State Forestry Forest Health Meeting – NMFWRI attended this quarterly meeting regularly.

(2) Federal and State Agency Multi-Party Monitoring Meeting – we attended several meetings of this organization, which is focused on the Manzano Mountains.

(3) Rio Tusas-Lower San Antonio CFRP – NMFWRI attended a meeting of this group, focused on the southern Carson National Forest and adjacent lands.

(4) Hermit's Peak Watershed Alliance – NMFWRI met with the director of this organization and has discussed the group with her on multiple occasions.

(5) La Jara Watershed Restoration – Beginning in December 2015, NMFWRI collaborated with Martha Graham of the New Mexico Rural Water Association and Jeff Goebel, an independent facilitator, to initiate a forest and watershed restoration collaborative in La Jara, a small community in Sandoval County. La Jara has a Mutual Domestic Water Users Association (WUA) and an acequia group, and we attended meetings of the WUA to discuss forest management activities in the watershed above their intake and water treatment facilities. Several meeting were held to discuss starting a collaborative organization with community members and agency personnel to focus on treating lands in the Santa Fe National Forest east of the village. Formation of the collaborative is still in progress. NMFWRI helped to plan and participated in a field day and meeting with the La Jara group in July 2016.

(6) Cimarron Watershed Alliance – we attended several meetings of this community-based landowner collaborative, including a planning meeting in Eagle Nest dedicated to the Regional Water Plan for the Moreno Valley.

(7) Estancia Basin Watershed Health, Restoration and Monitoring Project – NMFWRI have been part of this group since 2007.

(8) Otero Working Group – The NMFWRI has been involved with this group for two years. We began working on a strategy for the organization in Spring of 2016.

(9) SW Jemez CFLRP All Hands Meeting – NMFWRI attended a portion of the annual meeting of the Southwest Jemez CFLRP, at which they discussed ongoing research projects.

(10) Greater Santa Fe Fireshed Coalition – This collaborative group was organized in December, 2015. NMFWRI has been actively involved in advancing this group, and chairs the Communications Team, one of three committees. We led the effort to organize a community meeting in Santa Fe in April, 2016, and have collaborated on the creation of the organization's general strategy document. We participated in a field visit with Forest Service officials to view the Greater Santa Fe Fireshed Coalition project in August 2016.

(11) Sandia Watershed Workshop – we attended a meeting of this research-oriented group in the East Mountains.

(12) Collaborative associated with the Southwest Jemez CFLRP – NMFWRI has been involved with this since 2007. It was revitalized during the summer of 2016.

(13) The Dog Head Fire in the Manzano Mountains received a lot of publicity over the summer, and following the fire a number of agencies joined to coordinate their responses and mitigation efforts to avoid damaging flooding and other post-fire effects. A small group was formed to plan opportunities to measure the effects of pre-fire treatments in the burn zone. A consultant, Kristi Bonfantine, has prepared an initial report treatment effectiveness in reducing fire severity.

Our Collaboration Program Manager also followed Plan Revision in the national forests in New Mexico, and he attended public meetings organized by the Santa Fe National Forest to provide input on plan revision. NMFWRI attended meetings organized by the Forest Service on Forest Plan Revisions, including a meeting on the Cibola National Forest Plan Revision in Albuquerque and a technical meeting on the Santa Fe National Forest's wilderness planning in Pecos. FWRI also attended a field trip organized by the Santa Fe National Forest's plan revision team to the Gallinas Watershed.

AllAboutWatersheds.org

This portal, a forest and watershed restoration health information clearinghouse, is a joint effort with the Forest and Watershed Health Office of State Forestry. This web-based portal contain links, postings, and videos related to not only prescriptions, but groups, funding sources, monitoring protocols, etc., from across the State. It is used by groups (e.g., the Zuni Mountain Landscape CFLR) and agencies (e.g., the NM Environment Department). Planning was supported by Federal funds, and start-up funding for the portal was from State Forestry.

Other

- The Hart Allex Tree Farm outside of Peñasco was selected as State Tree Farm of the year, and FWRI participated in the field day when they received that recognition in October 2016. The Tree Farm program, administered by State Forestry, is one way FWRI outreaches to private forest landowners.

- San Juan-Chama partnership, Dulce, ongoing – This landscape spans the Colorado- New Mexico line, comprises a mix of private, state, and private land managers, and is considered to provide the long-term, sustainable answer to water for the human population of the middle Rio Grande.

- FWRI participated in the regional Wood Products Summit Ruidoso meeting, including staffing a booth in March 2016.

- FWRI is a member of the Advisory Board for the Rio Grande Water Fund and has participated in several events.

SUPPORT TO NMHU

FWRI also assists the Natural Resources Department at New Mexico Highlands University with teaching graduate and undergraduate level courses related to Forestry and Natural Resources Management.

The following courses were taught during the 2015-2016 semesters by NMFWRI staff:

- FOR 425/525: Field Safety Practices. Spring 2016. Dr. Rob Strahan.
- FOR 402: Silviculture. Fall 2016. Dr. Rob Strahan.
- FOR 105: Humans and Ecosystems. Fall 2015. Dr. Alan Barton.
- FOR 330: Natural Resource Law and Policy. Spring 2016. Dr. Alan Barton.
- FOR 412/512: Introduction to Surveying and Geographic Information Systems. Spring 2016. Patti Dappen.

In addition, NMFWRI staff were guest lecturers for a number of other courses during this period including FOR 589, Applied Ecology, FOR 625, Advanced Quantitative Methods, and FOR/GEOL/BIOL 650, Graduate Seminar.

Mentoring of students by NMFWRI staff included:

- Mentoring undergraduate student Max Suazo (Spring semester 2016). Using GIS to map fire occurrence in New Mexico, creating statewide fire maps for New Mexico 2010-2015.
- Mentoring Graduate Student – Benhaz Yekkeh (Spring semester 2016) to present for her project: *Relationship between Tree Canopy Cover and Discharge of Gallinas River through Time (From 1939 to 2015) in Las Vegas, NM: Using eCognition to estimate tree canopy from historic aerial photography.* This study uses aerial photography and GIS techniques to determine the percentage of tree canopy cover in upper Gallinas watershed from 1939 to 2015. It will use aerial photos imagery from 1939 through the 1990s above the USGS gauging station at Montezuma.
- Mentoring student interns Christopher Martinez and Zane Jones (summer 2016), both Forestry majors. They worked in the field doing common stand exams, and browns surface fuels transects. They also assisted in data entry using FFI software. This was excellent real world work experience for these undergraduate students.

The NMHU Department of Natural Resources Management had a high turnover during this period. NMFWRI staff served on a search committee for three new Forestry faculty members. This involved developing criteria for the positions, interviewing candidates, and writing reports for the university.

Student intern Christopher Martinez monitoring at Cerro de la Olla, summer 2016

Publications by FWRI staff

Barton, A.W. 2016. From Parks to Partnerships: National Heritage Areas and the Path to Collaborative Participation in the National Park Service's First 100 Years, *Natural Resources Journal* 56(1): 23–54.

Barton, A.W. 2016. Who Controls Western Forests? The Rise and Fall of New Mexico's Senate Bill 1. Presentation at the Annual Meeting of the Rural Sociological Society, Toronto. The paper was based on a court case involving the Lincoln National Forest, and included a discussion of NMFWRI's collaboration with the Otero Working Group.

Barton, A.W. 2016. Book Review: *Northern Neighbours: Scotland and Norway Since 1800*, by J. Bryden, O. Brox and L. Riddoch. *Sociologia Ruralis* 56(4): 616–17.

Strahan, R.T., Sánchez Meador, A.J., Huffman, D.W. & Laughlin, D.C. 2016. Shifts in community-level traits and functional diversity in a mixed conifer forest: A legacy of land-use change. Journal of Applied Ecology, doi 10.1111/1365-2664.12737.

Laughlin, D.C., Strahan, R.T., Huffman, D.W. & Sánchez Meador, A.J. 2016. Using trait-based ecology to restore resilient ecosystems: historical conditions and the future of montane forests in western North America. Restoration Ecology, doi 10.1111/rec.12342

Laughlin, D.C., Strahan, R.T., Moore, M.M., Fulé, Pete, Huffman, D.W. & Covington, W.W. *In review*. Functional diversity and composition in a multi-decade ecological restoration experiment. Journal of Applied Ecology.

Strahan, R.T., Laughlin, D.C. & Moore, M.M. *In review*. A functional trait-based model predicts different rates of germination and establishment of five grass species under experimentally-controlled light and soil conditions. PlosOne.

FWRI Staff

Alan Barton – Collaboration Program Manager, responsible for partnerships and facilitation.

Patti Dappen – GIS Specialist, lead staffer on eCognition and general GIS questions.

Josie Lujan – Administrative Associate, handles the office.

Kathryn Mahan – Monitoring Specialist, responsible for monitoring in general and riparian monitoring in particular.

Adrienne Miller – GIS Specialist, lead for the Vegetation Treatment database and Opportunity Mapping.

Kent Reid – Director, handles the bureaucracy.

Rob Strahan – Restoration Monitoring Program Manager, responsible for overall restoration monitoring.