

Final Report
on
Cooperative Work Plan FY'08

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Introduction

The ERI is a national leader in developing, testing and transferring science-based treatments to accomplish forest restoration. Our intent is simple – to develop practical science-based restoration treatments that can be readily implemented on the ground. This concise objective is the foundation of our many accomplishments. However, our goals do not stop there. While scientists are continually seeking to develop creative strategies for improving forest health, other staff members transfer this information by:

- Creating collaborative networks with federal agencies and other stakeholders;
- Working to synthesize scientific findings into outreach materials for diverse audiences;
- Assisting land managers with specific problems in the forest; and
- Providing technical assistance to those who seek to create healthy forests in their communities.

On October 5, 2004 President Bush signed into law the SOUTHWEST FOREST HEALTH AND WILDFIRE PREVENTION ACT, identifying the Ecological Restoration Institute at Northern Arizona University as one of three Institutes in the Southwest established for the purpose of ensuring the best available science is used in the development, implementation and monitoring of forest restoration treatments. The report outlines the progress we have made in accomplishing this goal with Fiscal Year 2008 funds.

The funding for Fiscal Year 2008 was allocated for a total amount of \$1,969,000. This is the final report for the FY2008 funding. All promised deliverables are complete with modifications as noted in the text.

Work Plan Summary

The plan of work outlined for this funding served to accomplish the following eight projects.

Project 1: Ponderosa Pine/Mixed-Conifer Restoration

Project 2: Landscape Scale Analysis

Project 3: Technical Support for Land Managers, Agencies, and Tribes

Project 4: Issues in Utilization and Harvest

Project 5: Assistance to Stakeholders and Communities to Support Collaborative Treatment Design

Project 6: Knowledge Services

Summary of Deliverables

Project 1: Ponderosa Pine/Mixed Conifer Restoration

The ERI is known for 30 years of continuous, applied scientific investigations that explore all aspects of the restoration of forest health in frequent fire forests. The primary emphasis for our work is the ponderosa pine ecosystem. The work proposed in 2008 will continue to reap the benefits of treatments initiated over the past five to ten years by collecting data that monitor a variety of biophysical and fire behavior responses to treatments. These data are best-monitored and most reliable long-term restoration sites in the Southwest. Requests for ecosystem responses and fire behavior responses to treatments are some of the most frequent information requests we receive from land managers. The need for this information was validated by the information requests we received from the Restoration of Frequent Fire Forests Conference held in Flagstaff in October 2006. In addition, our previous needs assessment conducted with the Arizona Governor's Forest Health Advisory Council uncovered the importance of this information as well.

These activities support Duty #1, Table One of PL108-317, specific land manager requests and requests from participants at the 2006 Restoration Conference.

Deliverables

- 1) Summary of treatment actions and ecosystem responses from sites in the Long-term Ecological Assessment Restoration Network (LEARN) for practitioners. Analysis of this long-term monitoring will inform working papers, presentations, field trips and workshops included under projects 4,6.

In 2008 we completed analyses on several LEARN sites in pinyon-juniper woodlands and mixed conifer forests. Key results are summarized below:

- Pinyon-juniper fuel treatments at Tusayan site, Kaibab National Forest: **A comparison of fire hazard mitigation alternatives in pinyon–juniper woodlands of Arizona** (David W. Huffman, Peter Z. Fulé, Joseph E. Crouse, Kristen M. Pearson) (**Appendix E**). Concern over uncontrollable wildfire in pinyon–juniper woodlands has led public land managers in the southwestern United States to seek approaches for mitigating wildfire hazard, yet little information is available concerning effectiveness and ecological responses of alternative treatments. We established a randomized block experiment at a pinyon–juniper site in northern Arizona and tested effects of no treatment (Control), thinning only (Thin), prescribed fire only (Burn), and thinning followed by prescribed fire (Thin + Burn) on overstory structure, hazardous fuels reduction, and woody understory responses. One year after

implementation, mean trees per hectare (TPH) of Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*), and basal area (BA) of pinyon, were significantly ($P < 0.05$) less in Thin and Thin + Burn treatments than Control. Additionally, pinyon TPH was less in Burn than Control. Quadratic mean diameter was significantly greater in Thin and Thin + Burn than in Control and Burn treatments. Thinning shifted diameter distributions from uneven- to even-sized. Crown fuel load (CFL) of both pinyon and juniper was significantly lower in Thin and Thin + Burn compared with Control and Burn treatments. Thin, Burn, and Thin + Burn treatments resulted in significantly greater 1-h surface fuel loads compared with the Control. The Thin treatment resulted in significantly greater mean load of the 1000-h fuel class compared with Burn and Control treatments, but did not differ from Thin + Burn. Forest floor Oi (litter) layer was not significantly affected by the treatments but Oe + Oa (duff) depth was significantly less in the Burn treatment compared with Thin and Control. Live shrubs and tree regeneration showed no differences among treatments. We concluded that thinning and thinning followed by prescribed fire were effective approaches for fuels reduction; however, resulting stand structures may be novel and outside the historical range of variability. Prescribed fire alone had minimal effects on structure and fuels reduction. Woody shrubs and tree regeneration in the understory suggested that these treatments may not have long-term deleterious ecological effects.

- Pinyon-juniper restoration at Mt Trumbull: **Effects of Slash on Herbaceous Communities in Pinyon–Juniper Woodlands of Northern Arizona** (Michael T. Stoddard, David W. Huffman, Thom M. Alcoze, and Peter Z. Fule) (**Appendix E**). Scattering slash (downed woody materials) after tree removal is increasingly prescribed by land managers as a treatment to promote the establishment and growth of understory vegetation in pinyon–juniper woodlands. However, the effects of scattering slash on soil resources and plant communities are poorly understood and often confounded with the release from tree competition. In order to examine how slash affects plant establishment, soil stability, soil nutrients, and soil microbiota, we initiated a 2 × 2 full factorial experiment with two levels of seeding and two levels of slash additions within 30 intercanopy spaces, repeated at two intact pinyon–juniper woodland sites with different soil characteristics in northwestern Arizona. Pretreatment data were collected in 2003 and posttreatment responses were measured in 2004 and 2005. Total plant cover increased within all treatments; however, grasses increased significantly only in the seed-and-slash treatment at both sites. In addition, a greater proportion of seed-and-slash plots contained more reproductively active grasses compared to seed-only plots. Slash treatments also resulted in significantly less sediment movement compared to nonslash treatments. Changes in soil nutrients were not

observed, except available NO₃-N decreased significantly in slash treatments. Arbuscular mycorrhizal potential and microbial biomass carbon increased as a result of the slash treatment. Addition of woody materials appeared to have general effectiveness at improving the ecological function of soils and promoting understory establishment and thus may be considered a desirable treatment for improving degraded conditions.

- Mixed conifer restoration at Middle Mountain, San Juan National Forest: **Changes in forest structure of a mixed conifer forest, southwestern Colorado USA** (Peter Z. Fulé, Julie E. Korb, and Rosalind Wu) (**Appendix E**). We selected a warm/dry mixed conifer forest (ponderosa pine, white fir, Douglas-fir, and aspen) in southwestern Colorado to reconstruct historical conditions of fire regime and forest structure in preparation for an experiment in ecological restoration. Although mixed conifer forests are of high ecological and social value in the Southwest, they have been less studied than ponderosa pine forests. Fire-scar analysis on a 150-ha area showed recurring fires at mean intervals of 24 years (all fires with minimum of 2 sample trees scarred) to 32 years (fire scarring 25% or more of sample trees) from the 16th century until the abrupt cessation of fire after 1868, concurrent with European settlement. There was no evidence in age or species-specific data of severe burning at the scale of the study blocks (approximately 200 ha). The forest remained unharvested throughout most of the 20th century, until a cut in the early 1990s removed approximately equal basal areas of ponderosa pine and white fir. Forest structure had already changed substantially, however. Total basal area increased from an average of 11 m² ha⁻¹ in 1870 to 27 m² ha⁻¹ in 2003, despite harvesting of at least 8.4 m² ha⁻¹. Ponderosa pine declined from representing nearly two-thirds of basal area in 1870 to one-third in 2003. The other species increased dramatically, especially white fir, which went from 12% to 35% of basal area and dominated stand density with an average of 392 trees ha⁻¹. Total tree density increased from 142 trees ha⁻¹ in 1870 to 677 trees ha⁻¹ in 2003. The ecological changes that occurred here since the 19th century have been in exactly the opposite direction considering the warm, fire-favoring climate expected in the 21st century. If warm/dry mixed conifer forests of southern Colorado are to have a reasonable chance for persistence under the future climate regime, restoring conditions more similar to the frequently burned, open forests of the past is likely to be a useful starting point.
- Each of these projects has been the focus of field trips and results are being incorporated into management.

- 2) One article for a scientific journal summarizing responses.
 - ✓ Fulé, P.Z., J.E. Korb, and R.Wu. In press. Changes in forest structure of a dry mixed conifer forest, southwestern Colorado USA. *Forest Ecology and Management*. See Appendix E, Publications.

- 3) Invasive plants are vexing practitioners and restoration projects throughout the Intermountain West. Severe wildfire can lead to invasion by exotic plants, but thinning and prescribed burning can also lead to the unintended establishment of nonnative plants. In 2008 we will monitor and evaluate existing treatments to analyze how restoration treatments should be modified to avoid creating opportunities for invasion. It will incorporate findings from ongoing work funded by, and in cooperation with, the Rocky Mountain Research Station.
 - ✓ A technical note summarizing responses to treatment actions and interaction with exotic plant invasions.
 - McGlone, C.M. and Egan, D. The role of fire in the establishment and spread of nonnative plants in Arizona ponderosa pine forests: A review. Submitted to the Arizona-Nevada Academy of Science. See Appendix E, Publications.

- 4) The Arizona Game and Fish Department in cooperation with the BLM Strip District and the ERI have monitored wildlife responses to landscape-scale restoration since 1997. The findings have shown that restoration treatments are beneficial or neutral to most wildlife species and have provided data on ways to mitigate undesirable effects. This in turn, has led to a change in attitude among wildlife practitioners and stakeholders towards restoration. This funding will permit monitoring of animal responses to continue on restoration projects in northern Arizona. **See Appendix B for Annual Progress Report from Arizona Game and Fish Department. Publications included separately in Appendix E.**
 - ✓ Prepare four manuscripts on wildlife responses from Mt. Trumbull and other restoration sites.
 - Wightman, C.S. *In review*. Post-fledging survival and movements of western bluebirds. *Southwestern Naturalist*.
 - Wightman, C.S., and S. S. Rosenstock. *In review*. Tassel-eared squirrel responses to fuel reduction and forest restoration: mosaics matter. *Restoration Ecology*
 - Wightman, C.S., and M.L. Wessel. *In review*. Western bluebird nestlings compensate for inflated ectoparasite infestations in restoration-treated forests. *The Condor*.

- Yarborough, R.F., C.W. Wightman, and S.S. Rosenstock. *Ready for submission*. Mule deer habitat selection in a restoration-treated ponderosa pine forest. *Journal of Wildlife Management*.
- ✓ Continue monitoring wildlife responses to restoration treatments.
 - Summary included in annual report, Appendix B.
- ✓ Help organize and participate in a joint ERI, Forest Service, BLM, Arizona Game and Fish workshop for wildlife professionals to discuss results.
 - AGFD Habitat Program staff participated in the October 2008 workshop sponsored by ERI, including a working group that developed recommendations for monitoring wildlife responses to treatments on USFS and other lands.
 - AGFD Research Branch participated in a January 2009 meeting with representatives from ERI, BLM, and NPS. ERI and AGFD staff provided a synopsis of prior and ongoing research efforts on Mt. Trumbull, and discussed their implications for management and future research/monitoring.
 - AGFD and ERI are planning a workshop for Spring 2009, integrating information gained from restoration-wildlife studies. Target audience includes wildlife/resource managers from USFS, BLM, NPS, AGFD as well as faculty/staff from ERI and the School of Forestry.

5) Understanding how different restoration treatments influence extreme crown-fire behavior is essential to properly design restoration treatments focused on reducing hazardous fuels and reducing wildfire intensity. This information will help determine the amount of thinning, burning and frequency of prescribed burning that are necessary to maintain long-term reduction of hazardous fuels. This project will be a retrospective analysis of areas that were treated prior to wildfire to determine how the treatment modified fire intensity. Data to inform this analysis were collected in 2007.

- A systematic review of all known literature and conclusions in 2008.

The systematic review was initiated in FY 2008. This project has proven to be more complex than we anticipated and it will be completed in FY 2009.

Accomplishments in 2008 included:

- Preparing and submitting a systematic review protocol to the Centre for Evidence-Based Conservation
 - ✓ Systematic Review #42: Do thinning and/or burning treatments on Ponderosa Pine and related forests in Western USA produce restoration of natural-fire behavior? **Appendix A** or available at <http://www.environmentalevidence.org/Documents/Protocol42.pdf>
 - ✓ Protocol format in table 1 below
- Searching thousands of articles; selected 189 articles for review.
- Preparation of data sets for meta-analysis of key fire behavior variables.

Table 1 - Systematic Review

CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW No. 42

WORKING TITLE: Do thinning and/or burning treatments on ponderosa pine and related forests in western USA produce restoration of natural fire behaviour?

REVIEW PROTOCOL

(available at <http://www.environmentalevidence.org/Documents/Protocol42.pdf>)

2. OBJECTIVE OF THE REVIEW

2.1 Primary question

Do thinning and/or burning treatments on ponderosa pine and related forests in western USA produce restoration of natural fire behaviour?

2.2 Secondary question (if applicable)

Potential secondary questions could be: What is the functional relationship between the variables and fire behaviour? How might relationships differ among pure ponderosa pine forests versus related forests (Jeffrey pine, dry mixed conifer, ecotonal ponderosa forests)? How might regional variability (Southwest, central Rockies, Black Hills, northern Rockies, Sierra Nevada, northern Mexico) affect restoration methods and outcomes?

3. METHODS

3.1 Search strategy

- Internet search engines and databases supported by Cline Library, Northern Arizona University: Ingenta, Forest Science Database (Ovid), JSTOR, Google Scholar.
- U.S. government databases (U.S. Department of Agriculture, Forest Service publications and proceedings)
- Libraries at universities with Forestry programs (M.S. and Ph.D. theses).

Search terms to include: western forests AND fuels treatments, fuels treatments AND ponderosa pine, fuels treatments AND Jeffrey pine, fuels treatments AND mixed conifer, thinning AND ponderosa pine, thinning AND Jeffrey pine, thinning AND mixed conifer, burning AND ponderosa pine, burning AND Jeffrey pine, burning AND mixed conifer, fire behaviour AND ponderosa pine, fire behaviour AND Jeffrey pine, fire behaviour AND mixed conifer. Searches will be conducted on both the common names ("ponderosa pine") and scientific names ("Pinus ponderosa") of the species.

- 6) The re-establishment of native understory plant communities is a critical factor in forest restoration. This project will evaluate different seeding approaches with the goal of encouraging natives while discouraging exotics. It will incorporate findings from ongoing work funded by, and in cooperation with, the Rocky Mountain Research Station.
- Technical note completed in 2008.
 - ✓ **Daniels, M.L., J.D. Springer, C.M. McGlone, and A. Wilkerson. Seeding as Part of Forest Restoration Promotes Native Species Establishment in Grand Canyon-Parashant National Monument (Arizona). Ecological Restoration.**
- 7) Little reliable quantitative scientific information exists in the Southwest to help evaluate the vulnerability of severely burned forests in the semi-arid Southwest to environmentally harmful reburning. This may be partially due to the very contemporary nature of the problem (it is only in the last 10 years we've seen overstocked forests burn catastrophically at a large scale). This project will conduct an analysis of fuel loads at sites that have burned catastrophically and analyze the potential for reburning. The information from this project will contribute to land management decisions about salvage logging and post-fire rehabilitation.
- Preparation of an evidence-based evaluation of the literature and preparation of recommendations for land managers.
 - ✓ **Roccaforte, J.P., PZ Fule', W. Chancellor. Post-Wildfire Fuels Project Progress Report, March 31, 2009. See Appendix E, publications.**
- 8) Land management policy calls for monitoring of the biophysical responses of land treatments. Yet, very little monitoring is done due to lack of human and financial resources dedicated to the task. Unfortunately, there is a common misperception that monitoring has to be expensive and exhaustive to be credible. What is needed is a simple, yet robust set of variables that can be simply measured by land managers to inform adaptive management. Based on 10 years of monitoring by ERI at sites across the West we will use a collaborative framework to identify those monitoring variables that are the most robust for demonstrating whether or not treatments are on a trajectory for achieving their restoration goals. Previous work developed for the Collaborative Forest Restoration Program will be used to inform this project.
- An integrated land manager and expert workshop will be held to identify the most important monitoring variables that indicate trends.
 - ✓ **SWERI Monitoring Workshop held October 15-17, 2008. See Appendix A for agenda and summary of workshop.**

- In FY'08 we will begin preparation of publications, scientific and practitioner oriented. These papers will be completed in FY'09. **This report will be provided as a deliverable in the FY09 funding.**

Project 2: Landscape-Scale Analysis

To strategically locate restoration-based hazardous fuel reduction treatments to achieve maximum benefit and efficiency planning must unfold at the landscape scale. The same is true for properly managing for multiple-species conservation. The ForestERA program provides technical support for collaborative processes attempting to prioritize treatments at the landscape scale. It also can help achieve collaboration objectives during the forest plan revision process.

The ForestERA tool is now actively used by stakeholders in many areas of the Southwest to inform decision-making. Following the initial landscape assessment in the White Mountains the Natural Resources Working Group has continued to request support services, it is proposed as the platform to be used in a stakeholder driven collaborative process for characterizing the wood available for wood utilization initiatives in Arizona, it provided information for the Greater Flagstaff Community Wildfire Protection Plan, and is being used Arizona Game and Fish for wildlife planning.

Evidence for the importance of this tool is the fact that it is referenced in the multi-agency USDA/DOI Wildland Fire Use Guide (http://www.fs.fed.us/fire/fireuse/wildland_fire_use/use_index.html). The Guide includes examples of the Western Mogollon Plateau Adaptive Landscape Assessment data (pp.17-18) and describes the use of landscape-scale analysis in Wildland Fire Use planning. The authors downloaded the images directly from the ForestERA web pages. The introduction states that it "provides **standardized procedures**, specifically associated with the planning and implementation of wildland fire use."

In 2008, ForestERA will continue to provide GIS support for implementation of the "20 Year Statewide Strategy for Restoration of Arizona's Forest" completed in May 2007. In addition, they will continue developing a model for Goshawk occupancy that will contribute to understanding habitat relations with this important animal. **(Update, 1/21/08- the ForestERA program will begin supporting a pilot project identified in the FY'09 Forest Service Budget Justification during FY'08. To accommodate this work two other activities were dropped: support for the Statewide Strategy and Support for previously completed landscape assessments).**

This work supports Duty #2, Table one of the Act. Specific audiences for each action are identified in the deliverables.

Deliverables

- Preparation of data layers and analyses in cooperation with Arizona Game and Fish, the U.S. Fish and Wildlife Service and the Rocky Mountain Research Station that estimate the occupancy or occurrence patterns and habitats of northern goshawk in the forested regions of northern and eastern Arizona. **See Appendix C.**
- Consultation and preparation to support activities identified in the President's FY'09 budget. The Forest Service budget justification for FY'09 includes the following language: "The request includes funding for a pilot project with partners in the Southwest Ecological Restoration Institutes to develop and test prioritizing restoration-based fuel reduction treatments that use the best available science and a collaborative process. (P.L. 108-317)." Final products from this work will include an analysis of potential priority locations and scheduling for restoration treatments that will restore forest health and simultaneously reduce the risk of unnatural fire. The final products to be completed in FY'09 will be informed by a collaborative process, include an analysis of how this assessment performed in terms of planning efficiency, and include a discussion about the ecological and economic efficiency of following the prioritization recommendations.

The other two institutes in New Mexico and Colorado will be actively engaged throughout the process. The hope is that if this approach proves effective it will be transferred to planning and implementation of treatments in the other states.

Initial work in FY'08 will accomplish the following:

- a. In consultation with the affected Forest Service parties, including RMRS, identify a site for the assessment.
- b. Determine the roles and responsibilities of participants and develop a scope of work;
- c. Design of a collaborative process;

Regarding a, b, c, above, multiple sites were considered over the course of numerous meetings between the Forest Service, stakeholders, and ERI staff. ERI staff participated fully in making every attempt to meet the goal of selecting a site and designing a collaborative process. Ultimately, however, the Forest Service was not in a position to select a site in FY 2008. As a result, the description of the landscape-scale restoration project was modified with Forest Service approval in the FY2009 work plan (please see FY09 work plan for details).

- d. Identification and refreshing of data layers required to conduct the analysis;

Updated data layers for north-central Arizona were prepared by ForestERA (see first deliverable in this section, above). ERI and ForestERA staff worked together to develop dedicated computer space within NAU's GRAIL geodata facility. Data and meta-data to support landscape-scale restoration efforts were transferred to the server in early 2009 and several training sessions were carried out for ERI staff.

- e. Outline of process for evaluating the economic and ecological efficiency of prioritized treatments.

The quantity and value of wood to be thinned under a landscape-scale restoration project is central to evaluating economic efficiency. ERI and ForestERA worked collaboratively to prepare the final report (submitted for publication): **Hampton, H., Wood Supply Follow-On Project Final Report, April 15, 2009 (Appendix C)**. Landscape-scale effects on hydrology were assessed in the collaborative study on post-fire watershed condition, **Hampton, H, B. Piehl, D.G. Neary, Forest Landscape Models of Soil Erosion and Sedimentation flowing Stand-Replacing Wildfire (Appendix C)**. These assessments of wood supply and watershed function contribute to the overall landscape-scale evaluation of economic and ecological aspects of restoration.

Project 3: Technical support for land managers, agencies and tribes

The literature shows that the preferred approach to learning by land managers is face to face contact. In response to requests from managers the ERI provides technical assistance in many forms from the classroom to the field. Demonstration plots are also an effective way to help people understand how to design and implement restoration treatments. Rapid Assessments that conclusively demonstrate historical fire regimes, stand density, spacing and structure for a given project is particularly powerful evidence that supports science-based treatment design. The ERI considers these activities some of the most important aspects of our work.

In 2008, we will also respond to requests from Region 3 to be involved with Forest Plan Revisions. This support will also be provided to other federal agencies and tribes who request it. **(Update 1/21/08, the promised information requests have been re-organized under the RAPs).**

This work responds to Duties #3 and #4, Table one of the Act and numerous land manager requests for assistance.

Deliverables

1. A report that describes information support for Forest Plan Revisions.

- ✓ Record of ERI Participation in the Forest Service Planning Process. See Appendix A.
2. One workshop for practitioners. **2 Completed.**
- ✓ C. Denton, D. Brewer, D. Lund. Presented information to district personnel on restoration on the North Kaibab and then conducted field trip. 10 attendees. September 22-24, 2008.
 - ✓ Denton, C., D. Brewer. 1/2 day workshop on restoration principles. Magdalena Ranger District, Cibola National Forest. February 23 to 25, 2009.
3. 15 field consultations. **16 Completed**
- ✓ Brewer, D. Met with White Mountain Group and Apache/Sitgreaves Leadership Team to discuss landscape scale assessment. Pinetop, AZ. April 9, 2008. 25 participants.
 - ✓ Denton, C. Contacted Apache/Sitgreaves NF by telephone and discussed Landscape Scale project as described in proposed 2009 federal budget. Invited ERI to 04/09/08 meeting to discuss further. Flagstaff, AZ. May 4, 2008
 - ✓ Brewer, D. Discussed landscape scale analysis with Stu Lovejoy of the Kaibab National Forest, Flagstaff, AZ. May 6, 2008.
 - ✓ Denton, C. Met with Planning Committee for Ruidoso WUI Working Group to discuss Perk-Grindstone Implementation and update for accomplishment map. Ruidoso, NM. May 8, 2008. 9 attendees.
 - ✓ Brewer, D. Participated with Greater Ruidoso Working Group and Upper Bonito Watershed Restoration Interdisciplinary meeting. Ruidoso, NM. June 2-4, 2008. 15 attendees.
 - ✓ Denton, C., D. Brewer. Met with Upper Bonito ID team for Lincoln NF and discussed field trip and situation with EA. Ruidoso, NM. June 12, 2008. 17 participants.
 - ✓ Brewer, D. Called Jeff Waters, Kaibab NF, Williams Ranger District Wildlife Biologist and discussed proposed aspen survey protocol. Jeff forwarded their design to us for review. Flagstaff, AZ. June 30, 2008.
 - ✓ Lund, D. Consultation and follow-up with Rich Reynolds, Region 3 on restoration and Goshawk coordination. North Kaibab. July 1-3, 2008.
 - ✓ Brewer, D., C. Denton, D. Lund. Took photo points for ERI Goshawk treatments. Springerville, AZ. July 7, 2008.
 - ✓ Brewer, D. Assisted Apache/Sitgreaves on review of proposed action for Wildland Urban Interface project. Flagstaff, AZ. July 9, 2008
 - ✓ Brewer, D. Consultation on Jim Lewis Project, Flagstaff, AZ. August 12, 2008.
 - ✓ D. Lund. Fire scar collection and interpretation. October 2, 2008. North Kaibab Ranger District.
 - ✓ W.W. Covington, D. Brewer, C. Denton, D. Lund. Participated in Regional Leadership Team Meeting concerning restoration efforts and barriers to

implementation. November 13, 2008. Williams and Flagstaff, AZ. 30 attendees.

- ✓ Brewer, D. Called Sue Schhardt, USDA-FS, Magdalena Ranger District concerning DFC statements for ponderosa pine ecosystems. Flagstaff, AZ. January 8, 2009
- ✓ Lund, D. Presented information on ERI restoration mark and differences with ERI's and goshawk restoration prescriptions. North Kaibab Ranger District. January 29, 2009. 10 attendees.
- ✓ Brewer, C. Reviewed methodology of proposed large scale assessment to be conducted by Forest Service with Regional Office NEPA specialist. Flagstaff, AZ. March 23, 2009.

4. 6 rapid assessments (RAPs). **Completed (Appendix D).**

- ✓ Lund, D. Worked on Piñaleno Project in the Coronado National Forest. Safford, AZ. August 4-8, 2008.
- ✓ Brewer, D., C. Denton, D. Lund. Conducted Rapid Assessment on plots within project area to determine HRV and other parameters for the Jim Lewis Project. Cloudcroft Ranger District, Lincoln National Forest. August 25-29, 2008.
- ✓ Brewer, D. C. Denton, D. Lund. Assessment of dominate ecosystems found in Spring Mountains in effort to determine fire regime as well as structure and composition of forest prior to settlement. September 15-18, 2008. Spring Mountains, NV.
- ✓ D. Brewer. Survey of existing ecological conditions in proposed restoration project in South Guadalupe Mountains NM. November 17-20, 2008. Carlsbad, NM.
- ✓ D. Brewer. Attempted to establish a pre-settlement plot adjacent to Summer Haven home sites located in the Santa Catalina Mountains, Tucson, AZ. *Note that trip was cancelled due to extreme snowy conditions.* December 1 and 2, 2008.
- ✓ Denton, C., D. Brewer. 2 day rapid assessment to determine structure and composition of ponderosa pine mixed, conifer zones found within Fisher project. Magdalena Ranger District, Cibola NF. February 23-25, 2009.
- ✓ Denton, C., D. Brewer. Follow-up rapid assessment to determine pre-settlement densities in various ecosystems found within South Guadalupe project area. Carlsbad, NM. February 19, 2009.

15 field consultations to support RAPs. **Completed.**

- ✓ Denton, C. Responded to request by Tonto N.F., for assistance in developing monitoring plan for project which includes MSO territories. Flagstaff, AZ. April 3, 2008.

- ✓ Denton, C., D. Brewer, D. Lund. Met with Kaibab NF Leadership Team to discuss landscape scale assessment as described in proposed 2009 Federal Budget. Flagstaff, AZ. April 29, 2008. 12 participants.
- ✓ Lund, D. Arizona Game and Fish and ERI discussion and review of restoration treatment at Williams Plot. Flagstaff, AZ. May 14, 2008. 5 participants.
- ✓ Denton, C. Discussed Landscape scale Firescape Planning Project for the Huachuca Mtns. with Sherry Tune of Coronado NF. Flagstaff, AZ. May 16, 2008.
- ✓ Denton, C., D. Brewer, D. Lund. Surveyed and marked presettlement plot in Pinaleno Mountains. Safford, AZ. May 19-23, 2008.
- ✓ Denton, C., D. Brewer. Met with ID Team for Jim Lewis Project on the Lincoln NF. They want us to do a rapid assessment (collecting pre-settlement data on density and composition). Cloudcroft, NM. June 11, 2008. 17 participants.
- ✓ Lund, D. Reviewed Jacob/Ryan proposed restoration project. Fredonia, AZ. June 13, 2008. 12 participants.
- ✓ Denton, C., D. Brewer, D. Lund. Completed the marking on the Pinaleno project on the Coronado NF. Safford, AZ. June 24-26, 2008.
- ✓ Brewer, D. Participated in ID team meeting and field review of Jim Lewis project. Cloudcroft Ranger District, Lincoln National Forest. July 16, 2008.
- ✓ Brewer, D., C. Denton, J. Seidenberg. Photo points retaken for full and modified restoration plots, at the Bald Mesa Plots. Coconino National Forest. August 13, 2008.
- ✓ Brewer, D., C. Denton, J. Seidenberg, D. Egan, D. Lund. Photo points retaken for full and modified restoration plots on Wells Plot. Kaibab National Forest. August 14, 2008.
- ✓ Lund, D. Fire scare collection and interpretation, USDA-FS, North Kaibab Ranger District. October 2, 2008
- ✓ D. Lund. At the request of Forest Service Regional Office re-took photo points at ERI/Goshawk mark located on Williams Ranger District. October 15-17, 2008.
- ✓ D. Lund. Support request from Forest Service Regional Office concerning additional photo needs for restoration and goshawk mark to be used in upcoming Regional Leadership meeting. October 22-23, 2008.
- ✓ Brewer, D. Initial contact with Magdalena District of Cibola NF for Sargent-Monica restoration project 12/15/08. The field work will be done in spring of 2009.

15 responses to information requests to support RAPs. **15 Completed**

- ✓ Brewer, D. Provided copies of various research topics on aspen management to personnel on Kaibab National Forest. Flagstaff, AZ. April 22, 2008.

- ✓ Brewer, D. Provided copies of various research topics on effects of timber harvest on watershed variables to personnel on Tonto National Forest. Flagstaff, AZ. April 23, 2008.
- ✓ Brewer, D. Contacted Tim Fruitts (Carson NF), Mike Atkinson (Acting DR, Guadalupe RD, Linclon NF), and John Phillips (Santa Fe NF) by telephone and discussed potential for ERI to assist them in proposed restoration projects. Flagstaff, AZ. May 7, 2008.
- ✓ Denton, C. Literature search and potential objectives and prescriptions for Piñaleno project. Flagstaff, AZ. May 10-20, 2008.
- ✓ Brewer, D. Sent letter and handouts to John Phillips (Santa Fe National Forest) listing items we can accomplish relative to restoration survey and design. Flagstaff, AZ. May 12, 2008.
- ✓ Denton, C. Contacted Bruce Buttrey of A/S NF concerning our possible participation in the Big Lake project. Flagstaff, AZ. May 16, 2008.
- ✓ Denton, C. Contacted Paul Womack of Gila NF on our continuing participation in the Burro and Willow Ck. Projects. Flagstaff, AZ. May 16, 2008.
- ✓ Denton, C. Discussed Jim Lewis project and our participation with Kathy Wallace of Lincoln NF. Flagstaff, AZ. May 16, 2008.
- ✓ Denton, C. Literature search and proposed objectives and prescriptions for Jim Lewis Project. Flagstaff, AZ. June 1-11, 2008.
- ✓ Lund, D. Conducted literature review on restoration principles/practices in preparation for 06/03/2008 meeting with Kaibab NF leadership team. Flagstaff, AZ. June 2, 2008.
- ✓ Brewer, D. Provided copies of various research topics on aspen management to personnel on Kaibab National Forest. Williams, AZ. June 3, 2008.
- ✓ Denton, C. Discussed Whitcom WUI project on A/S NF with Charlie Denton, Jr. for possible restoration prescription. Flagstaff, AZ. June 27, 2008.
- ✓ Lund, D. Met with BLM personnel to discuss future research proposals and monitoring requirements for Mt. Trumbell area. Lees Ferry, AZ. January 8, 2009. 10 attendees.
- ✓ Denton, C. Sent fact sheet and other information to Lakeside RD for Whitcom project. Flagstaff, AZ. January 16, 2009.
- ✓ Denton, C. Telephone information to Springerville Ranger District concerning restoration prescription on Eagar South Project. Flagstaff, AZ. January 29, 2009.

Project 4: Issues in Utilization and Harvest

The lack of economic value and places for small diameter wood creates a bottleneck that prevents thinning from proceeding at the pace and scale required to avoid catastrophic fire and restore forests. This issue is also one of the most volatile to navigate because of fears that economic utilization will ultimately drive and pervert

sustainable forest management. The ERI is committed to provide objective information to inform the debate on the appropriate scale of utilization. In 2008 we will continue to provide objective information services and support for collaboration that we hope will lead to private industry opportunities for the harvest and marketing of small diameter wood products. The need for assistance to advance small wood utilization and marketing was expressed repeatedly as service needed by participants at the October 2006 Southwest Ecological Restoration Institute conference.

Concern about global warming and greenhouse gases has made its way to the new Congress. Numerous policies are emerging that may formalize in the public sector private markets for carbon sequestration credits. The ERI launched a study in 2005 to analyze whether or not wildfire avoidance achieved through forest restoration treatments can be qualified to receive carbon credits. The results of this study are anticipated in early 2007. In 2008 we will pursue efforts to implement findings of the study. **(Update 1/21/08. In the past the ERI has subcontracted with the Greater Flagstaff Forests Partnership (GFFP) to support work oriented to utilization and marketing issues. The GFFP has laid-off their executive director and is redefining their future work.)**

These actions respond to Duties #3 and #4, Table one of the Act, The Governor's Forest Health Councils, private industry and needs identified at the 2006 Conference.

Deliverables

- 1) A report on information provided to support utilization.
 - Summary of Utilization-related activities. **See Appendix A.**
- 2) A white paper for policy-makers that analyzes whether or not carbon credits can be obtained for restoration treatments that reduce the risk of catastrophic crown fire and associate carbon release (*deliverable in Project 6.3*).
 - "Restored Southwest Ponderosa Pine Forests: Their Potential for Carbon Sequestration", Egan, S. and Seidenberg, J. **See Appendix E.**

Project 5: Assistance to Stakeholders and communities to support Collaborative Treatment Design

The ERI assists 13 community collaborative groups to understand, design and help monitor land management treatments that restore forests. These activities are based on requests from communities such as the Natural Resources Working Group, the Pinaleños group, Prescott Area Wildland Urban Interface Council, Greater Flagstaff Forests Partnership and others. These groups request one-on-one consultations, short workshops and information services.

This project responds to Duties #1, #3, #4 of the Act, community requests and needs identified at the 2006 Conference.

Deliverables

- 1) Ten responses to requests for information. **11 Completed.**
 - ✓ Seidenberg, J. Request for information from Craig Patterson regarding sustainable forestry/institutional barriers. Spoke with individual on phone about ERI's work in forest restoration with follow-up e-mail recommending specific ERI publications. April 1, 2008. Flagstaff, AZ.
 - ✓ Murfitt, L. Responded to request from Mary Kate Cunningham, AZ Governor's Office, on Forest Restoration and Carbon Sequestration. Provided two ERI papers on the subject. June 10 and July 1, 2008.
 - ✓ Murfitt, L. Request for information from Lucinda Andreani, Special Projects Director for Coconino County on putting together work sessions on Forest Health for the County Board of Supervisors. June 17, 2008
 - ✓ Sent the ERI publication "Monitoring social and economic effects of forest restoration" to Molly Pitts with the *N*orthern Arizona Wood Products Association. The document will assist her in preparing recommendations for the Governor's Forest Health Council Scorecard Subcommittee. Flagstaff, AZ. June 27, 2008.
 - ✓ Kalies, E. Provided maps in response to request for information on forest restoration treatments on the Coconino National Forest near Camp Navajo, to Valerie Horncastle, Wildlife Specialist, Research Branch of the AZ. Game and Fish Department. Flagstaff, AZ. September 9, 2008.
 - ✓ D. Brewer. Phone call to Dave Sire (Ecosystem Management Washington Office) to discuss feasibility of large scale NEPA analysis. October 20, 2008.
 - ✓ Stoddard, M. Sent before and after photos of prescribed fire within ponderosa pine forest. RMRC request. November 19, 2008.
 - ✓ Huffman, D. Sent literature related to treatment costs for restoration thinning and prescribed fire use in ponderosa pine forests to Gordon West at Restoration Technologies in Silver City, NM. January 12, 2009.
 - ✓ Denton, C. Sent information to Bob Taylor, Ed Collins, Kate Kline on prescribed burning and mortality rates on ponderosa pine at Mount Trumbull. Flagstaff, AZ. January 13, 2009.
 - ✓ Seidenberg, J. Requested by the Community Conversation on Sustainability planning committee to attend annual workshop at the du Bois Center Northern Arizona University. Represented ERI at the workshop, providing information to attendees on the connections between forest health and long-term community sustainability. Northern Arizona University. February 21, 2009. Over 100 attendees.
 - ✓ Huffman, D. Sent literature related to treatment costs for restoration thinning and prescribed fire use in ponderosa pine forests to Colin Shackelford at The Nature Conservancy in Alpine, TX. March 3, 2009.
- 2) Three field consultations. **4 Completed.**

- ✓ Dickson, R. "Teaching Ponderosa Pete's forest ecology curriculum in the classroom." Training session provided to 25 teachers from Flagstaff Unified School District and to representatives from local environmental education programs. Each participant was also given an activity kit with a set of 30 classroom books. April 17, 2008, Flagstaff, Arizona.
- ✓ Springer, J.D. Consultation with artist and designer regarding revegetation following construction of art project in Buffalo Park, City of Flagstaff. May 6, 2008.
- ✓ Springer, J.D. Consultation with retirement community in Prescott Valley regarding revegetation of golf course and tennis court with native species. May 30, 2008.
- ✓ Denton, C. Communication with Ruidoso NM Wildland Urban Interface Planning Committee on taking advantage of proposed stimulus packages and passing of Natural Resource Omnibus bill. Flagstaff, AZ. March 26, 2009.

Project 6: Knowledge Services

The ERI strives to deliver information in the form and language required by diverse audiences. We also seek to support immediate information needs to address land management challenges. This suite of information products is designed to meet the information needs of the public, policy makers, land managers, academics, business and environmentalists.

Better education and information transfer responds to the heart of PL108-317, duties #1,#3,#4, The needs of the Governor's Forest Health Council, Specific land manager needs and information services identified at the 2006 Conference.

Deliverable

- 1) An emerging approach to provide the best available research to medical practitioners is through "evidence-based" medicine. Studies, clinical analyses and expert opinion are weighted for their credibility and analyzed to help define the best therapies to address medical problems. The ERI seeks to use an evidence-based approach for the preparation of systematic reviews of existing research and information that can inform forest restoration. We propose two reviews.
 - a. Systematic Review of how restoration treatments influence extreme crown-fire (see Project 1, #5).
 - ✓ Systematic Review #42: Do thinning and/or burning treatments on Ponderosa Pine and related forests in Western USA produce restoration of natural-fire behavior? **Appendix A** or available at <http://www.environmentalevidence.org/Documents/Protocol42.pdf>

- b. Evidence-based review of the literature and synthesis of recommendation for land managers pertaining to the potential for burned areas to re-burn severely (See Project 1, #7).
 - ✓ Roccaforte, J.P., PZ Fule', W. Chancellor. Post-Wildfire Fuels Project Progress Report, March 31, 2009. See Appendix E, publications.
- 2) In 2006 the number of requests for information, fact sheets and other rapid response information increased dramatically. Establishing a help desk will provide a useful point of entry for and stakeholders seeking advice (**Update on 1/21/08, the ERI determined that establishing one formal position to manage requests is unnecessary. Staff is already doing this and therefore we will continue to fill requests using available expertise. With the funding saved from establishing a position the ERI will complete a comprehensive field guide to the understory plants of Northern Arizona. This guide will serve as an important benchmark of knowledge in a landscape that may change radically due to climate variability. This guide is also in demand by field biologists, educators and land managers).**
 - a. Report on requests (Appendix A)
 - b. Completion of the Field Guide to the understory plants of N. Arizona. **The field guide is complete and will be published in 2009.**
- 3) Occasional short summaries that compile best available information are needed by non-technical stakeholders and practitioners.
 - One white paper based on the carbon credit analysis
 - "Restored Southwest Ponderosa Pine Forests: Their Potential for Carbon Sequestration", Egan, S. and Seidenberg, J. **See Appendix E.**
- 4) Practitioners and stakeholders need very short, concise descriptions of land management options and the outcomes of those options. The Working papers distill information that already exists in the literature or is generated through activities conducted in projects 1 and 2.
 - a. 4 Working Papers or Technical Notes (See Project 1, #3, #6)
 - ✓ Egan, D. 2008. "Restoring Spatial Pattern to Southwestern Ponderosa Pine Forests, #22". Flagstaff, AZ. (**Appendix E**)
 - ✓ Brewer, D. "Accounting for Watershed and Other Resource Values--Consideration in the NEPA Analysis", Flagstaff, AZ. (**Appendix E**)
 - ✓ Daniels, M.L., J.D. Springer, C.M. McGlone, and A. Wilkerson. Seeding as Part of Forest Restoration Promotes Native Species Establishment in Grand Canyon-Parashant National Monument (Arizona). Ecological Restoration (**In Press, Appendix E**)
 - ✓ McGlone, C.M. and Egan, D. The role of fire in the establishment and spread of nonnative plants in Arizona ponderosa pine forests:

A review. Submitted to the Arizona-Nevada Academy of Science
(In review, Appendix E).

- 5) The ERI maintains an integrated web site that includes publications and information about the biophysical and social science aspects of restoration. Recommendations are peer reviewed and the ERI maintains the highest standards for information posted to the site.
 - a. Report on major updates to the web. **Appendix A.**
- 6) Direct communication with individuals is still the knowledge delivery choice preferred by practitioners and stakeholders alike. The ERI will continue to provide in person delivery to convey emerging scientific information on restoration treatments, community collaborations and other relevant topics.
 - a. 15 presentations. **15 Completed.**
 - ✓ McMillin, J. D., C. Hoffman, C. H. Sieg & P. Z. Fulé. 2008. Contribution of bark beetle outbreaks to fuel loading and fire behavior in pine forests of the Southwest. 2008 Western Forest Insect Work Conference, April 8-10, 2008, in Boulder, CO. 30 attendees.
 - ✓ Van Mantgem, P.J., N.L. Stephenson, J.C. Byrne, L.D. Daniels, J.F. Franklin, P.Z. Fulé, M.E. Harmon, J.M. Smith, A.H. Taylor, and T.T. Veblen. 2008. Widespread increase of tree mortality rates in the western United States. MTNCLIM 2008 Mountain Climate Research Conference, 9-12 June 2008, Silverton, Colorado.
 - ✓ McGlone, CM. June 17, 2008. Cheatgrass response to fuels management, fire, and post-fire land rehabilitation in Southwestern ponderosa pine forests. Jicarilla Apache Tribe Cheatgrass Management Workshop. Dulce, NM. ~50 attendees.
 - ✓ Laughlin, D.C. 2008. Ever since Warming: Topical gradients in plant ecology textbooks. Oral presentation at the 93rd Ecological Society of America Annual Meeting, Milwaukee, WI. August 5, 2008
 - ✓ Chancellor, WW, DW Huffman, and MM Moore. Characteristics of buckbrush (*Ceanothus fendleri*) shrubs exposed to herbivores after seven years of protection. Poster presented at the Fort Valley Experimental Forest -- A Century of Research 1909-2008 Conference. August 7-9, 2008.
 - ✓ Fulé, P.Z. 2008. Monitoring large-scale forest restoration treatments: integrating multi-disciplinary science and management. Moving Toward Tomorrow: Developing a Framework for Monitoring the Forested Ecosystems of the Southwest. October 15-17, 2008, Northern Arizona University, Flagstaff AZ.
 - ✓ Huffman, D.W. "Fuels reduction treatments in southwestern pinyon-juniper woodlands". Oral presentation given at the Society of

- American Foresters, National Convention. Reno, NV. November, 2008. 50 attendees.
- ✓ Youtz, J., M. Johnson, D. Allen-Reid, A. Bradley, B. Bird, C. Bada, Z. Evans, P. Fulé, K. Smith. 2008. Climate Change and Mixed Conifer/Aspen Systems in New Mexico: Considerations for Managers (panel presentation). New Mexico Forestry and Climate Change Workshop, November 20, 2008, Albuquerque, NM.
 - ✓ Peppin, D., P. Z. Fulé, C. H. Sieg, M. Hunter, and J. Beyers. 2008. Post-wildfire seeding in forests on federal lands: trends, costs, effectiveness, and use of native seed. Wildfires and Invasive Plants in American Deserts Conference, December 9-11, 2008, Reno, Nevada.
 - ✓ Covington, W. Presentation to AZ House of Representatives, Committee on Environment. "Restoring the Ecologic and Economic Integrity of Arizona's Forests and Watersheds." Phoenix, AZ. January 20, 2009. 20 attendees.
 - ✓ Smith, H.B. Doc. Presentation for the Coconino Rural Environmental Core (CREC) on January 28, 2009. Title of presentation was "Southwestern Ecosystems and Restoration." 37 attendees. Flagstaff, AZ. January 27, 2009.
 - ✓ Kalies, E.L. and W.W. Covington. 2009. The impacts of thinning and burning on wildlife species in southwestern ponderosa pine forests: a meta analysis. The Wildlife Society's Arizona and New Mexico 42nd Joint Annual Meeting, Gallup, New Mexico. February 5-7, 2009. 200 participants.
 - ✓ Laughlin, D.C. 2009. A tale of two forests: the functional consequences of vegetation dynamics. Invité séminaire de l'écologie à la Département de Biologie à l'Université de Sherbrooke, Sherbrooke, Quebec, Canada. March 10, 2009. 30 attendees.
 - ✓ Crisp, Debra L., Judith D. Springer, Michael T. Stoddard, Daniel C. Laughlin, and Barbara G. Phillips. Ecology and taxonomy of Rusby's milkvetch (*Astragalus rusbyi*), a rare endemic of Arizona's ponderosa pine forests. Changing Landscapes in the Southwest: Fifth Southwest Rare Plant Conference. March 16-20, 2009, Salt Lake City, UT. 50 attendees.
 - ✓ Springer, Judith D., David W. Huffman and Peter Z. Fule. Long-term responses of *Penstemon clutei* (Sunset Crater beardtongue) to root trenching and prescribed fire: clues for population persistence. Changing Landscapes in the Southwest: Fifth Southwest Rare Plant Conference. Salt Lake City, UT. March 16-20, 2009. 50 attendees.

- 7) Seeing is believing. Fortunately, many restoration treatments have been applied throughout the Southwest. The ERI will continue to take diverse audiences to the field to demonstrate and discuss the outcomes of forest restoration on ecological health and wildfire behavior.
- a. 15 Field Trips. **18 Completed.**
 - ✓ Brewer, D. Met with White Mountain Group and Apache/Sitgreaves Leadership Team to discuss landscape scale assessment. Pinetop, AZ. April 9, 2008.
 - ✓ Denton, C., D. Lund. Assisted NAU School of Forestry and RMRS make field presentations to Forest Service wildlife biologists at restoration research sites at Fort Valley. Flagstaff, AZ. April 16, 2008. 15 attendees.
 - ✓ Huffman, D.W. Field trip of pinyon-juniper research site (Tusayan District, Kaibab National Forest) for Joint Fire Science Program 'Road Tour'. May 7, 2008. Tusayan, AZ. 30 attendees.
 - ✓ Fulé, P.Z. 2008. Field trip presentation for Joint Fire Science Program "Roadshow" tour of fuel treatment sites. May 6, 2008. Fort Valley, AZ.
 - ✓ Denton, C. Field Trip as part of meeting with Planning Committee for Ruidoso WUI Working Group to discuss Perk-Grindstone Implementation and update for accomplishment map. Ruidoso, NM. May 8, 2008. 9 participants.
 - ✓ Lund, D. Arizona Game and Fish and ERI discussion and review of restoration treatments at Williams Plot. Flagstaff, AZ. May 14, 2008.
 - ✓ Denton, C. Discussed Landscape Scale Firescape Planning Project for Huachuca Mountains with Sherry Tune of Coronado NF. May 16, 2008.
 - ✓ Brewer, D. Field Trip associated with Greater Ruidoso Working Group and Upper Bonito Watershed Restoration Interdisciplinary meeting. Ruidoso, NM. June 2-4, 2008. 15 participants.
 - ✓ Lund, D. Field Trip with review of Jacob/Ryan proposed restoration project. Fredonia, AZ. June 13, 2008. 12 participants.
 - ✓ Springer, J.D. Consultation/field trip with Keith Pajkos (Arizona State Land Department) and JJ Smith (NAU Centennial Forest) regarding identification and habitat of endemic species at Centennial Forest. June 24, 2008.
 - ✓ Lund, D. Field Trip during consultation and follow-up with Rich Reynolds, Region 3 on restoration and Goshawk coordination. North Kaibab. July 1-3, 2008.

- ✓ Fulé, P.Z. 2008. Field trip presentation for the Society of Range Management. July 31, 2008. Grandview, AZ. 45 people.
- ✓ Covington, W., L. Murfitt, S. Rosenstock. Led a field trip for Larry Voyles, Director of AZ Game and Fish on "Restoration Treatments" at Ft. Valley and Gus Pearson Natural Area, Flagstaff, AZ. August 7, 2008.
- ✓ Murfitt, L., P. Fule. Led a field trip for Corey McDaniel and Clint Chandler of Senator Kyl's staff on "Restoration Treatments" at Ft. Valley and Gus Pearson Natural Area, Flagstaff, AZ. August 19, 2008.
- ✓ C. Denton, D. Brewer, D. Lund. Conducted Field trip as part of presentation to district personnel on restoration. September 22-24, 2008. North Kaibab Ranger District. 10 attendees.
- ✓ C. Denton. Monthly Wildland Urban Interface meeting and field trip to look at completed projects. October 27-29, 2008. Ruidoso, NM. 20 attendees.
- ✓ Smith, H.B. Doc. Field trip for the Coconino Rural Environmental Core (CREC) on January 27, 2009. The field trip was to show examples of Southwestern ecosystems and restoration results. 35 attendees. Flagstaff, AZ. January 28, 2009.
- ✓ Lund, D. Field trip related to presentation on ERI restoration mark and differences with ERI's and goshawk restoration prescriptions. North Kaibab Ranger District. January 29, 2009. 10 attendees.

Conclusion

This report documents completion of the work plan for FY'08 funding of \$1.969M. The ERI and its partners are grateful to the Forest Service for this financial support. This funding is focused on synthesizing and analyzing existing scientific information into fact sheets, white papers, working papers and peer-reviewed manuscripts; identifying wildlife habitat use in WUI treatment areas; and inventorying the impacts of landscape-level wildland fire use in ponderosa pine and other higher elevation forest types. We have also continued to work with NGOs and businesses to identify and refine methods for extracting and utilizing small diameter trees. These efforts will make substantial contributions to the advancement of forest restoration in the southwest.

Appendices

Appendix A: Reports and Summaries

Appendix B: Arizona Game and Fish Annual Report

Appendix C: Statewide Strategy and ForestERA Report

Appendix D: Rapid Assessments

Appendix E: Publications (sorted by Last Name)