

SWERI Five-Year Assessment Report

Southwest Ecological Restoration Institutes (SWERI)

Five Year Evaluation Report

Prepared by Meridian Institute, the U.S. Institute for Environmental Conflict
Resolution, and the USDA Forest Service Southwestern Region

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Executive Summary

The Southwest Forest Health and Wildfire Prevention Act (P.L. 108-317, 16 U.S.C. 6701(2004)) (the Act) establishes a unique program of applied research and service via three university-based restoration Institutes. The primary purpose of the Institutes is to develop, translate, and provide the best available science to land managers, practitioners and stakeholders designing and implementing forest restoration and hazardous fuel reduction treatments.

Section 7(a) of the Act requires a detailed evaluation of the programs and activities of each Institute five years after the date of enactment of the Act (October 5, 2004), and every five years thereafter to:

- 1) ensure, to the maximum extent practicable, that the research, communication tools, and information transfer activities of each Institute are sufficient to achieve the purposes of this Act, including—
 - a) implementing active adaptive ecosystem management practices at the landscape level;
 - b) reducing unnecessary planning costs;
 - c) avoiding duplicative and conflicting efforts;
 - d) increasing public acceptance of active adaptive ecosystem management practices; and
 - e) achieving general satisfaction on the part of affected entities;
- 2) determine the extent to which each Institute has implemented its duties under Section 5(c); and
- 3) determine whether continued provision of Federal assistance to each Institute is warranted.

The duties of the Institutes are to: 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 on dry forest and woodland ecosystems in the interior West; 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.

This evaluation is based on reports from each Institute, interviews with the affected entities identified in the Act conducted by Meridian Institute and the U.S. Institute for Environmental Conflict Resolution, and a review by the Forest Service in consultation with the three State Foresters and the Department of Interior. Based on this evaluation, each of the institutes has:

1) ensured to the maximum extent possible that their research, communication tools, and information transfer activities have made significant progress toward achieving the purposes of the Act; and 2) implemented the duties described under Section 5(c) to the best of their ability given scarce resources. The Institutes have addressed the purposes of the Act by:

- a) implementing active adaptive ecosystem management practices at the landscape level;
- b) reducing planning costs;
- c) avoiding duplication;
- d) increasing public acceptance; and
- e) achieving general satisfaction on the part of the affected entities.

Some examples of the Institutes' activities include the following: The New Mexico Forest and Watershed Restoration Institute (NMFWRI), which is involved with three landscape-level projects implementing ecosystem management and reducing planning costs by guiding local planning efforts, which increases long-term efficiency. The Institute avoids duplication by developing work plans in collaboration with major partners. Their education and outreach efforts demonstrate how forest restoration treatments are part of adaptive ecosystem management. The Colorado Forest Restoration Institute (CFRI) is collaborating with partners to implement adaptive ecosystem management at the landscape level on the Uncompahgre Mesas Forest Restoration Demonstration Project (UP Mesas), and the Woodland Park Healthy Forest Initiative (WPHFI). They are leading a collaborative assessment of historic forest structure to design forest restoration treatments that reduce wildfire risk, reestablish historic fire regimes, and sustain long-term forest health. The Arizona Ecological Restoration Institute (ERI) leads a Long-term Ecological Assessment and Restoration Network (LEARN) in Arizona and New Mexico which includes ponderosa pine and mixed conifer forests, as well as piñon-juniper woodlands. The sites are located on U.S. Forest Service, Bureau of Land Management, National Park Service, Department of Defense, and State lands. The information obtained from those sites is made available to affected entities for designing restoration treatments in the region through workshops and onsite technical assistance.

The affected entities interviewed expressed an interest in: broadening the scope of the Institutes to other ecosystems and larger landscapes; considering specialization by the Institutes to create more effective synergy; resolving discrepancies in funding among the Institutes; and improving coordination and building partnerships with other agencies and research entities.

The Act authorizes an appropriation of \$15 million annually, but the total annual Federal appropriation to implement the Act has ranged from \$400,000 to \$2.56 million. Despite this limitation the Institutes have successfully leveraged Federal funding to secure scarce State resources demonstrating the degree to which they have achieved general satisfaction on the part of affected entities. Their effectiveness, however, has been limited by funding levels well below the authorized appropriation.

In conclusion we have determined that each of the Institutes warrants continued provision of Federal assistance. In our view, no other existing entity has the capacity or mandate to carry out landscape scale forest restoration. As a result of the work that has been completed with scarce resources, the Institutes have generated a high degree of demand and relevance in their States, and a common understanding among affected entities that they fulfill an important role.

Interviews with affected entities indicate that their scope may need to be broadened to accomplish landscape restoration at a larger scale.

Preface

Background

The Southwest Forest Health and Wildfire Prevention Act (P.L. 108-317, 16 U.S.C. 6701(2004)) (the Act) establishes a unique program of applied research and service via three university-based restoration institutes, located in Arizona, Colorado, and New Mexico¹. The primary purpose of the Institutes is to develop, translate, and provide the best available science to land managers, practitioners and stakeholders designing and implementing forest restoration and hazardous fuel reduction treatments.

The responsibility for implementation of the Act was assigned to the Secretary of Agriculture, acting through the Chief of the U.S. Forest Service. The Chief of the U.S. Forest Service delegated the implementation of the Act to the Southwestern Region of the U.S. Forest Service. In 2005, the Forest Service established a Development Team to work with the Institutes to identify projects for annual workplans and an Executive Team to approve those work plans. The Development and Executive teams are chaired by the U.S. Forest Service and include representatives from the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), The Bureau of Indian Affairs (BIA), State Foresters from each State, and the three Institutes. The annual work plans are reviewed, revised and reconciled with Federal appropriations by the Development Team and approved by the Executive Team.

On June 13, 2005, the Governors of Arizona, Colorado and New Mexico signed a charter to clarify the duties and operating procedures for the Southwest Ecological Restoration Institutes, and their respective States, as envisioned in PL 108-317 (Appendix E).

The annual work plans are the basis for requesting Federal and State annual appropriations. Each Institute's performance of their duties is tied to the development and successful completion of annual work plans that achieve the purposes of the Act. For this reason, they are a major source of information for the five-year evaluation.

The activities proposed in the work plans (referred to as "projects") address information and service needs identified by land managers and the diverse stakeholders (referred to as "affected entities" in the Act). Needs are identified in reports from workshops, conferences, surveys, collaborative meetings, governmental task forces and councils, field trips, one-on-one communications, by phone, or through correspondence. The Institutes then work collaboratively throughout the year with stakeholders to plan projects that may be included in the annual work plan.

¹ The Act was passed by Congress on October 4, 2004.

Five Year Evaluation Requirement

Section 7 of the Act requires the Secretary of Agriculture, acting through the Chief of the U.S. Forest Service, and in consultation with the Secretary of the Interior, to complete a detailed evaluation of the programs and activities of each Institute five years after the date of enactment of the Act, and every five years thereafter. The evaluation is submitted to the Committee on Resources (now the Committee on Natural Resources), to the Committee on Agriculture of the House of Representatives, and to the Committee on Energy and Natural Resources of the Senate. The purpose of this report is to satisfy this requirement for 2009-the first five-year evaluation. The intentions of the evaluation, as defined in the Act, are:

- 1) To ensure, to the maximum extent practicable, that the research, communication tools, and information transfer activities of each Institute are sufficient to achieve the purposes of the Act, including:
 - a. implementing active adaptive ecosystem management practices at the landscape level;
 - b. reducing unnecessary planning costs;
 - c. avoiding duplicative and conflicting efforts;
 - d. increasing public acceptance of active adaptive ecosystem management practices; and
 - e. achieving general satisfaction on the part of the affected entities.

- 2) To determine the extent to which each Institute has implemented its duties under Section 5(c) of the Act, which are to:
 - a. 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 on dry forest and woodland ecosystems in the interior West;
 - b. synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuel reduction treatments on landscape scale using an adaptive ecosystem management framework;
 - c. translate for and transfer to affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuel reduction treatments;
 - d. assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuel reduction treatments; and
 - e. provide peer-reviewed annual reports.

- 3) To determine whether continued provision of Federal assistance to each Institute is warranted.

Evaluation Methodology

As a first step in the evaluation process, the Southwestern Region requested an evaluation report from each Institute describing how it had performed the duties specified in the Act. Key

accomplishments for each duty are summarized at the beginning of each Institute chapter that follows. The Institute evaluation reports are included in full in Appendix A.

The Southwestern Region then contracted with the US Institute for Environmental Conflict Resolution (USIECR) and the Meridian Institute to conduct interviews with affected entities (defined in the Act as land managers; stakeholders; concerned citizens; and the States of the interior West, including political subdivisions of the States) for the purpose of assessing their satisfaction with the Institutes and their views about how well the Institutes had achieved the purposes of the Act. The USIECR and Meridian were also tasked with compiling the five-year evaluation report. In preparation for the interviews, Meridian and USIECR developed a tentative list of interview questions. They then met with representatives from the three Institutes to discuss the interview methodology, solicit feedback on the draft questions, and obtain suggestions regarding potential interviewees. From this list, Meridian and USIECR prioritized from the list 61 people representing a broad diversity of affected entities to contact for interviews. Of those, 23 people responded and were either interviewed by phone or submitted written comments. Interviews were conducted from approximately mid-July to mid-August 2009. Everyone who expressed an interest in participating in the interview process was accommodated. See Appendix B for a list of interviewees.

Most of the interviewees were very familiar with the work of the Institute in their State. A few respondents were generally familiar with all three Institutes. The mix of respondents was fairly evenly spread among the Institutes; six respondents each had worked most closely with ERI and CFRI, and eight respondents were most familiar with NMFWR. Three of the respondents had detailed familiarity with all three Institutes. Table 2 shows the mix of perspectives among the interviewees.

Table 2:

Range of Perspectives

	ERI	CFRI	NMFWRI	GENERAL	TOTAL
Directors	1	1	1		3
Academics	2		1		3
State Government	1	1	4		6
Local Government	1	1			2
Private		2			2
Federal Government	1	1		2	4
Tribal			2		2
Other				1	1
TOTAL	6	6	8	3	23

The interviews were conducted with the understanding that interviewee comments and recommendations would not be attributed to individuals, but rather captured in an overall summary of interview results. The input was wide-ranging and very frank. While Meridian and USIECR would have preferred a larger response group, they concluded that even with a small sample, the interviews resulted in a good overview of affected entity views on the work of the Institutes. The interview results are reflected in the chapters that follow and summarized in Appendix C.

The determination about whether each of the three Institutes as well as the system as a whole has accomplished the purposes and duties of the Act is based on the sum of information available through the Institutes’ evaluation reports and the interview results.

Context

In the five years since the Institutes were established, they have all developed operational capacity and conducted activities to achieve the duties of the Act. The Act authorizes an appropriation of \$15 million for each fiscal year, but the total annual Federal appropriation to implement the Act has ranged from \$400,000 to \$2.56 million. Despite this limitation, the Institutes have successfully leveraged Federal funding with scarce State resources. Their effectiveness, however, has been limited by funding levels well below the authorized appropriation. See Table 3 for actual funding history

Table 3: Institute Actual Funding

	FY2005		FY 2006		FY 2007		FY 2008		FY 2009	
	Fed	State	Fed	State	Fed	State	Fed	State	Fed	State
CFRI	\$50	\$60	\$250	\$60	\$200	N/A	\$246	\$75	\$246	\$90
ERI	\$300	\$1,000	\$1,600	\$1,000	\$1,750	\$1,200	\$1,969	\$1,300	\$1,969	\$1,098
NMFWRI	\$50	\$182	\$250	\$250	\$250	\$250	\$345	\$250	\$345	\$243
TOTAL	\$400	\$1,242	\$2,100	\$1,310	\$2,200	\$1,450	\$2,560	\$1,625	\$2,560	\$1,431

Total Fed	\$9,820
Total State	\$7,058

Dollars in thousands

New Mexico Forest and Watershed Restoration Institute Assessment

Achievement of the Duties of the Act

Based on the information provided in NMFWRI's Five-Year Evaluation Report (attached in Appendix A), the Institute has performed a significant amount of work towards achieving each of the duties specified in the Act. Examples of significant contributions for each duty are summarized below.

Duty 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.

- NMFWRI completed pre- or post-treatment ecological restoration monitoring on 18 thinning projects, encompassing 4,600 acres across the State since January 2007.
- In 2007, NMFWRI began developing a catalogue of forest prescriptions, principally dealing with fuel treatments, which have been applied by land managers to New Mexico forests and woodlands. Six case studies have been produced and posted since 2007, and also one rewrite of a research station report.
- NMFWRI organized and co-hosted a seminar in August 2007 to discuss protocols and the formation of a statewide monitoring database. Fifty participants attended a 1.5 day meeting consisting of 17 presentations by monitoring practitioners from a variety of forest types. In early 2008, the Institute co-hosted a statewide meeting of practitioners and scientists to discuss management of mixed conifer and aspen in New Mexico, with 75 attendees. Over the past year, NMFWRI has teamed with other organizations to organize a New Mexico Watershed Forum and the New Mexico Forests and Climate Change meeting that took place in October and November 2008, respectively, in Albuquerque.

Duty 2: Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuels reduction treatments on a landscape scale using an adaptive ecosystem management framework.

- Regular bi-monthly meetings with the Santa Fe National Forest, the Valles Caldera National Preserve, the Nature Conservancy, and other stakeholders have been convened by the NMFWRI since the summer of 2008 to begin planning the restoration of the Jemez River basin. The total planning unit includes about 210,000 acres, with the first round of projects envisioned for 46,000 acres. The NMFWI is working to broaden the range of stakeholders involved in the planning, with the goal of applying for Forest Landscape Restoration Act funding the first year it becomes available.
- Since 2008, NMFWRI has convened the meetings of the Estancia Basin Monitoring Steering Committee, which comprises the three Soil and Water Conservation Districts

(Claunch-Pinto, Edgewood, and East Torrance) of the 1.5 million-acre basin, as well as representatives from cooperating groups (State Forestry, New Mexico Environment Department, Natural Resources Conservation Service (NRCS), U.S. Forest Service, BLM, Chilili Land Grant). Besides chairing the meetings, the NMFWRI helps with mapping, and interacts with consultants as they monitor thinning projects.

- The NMFWRI worked with the Tierra Y Montes Soil and Water Conservation District and the Las Vegas State Forestry office to build a project map (primarily thinning projects) of the Gallinas Watershed. The Gallinas is the municipal watershed for Las Vegas, and has been prioritized by the NRCS, the U.S. Forest Service, and New Mexico State Forestry for restoration.
- The NMFWRI teamed with the Lower Pecos Watershed Alliance and New Mexico Tech in the development of a research project in the Sacramento Mountains to examine how thinning would impact surface and subsurface water budget. The NMFWRI established pre-treatment vegetative monitoring plots on the 555-acre treated area in the summer of 2008, and on the 359-acre non-treated area in the summer of 2009. This project was partially supported with State funding.
- The NMFWRI is the coordinator of the multi-party monitoring training and technical assistance that is provided to the U.S. Forest Service's Collaborative Forest Restoration Program (CFRP). Since mid-2007, the NMFWRI and its contractors have written and published eight white papers for CFRP grantees that cover a wide range of topics.

Duty 3: Translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuels reduction treatments.

- The NMFWRI established a 10-acre demonstration area in a ponderosa pine stand on the Pritzlaff Ranch outside of Las Vegas, highlighting restoration using evidence-based, goshawk, and genetic guidelines. Thinning of this stand was completed in the fall of 2008. Four formal groups have visited this site, and additional tours have been made by individuals.
- The Forest and Watershed Health Information Clearinghouse is a joint effort with the Forest and Watershed Health Office of New Mexico State Forestry. Still under construction, it contains links, postings, and videos related to not only prescriptions, but groups, funding sources, monitoring protocols, etc., from across the State. Planning was supported by Federal funds, but the funding for the clearinghouse is from New Mexico State Forestry.

Duty 4: Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuels reduction treatments.

- Geographic Information System (GIS) aids in planning restoration activities by providing a landscape-scale. Since January 2007, NMFWRI has developed 155 project maps for 20 stakeholders' groups throughout the State.
- Since July 2007, NMFWRI has trained 30 individuals from government and non-profits in GIS use, and provided datasets to 16 groups.
- NMFWRI has provided funding so the New Mexico Forest Industry Association (NMFIA) can retain an executive director. The Institute supported NMFIA to train 142 workers in FY 2009. It helped develop the woods-worker safety course, which has resulted in a 60 percent reduction in worker's compensation insurance costs.
- At the request of Alamo Band of the Navajo Nation, the NMFWI taught a two-week training course for them in December 2008 that incorporated a week of basic ecology and restoration-based fuel reduction principles, and a week of chain saw use and woods safety. This core course has been requested by other groups, and the Institute expects to modify it according to results and group needs.

Duty 5: Provide peer-reviewed annual reports.

Annual reports have been prepared every year. They have been circulated among the Institute's stakeholder group for comment before being submitted. The NMFWRI annual reports are available at <http://www.nmfwri.org/>.

Achievement of Purposes of the Act

NMFWRI has demonstrated progress towards achieving the purposes of the Act through many of its activities and outcomes, including, for example:

Purpose 1: Implementing active adaptive ecosystem management practices at the landscape level;

NMFWRI is part of three landscape-level efforts: A) Estancia Basin Monitoring, which comprises the basin's three Soil and Water Conservation Districts, representatives from cooperating agencies, and a contractor; B) the Jemez River Watershed restoration effort, with three major landowners; and C) the Gallinas River watershed, the drinking-water watershed for Las Vegas.

Purpose 2: Reducing unnecessary planning costs;

By participating in local planning efforts like those at Sugarite Canyon State Park, the Cimarron Watershed Alliance, and Ramah Navajo, the NMFWRI is able to guide the efforts of those local groups, saving them money in the short-term, and increasing their efficiency

in the long-term. One specific service the Institute offers is assistance with GIS, providing maps that give a project-level point of view. This service is especially useful for communities, tribes, and CFRP grantees who cannot afford to have their own GIS expertise or software.

Purpose 3: Avoiding duplicative and conflicting efforts;

The organization in the State with the mandate closest to the NMFWRI is the Forest and Watershed Health Office (WHO) of New Mexico State Forestry; the Institute avoids duplication of effort by weekly conversations with that group, and by participation in the quarterly meetings of the group that coordinates WHO's work. The NMFWRI does not work with private landowners without first contacting the local district office of New Mexico State Forestry, and are often on the ground with people from the district office. The NMFWRI has an advisory board made up of seven men and women representing seven different stakeholder groups. The board meets at least once a year to review NMFWI programs and to provide advice on effort and direction, and serves as another safeguard to avoid duplication of effort. Finally, all major partner organizations take part in helping the NMFWRI develop its annual work plans.

Purpose 4: Increasing public acceptance of active adaptive ecosystem management practices; and

NMFWRI education efforts to date have been targeted at stakeholders in land management. The Institute has compiled case studies on successful prescriptions to reduce the risk of catastrophic wildfire, and convened seminars on monitoring and mixed conifer management for fire. The Institute has held numerous small-group trainings on the subject of monitoring, and presented to the regional Forest Service timber staff on SWERI's ability to help with restoration efforts. The NMFWRI is engaged with other institutions in a study to examine how thinning a watershed with a mix of forest types affects surface and subsurface water budgets. If a rigorous study were to demonstrate that treatment increases water yield, public support for restoration treatments would likely increase.

Purpose 5: Achieving general satisfaction on the part of affected entities.

On the basis of the interviews with individuals familiar with the NMFWRI, it is apparent that the Institute has been successful at achieving general satisfaction on the part of affected entities. The sense from the interviews is that the NMFWRI is responsive to affected entities' needs and that it produces high-quality results quickly. Interviewees reported many tangible benefits from their interactions with the NMFWRI, especially with regards to training, help with prescriptions, monitoring, GIS/mapping support, and assistance in building collaborative partnerships. A "Joint Powers Agreement" with the New Mexico Forest and Watershed Health Office is a mechanism that has been especially helpful, because it has enabled State government to accomplish work that could not have been undertaken without the Agreement. The NMFWRI is also providing unique benefits to New Mexico watershed groups, Tribal entities in the State, and community constituents in terms of independent science technology and data. The following comments reflect

interview sentiments regarding the Institute's services: "Staff of the Institute are some of the best in the field"; "The Institute has always been there when needed and provided answers to questions Staff listen carefully to problems and unique situations, and then formulate an appropriate response. "The NMFWR I is surprisingly efficient considering the numbers of State-wide projects they are engaged in." "Their level of monitoring is just right-not too much. They do a great job steering treatments in the right direction."

Colorado Forest Restoration Institute Assessment

Achievement of the Duties of the Act

Based on the information provided in CFRI's Five-Year Evaluation Report (attached in Appendix A), the Institute has performed a significant amount of work towards achieving each of the duties specified in the Act. Examples of significant contributions for each duty are summarized below.

Duty 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

- CFRI co-sponsored, with the U.S. Forest Service and the Colorado State Forest Service (CSFS), the development of ponderosa pine forest management guidelines that translated ecological research and principles into applicable management choices.
- CFRI produced a widely-used photo guide that provides visual examples of pre- and post-treatment forest conditions that meet the twin goals of restoration and fuels reduction.
- Partnering with the CSFS, CFRI hosted two short courses for land managers on the ecology and management of piñon-juniper forests in La Junta and Durango, targeting land managers.
- CFRI's role in ecological monitoring in the WPHFI will contribute information on the effectiveness of hazardous fuels treatments to reduce extreme fire behavior and restore healthy ponderosa pine conditions. Results from initial treatments will be compiled and analyzed in the fall of 2009.

Duty 2: Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuels reduction treatments on a landscape scale using an adaptive ecosystem management framework

- Working in partnership with the Regional Office of the Rocky Mountain Region of the U.S. Forest Service, CFRI published four reports on the historic range of variability of three regions (Front Range, Grand Mesa, and South-Central Highlands) and one forest type in Colorado (ponderosa pine on the Front Range). This historic range of variability reports synthesized current scientific research on historic disturbance regimes and their impact on forest stand structure development. Such reports provide a reference point for managers to define restoration goals and design restoration treatments.
- CFRI synthesized and produced a publication summarizing the current scientific knowledge concerning the historic ecology and disturbance regimes in piñon-juniper

forest ecosystems, with an eye toward management implications. Two outreach workshops were delivered in tandem with this publication.

- CFRI synthesized and produced a publication summarizing current knowledge about lodgepole pine forests and potential impacts of mountain pine beetle infestation, including expert opinions on what is known about catastrophic wildfire in lodgepole pine forests and the effect of mountain pine beetles on fire risk and behavior.

Duty 3: Translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuels reduction treatments;

- CFRI sponsored a review of literature and interviews of private land managers for barriers to using prescribed fire on private lands. The review was published and widely disseminated.
- CFRI has made more than two dozen presentations to agency staff, land managers, communities, and policy makers drawing on available ecological and social science regarding issues surrounding forest restoration and hazardous fuels reduction.
- Drawing on applied social science research in collaborative environmental management, CFRI has provided assistance and support to a variety of forest health collaboratives around the State. For example, during the summer and fall of 2008, CFRI helped coordinate the transition of the Colorado Bark Beetle Collaborative (CBBC) from an intergovernmental cooperative to a multi-stakeholder collaborative group involving non-governmental organizations, such as the Colorado Timber Industry Association and environmental organizations. CFRI developed a structured process to redefine the group's organizational structure, by-laws, and operating procedures.

Duty 4: Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuels reduction treatments;

- The WPHFI involves Federal, State, and local governments, and the Coalition for the Upper South Platte (CUSP), Colorado Springs utilities, and a local loggers cooperative to ramp up implementation of restoration-based hazardous fuels reduction projects on Federal and non-Federal lands in a 40,000-acre project area. CFRI has provided technical assistance to WPHFI on ecological and socio-economic monitoring. CFRI will compile and analyze the data, and facilitate adaptive management workshops based on the evidence.
- The UP Mesas project involves the U.S. Forest Service, CSFS, conservation organizations, and the timber industry to address forest conditions outside the historic range of variability on the Uncompahgre Plateau of western Colorado. CFRI conducted evidence-based field-assessments that provided the baseline information used to design restoration and fuels reduction treatments. CFRI is also helping the collaborative group

monitor ecological and socio-economic indicators to gauge project effectiveness and identify needs for adaptation and improvement over the long-term.

Duty 5: Provide peer-reviewed annual reports.

The CFRI has prepared annual reports as required under the Act. They have been circulated among stakeholder groups for comment before being submitted.

Achievement of the Purposes of the Act

CFRI has demonstrated progress towards achieving the purposes of the Act through many of its activities and outcomes, including, for example:

Purpose 1: Implement active adaptive ecosystem management practices at the landscape level:

CFRI's two flagship projects are the Uncompahgre Mesas Forest Restoration Demonstration Project (UP Mesas) and the WPHFI. These two initiatives encompass approximately 52,000 acres. The UP Mesas project is occurring on the Ouray Ranger District of the Grand Mesa, Uncompahgre, and Gunnison National Forest (GMUG National Forest), and involves a collaborative group comprised of the U.S. Forest Service, CSFS, representatives from local conservation organizations, private landowners, and the timber industry. CFRI took a leadership role in conducting a science-based approach to collaboratively assess historic forest structure as the foundation to propose restoration-based treatments to reduce wildfire risk to private property, re-establish more ecologically consistent fire regimes, and sustain long-term healthy forest conditions. CFRI is following through with leading a collaborative ecological monitoring program with participating stakeholders to gauge the short- and long-term effectiveness of proposed management activities, which include logging and prescribed burning. CFRI will facilitate the learning and adaptive management of restoration treatments based on monitoring results over the life of the project.

In the WPHFI, CFRI is leading a collaborative monitoring effort to gauge the effectiveness of treatments to reduce hazardous fuels and restore historic forest conditions in the project area. Monitoring results will be fed back to the WPHFI collaborative forum, comprised of the U.S. Forest Service, CSFS, Teller County, the City of Woodland Park, and the CUSP, a local non-profit watershed protection group. The monitoring results will help with adaptive management on both Federal and private lands.

Purpose 2: Reduce unnecessary planning costs:

The UP Mesas project is an example of how CFRI's involvement in science-based collaborative assessment and monitoring can feed into U.S. Forest Service's efforts to expand restoration treatments across the Uncompahgre Plateau, a 1.4-million acre landscape that has clearly-identified restoration needs. Monitoring information from the 17,000 acre demonstration project will help reduce upfront planning costs when the U.S. Forest Service proposes additional treatments on the Plateau.

CFRI has been involved in facilitating collaborative learning between the U.S. Forest Service and interested and affected stakeholders to address large-scale aspen decline on the GMUG National Forest. CFRI sponsored a joint workshop including researchers, managers, and other interested parties to examine ongoing experimental treatments and the linkages to local forest products industry, with the intent of laying the groundwork for a long-term stewardship contract for aspen management. By convening a collaborative process around the science and management concerns regarding aspen decline, CFRI is helping reduce planning costs associated with the stewardship contract.

The monitoring of current treatments associated with the WPHFI will contribute evidence-based information for the planning and design of future proposed fuels reduction and forest restoration treatments, not only in the WPHFI project area, but across the ponderosa pine forests of the Front Range.

CFRI is sponsoring a collaborative learning effort involving Federal and State forestry agencies, conservation organizations, industry, and interested publics to examine the current knowledge and management effects of warm, dry mixed-conifer forests on the Pagosa Ranger District of the San Juan National Forest. The product of the collaborative learning will be a published report documenting the scientific and social “zones of agreement” around the historic range of variability of warm, dry mixed-conifer forest types in Southwestern Colorado, evidence-based information concerning the effectiveness of past and current treatments, and a protocol for monitoring future treatments on national forest lands. Such a report will be useful to the U.S. Forest Service and possibly private forest landowners in future planning efforts, giving managers the confidence to plan and design treatments in warm, dry mixed-conifer forests.

CFRI is in the early phases of working with the CBBC and a new forest health coalition in the Roaring Fork Valley to conduct a collaborative learning effort to synthesize scientific and evidence-based information, and articulate social zones of agreement concerning lodgepole pine forest management in the wake of the mountain pine beetle infestation. This upfront collaborative, science-based effort will support planning and treatment design on national forest and adjacent non-Federal lands.

Purpose 3: Avoiding duplicative and conflicting efforts:

By emphasizing the demonstration nature of the effort, CFRI’s involvement in the UP Mesas projects lays the groundwork for expanding treatments across other areas of the Uncompahgre Plateau with similar restoration and fuels reduction goals. The U.S. Forest Service will not have to reinvent the wheel for every single proposed project under the same set of goals. This philosophy is modeled in each of CFRI’s initiatives– i.e., laying the scientific and social zones of agreement foundation for a specific landscape, with the intent that subsequent efforts under the same set of goals can build off these zones of agreement, rather than having to start from scratch every time.

Purpose 4: Iincreasing public acceptance of active adaptive ecosystem management practices; and

CFRI's role as a convener, facilitator, and science participant has helped bring and keep interested and affected publics at the table with managers. For example, CFRI's participation in the collaborative evidence-based assessment of historic forest conditions for the UP Mesas project provided members of the conservation community with a high degree of confidence that the proposed action was based on a solid ecological science foundation. CFRI's role in the monitoring of the WPHFI demonstration project was welcomed by a diversity of organizations, such as municipal, county, State, and Federal government agencies; watershed coalitions; and others.

Purpose 5: Achieving general satisfaction on the part of affected entities

On the basis of the interviews with individuals familiar with CFRI, it is apparent that the Institute has been successful in achieving general satisfaction on the part of affected entities. Interviewees reported that CFRI has played a significant role in the restoration arena, and that it has grown over time. Increasingly, CFRI is becoming a go-to source of information for adaptive ecosystem management. The Institute's current emphasis on investigating the effect of restoration efforts is helping further knowledge and effectively encouraging landowners to complete management work on their land. One of the most frequently cited contributions by CFRI is the service it has provided as an intermediary and facilitator. CFRI has demonstrated an ability to serve as a bridging organization by bringing together diverse groups, effectively identifying the issues of greatest concern, and developing action plans for moving forward constructively. CFRI is well respected for its ability to tackle highly polarized issues, develop common ground, and keep groups focused on areas of mutual concern. The CFRI is viewed as credible and skilled in working with diverse groups on complex and sometimes controversial projects. Interviewees also spoke highly of the Institute in terms of its responsiveness to their needs, including timeliness, quality of response, and effectiveness. Many interviewees attributed the Institute's recent successes to the Director's leadership, and his understanding of community forestry and collaboration.

Arizona Ecological Restoration Institute Assessment

Achievement of the Duties of the Act

Based on the information provided in ERI's Five-Year Evaluation Report, the Institute has performed a significant amount of work towards achieving each of the duties specified in the Act. Examples of significant contributions for each duty are presented below.

Duty 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.

- Under the Act, fuel-treatment research supported by the ERI has broadened into several fields of study: fire behavior, fuels, forest dynamics, plant community responses, wildlife responses, and social and economic aspects of forest restoration. These studies are carried out throughout the Southwest and in more distant areas of the Intermountain West, as well.
- A central component of the ERI's studies of restoration treatments is the Long-term Ecological Assessment and Restoration Network (LEARN). The network covers the ponderosa pine forests of Arizona from the Arizona Strip in the northwest through the eastern Apache-Sitgreaves National Forests on the Arizona-New Mexico border. Additional sites are located in Colorado and New Mexico. The network includes ponderosa pine and mixed conifer forests, as well as piñon-juniper woodlands. Each site is set up as a stand-alone controlled, replicated experimental study testing a full restoration treatment (i.e., thinning young trees to restore historical density, spatial pattern, and species composition; treatment of fuels; re-introduction of low-severity surface fire), and an untreated control. The LEARN sites are located on public lands including U.S. Forest Service, BLM, National Park Service, Department of Defense (DoD), and State lands. The excellent data obtained from the LEARN sites is made possible by a substantial investment in human and computing resources; these investments pay off when information is transferred from questions and concepts to documented information for management.

Duty 2: Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuels reduction treatments on a landscape scale using an adaptive ecosystem management framework.

- The premier example of the ERI's work to adapt research findings to large-scale treatments is the Mt. Trumbull ecosystem restoration project in northwestern Arizona. Beginning in 1995, this multi-scale collaborative project brought together BLM managers, State wildlife experts, and ERI scientists to develop a joint project that remains the largest, permanently monitored forest restoration project in the Southwest. The long-term Mt. Trumbull treatments were still in progress when the Act was

authorized. Since then, the ERI staff has developed syntheses of the effects of large-scale treatments on potential fire behavior. Carrying the adaptive management cycle to completion, the Institute carried out the first landscape-scale monitoring assessment of a southwestern forest restoration project that included both implementation monitoring (*Were the project activities done correctly?*) and effectiveness monitoring (*Did it achieve the desired ecological result?*).

- The greater Grand Canyon region comprises a vast landscape within which ERI-supported restoration projects are contributing to improved management and conservation. For several years, the ERI staff has worked to characterize historical forest conditions and fire regimes in this region along an elevational gradient from ponderosa pine to spruce-fir forests.
- Looking ahead to the near future, the ERI is collaborating with numerous stakeholders in the largest landscape-scale forest restoration effort proposed to date-the Four Forests Restoration Initiative-a project covering several hundreds of thousands of acres in Arizona. This work, again, is built on the foundation of knowledge and experience that the ERI has achieved during the past decade of work, including that funded by the Act.

Duty 3: Translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuels reduction treatments.

- Since 2005, the ERI has translated scientific information to affected entities through a variety of means: working papers, white papers, fact sheets, web site/e-Library, workshops, and presentations. During that time the ERI has produced 14 working papers and 11 white papers. The ERI Working Papers series present and translate scientific findings from the research and observations of ERI researchers as well as researchers from other organizations and universities. Topics are chosen for their relevance to land managers because they represent the largest audience for these publications. The ERI White Paper series is designed to reach policymakers, social scientists, and, to some extent, land managers with information about socio-economic issues related to forest restoration and hazardous fuels reduction. Working papers and white papers are sent by mail and/or electronically to 1,300 affected entities throughout the Southwest and beyond. They are also posted on the ERI web site and in the ERI electronic Library.
- During the past five years, the ERI Agency Outreach team conducted 13 workshops for agency land managers. In these workshops, ERI Agency Outreach personnel provided information about ecological restoration and how it could be applied to Federal lands to reduce hazardous fuels while meeting other goals and objectives of the agency. The ERI has also hosted and participated in several conferences and workshops during this period. For example, the Conserving and Restoring Old Growth in Frequent-fire Forests of the American West workshop in April 2006; later that year, the ERI and SWERI hosted a three-day workshop-Conserving and Restoring Frequent Fire Landscapes of the West:

Linking Science, Collaboration, and Practice; in 2007, the ERI conducted two workshops for practitioners; the ERI also hosted the SWERI Biophysical Monitoring Workshop in October 2008.

Duty 4: Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuels reduction treatments.

The ERI Agency Outreach Team participated in the planning for 23 fuels reduction projects during the past five years. These projects took place on lands administered by the U.S. Forest Service, including each of the national forests in Arizona, and several national forests in New Mexico. Each project was undertaken following a request from U.S. Forest Service personnel for ERI services. Featured projects include: Jim Lewis Project/Sacramento Ranger District/Lincoln National Forest and Eager South Wildland-Urban Interface Fuel Reduction Project on the Apache-Sitgreaves National Forests.

Duty 5: Provide peer-reviewed annual reports.

The ERI has prepared annual reports as required under the Act. They have been circulated among stakeholder groups for comment before being submitted.

Achievement of the Purposes of the Act

ERI has demonstrated progress towards achieving the purposes of the Act through many of its activities and outcomes, including, for example:

Purpose 1: Implementing adaptive ecosystem management practices at the landscape level

The premier example of ERI's efforts to implement adaptive ecosystem management practices at the landscape level is the Mt. Trumbull ecosystem restoration project in northwestern Arizona (mentioned above). The entire effort is based on being adaptive to findings of ERI and Arizona Game and Fish Department researchers as well as recommendations about the leave-tree ratio, methods of treating slash, prescribed burning prescriptions from Federal land managers and environmental groups.

Purpose 2: Reducing unnecessary planning costs

Although it is difficult to quantify any exact reduction in unnecessary planning costs, the ERI has made considerable efforts to provide research and expertise to Federal land planners as well as citizens' groups that are interested in forest restoration planning. For example, the ERI Agency Outreach Team participated in the planning for 23 fuels-reduction projects (mentioned above); the ERI has been instrumental in founding and supporting the Greater Flagstaff Forest Partnership; the ERI has worked closely with the New Mexico-based Collaborative Forest Restoration Program (CFRP) in the development and upgrading of handbooks about multi-party monitoring; and the ERI has worked with collaborative

groups in Ruidoso, New Mexico and in the Pinalenos Mountains of Arizona. In addition, ERI staff was instrumental in developing the Statewide Strategy for Restoring Arizona's Forests and the Wood Supply Analysis for Northern Arizona.

Purpose 3: Avoiding duplicative and conflicting efforts

The ERI is constantly looking to form collaborative arrangements with groups/agencies interested in planning and implementing forest restoration treatments. This not only helps to avoid duplicative and conflicting efforts, but serves to build strong bonds with people and organizations that share like-minded goals. The ERI's work with Federal and State agencies at Mt. Trumbull is a good example of this kind of work, as is the ERI's participation on the Arizona Governor's Forest Health Council, the Greater Flagstaff Forest Partnership board, and, most recently, in the discussions about the Four Forest Initiative in Arizona.

Purpose 4: Increasing public acceptance of active adaptive ecosystem management practices

The ERI's work with public groups, such as the Greater Flagstaff Forest Partnership, as well as groups in Ruidoso, New Mexico, the White Mountains, and the Pinalenos Mountains, has helped the public in those areas see the need for adaptive ecosystem management practices, especially the importance of pre and post-treatment monitoring.

Purpose 5: Achieving general satisfaction on the part of affected entities

On the basis of the interviews with individuals familiar with ERI, it is apparent that the Institute has been very successful in achieving general satisfaction on the part of affected entities. According to one interviewee, it is impossible to have a conversation with any U.S. Forest Service employee about restoration without some reference to ERI's work. The opportunity to see different prescriptions tested by ERI (including the evolution of ecosystems over time), is widely perceived by interviewees as one of the most tangible contributions by ERI. Several interviewees cited ERI's wealth of useful publications as an outstanding resource for forestry professionals everywhere. One specific example mentioned was the "Green Book on Restoration of Southwest Pine Forest; in the words of the interviewee, "the best available publication on the topic." In addition, ERI is already seen as a leader in helping to expand the scope of restoration thinking to whole ecosystems—not only to the ecosystems of the Southwest, but to the whole country. Part of this ripple effect is because of the way the Institute impacts Northern Arizona University forestry students who later go on to faculties and agencies around the country. ERI is generally viewed as well run, responsive, timely and extremely effective. The Institute's service is enhanced by having high-quality knowledgeable staff and by having public relations, policy, and community outreach capacity—the kinds of people who are not typically employed at research organizations. Interviewees provided a number of comments on ERI's exceptional level of service and value to the restoration community: "Willingness to stay involved and supportive in partnerships even through the ebbs and flows of funding"; "Incredible in their openness and communication"; "Congress is getting its money's worth out of ERI"; and "I can't stress enough the value of having this kind of Institute in the area."

SWERI System Assessment and Recommendations

System Assessment

It is apparent from the Institute reports and the interviews with affected entities that the Institutes have all made significant progress towards implementing the duties and achieving the purposes of the Act. The Institutes have made a real difference to the health of western forest-based ecosystems and performed effectively given available resources. Their productivity has been to a large extent proportional to their funding levels, with the Arizona Ecological Restoration Institute (ERI) having significantly more resources than the other two Institutes, but all three Institutes are achieving the purposes for which they were established. As a result of the work that has been completed, they have generated a high degree of demand and relevance, and the sense that they fulfill a unique role that no other institutions or agencies can do.

The Institutes have faced questions at times about their value-added niche in the ecological restoration research arena—particularly their place in the institutional landscape. They have sometimes been viewed as unwelcome competitors for scarce funding, and occasionally as irrelevant by players who viewed their expertise as duplicative. These perceptions seem to be largely in the past—although plenty of work is still needed to improve collaboration and communication, and to build the kinds of partnerships that will enhance and leverage restoration efforts in which so many agencies and groups have an important role to play. The unique value-added niche of the Institutes, as perceived by affected entities, though still evolving, has been variously described as “helping democratize science for good use by managers”; “asking some of the tough management questions and getting answers”; “pulling stuff out of the ivory tower and putting it into a form that can be readily understood”; and “conveying the benefits of science to decision makers, local agency staff, sawyers on the ground.”

The contributions by the Institutes vary, not only because of the differential in funding levels, but also because some specialization has occurred. All of the Institutes provide a suite of services, but ERI has become especially well known for its ecological research, publications and outreach; CFRI for facilitation, collaboration and conflict resolution (especially recently); and NMFWRI for workforce development, including training and mechanical treatments as well as for its GIS services. These institutional strengths have developed somewhat organically to reflect each State’s biophysical, socio-economic, and political contexts and issues, as well as the inclinations and abilities of leadership and staff. An important question for the Institutes is, given limited resources (especially for the Colorado and New Mexico institutes), how strategically to invest in specialization while continuing to meet the diversity of ecological restoration needs in each State. Many of the most appreciated achievements to date for all three Institutes are in value-added contributions for small organizations and local governments—who have benefited a great deal from the tangible assistance provided by the Institutes in designing,

implementing, and monitoring on-the-ground treatments as well as from the other services provided.

Many affected entities believe that the stage has been set, and the imperative exists now more than ever due to the effects of climate change, new insect pests, social and economic issues etc., for the Institutes to play an increasingly important role in large-scale restoration. The Institutes can help address the scientific questions and collaboration challenges that stand in the path of this work. To achieve full capability they need stability in directors, continuing improvement in host university relationships, and in the minds of many, more funding.

Affected Entity Recommendations that Apply to the System

The affected entities who were interviewed for the evaluation offered a number of recommendations that apply to the system of Institutes.

- 1) ***Broaden the Scope of the Institutes to Other Ecosystems and Larger Landscapes.*** Many interviewees talked about the need for a broader perspective beyond Ponderosa pine and piñon-juniper ecosystems. For example, the bark beetle epidemic and aspen decline are pressing forest ecosystem management issues which extend beyond restoration imperatives in dry, frequent-fire forest types. The mandate for a broader perspective is not reflected in the legislation that established the Institutes, but there is a perceived imperative to scale up restoration efforts in the face of intersecting forces such as climate change and rapid population growth in fire-prone landscapes. The Institutes can play a critical role in supporting a broader array of long-term forest health issues beyond large-scale ecological restoration, but their effectiveness may be limited by too narrow an ecological scope. For example, treatments on upland ecosystems can change the dynamics of runoff and impact adjacent or related ecosystems, such as mid-elevation grasslands, woodlands, and wetlands that are threaded throughout ponderosa pine forests; all of these landscapes should be considered when assessing treatment effectiveness.

A natural expansion would be to extend the geographic scale of restoration efforts to encompass watersheds. The broadening of scope should include outreach and active management as well as research, i.e., the kinds of things others are unable to do, but for which there is a critical need. It would also require partnering with many more land management entities than is currently the case and, in some situations, working across State boundaries. Thus far, State boundaries are seen as impeding on-the-ground jurisdictional cooperation. There is a great opportunity, and urgency, for the Institutes to make a real difference in western ecosystems by expanding the reach of the Institutes through watershed approaches, partnering with scientists in other institutions across the West, and other creative mechanisms. One concrete suggestion to enhance cooperation across State lines was to call upon the Western Governors' Association to jointly sponsor and organize an initiative to examine the role of the Institutes and others who need to cooperate in landscape-scale ecological restoration.

- 2) ***Consider Some Specialization by the Institutes.*** Questions were raised in a few of the interviews about possible duplication of effort among the three Institutes (as well as with various academic institutions and other research entities). To avoid these problems and to create more effective synergy among the Institutes, several interviewees suggested some strategic specialization, which to some extent is already occurring. For example, CFRI has demonstrated particular strengths in facilitation, collaboration and conflict resolution—high value services because large landscape restoration efforts are necessarily cross-jurisdictional, involving many diverse stakeholders who do not always agree or coordinate; NMFWRI has developed strong capacity in GIS and workforce development, including training and mechanical treatments; and ERI has a well developed track record in ecological research and outreach. It would behoove the Institutes to work together on a forward-looking strategic plan that would address choices and priorities for the future, including whether to further specialize in the areas where they are already strongest as well as possibly in other areas where there are emerging needs. In any case, specialization should not come at the cost of any individual Institute's ability to meet needs within its State. All of the Institutes should build and retain enough capacity to provide site-specific ecological restoration assistance.
- 3) ***Assess Funding Levels and Discrepancies in Funding among the Institutes.*** The interviewees agreed that additional funding would enable the Institutes to perform more of the valuable work they are already doing, expand their scope of impact to large-scale landscape restoration, and allow them to help respond to looming imperatives such as climate change. Several interviewees suggested increasing funding especially for CFRI and NMFWRI, on the assumption that not only are additional services in high demand, but that current funding levels are barely sufficient to maintain their institutional integrity. There were mixed views as to the ability of the two smaller Institutes to absorb a rapid increase in funding—some interviewees suggested that a large infusion of additional resources would not be effectively utilized in the near term, while others maintained that those Institutes do indeed have the institutional foundation to be able to grow quite rapidly.
- 4) ***Improve Coordination and Build more Partnerships with Other Agencies and Research Entities.*** It was apparent from the interviews that relationships with other agencies and research entities have not always been easy—there have been growing pains and bumps in the road, turf battles, and hard feelings over perceived and real slights. There is still a real reluctance in some places (especially, according to some interviewees, on the part of some U.S. Forest Service field units) to take advantage of the services and expertise of the Institutes. In some cases the Institutes are seen as outright competitors, in others as diluting the authority/control by local jurisdictions over projects. However, interviewees report concerted recent efforts at improved communication and dialogue, which seem to be bearing fruit. There is also a high degree of interest in seeing more advantage taken of Institute services by other Federal agencies in addition to the

U.S. Forest Service. Relationships could be further improved by additional outreach, as well as continued examination and articulation of the Institutes' highest value niche in the ecological restoration arena relative to other players.

Appendix A – Institute Evaluation Reports

Each of the Institutes prepared an evaluation report to comply with the five-year evaluation requirement of the Southwest Forest Health and Wildfire Prevention Act. Each Institute's evaluation focused on the Institute's performance for each of the program duties specified in the Act. (See Table 1) An Institute's successful implementation of its program duties demonstrates that its programs and activities have sufficiently met the purposes of the Act. Continued Federal assistance to an institute is warranted if it has programs and activities that have resulted in the achievement of the purposes of the Act.

Table 1: Duties specified in the Southwest Forest Health and Wildfire Prevention Act (PL 108-317)

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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;
 2. Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuels 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 fuels reduction treatments;
 4. Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuels reduction treatments;
 5. Provide peer-reviewed annual reports.
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NMFWRI Report

Since 2005, the Institutes have developed and completed work plans under the Act.

The NMFWRI work plans have reflected the views and needs of our statewide stakeholders from the beginning. The first ones were written by NMHU professors. Fiscal Year 2006 had projects on building the capacity of the Institute, developing consensus on ecological restoration monitoring, and restoration-based hazardous fuels reduction prescriptions for forests and woodlands. Since Ken Smith came on as Director in January 2007, work plans have been prepared by staff. The 2007 work plan contained projects which continued the 2006 work, and added technical assistance for communities. These two years were funded at \$500,000 each year, equally split between Federal and State funds.

The 2008 work plan went through several revisions based on budgetary restrictions, but the final version continued previous work and added projects on landscape-scale public information assessments, public outreach and information dissemination, wood utilization, and educational initiatives. The work was funded with a combination of Federal (\$345,000) and State (\$250,000) funds. The 2009 work plan also was revised before final funding. It adds a pilot landscape project and continuing education and forest worker safety trainings. Total funding is again \$595,000, with the Federal-State split as in 2008.

From the beginning, we have endeavored to work with our two sister Institutes. The pilot landscape project, in Arizona and lead by ERI, is the first planned, on-the-ground joint effort. Another example of a successful collaboration was the CFRI-NMFWRI work on the Uncompahgre Plateau last summer. Organized by CFRI, we spent a week determining historic stand structure of mixed conifer forests with community members and the U.S. Forest Service.

About The New Mexico Forest and Watershed Restoration Institute

The overall goal of NMFWRI is to ensure that the best available science is used by land managers and stakeholders to implement effective restoration-based forest treatments in New Mexico. The work plans and agenda for NMFWRI are based on the duties and purposes outlined in the authorizing Federal legislation, the recommendations found in the [New Mexico Forest and Watershed Health Plan](#), and through field conversations with natural resource professionals and other stakeholders. The authorizing legislation, Forest and Watershed Health Plan, and other related links and documents can be accessed on the [NMFWRI web site](#). NMFWRI works closely with the [New Mexico State Office of Forest and Watershed Health](#) to efficiently utilize resources and avoid redundancy between the two organizations. The [NMFWRI advisory board](#), which consists of natural resource professionals representing some of our major stakeholders, meets twice annually to review NMFWRI activities and to provide the director and staff with feedback on current or potential projects.

Since reaching full staffing in mid-2007, NMFWRI has participated in approximately 40 projects involving a multitude of land management entities across the State. Time commitments for these projects ranged from a few hours (making maps or global positioning system (GPS)

training) to multiple weeks (field monitoring and data analysis). At full staffing, NMFWRI has six full-time employees. In addition to the full-time staff, we employ Highlands' undergraduates as work-studies, a small group of undergraduates to assist with summer field work, and contractors as needed.

To What Extent Did The Institute Meet The Duties Under The Act?

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**

Case studies - One of the initial efforts of NMFWRI was to collect information on fuels treatments in the southwest, especially in ponderosa pine and lower mixed conifer forests and piñon-juniper woodlands in New Mexico. One idea that is stressed in the scientific literature is that fuels treatment, while beneficial to human communities and helpful in maintaining forest health, is not necessarily restoration. Thinning for fuel treatment may not preserve historic structure; in contrast, restoration helps move a degraded forest onto a trajectory that is closer to the historical range of variability. Thanks to efforts of the Ecological Restoration Institute (ERI) and the U.S. Forest Service, restoration has become such a part of the thinking of foresters and other land managers that restoration principles are incorporated into anything they do. Except for possibly piñon-juniper woodland in the wildland-urban interface, thinnings designed by professionals primarily for fuel treatment also take into consideration wildlife, recreation, and historic forest structure. Because this is the case, much can be learned from their experience.

In 2007, NMFWRI started to compile a [catalog of forest prescriptions](#) that were applied to the landscape in different regions and ecosystems of New Mexico. These case studies provide an easily accessible place for stakeholders to review the types of prescriptions that are applied by forest managers in various vegetation types. We include economic data (costs per acre) when possible to supplement the prescription information. The majority of the case studies posted on our website deal with fuels treatments.

Day-long seminars - From our beginning, conversations and visits around the State uncovered a desire for short, technical meetings focused on a specific topic. As a result, we have held a series of workshops designed to facilitate an information exchange between presenters, many of whom are practitioners, and audience members. The first of these one-day seminars brought together monitoring practitioners to discuss protocols and the formation of a statewide monitoring database. It was held in August 2007 at the Sevilleta Field Station. This workshop was co-hosted with the State Office for Forest and Watershed Health. Fifty participants attended a 1.5 day meeting consisted of 17 presentations by monitoring practitioners from a variety of forested ecosystems across the State, followed by a discussion about developing a statewide monitoring database. All the presentations and the minutes of the monitoring database discussion were summarized and placed on the NMFWRI web site ([Forest and Watershed Monitoring Meeting](#)). The workshop's outcomes are driving the future direction of the statewide database.

In early 2008, NMFWRI co-hosted a statewide meeting of practitioners and scientists to discuss management of mixed conifer and aspen in New Mexico (75 attendees). The goal of this meeting was to expose land managers to the current research focused on the types of natural disturbance occurring in this forest type, and for the research community to hear about on-going management practices. Presentation topics covered the gamut, with presenters from New Mexico State Forestry, the U.S. Forest Service, the forest research community, the forest-owning public, and included participants from Arizona and Colorado. A synopsis of the mixed conifer/aspen ecology and management meeting is posted on our website.

Over the past year, NMFWRI has teamed with other organizations to organize a New Mexico Watershed Forum and the New Mexico Forests and Climate Change meeting that took place in October and November 2008, respectively, in Albuquerque.

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

Valles Caldera-Jemez - In the summer and fall of 2007, the NMFWRI staff participated in a series of meetings hosted by the Santa Fe National Forest to explore the possibility of developing a multi-jurisdictional stewardship contract in northern New Mexico. NMFWRI and other entities contacted potential partners with regard to the development of proposals related to the then-proposed Forest Landscape Restoration Act (FLRA). Regular bi-monthly meetings with the Santa Fe National Forest, the Valles Caldera National Preserve, the Nature Conservancy, and other stakeholders have been held since the summer of 2008 to begin planning this landscape-scale restoration effort. The total planning unit includes about 210,000 acres, with the first round of projects envisioned for 46,000 acres. This planning has progressed to the point that a collaborative plan to solicit input from all area stakeholders has been prepared by the Supervisor's Office of the Santa Fe National Forest, with input from the larger group. The next step will be to broaden the range of stakeholders involved in the pre-NEPA planning, with the goal of having NEPA-ready sites by the time the FLRA is funded.

Estancia - In April 2007, the Claunch-Pinto Soil and Water Conservation District requested NMFWRI participation in the review of proposals for a long-term monitoring project in the Estancia Basin. Since 2008, NMFWRI has convened the meetings of the Estancia Basin Monitoring Steering Committee, which comprises the three Soil and Water Conservation Districts in the basin (Claunch-Pinto, Edgewood, and East Torrance) and representatives from cooperating agencies (State Forestry, New Mexico Environment Department, NRCS, U.S. Forest Service, Chilili Land Grant). Besides chairing the meetings, NMFWRI personnel are closely interacting with the SWCA consulting group as they monitor thinning projects throughout the basin. We are also helping the three districts map their prior thinning projects (Estancia Basin Thinning Map) and we are building property ownership maps to identify possible areas for contiguous thinning treatments in the East Mountains.

Additional efforts - NMFWRI is also working with the Tierra Y Montes Soil and Water Conservation District and the Las Vegas State Forestry office to build a project map (primarily thinning projects) of the Gallinas Watershed. The Gallinas is the municipal drinking-water watershed for Las Vegas, and has been prioritized for restoration.

Following two site visits to the Coleman Ranch in the fall of 2007, NMFWRI teamed with the Lower Pecos Watershed Alliance and New Mexico Tech in the development of an on going project designed to examine how thinning in a mixed conifer stand would impact surface and subsurface water budget. NMFWRI conducted a pre-treatment inventory over the 600-acre stand in June 2008. This project was partially supported with State funding.

CFRP - NMFWRI is the coordinator of the multiparty monitoring training and technical assistance that is provided to the U.S. Forest Service's Collaborative Forest Restoration Program (CFRP). (The funding for this effort is separate from the funds received for the NMFWRI Federal work plan, but the deliverables and required work are related to the objectives in the authorizing legislation and the annual work plans, as well as our future workload and funding requests). In this role, NMFWRI or contracted personnel facilitate multi-party meetings for CFRP grantees, help grantees develop a project-specific monitoring plan, provide on-site training in data collection for CFRP team members, youth groups, or others who will be gathering monitoring data for the project, and provide assistance with data analysis and final report writing. Since mid-2007, NMFWRI and its contractors have written and published eight white papers for CFRP grantees that cover a wide range of topics of interest to the grantees. These papers are disseminated at meetings and are posted on the NMFWRI web site as part of the New Mexico Forest Restoration Series. One of these efforts (Working Paper 5) involved a five-person team that identified which of the 102 projects that have been funded since CFRP's inception could be included in a 15-year monitoring effort that is called for in the CFRP authorizing legislation. The recommendations of this paper include core ecological variables that every CFRP project should monitor, as well as the twenty projects across multiple jurisdictions and forest types to be measured at five, ten, and fifteen years after treatment. This long-term monitoring closes the feedback loop essential for adaptive management; it also will require additional staff and budgetary resources that have not been requested in the past.

1) Translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuels reduction treatments;

Demonstration area - In June 2007, ERI and the U.S. Forest Service held a restoration workshop in Albuquerque in which NMFWRI participated. As a result, NMFWRI established a 10-acre demonstration area in a ponderosa pine stand on the Pritzlaff Ranch outside of Las Vegas. Areas of equal size were marked according to evidence-based guidelines developed by ERI, Northern Goshawk guidelines developed by the U.S. Forest Service, and genetic (phenotypic) guidelines developed by NMFWRI. Areas are large enough for visitors to see what a residual stand would look like. The ERI and Northern Goshawk plots exhibit the group-and-opening structure characteristic of historic ponderosa pine stands. In this demonstration of a genetic prescription, trees were left or cut without concern for clumps or openings. Thinning of this

stand was completed in the fall of 2008. Four formal groups have visited this demonstration site since it was marked, and additional tours have been made by individual forest managers.

Prescription Assistance - One of our major tasks is to work with managers to produce prescriptions that blend recommendations for restoration and fuel treatments, which will then be adapted and applied to the unique conditions of each stand and watershed. Restoration in New Mexico almost always means the reintroduction of low-intensity fire into the ecosystem. In most cases, vegetative structure must be manipulated by removing some trees from the stand before fire can be reintroduced safely. In 2007, NMFWRI began compiling a catalog of forest prescription applied in New Mexico. That task is described above under Duty 1. Another part of that task was a survey of the technical literature. As we worked on this task, we became aware of and were greatly impressed with existing collections of information about restoration and fuel treatments. An excellent example is the booklets and other extension material targeted at evidence-based restoration that have been produced since 1997 by ERI. Other groups also have published excellent work on restoration-based fuels treatment. Hunter and others (2007) "A comprehensive guide to fuels treatment practices for ponderosa pine in the Black Hills, Colorado Front Range, and Southwest," (published as Gen. Tech. Rep. RMRS-GTR-198) is one we recommend to practitioners. Another publication, Graham and others (2004) "Science basis for changing forest structure to modify wildfire behavior and severity," (published as Gen. Tech. Rep. RMRS-GTR-120), we liked so much we synthesized it and posted the synthesis ("Science basis for changing forest structure") on our website. While some of the resources NMFWRI recommends do not focus exclusively on New Mexico, they are comprehensive in scope and excellent in quality, and fulfill the intent to give forest managers a place to go when they need information regarding prescriptions used in forest and woodland similar to their own.

A new project is the Forest and Watershed Health Information Clearinghouse, a joint effort with the Forest and Watershed Health Office of State Forestry. This web-based clearinghouse is under construction. It will contain links, postings, and videos related to not only prescriptions, but groups, funding sources, monitoring protocols, etc., from across the State. Planning was supported by Federal funds, but the funding for the clearinghouse is from State Forestry. The clearinghouse will become a valuable tool for exchanging information about restoration.

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

Geographic Information Systems (GIS) Services – One of the important areas of our work is in Geographic Information Systems. We work closely with project managers at all levels across the State to provide them with maps that will assist them with project planning. This service is especially useful for communities, tribes, and CFRP grantees who cannot afford to have their own GIS expertise or software. Boundary maps containing either traditional topographic information or images inform the public and decision-makers of the geographic context of restoration activities and resources. Statewide maps showing locations of project and forest

industries have been especially useful to elected officials. GIS aids in planning restoration activities by providing a landscape-scale view of historical treatments, fire history, vegetation types and conditions, and community and wildland urban interface locations.

Our GIS unit assists monitoring by enabling unbiased determination of sampling site locations. Use of GPS to precisely determine locations of sampling points improves the statistical validity of pre-treatment and long-term monitoring. Training and education of governmental agencies and non-profits in the use of GIS and GPS improve the availability of information related to the location of restoration activities, further enabling landscape- and project-oriented restoration strategies.

Implementation – A healthy, restored forest depends upon a healthy, restored forest industry. NMFWRRI has been involved with promotion and support of industry at several levels. Notably, we have provided funding to enable the recently formed New Mexico Forest Industry Association (NMFIA) to retain an Executive Director. This monetary support will diminish as the industry strengthens, but our moral support for industry will not. Society’s ability to pay for restoration-based hazardous fuels treatments is competing against other needs; we do not have the ability to pay for universal health care for children, and forest health is lower on our priority list. A way must be found for small diameter material to pay its way out of the woods. In the words of a flooring producer in Las Vegas, “we can’t grant our way to forest health.”

Training is another part of implementation. We first paid attention to training to lower the costs of worker’s compensation insurance. We worked with other organizations to modify an existing safety course to the point it was accepted by the major insurance underwriters in New Mexico, and operators whose workforce received the training had their worker’s comp rates reduced by 60 percent. That experience, and a belief that knowledge about tools helps both safety and efficiency, led us to sponsor training in chain saw use using a program called “The Game of Logging.” Most recently, the Alamo Band of the Navajo Nation was awarded a CFRP grant to establish a crew of woods workers. Following their request and using that grant money, we taught a two-week training course for them that incorporated a week of basic ecology and restoration-base fuel reduction principles, and a week of chain saw use and woods safety. This core course has been requested by other groups, and we expect to modify it according to results and group needs.

5) Provide peer-reviewed annual reports.

Annual reports have been prepared every year. They have been circulated among our stakeholder group for comment before being submitted. They are available on our website.

REFERENCES

NMFWRI web links

NMFWRI home page

www.nmfwri.org

NMFWRI advisory board

www.nmfwri.org/images/stories/pdfs/about/2008advisoryboard.pdf

Catalog of forest prescriptions

www.nmfwri.org/images/stories/pdfs/For_Land_Managers/NMForestPrescriptions.pdf

Forest and Watershed Monitoring Meeting

www.nmfwri.org/images/stories/pdfs/Restoration_Workshops/2007ForestWatershedMonitor.pdf

Mixed conifer/aspen ecology and management meeting

www.nmfwri.org/images/stories/pdfs/Restoration_Workshops/2008MixedConiferAspen.pdf

New Mexico Forest Restoration Series

www.nmfwri.org/restoration-papers

Estancia Basin Thinning Map

www.nmfwri.org/images/stories/pdfs/Estancia_Basin_Monitoring/small_estancia_6_1_0_8_small.pdf

Science basis for changing forest structure

www.nmfwri.org/images/stories/pdfs/For_Land_Managers/SummaryofScienceBasis.pdf

Other links mentioned in the narrative

New Mexico Forest and Watershed Health Plan

www.nmfwri.org/images/stories/pdfs/about/001025-NMFWHPlan-722200842703.pdf

New Mexico State Office of Forest and Watershed Health

www.emnrd.state.nm.us/fd/FWHPlan/ForestAndWaterShedHealth.htm

New Mexico Watershed Forum

www.watershedforum.org/

New Mexico Forests and Climate Change

www.forestguild.org/nmfccworkshop.html

Forest and Watershed Health Information Clearinghouse

www.allaboutwatersheds.org

Annual Reports

www.nmfwri.org/annual-reports

CFRI Report

Since 2005, the Institutes have developed and completed work plans under the Act.

The Colorado Forest Restoration Institute's (CFRI) work plans are based on semi-annual statewide needs assessments. The assessments are performed by the director and are comprised of targeted interviews and focus group discussions with individuals representing affected entities, such as the U.S. Forest Service, U.S. Bureau of Land Management (BLM), and the Colorado State Forest Service. Needs assessments were conducted in 2005, 2007, and 2009. Dr. Dan Binkley, the founding director of CFRI, conducted the 2005 and 2007 needs assessment; Dr. Tony Cheng assumed the CFRI directorship May 2008 and conducted the 2009 needs assessment.

FY2005 Work Plan

The main goal for FY2005 was to begin building the organizational capacity to develop and sustain programs pursuant to the Act. This included creating a website, conducting a statewide needs assessment, and attending organizing meetings involving the three Institutes. Federal dollars provided under the Act totaled \$50,000.

FY2006 Work Plan

The FY2006 work plan was the first full work plan approved for CFRI in summer 2005. Three goals were identified and worked on: 1) developing outreach products and activities contributing to restoration-based hazardous fuels reduction; 2) an applied study on wood chip impacts and decomposition; and 3) conducting a comprehensive assessment of restoration issues in piñon-juniper forests. Deliverables included: researcher-manager field tours investigating restoration-based hazardous fuel reduction projects; a statewide networking workshop for collaborative forest restoration initiatives; publications describing aspen forest conditions and a photo-based guide to restoration-based hazardous fuels reduction management; and a workshop convening scientific experts on piñon-juniper ecology and fire risk. Federal dollars provided under the Act totaled \$250,000.

FY2007 Work Plan

The FY2007 work plan continued the work identified in the FY2006 work plan. Three goals were identified and worked on: 1) Developing outreach activities and products contributing to restoration-based hazardous fuels reduction; 2) continued applied research on fire risk and restoration issues in piñon-juniper forests. Deliverables included: publication of a report synthesizing current knowledge of piñon-juniper ecological variation and management; publication of management guidelines for restoration-based hazardous fuels reduction in ponderosa pine forests in Colorado's Front Range; publication of a report synthesizing barriers to prescribed burning on private lands; publication of a report on lodgepole pine ecology and mountain pine beetle impacts; two networking workshops bringing together wood producers in

Colorado to learn about economic opportunities associated with forest restoration; and two short courses delivered to managers on piñon-juniper ecology and management. Federal dollars provided under the Act totaled \$250,000.

FY2008 Work Plan

The FY2008 work plan expanded the work of CFRI into more on-the-ground, applied projects. Three goals were identified and worked on: 1) Developing outreach activities and products contributing to restoration-based hazardous fuels reduction; 2) continued applied research on ecological variation and restoration of piñon–juniper forests; 3) evidence-based approaches to forest restoration, including an applied demonstration forest restoration project. Deliverables included: evidence-based assessment of historic forest structure for the Uncompahgre Plateau Mesas Forest Restoration Project; establishment of a monitoring and adaptive management program for the Woodland Park Healthy Forest Initiative; final publication of the scientific synthesis of ecological variation and disturbance regimes in piñon-juniper forests in a peer-reviewed journal; and a second statewide networking workshop for collaborative forest restoration initiatives. Federal dollars provided under the Act totaled \$246,000.

FY2009 Work Plan

The FY2009 Work Plan builds on the momentum from the FY2008 work plan deliverables and emphasizes field-based application of restoration-based hazardous fuels reduction as well as working with affected entities to address the impacts of the mountain pine beetle infestation and other forest health concerns that affect long-term forest and community resilience to disturbance. Five goals were identified and in progress: 1) Developing outreach activities and products contributing to restoration-based hazardous fuels reduction; 2) Involvement with the Northern Arizona University Ecological Restoration Institute and the New Mexico Forest and Watershed Restoration Institute in a pilot landscape restoration project; 3) addressing the economics of restoration-based projects through wood utilization in partnership with the Colorado Wood Utilization and Marketing Program; 4) supporting forest health collaborations through science- and evidence-based approaches; 5) evidence-based approaches to forest restoration. Deliverables included: short courses on collaborative forest assessment and post-treatment monitoring and adaptive management; two networking workshops for wood producers; two reports summarizing lessons learned from the Uncompahgre Plateau Mesas Forest Restoration Project and the Woodland Park Healthy Forest Initiative; and continued implementation of collaborative monitoring programs for restoration-based hazardous fuels reduction projects. Federal dollars provided under the Act totaled \$246,000.

In addition to deliverables identified in the work plans, we have worked with the Arizona and New Mexico restoration institutes. The pilot landscape project, led by the Arizona ERI, continues to evolve with the development of a four-National Forest initiative to conduct forest restoration at a landscape scale. The three Institutes also collaborated in designing a workshop to identify common monitoring indicators and measures to document and evaluate the effectiveness of restoration-based treatments. Individuals from the NMFWRP participated in

the historic forest structure assessment conducted for the Uncompahgre Plateau project, and efforts are underway to apply work conducted by the ERI to design and implement a landscape-scale forest restoration project on the San Juan National Forest.

About The Colorado Forest Restoration Institute

The CFRI is housed within the Warner College of Natural Resources at Colorado State University. As such, it is well positioned to leverage the science and outreach capacity within the College by drawing on the expertise of faculty, staff, and students, and the Colorado State Forest Service. Located in Fort Collins, Colorado, CFRI is fortunate to be located in close proximity to the U.S. Forest Service Rocky Mountain Research Station (RMRS), affording opportunities for collaboration with RMRS scientists to synthesize current research pertaining to restoration-based hazardous fuels reduction and insect infestation impacts on Colorado's forests, as well as drawing on RMRS research expertise in conducting forest condition assessments and monitoring.

The mission of the CFRI is to build the capacity of land managers, communities, and policy-makers to address forest health and restoration issues through science- and evidence-based approaches to assessing, designing, and adaptively managing restoration projects. CFRI staff brings ecological and social science expertise to bear on forest restoration issues, and are constantly called upon to work with agencies, collaborative partnerships, and policy makers, such as the Governor's Forest Health Advisory Council. Currently, CFRI is staffed by a director, a program associate, and a part-time research associate whose time is shared by the Colorado State Forest Service's Wood Utilization and Marketing Program (COWOOD). CSFS also provides the services of an outreach forester.

To What Extent Did The Institute Meet The Duties Under The Act?

Duty 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.

From the beginning, CFRI has worked with Front Range Fuels Treatment Partnership to address the dual goals of forest restoration and hazardous fuels reduction in Colorado's Front Range. Two items of note have contributed to project implementation. The first is co-sponsoring, with the U.S. Forest Service and the Colorado State Forest Service, the development of management guidelines that translate ecological research and principles into management. The second is a photo guide that provides visual examples of pre- and post-treatment forest conditions that meet the twin goals of restoration and fuels reduction.

CFRI has also conducted more active delivery of principles and recommendations of restoration treatments. Partnering with the CSFS, CFRI hosted two short courses on the ecology and management of piñon-juniper forests in La Junta and Durango targeting land managers. These two-day workshops were well attended and equipped managers with knowledge and confidence to restore and manage piñon-juniper forests in line with ecological principles.

Duty 2: Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuels reduction treatments on a landscape scale using an adaptive ecosystem management framework.

A hallmark project of CFRI is the synthesis and publication of current scientific knowledge concerning the historic ecology and disturbance regimes in piñon-juniper forest ecosystems. As the dominant forest type in the southwest, there have been and continue to be numerous efforts to manage piñon-juniper systems to reduce fuels and restore conditions. Yet, surprisingly little comprehensive scientific investigations have been conducted that provide insight into the question, “Restore to what?” CFRI led a systematic synthesis and adaptation of findings from conventional research into piñon-juniper ecology, with an eye towards management implications.

Concerns over the mountain pine beetle infestation in Colorado’s high country prompted CFRI to synthesize current knowledge about lodgepole pine forests and mountain pine beetle impacts. A report was published compiling what was known about catastrophic wildfire in lodgepole pine forests and the effect of mountain pine beetles on fire risk and behavior. While it was controversial at first, conventional wisdom has evolved to be in line with the findings produced in the report.

Duty 3: Translate for, and transfer to, affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuels reduction treatments.

One of the tools in the restoration-based hazardous fuels reduction toolbox is prescribed fire. Either as a stand-alone treatment or in combination with mechanical treatments (i.e., thinning, chipping), land managers, especially on private lands, are using prescribed fire to achieve restoration and fuels reduction goals. However, there are barriers to being able to use prescribed fire effectively. CFRI sponsored a review of literature and interviews of private land managers for barriers to using prescribed fire on private lands. The review was published and widely disseminated.

In addition to published reports and bulletins, CFRI uses short-courses, trainings, and on-site field trips to transfer knowledge about restoration-based treatments to affected entities. CFRI has made over two dozen presentations to agency staff, land managers, communities, and policy-makers drawing on available ecological and social science regarding issues surrounding forest restoration and hazardous fuels reduction. For example, in 2008, a new community coalition in the Roaring Fork Valley formed around concerns about the mountain pine beetle impacting the valley’s forests. Dr. Jessica Clement helped organize workshops bringing together researchers, managers, and community members to learn about lodgepole forest ecology, fire risk, and the beetle infestation. Such presentations help coalitions understand the key issues and organize to take effective action.

One key area CFRI is involved in is transferring scientific and interdisciplinary knowledge in the design, implementation, and adaptive management of collaborative processes involving multiple stakeholders. Colorado has numerous forest health and restoration collaborative

initiatives, from subdivision-level Community Wildfire Protection Plan groups to regional partnerships, such as the Front Range Roundtable and Colorado Bark Beetle Cooperative (CBBC). Drawing on applied social science research in collaborative environmental management, CFRI provides assistance and support to a variety of groups. For example, during the summer and fall of 2008, CFRI helped coordinate the transition of the CBBC from an intergovernmental cooperative to a multi-stakeholder collaborative group involving nongovernmental organizations, such as the Colorado Timber Industry Association and environmental organizations. CFRI developed a structured process to redefine the group's organizational structure, by-laws, and operating procedures. As a result, the CBBC continues to be an effective voice for drawing Federal, State, and local resources to address the impacts of the mountain pine beetle on local communities.

Duty 4: Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuels reduction treatments.

Since 2008, CFRI has stepped up its efforts in working with affected entities to develop adaptive management approaches to restoration and wildfire mitigation. Two demonstration projects are off the ground and are part of multi-stakeholder collaborative efforts to achieve restoration and fuels reduction goals, the Woodland Park Healthy Forest Initiative (WPHFI) and the Uncompahgre Plateau Mesas Forest Restoration Demonstration Project (UP Mesas).

The WPHFI was created as a demonstration implementation project of the Front Range Roundtable. Federal, State, and local governments are involved, as are the Coalition for the Upper South Platte (CUSP), Colorado Springs Utilities, and a local logger's cooperative. The purpose of the WPHFI is to ramp up implementation of restoration-based hazardous fuels reduction projects in a 40,000-acre project area based on the Teller County Community Wildfire Protection Plan and the Pike National Forest's wildland-urban interface fuels management objectives. CFRI's role is to provide technical assistance for the group to identify and collect monitoring information regarding the ecological and socio-economic outcomes of the project. In mid-March 2009, CFRI staff held a "train-the-trainer" field day with land managers, CUSP staff, Colorado State University Extension, and local area high school teachers to clarify ecological indicators and measurement methods. Pre-treatment data was collected for one of the treatment units; post-treatment data collection will proceed in 2009 by CUSP. CFRI will compile and analyze the data, and facilitate adaptive management workshops based on the evidence.

In addition to the ecological monitoring, CFRI is conducting socio-economic assessments and monitoring of the project. A scientifically-valid community survey is being administered by the CUSP to gauge local community residents' understanding and perception of restoration-based hazardous fuels treatments. The economics of the project are being assessed in two ways. First, a cost-analysis of the collaborative effort is being conducted; second, an analysis of wood utilization from the project will measure the impact on revenue generation, renewable energy, and local jobs.

The UP Mesas project addresses forest conditions outside the historic range of variability on the Uncompahgre Plateau of western Colorado. Threat of uncharacteristically large and intense fires, and loss of mule deer habitat are among several ecological concerns, as well as the risks these pose to local communities and economies. The ranger for the Ouray Ranger District worked with the Uncompahgre Plateau Project, a local non-profit organization working on stewardship issues on the Plateau to organize a multi-stakeholder collaborative group to provide input and a sounding board for what was originally a 70,000-acre project area; the area was negotiated down to 17,000 acres.

CFRI stepped in to address ecological uncertainties about historic forest structure and disturbance regimes by conducting two evidence-based field assessment workshops in 2008. The historic structure assessment provided the baseline information from which the Ouray Ranger District staff developed a proposed action for diverse restoration and fuels reduction treatments in ponderosa pine, mixed-conifer, and aspen forest stands. The project was also intentionally designed to provide local mills commercial timber to retain jobs. In summer 2009, CFRI worked with the collaborative group to identify ecological and socio-economic indicators, and conducted another field workshop to train the trainers regarding ecological monitoring measurement methods.

Duty 5: Provide peer-reviewed annual reports.

CFRI has prepared annual reports since its inception. Each report is distributed to affected entities for review and comment before being submitted. A stakeholder assessment was also conducted accompanying the FY2007 annual report.

CFRI website: <http://warnercnr.colostate.edu/cfri-home/>

ERI Report

Since 2005, the Institutes have developed and completed work plans under the Act.

The ERI work plans are designed to ensure that the best available science is used by land managers and stakeholders to develop and implement comprehensive, restoration-based forest treatments. Annual work plans of the ERI followed the guidance of the authorizing legislation and were approved by both the R-3 Development Team and Executive Team. The activities and deliverables in each work plan build upon: 1) policy directives from the U.S. Forest Service, the Western Governors' Association, the Department of the Interior, and other organizations designed to advance forest restoration and reduce the risk of unnatural wildland fire; 2) assessments of needs of land managers and other affected parties; and 3) long term work. The following is a summary of the ERI work plans from 2005-2009.

2005 Work Plan

- Budget from Federal dollars provided under the Act: \$400,000
- Three goals identified and worked on
 - Goal One: Contribute to improving the health of degraded public and private forest lands at risk for unnatural, catastrophic fire through the development and promotion of science-based restoration treatments for project-level action.
 - Goal Two: Translate and transfer biophysical and social science research into communication products for land managers, communities and other stakeholders to inform project-level action.
 - Goal Three: Support collaborative action to identify utilization options for small diameter wood.

2006 Work Plan

- Budget from Federal dollars provided under the Act: \$1.6 million
- Four goals identified and worked on
 - Goal One: Support a knowledge-based and spatially explicit collaborative landscape-scale assessment to help design a twenty-year strategy for restoring degraded frequent-fire forest ecosystems. The strategy will strive to engage stakeholders to prioritize the location of restoration-based and hazardous-fuel reduction treatments to protect and enhance community protection and economic viability; human and wildlife habitats; watersheds and other critical components of Arizona's landscape ecosystems.
 - Goal Two: Develop, transfer, apply, monitor, and update practical science based, forest restoration treatments to improve the health of ponderosa pine forests.

SWERI Five-Year Assessment Report (10/13/09)

- Goal Three: Synthesize, translate, and deliver biophysical and social science knowledge into communication products for land managers, communities and other stakeholders to inform project-level action.
- Goal Four: Provide technical assistance to collaborative efforts by affected entities to develop, implement, and monitor adaptive ecosystem management restoration treatments that are ecologically sound, economically viable, and socially responsible.

2007 Work Plan

- Budget from Federal dollars provided under the Act: \$1.75 million
- Deliverables based on nine work projects: 1) ponderosa pine/mixed conifer restoration; 2) piñon-juniper restoration; 3) evaluating post-fire re-burn potential; 4) salvage logging and other post-fire treatments; 5) landscape assessment, practitioner and stakeholder knowledge services; 6) wood utilization; 7) assistance to communities to design and monitor treatments; 8) assistance to practitioners; and 9) peer-reviewed reports.

2008 Work Plan

- Budget from Federal dollars provided under the Act: \$1.97 million
- Deliverables based on six projects: 1) ponderosa pine/mixed conifer restoration; 2) landscape-scale analysis; 3) technical support for land managers, agencies and tribes; 4) issues in utilization and harvest; 5) assistance to stakeholders and communities to support collaborative treatment design; and 6) knowledge services.

2009 Work Plan

- Budget from Federal dollars provided under the Act: \$2 million
- Deliverables based on seven projects: 1) ponderosa pine/mixed conifer restoration; 2) piñon-juniper restoration; 3) implementation of restoration-based treatments at the landscape scale; 4) technical support for Federal, State and tribal land managers; 5) support for the restoration economy; 6) stakeholder assistance; and 7) knowledge services.
- While the three SWERI Institutes have collaborated in the past, this work plan expressly calls for such collaboration: “Specific coordinated actions for 2009 include:
 1. Determining overall resource benefits achieved through restoration and reducing wildfire threat using a landscape analysis (project 3 in all three work plans);
 2. Assessing the effectiveness and efficiency of alternative treatments and the strategic location of those treatments (project 3 in all three work plans); and,
 3. A synthesis of our current State of knowledge concerning the ecology and management

of southwestern mixed conifer and aspen forests. In addition to these specific projects, the three Institutes will continue to jointly visit field projects, hold discussions with policymakers, and seek better ways to coordinate activities across State lines.”

About The Ecological Restoration Institute

The Ecological Restoration Institute (ERI) at Northern Arizona University (NAU) is nationally recognized for mobilizing the unique assets of a university to help solve the serious problems of degraded forest health and unnaturally severe wildfire in the frequent-fire forests of the Southwest and Intermountain West. The mission of ERI is to serve as an objective leader in research, scholarship, education, and, in collaborative efforts, to help interested parties plan and implement restoration treatments for these forests and woodland landscapes. In this light, the ERI provides land management agencies and communities with applied scientific knowledge (e.g., comprehensive focused studies, monitoring and evaluation research, and technical support) about issues related to both the ecological and social aspects involved in restoration treatments.

The ERI was formally established by the Arizona Board of Regents in 1997 and by Federal legislation in 2004 (Southwest Forest Health and Wildfire Prevention Act of 2004, P.L. 108-317). In 2005, the ERI became part of the Southwestern Ecological Restoration Institutes—an association that unites the ERI with similar organizations at Colorado State University and New Mexico Highlands University. The ERI employs a staff of about 35 people including ecologists, administrators, professors, and outreach personnel. In addition, the ERI subcontracts with experts in other disciplines (e.g., ecological economics, conservation biology, and sociology) to provide research and expertise about forest restoration issues. The Institute also provides educational and field experiences to NAU undergraduate and graduate students. The ERI is funded by a combination of programmatic State and Federal funding, and through competitive grants programs. More information about the ERI is available at <http://www.eri.nau.edu>.

To What Extent Did The Institute Meet The Duties Under The Act?

Duty 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.

Even prior to the passage of the Act, the Ecological Restoration Institute was involved in assessing the dramatic and dangerous changes in forest and wildfire conditions in the Southwest, and testing and applying treatments designed to restore characteristic Southwest forest structure and a more benign fire behavior (Covington and Moore 1994, Fulé et al. 2001, Waltz et al. 2003). As a result of this strong, pre-existing foundation of forest restoration theory and practice, the ERI was well positioned to initiate new investigations of alternative treatments once the Act was signed into law. Under the Act, fuel treatment research supported by the ERI

has broadened into several fields of study: fire behavior, fuels, forest dynamics, plant community responses, wildlife responses, and social and economic aspects of forest restoration. These studies are carried out throughout the Southwest (Figure 1) and in more distant areas of the Intermountain West as well. Moreover, with the support provided by the Act, the ERI has been able to transfer and promote its findings through outreach activities and publications, workshops, and participation in collaborative groups working on forest-related issues.

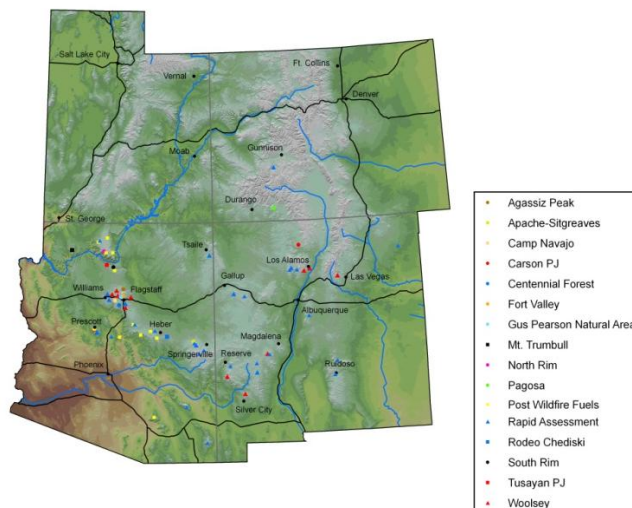


Figure 1. Map of LEARN sites and other ERI field sites in the Southwest.

A central component of the ERI’s studies of restoration treatments is the Long-term Ecological Assessment and Restoration Network (LEARN). The network covers the ponderosa pine forests of Arizona from the Arizona Strip in the northwest through the eastern Apache-Sitgreaves National Forests on the Arizona-New Mexico border. Additional sites are located in Colorado and New Mexico. The network includes ponderosa pine and mixed conifer forests, as well as piñon-juniper woodlands. Each site is set up as a stand-alone controlled, replicated experimental study testing a full restoration treatment (i.e., thinning young trees to restore historical density, spatial pattern, and species composition; treatment of fuels; re-introduction of low-severity surface fire), and an untreated control. The LEARN sites are located on public lands including U.S. Forest Service, U.S. Bureau of Land Management (BLM), National Park Service, Department of Defense (DoD), and State lands. Depending on the needs and interests of the managing agency and other stakeholders, additional treatments are tested. Examples of additional treatments include comparison of different levels of thinning (Fort Valley: Coconino National Forest), testing a “minimal” thinning alternative (Grand Canyon National Park), and burn-only treatments (Kaibab, Apache-Sitgreaves, and San Juan national forests). The excellent data obtained from the LEARN sites is made possible by a substantial investment in human and computing resources; these investments pay off when information is quickly transferred from questions and concepts to documented information for management.

The strong scientific design of the LEARN network has resulted in many well-documented contributions to knowledge. Examples include the restoration of understory plant community composition and productivity (Laughlin et al. 2006, Moore et al. 2006, Laughlin et al. 2008), mortality of old trees (Fulé et al. 2007), and assessment of minimal-impact restoration treatments (Fulé et al. 2006)—all important issues when considering restoration at either the project or landscape scale.

Restoration-based fuel reduction in piñon-juniper ecosystems provides an example of the ERI's impact in research and development of treatments. Relatively little is known about the fire ecology, historical fire regimes, or fire hazards of piñon-juniper ecosystems (Baker and Shinneman 2005), despite the fact that piñon-juniper comprises the greatest extent of woody vegetation in the Southwest and the Intermountain West. The ERI, in partnership with Federal and State agencies, initiated early research more than a decade ago in northwestern Arizona.

Under the Act, the ERI expanded piñon-juniper research to the southwestern region. We carried out the first landscape-scale, dendrochronologically precise piñon-juniper fire history reconstructions in Arizona and New Mexico, contributing useful information for management and finding a new perspective, including small-scale, patchy, severe fires that had been missing from previous analyses (Huffman et al. 2008a). The ERI worked with the Kaibab National Forest to implement a test of ecologically-based cutting and burning treatments in piñon-juniper near the Grand Canyon, showing that fuel loads could be reduced while conserving old trees (Huffman et al. 2009). Finally, the ERI staff demonstrated that native understory species could be restored on harsh piñon-juniper sites by making use of thinning residues to enhance soil moisture (Stoddard et al. 2008). These advances have been shared with managers in the field and at professional meetings (Huffman et al. 2008b). Under the current ERI work plan, we are initiating a systematic review of piñon-juniper fire ecology and expanding treatment efforts to larger landscapes in collaboration with land management agencies.

Full reports of ERI Ecology Group activities from 2004-2005, 2005-2006, and 2007 and the publications referenced above and below can be found on the ERI website e-library at <http://library.eri.nau.edu/>.

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

In order for restoration to make a significant impact on the multiple threats to forest ecosystem sustainability in the Interior West, treatment activities must move beyond small-scale experiments to large landscapes. As scale increases, there is increased need and opportunity to use adaptive management to answer critical questions about effects on wide-ranging species.

The premier example of the ERI's work to adapt research findings to large-scale treatments is the Mt. Trumbull ecosystem restoration project in northwestern Arizona. Beginning in 1995, this multi-scale collaborative project brought together Federal land managers, State wildlife

experts, and ERI scientists to develop a joint project that remains the largest, permanently monitored forest restoration project in the Southwest. Information that had been derived from the scientific literature and from the results of the ERI's early work was integrated to develop a landscape-scale test of restoration methods. Prior to treatment, the landscape was measured with permanent plots for key vegetation, fuel, and wildlife variables. Studies of mobile species, which cannot be accurately done on small plots, were designed into the Mt. Trumbull treatments. Subjects included invertebrates, small mammals, passerine birds, squirrels, and deer. The long-term Mt. Trumbull treatments were still in progress when the Act was authorized. Since then, the ERI staff has developed syntheses of the effects of large-scale treatments on potential fire behavior (Roccaforte et al. 2008). Carrying the adaptive management cycle to completion, we carried out the first landscape-scale monitoring assessment of a southwestern forest restoration project that included both implementation monitoring (Were the project activities done correctly?) and effectiveness monitoring (Did it achieve the desired ecological result?) (Roccaforte et al. 2009). The Mt. Trumbull project is also notable for providing the earliest and best-documented research on restoration effects on wildlife, through the partnership with the Arizona Game & Fish Department (e.g., Wightman and Germaine 2006).

The greater Grand Canyon region comprises a vast landscape within which ERI-supported restoration projects are contributing to improved management and conservation. For several years, the ERI staff has worked to characterize historical forest conditions and fire regimes in this region along an elevational gradient from ponderosa pine to spruce-fir forests (Fulé et al. 2002, 2003). Ecological information was applied to test restoration treatments at LEARN sites in Grand Canyon National Park and the Kaibab National Forest, as well as testing the effects of landscape-scale wildland fire use treatments (Fulé and Laughlin 2007, Laughlin and Fulé 2008). Under current ERI work plans, we are using the results of this work to expand large-scale studies to the western Grand Canyon region.

Looking ahead to the near future, the ERI is collaborating with numerous stakeholders in the largest landscape-scale forest restoration effort proposed to date—a project covering several hundreds of thousands of acres in Arizona. Currently, four national forests in Arizona (Apache-Sitgreaves, Coconino, Kaibab, and Tonto) are joining forces to initiate the project. The ERI anticipates providing scientific support through syntheses of existing information, development of new information, and outreach to managers and the public on all aspects of restoration science. This work, again, is built on the foundation of knowledge and experience that the ERI has achieved during the past decade of work, including that funded by the Act.

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

Since 2005, the ERI has translated scientific information to affected entities through a variety of means: working papers, white papers, fact sheets, web site/e-Library, workshops, and presentations. The following is a summary of work in those outreach areas.

Working Papers

The ERI Working Papers series presents and translates scientific findings from the research and observations of ERI researchers as well as researchers from other organizations and universities. These findings serve as the basis for the management recommendations that are the primary focus of each working paper. Each working paper deals with a particular topic. Topics are chosen for their relevance to land managers because they represent the largest audience for these publications. The ERI Working Paper series has published 14 papers during the past five years. Some of the topics include: restoring understory communities, restoring forest roads, treating slash following restoration treatments, controlling invasive species, effects of forest thinning treatments on fire behavior, managing coarse woody debris, the effects of prescribed and Wildland Fire Use fires, and developing spatial patterns in southwestern ponderosa pine forests. Working papers are sent by mail and/or electronically to 1,300 affected entities throughout the Southwest and beyond. They are also posted on the ERI web site and in the ERI e-Library at <http://library.eri.nau.edu>.

White Papers

The ERI White Paper series is designed to reach policymakers, social scientists, and, to some extent, land managers with information about socio-economic issues related to forest restoration and hazardous fuels reduction. During the past five years, the ERI has published 11 white papers on a variety of topics. These include: carbon sequestration and forest health, public perceptions of forest restoration, effectiveness of communications between U.S. Forest Service personnel and homeowners in a high fire hazard area, wilderness management and the restoration of fire to the landscape, Forest Service contracting, community stewardship and the White Mountains Stewardship Contract, multiparty monitoring, and collaboration within a natural resource management context. White papers are sent by mail and/or electronically to 1,300 affected entities throughout the Southwest and beyond. They are also posted on the ERI web site and in the ERI e-Library at <http://library.eri.nau.edu>.

Fact Sheets

The ERI produced six fact sheets during the last five years. These relatively brief papers have covered topics such as: understanding fire and fire behavior, restoring the ecological and social integrity of western forests, forest restoration treatments and fire behavior, diameter caps and their effects on restoration treatments, and accounting for watershed and other resource values in the NEPA process.

Multiparty Monitoring Handbooks

In 2005, the ERI, along with several partners, produced a six-book series about multi-party monitoring as part of the U.S. Forest Service Collaborative Forest Restoration Program (CFRP). These books, which cover a wide range of topics from budgeting to collecting data, have proven to be an invaluable resource for participants in the CFRP and other local groups who are

concerned about hazardous fuels reduction and restoration. The series has been recently updated and is available online at:

<http://www.eri.nau.edu/joomla/content/view/109/120/lang.en>.

Web site/e-Library

The ERI web site at <http://www.eri.nau.edu> has been online and continuously updated during the past five years. The site has numerous pages covering all aspects of the organization's mission and work. It also features an extensive e-Library that holds all ERI publications and other media efforts. Recently, we have added video clips of presentations and teaching to the site. More features, including a photo gallery, are planned for the near future. In 2008 and 2009, Dave Egan (ERI editor/writer) and Krista Coquia (ERI web design/maintenance) conducted surveys of web site use and made suggestions for updates.

Publications Survey

In 2008, Dave Egan, in collaboration with local survey consultant, Anne Mottek Lucas, conducted an on-line survey of people who receive our outreach publications electronically. This information has been analyzed and will be used to better address the needs of those people—land managers, policymakers, academics, interested citizens—who receive ERI publications and visit the ERI web site.

Other Publications

The ERI played a major role in the writing (Diane Vosick) and editing (Dave Egan) of the Statewide Strategy for Restoring Arizona's Forests—a document commissioned by then, Governor Napolitano that has since its publication in 2007 served as the basis for restoration efforts in the State.

Workshops

During the past five years, the ERI Agency Outreach team conducted 13 workshops for agency land managers. In these workshops, ERI Agency Outreach personnel provided information about ecological restoration and how it could be applied to Federal lands to reduce hazard fuels while meeting other goals and objectives of the agency.

The ERI hosted the Conserving and Restoring Old Growth in Frequent-Fire Forests of the American West in April 2006. This workshop produced a series of papers that were published in the on-line journal, *Ecology & Society* (<http://www.ecologyandsociety.org/viewissue.php?sf=33>). The authors “make a case for taking a new look at managing for old growth—one that recognizes the regional and climatic differences in forest ecosystems and the effects those variations have on disturbance processes, such as surface fire, and, consequently, on forest structure and composition; one that understands that, in many dry western forests, catastrophic crown fire, not logging, is now the

greatest threat to old growth; one that appreciates the need for a tempered, but active, hands-on management approach; and one that recognizes that we may have the technical means to make a difference in the forests, but we must do a better job of educating and social marketing to change peoples' behaviors."

In October 2006, the ERI and SWERI hosted a three-day workshop titled, "Conserving and Restoring Frequent-fire Landscapes of the West: Linking Science, Collaboration, and Practice." The meeting was held on the NAU campus and featured field trips to restoration sites in the greater Flagstaff area. Several presentations at the workshop can be accessed at the following link: <http://www.eri.nau.edu/joomla/content/view/44/85/lang.en>.

In 2007, the ERI conducted two workshops for practitioners. The first was a meeting with 23 representatives from the Bureau of Land Management, Arizona Game and Fish Department, and the ERI included a field trip to a restoration treatment site in Williams, Arizona. In the second workshop, which was attended by 42 participants, Dave Huffman (ERI researcher) presented a half-day continuing education for ecosystem managers (CEEM) course on ecological restoration.

The ERI hosted the SWERI Biophysical Monitoring Workshop in October 2008 on the NAU campus. The workshop organizers assembled people from throughout the Southwest to discuss monitoring forest restoration from four specialized perspectives (botany, wildlife, fire, and forestry) and at two different scales—project and landscape. The results of their discussions indicate that there are existing methodologies that could be employed to determine whether a restoration treatment has been successful in reducing hazardous fuels and restoring the forest.

Presentations

During the past five years, ERI personnel have made presentations to land managers and other groups interested in matters related to ecological restoration and hazardous fuels reduction. For example, in 2007, the ERI conducted 33 presentations to various groups in Arizona, New Mexico, Texas, Utah, Colorado, and Montana. In addition, ERI staff led ten field trips for diverse audiences to demonstrate and discuss the outcomes of forest restoration on ecological health and wildfire behavior.

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

The ERI Agency Outreach Team participated in the planning for 23 fuels-reduction projects during the past five years. These projects took place on lands administered by the U.S. Forest Service, including each of the national forests in Arizona, and several national forests in New Mexico. Each project was undertaken following a request from the U.S. Forest Service personnel for ERI services. Featured projects during this time period include: Jim Lewis Project/Sacramento Ranger District/Lincoln National Forest and Eager South Wildland-Urban Interface Fuel Reduction Project/Springerville District/Apache-Sitgreaves National Forests.

Jim Lewis Project

In June 2008, the Sacramento Ranger District Interdisciplinary Planning Team asked the ERI Agency Outreach Team to provide them with information about the pre-European settlement stand structure in mixed conifer, ponderosa pine, and piñon-juniper sections of the forest. The ERI team established plots and conducted rapid assessments in the mixed conifer and ponderosa pine forests (piñon-juniper areas were not studied because a 1953 fire destroyed most of the pre-settlement evidence). All areas studied proved to be outside the range of natural variability for tree density and fuel loading. The ERI team provided a report of their findings, including recommendations for possible land management actions to restore the forest and reduce fuel loads. The ERI Agency Outreach Team has performed similar studies on many national forest sites in Arizona and New Mexico.

Eager South Project

In preparation of an Environmental Assessment for the Eager South Wildland-Urban Interface Fuel Reduction Project, the Interdisciplinary Planning Team from the Apache-Sitgreaves National Forests requested assistance from the ERI to help determine pre-European settlement stand structure information. The ERI Agency Outreach Team used their rapid assessment techniques to compare tree densities and fuel loading between pre-European settlement and current conditions. The U.S. Forest Service then authorized about 3,600 acres for restoration treatments, including a 400-acre block, south of Point of the Mountain, where the ERI Agency Outreach Team advised and assisted the U.S. Forest Service personnel with implementing a full restoration mark. This plot has become a template for ecological restoration/hazardous fuels reduction in Region 3.

Members of the ERI Agency Outreach Team have also been active participants in the Greater Ruidoso Area Wildland-Urban Interface Working Group, since the group's inception in 2000. As part of this effort, they have participated in the planning, reviewing, and monitoring of more than 36 projects implemented by the Mescalero BIA, Mescalero Tribal Forestry, Bureau of Land Management, Village of Ruidoso, Lincoln County (NM), New Mexico State Forestry, and the Lincoln National Forest.

In addition to work undertaken by the ERI Agency Outreach Team, then ERI Research Specialist, Jesse Abrams, conducted a needs assessment for collaborative planning in the White Mountains. This initial study provided significant data to the White Mountains Landscape Data Atlas. The ERI supported this project and Jesse was part of the team of researchers. Jesse and other ERI staff (Anne Moote and Matt Tuten) were also active in several CFRP projects in New Mexico and the Pinaleños Group in southern Arizona, working with stakeholders in these areas on monitoring and collaboration issues.

Provide peer-reviewed annual reports.

The ERI has prepared annual reports. They have been circulated among our stakeholder group for comment before being submitted. The 2006 and 2007 annual reports are available online at <http://www.eri.nau.edu/en/about-the-eri>.

Appendix B - Interviewees

James Allen
Executive Director
Northern Arizona School of Forestry

Dennis Becker
Assistant Professor
Department of Forest Resources,
University of Minnesota

Butch Blazer
State Forester
New Mexico

Tony S. Cheng
Director
Colorado Forest Restoration Institute

Wally Covington
Director
Ecological Restoration Institute

Doug Cram
NMSU Cooperative Extension

Carol Ekarius
Executive Director
Coalition for the Upper South Platte

Bill Ferranti
Alamo Navajo School Board

Sam Foster
Director
Rocky Mountain Research Station

Ron Gardiner
Land and Water Clinic

Michael Henio
Ramah Navajo Chapter

Jeff Jahnke
State Forester
Colorado State Forest Service

Chad Julian
Forestry Supervisor
Boulder County Parks & Open Space

Carmine Lockwood
Staff Officer
Grand Mesa, Uncompahgre, & Gunnison
National Forest

Mark Meyers
New Mexico State Land Office

Pam Motley
Outreach Coordinator
Uncompahgre Plateau Partnership

Anne Mottek Lucas
Greater Flagstaff Forest Partnership

Corbin Newman
Regional Forester
U.S. Forest Service

Paul Orbuch
Orbuch Consulting

R. Kent Reid
Interim Director NMFWRI
NMHU

Susan Rich
Forest and Watershed Health Office
State Forestry

Steve Rosenstock
Wildlife Biologist
Arizona Game and Fish Department

Paul Summerfelt
Fuel Management Officer
City of Flagstaff Fire Department

Appendix C - Summary of Affected Entity Interviews

Summary of Interviews with Affected Entities with Respect to NMFWRI

1) What has been the value-added contribution of the Institute? What difference have the Institute's contributions made?

Interviewees reported many tangible benefits from their interactions with the NMFWRI, especially with regard to training, help with prescriptions, monitoring, GIS/mapping support, and assistance in building collaborative partnerships. A "Joint Powers Agreement" with the New Mexico Forest and Watershed Office is a mechanism that has been especially helpful because it has enabled State government to accomplish work that could not have been undertaken without the Agreement. Some examples of value-added contributions follow:

- a. The Alamo Navajo School Board got involved with the Institute as a result of a Collaborative Forest Restoration Program (CFRP) grant. The CFRP grant targets Alamo Navajo band members who are unemployed in an effort to train them with marketable skills. The Institute's efforts were instrumental in helping get that program established. Their technical expertise with regard to needed equipment and training for two different crews in hands-on chain saw training and monitoring protocol was viewed as invaluable.
- b. Under the previously mentioned CFRP grant there was a need to thin 120 acres in the Gallinas region of the Magdalena District, on the Cibola National Forest. Institute staff trained the grantee's personnel, and helped map and set the 13 permanent monitoring points for the thinning. In addition, they helped perform the actual monitoring, using the standard stand exam and three wildlife transects. When faced with questions about whether it was possible under current prescription caps and cutting guides for the grantee to meet the final project goals, the Institute analyzed the data and came to the conclusion that they could meet the goals under the caps in the prescription. This is one example of how Institute staff helped with resolving questions over a potential problem.
- c. The Institute helped put together a four day hands-on chain saw training course for crew members to teach safety and felling techniques that they would otherwise not have learned. The course was instrumental in grounding students and crew in restoration programs. The training gave the crew a sense of ownership in the program and in the concept of ecological restoration.
- d. The NM Forest Industry Association, the entity in charge of safety training for the State, is looking at the curriculum developed by the Institute that was used for a hands-on safety training event conducted for one group. It is hoped that the training might be implemented statewide.

- e. To date, there have been no rigorous research products produced on a regular basis such as graduate research manuscripts or peer-reviewed papers related to hazardous fuel-reduction treatments or other issues. However, there has been a dedicated effort to monitor forest stands for trend data. Management and restoration recommendations by the Institute have come from synthesizing current and past literature. The Institute is seen as having done a good job of making knowledge available to the Federal agencies and private stakeholders on restoration treatments through their webpage, handouts, and conferences. The interviewees said that they would like the Institute be even more active in getting products into circulation and use.
- f. The NMFWRI has provided unique and independent support for fuels reduction planning and monitoring through Taos County in a variety of partnerships with the Carson National Forest, the Taos County Government, and the Village of Questa. Their GIS staff played a key role in several CWPP CORE team plan developments.
- g. The NMFWRI is providing unique benefits to New Mexico watershed groups and community constituents in terms of independent science technology and data. In particular, the GIS mapping department at NMFWRI is viewed as a key statewide resource that would be otherwise unavailable.

2) What has been the role of affected entities in the Institute's planning and program development process?

- The Institute is an instrumental participant in the State's Forest and Watershed Health Office Coordinating Group, which meets quarterly.
- The Institute's Advisory Group has been an effective mechanism for affected entities to provide input. The upcoming selection of a permanent director will provide an opportunity to revisit the Advisory Group's charge, composition, and functioning—e.g., to review the best way to truly involve stakeholders and to possibly make some changes to improve the Advisory Group's effectiveness.
- The Institute has been responsive to recommendations for tailoring training to meet specific needs and goals.

3) What has been the experience of affected entities in terms of the Institute's responsiveness to their needs (timeliness, quality of response, effectiveness)?

The sense from the interviews is that the NMFWRI is very responsive to affected entities' needs and that they produce high quality results quickly. Interviewees commented specifically on the Institute's responsiveness with regard to GIS, monitoring, thinning prescriptions, and serving as an education resource. The following comments reflect interview sentiments regarding the Institute's services:

- “Staff of the Institute are some of the best in the field.”
- “The Institute has always been there when needed and provided answers to questions. Staff listen carefully to problems and unique situations, and then formulate an appropriate response. The quality provided has always been professional and effective.”
- “The NMFWRRI is surprisingly efficient considering the numbers of statewide projects they are engaged in.”
- Their level of monitoring is just right—not too much. They do a great job steering treatments in the right direction.”

4) What issues or concerns have emerged in your interactions with the Institutes? How were these issues addressed?

Some concern was expressed about the NMFWRRI being able to deliver services because of its limited funding base.

Transition at the director’s level has resulted in some commitments not being followed up on as personnel were changed. These situations were eventually resolved, and are not expected to re-occur.

5) What recommendations do you have for improving the Institute’s service in the future?

- a. Enhance the work it is already doing as an independent source of science, technology and data. Among the specific recommendations in this area were:
 - Continue the momentum that is already established toward the creation of a statewide web portal.
 - Develop into a strong entity that will provide extensive support for monitoring and assessment, the tools needed to succeed with large-scale restoration treatments, and the follow up that is going to be needed for this landscape-scale restoration work.
 - Offer more and longer trainings; one example: provide a 160-hour course comprised of hands-on training, more in-depth monitoring training, silviculture and safety training.
 - Develop a watershed collaborative resource center, dedicated to facilitating watershed community plans and project development.
 - Restart a forest worker safety program that has been tabled.

- Expand the opportunities available under the existing Joint Powers Agreement by developing additional projects to benefit the State Forest and Watershed Office.
- b. Build its research capacity. To be effective, “ahead of the curve”, and responsive to the needs of New Mexico stakeholders, some interviewees encouraged the Institute to develop a significant research program, accomplished through formal partnerships with other universities, since New Mexico Highlands University has limited research capabilities.
- c. Function as the collaborative hub of water and natural resource management agencies in the State for planning and monitoring support, and for helping promote coordination among multiple land managers on landscapes with checkerboard ownership. The NMFWRI should be a key adjunct for the New Mexico State Water Plan, the New Mexico Forest and Watershed Health Plan and the New Mexico Non-Native Phreatophyte Watershed Management Plan.
- d. Build institutional strength and capacity, specifically:
- Develop the forestry school at Highlands University in a way that does not detract from the Institute—the two entities should complement rather than compete with one another.
 - Make sure there is a direct line from the Institute to the President of the University. The Institute needs strong support from the University to succeed.
 - Make sure the permanent director is a great communicator, able to sell the Institute’s programs. There is a real need to make others in NM aware of, and willing to utilize, the Institute’s services.
- 6) What has been the Institute’s role in promoting, implementing, and gaining wider acceptance for restoration-based adaptive ecosystem management?**
- a. The Institute has been helpful in translating the concept of restoration-based adaptive ecosystem management into terms that the lay person can understand. An example was an Institute report on the analysis of the caps in a prescription. The information and data were presented in a manner that could be used by people who are not necessarily familiar with the terms used by forestry professionals. The simpler language made it easier to understand restoration objectives and accomplishments.
- b. The Institute has been effective in “selling” restoration to training crews by teaching them restoration fundamentals.

7) In what ways has the Institute contributed to reducing planning costs, duplication, and/or avoiding conflicts?

Interviewees provided the following concrete examples of cost savings:

- The NM Watershed Health Plan called for a statewide information clearinghouse. The Institute has made a significant contribution in that regard by taking on development of a State-wide web portal. Such a portal was impossible under State auspices because of IT security concerns. This initiative illustrates the ability of the Institute to do things that State and Federal agencies are sometimes unable to accomplish—saving agency money as well as responding to a statewide need.
- The Institute provided in-kind training that has enabled an affected entity to save funds and use the money to keep a restoration crew moving forward.
- The Institute has taken an active role in collaborating with the CFRP program to assist grant recipients across the State with their monitoring requirements.
- Funders have demonstrated more confidence and willingness to commit resources when the Institute is involved because they know they are more likely to get good results.
- By working closely with other entities to address landscape needs collaboratively, the Institute has helped get a bigger “bang for the buck” when resources were limited.

8) In what ways has the Institute promoted improved cooperation with local entities? Regionally? With Federal agencies?

Interviewees provided the following examples of improved cooperation that have resulted from the Institute’s efforts:

- The Institute helped write a CFRP grant that was subsequently funded due in part to the support from the Institute. CFRP grants require collaboration and cooperation among multiple stakeholders.
- Staff at the Institute have travelled across the State to help meet collaboration needs.
- The Institute has helped build connections between affected entities and all levels of government as well as with the private sector. In one notable example, the Institute arranged for an existing Tribal forestry crew to show new crews how to perform equipment maintenance and production cutting—effectively bridging a cultural gap. According to the interviewee, it would not have happened without the Institute’s help.

9) Are there any other insights or suggestions regarding past or future work of the Institutes?

Having the stability of a permanent director will be a benefit. Strong leadership will be the key to the Institute's continuing success.

Summary of Interviews with Affected Entities with Respect to CFRI

1) What has been the value-added contribution of the Institute? What difference have the Institute's contributions made?

- a. One of the most frequently cited contributions by CFRI is the service it has provided as an intermediary and facilitator. CFRI has a demonstrated ability to serve as a bridging organization by bringing together diverse groups, effectively identifying the issues of greatest concern, and developing action plans for moving forward constructively. Specifically, the CFRI has provided assistance to several groups by soliciting appropriate stakeholder involvement, developing mission statements or charters, reviewing potential methods of increasing financial support (including the formation of nonprofits), assisting in the development of common agreement within groups concerning knowledge transfer of forest management science to various publics, and intervening as an intermediary when issues have arisen. Interviewees said this kind of linkage has been invaluable.

A concrete result of CFRI's facilitative ability is vastly improved communications between researchers and land managers. In Colorado there are several research centers dealing with forest ecology, management, and restoration concerns, including the Rocky Mountain Research Center, the University of Colorado, and the U.S. Geological Survey. CFRI has successfully opened up dialogue to address concerns about research projects that land managers did not view as addressing their needs; CFRI has also helped researchers understand some of the practical limitations faced by land managers. As a result, relationships among groups that were previously at odds are vastly improved. Another example is CFRI's role within the scientific community to help resolve disagreements about terminology—again a significant shift has occurred thanks to CFRI's intervention.

- b. CFRI has directly impacted on-the-ground restoration by providing information concerning best-management practices to achieve healthy and sustainable ecosystems through proper restoration techniques that have been incorporated into management plans and field work. CFRI's evidence-based assessments have helped forest managers feel more confident about treatment recommendations, especially when these treatments have been viewed as controversial. They have also contributed important expertise by developing multi-party monitoring protocols and teaching monitoring techniques. According to one interviewee, CFRI has helped its managers "view the forest differently

than we did five years ago.” Another interviewee noted that “CFRI has contributed to a mindset change regarding forest management.”

- c. CFRI is also playing an important role in helping to educate the public about ecological restoration. Specifically, they are assisting in the establishment of a public demonstration project and in organizing fieldtrips. These kinds of efforts are seen as having the potential to produce huge benefits down the road.

2) What has been the role of affected entities in the Institute’s planning and program development process?

Interviewees reported primarily informal communications with the director regarding the Institute’s planning and program development processes—and a strong sense that he is extremely welcoming of that kind of communication and open to ideas.

Involvement of people from Colorado on the Executive Team was noted as another effective communication avenue with CFRI and all the Institutes.

3) What has been the experience of affected entities in terms of the Institute’s responsiveness to their needs (timeliness, quality of response, effectiveness)?

The CFRI has steadily improved over time and currently gets high marks for responsiveness and effectiveness. Many interviewees attributed the Institute’s recent successes to the quality of Tony Cheng’s leadership, and in particular his understanding of community forestry and collaboration. Several people talked about how accessible and receptive he is, and how willing to address needs that arise. His willingness to “hold the U.S. Forest Service’s toes to the fire” was also noted as something that was much appreciated—especially since the perception was that there is not anyone else in the State to play that role.

A few interviewees commented on the perception that CFRI’s effectiveness is limited by staffing and resources. They say it does an outstanding job given those limitations, accomplishing a great deal with only a few part-time people, but that CFRI is nevertheless constrained by those limitations.

4) What issues or concerns have emerged in your interactions with the Institute? How were these issues addressed?

- a. One interviewee mentioned that the accounts payable process is extremely slow. This is not necessarily the fault of CFRI, because finances flow through the university, but it has apparently been a bothersome issue for years.
- b. In years past, the Institute had ideas on management responses to fire mitigation issues that significantly conflicted with others’ views. Those differences have been resolved.

- c. Another past concern was the perceived overlap of CFRI objectives and responsibilities with those of some other entities in the State, and confusion about who was the lead/decision-maker when perspectives differed. This issue was effectively resolved by clearly defining the role of the CFRI.

5) What recommendations do you have for improving the Institute's service in the future?

Interviewees had a number of concrete suggestions for CFRI's future direction:

- a. Respond to Colorado's urgent need to re-energize its forest products industry and develop new methods to utilize the massive amount of dead timber (the result of mountain pine beetle and other insect infestations). The CFRI has started to work in this arena, and the Institute should continue to keep this as a priority. Restoration work will be significantly impaired without adequate outlets for the raw materials removed as a result of forest management projects.
- b. Become a central repository for restoration information in Colorado, and, specifically, for information about the Front Range. Recent CFRI reports on forest restoration are very helpful, but when conducting a search for available material it is hard to know where to begin and where to look. CFRI could make a significant contribution by providing more ready access to Colorado-specific materials.
- c. Convene a meeting about the possible unforeseen consequences in 100 years of current management practices across western landscapes (e.g., look for analogies to management approaches like fire suppression, which has had such catastrophic results).
- d. Develop a stronger presence in cross-boundary efforts, and go beyond just Federal land management projects. This is imperative because many restoration-based adaptive ecosystem management needs span Federal and non-Federal boundaries. CFRI can demonstrate a leadership role in developing a cross-jurisdictional demonstration project that meets both short-term wildfire risk mitigation goals and long-term forest stewardship and resilience goals.
- e. Increase funding from Congress and broaden the scope of legislation that created CFRI to allow the Institute to address major needs that are currently beyond its capacity. According to one interviewee: "CFRI's impact has always been hampered by embarrassingly minimal funding. It barely has sufficient funding for supporting the directorship, a full-time program associate, and a small number of projects. While it is always the case that more funding is needed, it is definitely the case with CFRI. At its existing funding levels of about \$250K/year, CFRI can barely meet demands for its services and existing projects, let alone be able to grow and expand its reach and impact." Several interviewees emphasized the needs associated with the pine beetle infestation—an enormous, looming problem for Colorado's Front Range over the next decade and beyond. They suggested that with more resources CFRI could provide

critical assistance with both the science and the community response to beetle-kill forest management, which is likely to be extremely controversial. As the legislation reads, this issue falls outside the Act's specification of addressing restoration in dry frequent-fire forest types, as lodgepole pine is considered a moist, infrequent-fire forest type (fires every 100-350 years).

6) What has been the Institute's role in promoting, implementing, and gaining wider acceptance for restoration-based adaptive ecosystem management?

Interviewees reported that CFRI has played a significant role in the restoration arena, and that it has grown over time:

- Increasingly, CFRI is becoming a go-to source of information for adaptive ecosystem management. The Institute's current emphasis on investigating the effect of restoration efforts is helping further knowledge and effectively encouraging landowners to complete management work on their land.
- The Uncompahgre Plateau Mesas Forest Restoration Demonstration Project ("UP Mesas") was cited as a current demonstration project for restoration-based adaptive ecosystem management. According to interviewees, it has all the necessary elements for a successful initiative: strong agency leadership, active and interested stakeholder involvement, collective desire for a strong science basis for defining goals and prescriptions, and a commitment to monitoring and learning—all developed with support from CFRI.
- CFRI has helped promote broader understanding of the value of restoration and the need for projects that are economically viable. As a result, many in the environmental community (and others) who were previously opposed to treatments are now more willing to accept them.
- CFRI is helping managers think about restoration in bigger picture terms—by encouraging and facilitating work across boundaries.
- Through education and outreach CFRI has been a catalyst for putting fire back into the ecosystem. In one example an interviewee described having conducted more prescribed burning last year than in the previous ten years—as a direct result of what had been learned from CFRI.

7) In what ways has the Institute contributed to reducing planning costs, duplication, and/or avoiding conflicts?

- CFRI support for monitoring has been an important way in which they have helped focus work to be more efficient and cost effective. They are also engaged in

monitoring the costs of monitoring—so that future monitoring efforts can be designed to be even more cost effective.

- Small non-profit organizations and local governments have reaped financial (and other) benefits from CFRI through the Institute's support for conferences, subsidizing meeting attendance, providing consultation on planning issues and management questions, setting up site visits, etc. This kind of service is especially beneficial for small organizations and local government agencies that lack the resources of larger entities. CFRI's assistance to these groups also leverages impact across broader landscapes and promotes cross-boundary and cross-jurisdictional cooperation and efficiency.
- The CFRI is taking an active role in assembling stakeholders to engage in discussions about forest management issues. The Institute has been successful in convening a broad constituency in open, non-threatening forums so that individual and group perspectives can be presented and understood by all. This allows thoughtful consideration about how to meet restoration needs while avoiding conflicts and duplication.

8) In what ways has the Institute promoted improved cooperation—with local entities? Regionally? With Federal agencies?

The CFRI is well respected for its ability to tackle highly polarized issues, develop common ground, and keep groups focused on areas of mutual concern. The CFRI is viewed as credible and skilled in working with diverse groups on complex and sometimes controversial projects. Interviewees provided numerous examples:

- The collaboration workshops conducted by the CFRI have been mechanisms for opening dialogue among groups that may be competing for the same funds or political assistance. These groups are beginning to work together on issues such as bark beetle impacts and improving the forest products industry.
- CFRI has had a lead role in organizing and managing the transition of the Colorado Bark Beetle Cooperative (CBBC) from an intergovernmental cooperative to a multi-stakeholder collaborative. Through CFRI's efforts, the CBBC has built on its legacy of cooperation between Federal, State, and local entities, and expanded its reach to other government agencies and non-governmental entities. It is now a model for a regional, place-based collaboratives focused on forest health-related goals and objectives. Its success is manifested in increased attention from policy makers and funding for priority projects.
- CFRI participated in the development of management guidelines for ponderosa pine and lodgepole pine.

- CFRI has contributed science synthesis and management trainings for piñon-juniper forest types in response to widespread need of managers to gain greater understanding of piñon-juniper dynamics and management options.
- CFRI provides financial support for a position with COWOOD and the Colorado Forest Products marketing program.
- CFRI has consulted with the Colorado State Forest Service (CSFS) on the Forest Health Advisory Council and the Statewide Forest Resource Strategy, with CFRI convening a series of regional strategy discussions around Colorado in fall 2009.
- CFRI is working on a cooperative agreement with Fort Lewis College to help support the testing and evaluation of a pilot Community Wildfire Protection Plan (CWPP) organizing framework in SW Colorado.
- CFRI will be facilitating listening sessions for Colorado's draft Statewide Forest Resource Assessment.

9) Are there any other insights or suggestions regarding past or future work of the Institute?

Interviewees expressed a keen interest in seeing the Institute continue to assist agencies and Colorado landowners/residents in current research findings, monitoring protocols, collaboration efforts, and training. Many believe that the CFRI can serve as an essential bridge between research and management, as well as continuing to provide a neutral, objective presence in both place-based initiatives and policy discussions.

Summary of Interviews with Respect to ERI

1) What has been the value-added contribution of the Institute? What difference have the Institute's contributions made?

Interviewees cited a number of areas where ERI has made significant value-added contributions:

- a. ERI's on-the-ground projects contribute research results and serve as valuable learning tools for forest managers. Field trips to ERI demonstration projects were noted by several interviewees as having influenced the design and implementation of their own treatments. Being able to see different prescriptions tested by ERI, and the evolution of the ecosystem over time is widely perceived by interviewees as one of the most tangible contributions by ERI.
- b. ERI's wealth of useful publications was cited by several interviewees as an outstanding resource for forestry professionals everywhere. One example mentioned was the "Green Book on Restoration of Southwest Pine Forest (Friederici,

- P. (ed.). 2003. *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Washington, D.C.: Island Press).” According to one interviewee, it is the best available publication on the topic. ERI does a particularly good job translating scientific information to lay audiences and forest planners in the region. While occasionally controversial in its message (which is not uncommon for this subject), most see tremendous value in the knowledge provided. Few other entities exist that provide comparable knowledge.
- c. ERI’s work has had a large ripple effect—beyond Arizona or even the Southwest—because of the way the Institute impacts NAU forestry students who later go on to faculties and agencies around the country. The NAU School of Forestry offers students on-the-ground experience with ERI. That experience is central to their learning, and is often the reason they become excited about research and decided to continue in the field. Interviewees see this aspect of ERI becoming increasingly important.
 - d. ERI’s ability to leverage its value and influence is also reflected in outreach conducted by the city of Flagstaff. In the last 10 years the city has been able to share wildfire prevention expertise with about 35 other western communities at risk from wildfire. While not a visible product of ERI, those communities turned to Flagstaff because of what ERI has allowed the city to accomplish. Many of those communities are outside of Arizona.
 - e. Even though the work of ERI in the social science context has been somewhat limited, it was noted by some interviewees as having been very beneficial to furthering the role of collaboration and other social processes that have a goal of ecological restoration. In particular, ERI has been very beneficial in furthering the dialogue among lay audiences and bringing a credible, scientific, neutral voice to the debate on controversial forest management issues—thereby helping build consensus. They have also provided opportunities for social science students even when their efforts might appear to be out of the “mainstream” of forestry research.
 - f. ERI has catalyzed and/or provided the scientific underpinning for other important initiatives such as plans completed by the Arizona Forest Health Advisory Council, which was initiated by the governor but, behind the scenes, has benefited significantly from ERI’s efforts. Other examples include the Northern Arizona Wood Supply Study and the Four Forests Restoration Initiative.
 - g. ERI has made a direct contribution to the Arizona State Fish and Game Department through its work on applied habitat management. ERI and the Department recognize the synergy between their respective objectives and the need to learn from one another about restoration and wildlife. It has been an extremely effective collaboration that has benefited and strengthened both entities.

- h. ERI has emphasized monitoring and the application of adaptive management approaches, which have evolved considerably since the inception of ERI. ERI's partnership with the Greater Flagstaff Forest Partnership (GFFP) was noted by interviewees as an example in which students are given the opportunity to conduct monitoring, thereby supporting their education and providing useful information. How monitoring information is used to inform decision making is somewhat less clear, but largely outside ERI's direct responsibility.
- i. In Arizona, ERI played an active role on the Arizona Governors Forest Health Advisory Council, which led to the development of a statewide strategy. ERI responded to specific requests for technical assistance through an extensive network of land managers, and it has also held numerous workshops on issues they determined to be of interest to a wide variety of affected entities. The ERI has also developed desired condition statements for restoration treatments in Northern Arizona.

2) What has been the role of affected entities in the Institute's planning and program development process?

The interviewees had generally not had a role in ERI's planning and program development process, except through informal conversations with ERI staff.

3) What has been the experience of affected entities in terms of the Institute's responsiveness to their needs (timeliness, quality of response, effectiveness)?

ERI is generally viewed as well run, responsive, timely and extremely effective. ERI's service is enhanced by having high-quality, knowledgeable staff and by having public relations, policy, and community outreach capacity—the kinds of people who are not typically at research organizations. This enables ERI to become more visible in many forums, e.g., local Society of American Foresters' (SAF) meetings, the Greater Flagstaff Forest Partnership, the Governor's office, Congressional delegations—thereby extending its reach and educational impact.

Part of ERI's effectiveness can be attributed to its size and organizational flexibility; it is large enough to be able to respond to a wide variety of needs, but small and flexible enough to avoid the bureaucratic rigidity of many larger government entities.

Interviewees provided a number of comments on ERI's exceptional level of service:

- Willingness to stay involved and supportive in partnerships even through the ebbs and flows of funding
- Ability to respond to requests for help, supply speakers, assist with small-scale local projects, etc.
- Generous provision of student assistance, which many interviewees noted was essential to their operations

- “Incredible in their openness and communication.”

4) What issues or concerns have emerged in your interactions with the Institutes? How were these issues addressed?

- a. The issues/concerns described generally had to do with how ERI navigates its position as the “900-pound gorilla on the block.” For example, some believe that ERI’s resources (which are substantial compared to the other two Institutes) come in part from budgets of other resource entities, such as the Rocky Mountain Research Station. There are ongoing communications to deal with these perceptions.
- b. At its inception, ERI was viewed by some as yet another “smokescreen” for clear-cutting and other practices—established for the purpose of benefiting the forest products industry. However that concern has been largely, if not entirely, ameliorated by ERI’s educational and outreach initiatives, which have created broad appreciation for the benefits of forest restoration.
- c. There is some concern that ERI’s desire and ability to respond to small, local requests may diminish as the Institute’s scope expands to larger scale restoration initiatives. This shift has been slightly in evidence already, although not yet to a significant extent. (Note: this concern extends to the other Institutes as well).
- d. The Arizona Governor’s Forest Health Advisory Council identified action items under their State strategy, but those items often did not correspond to U.S. Forest Service priorities or work plan and budget constraints. To address this discrepancy, the U.S. Forest Service worked with ERI to develop a plan of action that more accurately reflects the agency’s work planning timeframe and budget.

5) What recommendations do you have for improving the Institute’s service in the future?

There were a few specific suggestions for different/expanded services in the future:

- Put more emphasis on social science research relative to restoration, given the dearth of information in this area.
- Assume an even stronger leadership role in landscape-scale projects.
- Help focus the Federal dollars going into fire mitigation toward more holistic approaches.
- Continue to grow the outreach aspect of its operation because of the benefit of having ERI’s voice in community discussions about restoration.
- Apply additional resources to the unanswered questions about impacts of restoration on wildlife.
- Work with the U.S. Forest Service and other affected entities to develop projects that implement the recommendations of the Governor’s Forest Health Advisory Council,

and are within the budget constraints and planning horizons of the U.S. Forest Service and other land management agencies.

6) What has been the Institute's role in promoting, implementing, and gaining wider acceptance for restoration-based adaptive ecosystem management?

ERI is well established as a consistent voice for restoration-based adaptive ecosystem management. According to one interviewee, it is impossible to have a conversation with any U.S. Forest Service employee about restoration without some reference to ERI's work. ERI has played a particularly significant role in promoting the monitoring aspect of restoration-based adaptive ecosystem management. Monitoring has historically been lacking, particularly in the Federal agency context. ERI has been a leader in helping to close that gap, and to extend monitoring efforts to landscape-scale ecological restoration and health. ERI has also contributed significantly to monitoring efforts in a variety of local projects. A couple of notable products that have resulted from their work in the restoration arena include:

- Desired Condition Statements, as a means of moving forward on the Four Forests Restoration Initiative in Northern Arizona.
- A workshop in 2008 to develop a "Framework for Monitoring the Forested Ecosystem of the Southwest."

ERI is already a leader in helping to expand the scope of restoration thinking to whole ecosystems—not only to the ecosystems of the Southwest, but to the whole country. ERI has used its stature and credibility to promote restoration-based adaptive ecosystem management to the public, the Arizona State legislature and to Congress, in a very effective manner.

Because of the inherently controversial nature of some of this work, ERI has sometimes been at the center of controversy; overall, however, ERI has succeeded in forging a healthy conversation about ecological restoration, leading to identification and eventual resolution of conflicts and differences in values and opinions.

7) In what ways has the Institute contributed to reducing planning costs, duplication, and/or avoiding conflicts?

Interviewees acknowledged the difficulty of quantifying cost savings, but pointed to a number of ways that ERI is contributing in a financial sense:

- a. ERI's ability to provide student assistance to local entities such as the GFFP for pre and post-treatment monitoring, has been invaluable, and it is viewed as the only way much of that work could have been accomplished.
- b. ERI's success at procuring grant funding has been instrumental and of great benefit to other entities with whom they partner.

- c. ERI's emphasis on monitoring will save money in the long term because of the lessons learned and the improved project designs that will result.
- d. As noted above, ERI is viewed as a credible neutral entity. From that perspective, through outreach and education, they have helped bridge gaps between opposing parties, thereby avoiding potentially costly battles over restoration projects.

8) In what ways has the Institute promoted improved cooperation—with local entities? Regionally? With Federal agencies?

ERI's somewhat unique niche as a credible neutral scientific entity has positioned it to play a central role in improving cooperation among a variety of agencies and institutions. The Four Forests Restoration Initiative is one example; another is the adoption by the City of Flagstaff of a wildland interface code, a three-year effort that was easier to accomplish because of ERI's constructive role in the debate about the code.

9) Are there any other insights or suggestions you would like to share regarding past or future work of the Institute?

- "I can't stress enough [the] value of having this kind of institute in [the] area."
- "Congress is getting its money's worth out of ERI."

Appendix D - Acronyms

BIA – Bureau of Indian Affairs

BLM – Bureau of Land Management

CBBC – Colorado Bark Beetle Collaborative

CFRI – Colorado Forest Restoration Institute

CFRP – Collaborative Forest Restoration Program

COWOOD – Colorado State Wood Utilization and Marketing Program

CSFS – Colorado State Forest Service

CUSP – Coalition for the Upper South Platte

DoD – Department of Defense

ERI – Ecological Restoration Institute

FLRA – Forest Landscape Restoration Act

FWS – U.S. Fish and Wildlife Service

GIS – Geographic Information System

GMUG – Grand Mesa, Uncompahgre, Gunnison National Forest

GPS – Global Positioning System

LEARN – Long Term Ecological Assessment and Monitoring Network

NAU – Northern Arizona University

NMFIAr` – New Mexico Forest Industry Association

NMFWRI – New Mexico Forest and Watershed Restoration Institute

RMRS – Rocky Mountain Research Station

SWERI – Southwest Forest Ecological Restoration Institutes

UP Mesas – Uncompahgre Mesas Forest Restoration Demonstration Project

SWERI Five-Year Assessment Report (10/13/09)

USIECR – U.S. Institute for Environmental Conflict Resolution

WHO – New Mexico Forest and Watershed Health Office

WPHFI – Woodland Park Healthy Forest Initiative

Appendix E – State Government Charter

Charter for the Southwest Ecological Restoration Institutes

This Charter clarifies the goals, duties and operating procedures for the SOUTHWEST ECOLOGICAL RESTORATION INSTITUTES, and their respective States, as envisioned in PL 108-317. This Charter is entered into by and among the Governors of the States of Arizona, Colorado and New Mexico, and the Presidents of Northern Arizona University, Colorado State University and New Mexico Highlands University, on behalf of their respective governing boards, hereafter referred to collectively as “the Parties.”

1. PURPOSE

A. The purpose of the SOUTHWEST ECOLOGICAL RESTORATION INSTITUTES (“SWERI”) is to bring the unique strengths of the member universities, individually, collectively and in cooperation with other institutions to help support land managers and their collaborators working to achieve comprehensive ecological restoration treatments on the ground.

B. To assure that ecological restoration treatments are effective and efficient, the Institutes identified by PL 108-317 will develop, translate and transfer practical, operation-oriented scientific knowledge to land managers, collaborative community groups and others who cooperate in the design and implementation of ecosystem restoration treatments. A key mission is to assure, through systematic collaboration and coordination of resources, that all levels of government and stakeholders from the local to the State, regional, and national levels have the best information available to ensure that collaborative ecosystem restoration treatments are implemented in the most effective and efficient manner for restoring the ecological, economic, and social integrity of the greater ecosystems of the Interior West.

C. The SOUTHWEST ECOLOGICAL RESTORATION INSTITUTES are established by Northern Arizona University, Colorado State University and New Mexico Highlands University. The respective States will be involved and represented, at a minimum, by their State Foresters. The institutes will have many diverse stakeholders who are involved in the design and implementation of ecological restoration treatments in frequent fire forests and associated woodlands. These stakeholders may include when appropriate, but are not limited to: the Federal land management agencies; State governments; tribes; elected officials; local governments; and nongovernmental entities that include collaborative community groups and environmentalists, the Western Governors’ Association, and business.

D. The SOUTHWEST ECOLOGICAL RESTORATION INSTITUTES has no regulatory authority and recognizes that all legal authority is reserved by its members in accordance with existing law. It also recognizes that the institutes, by virtue of their affiliation with universities, may have duties beyond those specified in this agreement.

2. BACKGROUND

A. The need for restoring ecosystem health in the Southwest has been evident for decades, especially for its ponderosa pine and drier mixed conifer forests. As a result of disruption of the natural frequent fire regime and past harvesting and grazing practices, forests became dense and vulnerable to unnaturally severe, stand-replacing fires. In many watersheds, over 90 percent of these forests are considered at moderate or high risk for crownfires due to dense stand structure and accumulated fuels. Fire acreage and size have been steadily increasing, culminating in the largest fire in southwestern history, the 468,000-acre Rodeo-Chediski fire in 2002, a fire that devastated watersheds and economies over an entire region. Entire States and regions are now at risk of losing the ecological and environmental benefits of greater ecosystems at the scale of millions of acres.

B. Many managers, from resource specialists to land managers, feel that science shows that thinning, burning, and other forest restoration techniques can be effective in restoring forest health and reducing the threat of unnatural fire in the frequent fire forest types of the Interior West. A central question is how to use the best science to get restoration done in the most effective and efficient way possible, while learning how to improve our treatments as we move forward. Although there are clear needs for the discovery of additional scientific information, the flood of existing scientific literature, the disconnected sources of information, and the complexity of environmental analysis can overwhelm the resources of practitioners, stakeholders and decision-makers. Wildland ecosystems and their dependent human communities are the ultimate victims if managers cannot mobilize the critical information for rapid, thorough, and scientifically defensible environmental analysis.

3. STRUCTURE

A. Goals and Legislative Intent

3.1. *Goal. The goal of the SOUTHWEST ECOLOGICAL RESTORATION INSTITUTES is to obtain, summarize, and transfer relevant and accurate scientific information to managers and other key stakeholders.*

3.2. *Legislative Purpose of PL 108-317 as published is:*

- a. To enhance the capacity to develop, transfer, apply, and monitor, and regularly update practical science-based forest restoration treatments that will improve the health of dry forest and woodland ecosystems and reduce the risk of severe wildfires, in the Interior West;
- b. To synthesize and adapt scientific findings from conventional research programs to the implementation of forest and woodland restoration on a landscape scale;

- c. To facilitate the transfer of interdisciplinary knowledge required to understand the socioeconomic and environmental impacts of wildfire on ecosystems and landscapes;
- d. To require the institutes established under this Act to collaborate with Federal agencies--
 - i. to use ecological restoration treatments to reverse declining forest health and reduce the risk of severe wildfires across the forest landscape;
 - ii. to design, implement, monitor and regularly revise wildfire treatments based on the use of adaptive ecosystem management;
- e. To assist land managers in--
 - i. treating acres with restoration-based applications; and
 - ii. using new management technologies (including the transfer of understandable information, assistance with environmental review, and field and classroom training and collaboration) to accomplish the goals identified in--
 - 1. the report entitled '10-Year Comprehensive Strategy: A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment' of the Western Governors' Association ;
 - 2. the report entitled 'Protecting People and Sustaining Resources in Fire-Adapted Ecosystems-A Cohesive Strategy' (65 Fed. Reg. 67480); and
 - 3. The National Fire Plan.
- f. To provide technical assistance to collaborative efforts by affected entities to develop, implement, and monitor adaptive ecosystem management restoration treatments that are ecologically sound, economically viable, and socially responsible; and
- g. To assist Federal and non-Federal land managers in providing information to the public on the role of fire and fire management in dry forest and woodland ecosystems in the Interior West.

B. Duties

3.3. Institutes. Each Institute shall engage in the following activities to the extent funding for such activities has been appropriated pursuant to PL 108-318 or is otherwise made available:

- a. Provide an annual work plan as a condition to receive Federal funds for each fiscal year **on a date to be determined by the US Department of Agriculture-US Forest Service in consultation with the Department of the Interior.** The work plan will follow the template provided by the Secretaries.

- i. The annual work plans will be developed in consultation with the Secretary of Agriculture/US Forest Service, the Secretary of Interior, the State Foresters and the stakeholders as described in paragraph 1.C above.
 - ii. The work plans will contain assurances and performance measures that are satisfactory to the Secretaries and reflect that the activities will serve the legislative purpose of PL 108-317
- b. Develop, conduct research on, transfer, promote, and monitor ecosystem restoration treatments including restoration-based hazardous fuel reduction prescriptions to reduce the risk of severe wildfires and improve the health of dry forest and woodland ecosystems in the Interior West;
- c. 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;
- d. Translate for and transfer to affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuel reduction treatments;
- e. Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuel reduction treatments;
- f. Provide for continuing education, formal coursework, and public education as necessary and useful;
- g. Convene one or more meetings among the Institutes annually to share lessons learned and to coordinate activities so as to avoid undesirable duplication;
- h. Subject to the availability of Federal funding, convene, State-by-State, one or more meetings annually of the stakeholders identified in paragraph 1.C above to: define and prioritize science needs; identify and prioritize information needs that can be synthesized from existing information; and, identify audiences that will benefit from the services provided by the Institutes. If a representative body able to perform these functions already exists in the State, an Institute may use its services to fulfill this requirement;
- i. Provide peer-reviewed annual reports to the university presidents, the Governors, the Secretary of Agriculture and Chief of the Forest Service and Secretary of Interior;
 - i. For purposes of this Charter, peer review means a meeting of the stakeholders identified in paragraph 1.C to review the annual report and work conducted by each institute.

- ii. The annual peer-review will be conducted by October 31 following the end of the Federal fiscal year. A final report will be prepared by December 31st of the same year.
- j. Notwithstanding any provision of this Charter to the contrary, no institute shall be prohibited from performing its duties described herein and other functions by contracting for their performance.

3.4. States. The State funding for the Institutes required under this Section 3.4 may be provided by the annual University budget or funding for the Institutes may be provided by other sources as may be available and appropriate. Each State:

- a. Shall provide facilities for the institutes; and
- b. Shall provide State funding to support a portion of the operations of the institutes.

C. Charter Implementation

3.5. Coordinating Committee. There is hereby created a Coordinating Committee whose membership and purposes shall be:

- a. The Coordinating Committee shall consist of the Executive Director(s) of each Institute, the State Forester from each State, a designated representative of each State Governor and a representative of the Western Governors Association.
- b. The primary purpose of the Coordinating Committee is to implement the purposes and intent of this Charter by providing management and administrative guidance on matters affecting all the Parties.
- c. The Coordinating Committee shall adopt its own procedures and determine the frequency of its meetings.
- d. Examples of matters affecting all the Parties include, but are not limited to:
 - (i) Establishing protocols for communications among all three Institutes;
 - (ii) Identifying opportunities for leveraging resources;
 - (iii) Addressing common interests and opportunities for mobilizing critical information for rapid, thorough and scientifically defensible environmental analysis;
 - (iv) Determining how the Institutes should collectively model collaboration as a primary value.
- e. Subject to the availability of funds, each Institute will fund its own participation in the annual meeting, travel, communications and incidental expenses of the Coordinating Committee.

4. Amendment

This Charter may be amended only by an instrument in writing executed by an authorized representative of each Party.

5. Termination

If, as a result of the monitoring and evaluation five years following enactment of PL 108-318, the Secretary, in consultation with the Secretary of the Interior, determines that an Institute does not qualify for further Federal assistance under this Act, the non-qualifying Institute shall receive no further Federal assistance under this Act, and shall cease to be a Party to this Charter, until such time as the qualifications of the Institute are reestablished to the satisfaction of the Secretaries.

6. Participant signatures

NOW, THEREFORE, in consideration of the mutual promises set forth above, the undersigned Parties do hereby execute this Charter, which shall become effective on the date on which it has been signed by all Parties.

On behalf of the States:

Governor Janet Napolitano, Arizona Date

Governor Bill Richardson, New Mexico Date

Governor Bill Owens, Colorado Date

On behalf of the Institutes:

John Haeger, President, Northern Arizona University Date

Manny Aragon, President, New Mexico Highlands University Date

Dr. Larry Edward Penley, Colorado State University Date