

**ARIZONA GAME AND FISH DEPARTMENT  
 HABITAT PARTNERSHIP COMMITTEE  
 HABITAT ENHANCEMENT AND WILDLIFE MANAGEMENT PROPOSAL**

Game Branch / HPC Project Number:	15-210
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**PROJECT INFORMATION**

**Project Title:** Mule deer use and long-term dynamics of habitat quality on a restored forest landscape at Grand Canyon-Parashant National Monument

**Region and Game Management Unit:** Region II, Unit 13A

<b>Local Habitat Partnership Committee (LHPC):</b> <ul style="list-style-type: none"> <li>Arizona Strip Habitat Working Group</li> </ul>	<b>Was the project presented to the LHPC?</b> <b>YES</b> <input checked="" type="checkbox"/> <b>NO</b> <input type="checkbox"/> Presented to leadership members through email and phone conversations
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**Has this project been submitted in previous years?** YES NO  
**If Yes, was it funded?** YES NO → **Funded HPC Project #(s):**

**Project Type:** Monitoring and Evaluation

**Brief Project Summary:** In 1995, concern over poor forest health and downward mule deer population trends led the Ecological Restoration Institute (ERI) at Northern Arizona University, the Bureau of Land Management (BLM), and the Arizona Game and Fish Department (AZGFD) to join in a long-term partnership to implement restoration treatments on a large ponderosa pine landscape in the Uinkaret Mountains and Grand Canyon-Parashant National Monument (GCPNM). A main focus of the partnership was to investigate effects of treatments on habitat quality and population dynamics of select wildlife species. To accomplish this, the partnership invested considerable time, effort, and funding in treating nearly 4,000 acres. The ERI installed an extensive grid of monitoring plots to rigorously characterize and compare treatment outcomes in terms of forest structure and vegetation. **Forest and vegetation manipulations are commonly done to improve habitat for important wildlife species; however, long-term monitoring is often neglected, and thus learning from these sorts of projects and gaining information that might be useful for adaptive management can be limited.** This proposal seeks funding to analyze mule deer use of the landscape, conduct re-measurement of the monitoring plot network, and quantify long-term changes to mule deer habitat that have resulted from forest restoration treatments. **We propose this as a two-year project (2016-2017), with a funding request of approximately \$100,000 per year. The Ecological Restoration Institute will provide matching funds of approximately \$110,000 - \$130,000 per year** (see Itemized Use of Funds). This project is unique in the following important ways: 1) The project provides a one-of-a-kind opportunity to document 20-year effects of landscape-scale restoration on mule deer habitat quality and use. No other study landscape of this size, having rigorous pretreatment and long-term post-treatment monitoring data, exists in the Southwest; 2) Information from the project will help the BLM develop long-term strategies for conserving mule deer populations and restoring high-quality habitat (a new vegetation management plan for the areas is currently being prepared).; 3) The project will enable comparison of deer habitat and use between treated and untreated areas. 4) The project will deliver critical science to wildlife managers, policy makers, researchers, and interested stakeholders. 5) The project will provide learning opportunities to forestry and wildlife management students at Northern Arizona University.

**Big Game Wildlife Species to Benefit (% benefit per species) :** Mule deer (100%)

<p><b>Implementation Schedule</b> (Month/Day/Year):</p> <p><u>Project Start Date:</u> April 1, 2016</p> <p><u>Project End Date:</u> March 31, 2018</p>	<p><b>Environmental Compliance:</b></p> <p>NEPA Completed: Yes[] No[] N/A[X]                  Projected Completion Date: _____</p> <p>State Historic Preservation Office - Archaeological Clearance:                  (Provide Attachment)                  Yes[] No[] N/A[X]                  Projected Completion Date: _____</p> <p>Arizona Game and Fish Department EA Checklist: N/A[X]                  To be Completed by: _____                  Projected Completion Date: _____</p>
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**PROJECT FUNDING**

<b>Special Big Game License Tag Funds Requested:</b>	\$ 202,534
<b>Cost Share or Matching Funds:</b>	\$ 240,458
<b>Total Project Costs:</b>	<b>\$ 442,992</b>

**PARTICIPANT INFORMATION**

<p><b>Applicant</b> (please print): David W. Huffman</p>	<p><b>Address:</b> Box 15017                  Ecological Restoration Institute                  Northern Arizona University                  Flagstaff, AZ 86011-5017</p>	<p><b>E-mail:</b> David.Huffman@nau.edu</p>
<p><b>Telephone:</b> (928) 523-7528</p>		<p><b>Date:</b> 08/28/2015</p>

**AGFD Contact and Phone No.** (If applicant is not AGFD personnel):  
 Luke Thompson (928) 856-0724; James deVos (609) 942-3000

**Project has been coordinated with:**  
 Luke Thompson (AGFD) 928) 856-0724

**NEED STATEMENT – PROBLEM ANALYSIS:**

The Uinkaret Mountains form an island of forested uplands among the arid woodlands, shrublands and sandy deserts north of the Grand Canyon and west of the Kaibab Plateau. These mountains of the Arizona Strip are renowned for large-antlered, trophy-class mule deer (*Odocoileus hemionus*) bucks. However, despite their remoteness and importance for mule deer, the forests of these mountains have been heavily impacted by over a century of logging, grazing, and fire exclusion, and have become densely overgrown with young trees like most of the ponderosa pine forests around the Southwest (Covington and Moore 1994, Waltz et al. 2003). These conditions are far departed from those of the more open forests, which were dominated by large old trees and diverse understory plant communities prior to Euro-American settlement of the region and associated changes in land use. Closed, dense forest conditions led to serious concern among public resource managers for protection and conservation of ecosystem services and habitat for wildlife and important plant species. To address these concerns the Ecological Restoration Institute (ERI) at Northern Arizona University, the Bureau of Land Management (BLM), and the Arizona Game and Fish Department (AZGFD) developed a partnership in 1995 to implement ponderosa pine restoration treatments and study ecosystem responses on a large (approximately 4000 acres) landscape in Grand Canyon-Parashant National Monument (GCPNM) in the Uinkaret Mountains of northwestern Arizona. Prior to this project, relatively little science-based information was available concerning operational restoration approaches or resource responses to restoration treatments on southwestern ponderosa pine landscapes.

In order to examine landscape-scale responses, particularly those of wide-ranging wildlife such as mule deer, over 250 ecosystem monitoring (EM) plots were installed along a broad systematic sampling grid. From 1995 through 1997 the ERI collected baseline, pretreatment data related to forest structure, fuels, and vegetation on these plots and in partnership with AZGFD and BLM, a number of wildlife studies were initiated. Restoration treatments that included thinning and reintroduction of low-intensity fire were implemented on treatment units across the landscape. An area of just over 850 acres was left untreated as a control landscape for comparison. A subset of the EM plots were periodically remeasured over the 13-18 years since treatment implementation. Utilizing plot data and study design, numerous investigations covering a wide range of topics have been completed and published in peer-reviewed scientific journals, technical reports, and graduate theses and dissertations (see Appendix I). Many of these were translated into working papers and fact sheets for managers and stakeholders. The most recent remeasurement of the EM plots was done in 2003.

A limited number of studies have examined effects of these landscape-scale restoration treatments on mule deer use and habitat quality. For example, Horncastle et al. (2013) documented intensive use of the treated landscape by female mule deer. Germaine et al. (2004) found the mid-story oak (*Quercus gambelii*) in restored management units provided thermal and hiding cover for day-bed sites. McGlone et al. (2009) found greater herbaceous plant abundance and species richness in the treated experimental units compared with paired, untreated control units; however, cheatgrass (*Bromus tectorum*), and annual exotic grass also became a dominant species. **Although these studies have been helpful for developing adaptive strategies for restoration of forests in the Southwest, additional information concerning fine scale patterns of deer use and long-term treatment effectiveness would significantly extend the contribution of the studies at the site. Accomplishment of the project objectives will result in new information relevant to long-term ecosystem restoration and improvement of mule deer at fine- to landscape-scales.** Close collaboration among ERI, AZGFD, and BLM partners will ensure that information produced is relevant and effectively transferred to resource managers and stakeholders. Work done under this proposal will lead to publication of at least two peer-reviewed journal articles as well as research summary reports for resource managers and stakeholders, an informational web page, and field workshops.

#### *Literature Cited*

- Germaine, S.S., H.L. Germaine, and S.R. Boe. 2004. Characteristics of mule deer day-bed and forage sites in current-condition and restoration-treated ponderosa pine forest. *Wildlife Society Bulletin* 32:554-564.
- Horncastle, V.J., R.F. Yarborough, B.G. Dickson, and S.S. Rosenstock. 2013. Summer habitat use by adult female mule deer in a restoration-treated ponderosa pine forest. *Wildlife Society Bulletin* 37:707-713.
- McGlone, C.M., J.D. Springer, and W.W. Covington. 2009. Cheatgrass encroachment on a ponderosa pine forest ecological restoration project in northern Arizona. *Ecological Restoration* 27:37-46.

#### **PROJECT OBJECTIVES:**

1. Describe current mule deer use of restoration treatment areas across the GCPNM landscape;
2. Evaluate abundance and distribution of important habitat elements such as forest structure, mid-story woody vegetation, and understory plants;
3. Analyze links between mule deer use, fine-scale habitat characteristic, and restoration treatment (e.g., tree thinning, tree thinning and prescribed fire, multiple entries with prescribed fire), and;
4. Analyze long-term (20-year) changes in habitat quality and treatment effectiveness using previously collected data.

## **PROJECT DESCRIPTION AND STRATEGIES:**

### *Measurement of Mule Deer Use*

Mule deer use will be quantified using a pellet count method. All ecosystem monitoring (EM) plots (treated and untreated areas) will be visited in early summer and existing pellet groups will be removed from within the plot area. Plots will be revisited twice, in mid- and late-summer, and new pellet groups on plots will be counted and removed. During these plot visits, other signs of mule deer use (antler rubs, tracks, day-beds) will be documented. Lastly, camera traps will be installed in early-, mid- and late-summer at up to three water source in both treated and untreated areas. Camera traps will be left in place for two weeks during each of the three periods.

### *Remeasurement of Ecosystem Monitoring (EM) Plots*

Habitat quality will be determined through remeasurement of EM plots. The rectangular, 66 x 164-ft, monitoring plots were adapted from the National Park Service's Fire Monitoring protocols and installed in 1996-1997. At time of establishment, plots were measured for baseline pre-treatment overstory and sapling tree density, canopy cover, tree regeneration density, woody surface fuel loading, and understory abundance and composition. In addition, increment cores were collected from large and old trees as well as a subsample of smaller trees in order to reconstruct historical pre-fire exclusion conditions using techniques of dendrochronology. In 2003, plots on approximately half the mechanically treated units, and all of the plots within the untreated control, were remeasured. We propose to remeasure all forest structure, fuels, and vegetation variables on all EM plots on both treated and untreated areas of the landscape over two field seasons (2016 and 2017). In order to accurately compare long-term landscape responses to restoration treatments, remeasurements will follow protocols and standards set out at the initiation of the project. Plot layout and sampling details can be found in Roccaforte et al. (2008)

### *Analysis*

Mule deer abundance will be estimated from pellet group counts recorded in the field using the PELLET program for Microsoft Excel. Deer abundance on treated plots will be compared with untreated plots using standard statistical means tests (e.g., Student's t-test). Additionally, surface maps of deer abundance will be developed using interpolation techniques. Maps will be classified and analyzed to characterize spatially explicit landscape patterns of deer abundance. Other signs of deer use will be categorized and summarized using descriptive statistics. Camera trap images capturing deer will be counted and analyzed similar to methods described in published literature. Deer use indicated by images will be compared between treated and untreated areas. Maps from these data will be constructed and analyzed as described above for abundance based on pellet counts.

Mule deer habitat quality will be evaluated by quantifying important structural elements on EM plots. Habitat elements include stand basal area, abundance of mid-story woody vegetation, and herbaceous understory composition. Quantities will be compared between treated and untreated areas. Long-term changes in habitat elements among treated and untreated areas will be analyzed and models that include time since treatment and treatment type will be explored. In addition, we will develop multivariate habitat indices using structural elements as well as biophysical attributes of the EM plots. We will develop landscape maps using spatially explicit index values. Maps will be analyzed to examine spatial patterns of habitat quality across the landscape.

Maps of mule deer use and habitat quality will be overlaid to display spatial relationships. Relationships among deer use and habitat quality variables will be tested using correlation analysis (e.g. Spearman's rank correlation test). Other models that characterize spatially explicit relationships between deer use and habitat will be explored.

## **PROJECT LOCATION**

The study will be conducted on a large landscape (~4000 acres) within the Grand Canyon-Parashant National Monument (GCPNM) in northwestern Arizona (lat. 36.371003, long. -113.171200 (WGS84)).

## **LAND OWNERSHIP AT THE PROJECT SITE(S):**

USDI Bureau of Land Management

## **HABITAT DESCRIPTION:**

The GCPNM is within the Arizona Strip District, managed by the Bureau of Land Management (BLM). Elevation at the site ranges 6,560-7380 ft and receives an average of about 18.5 inches of precipitation annually. Temperature in January averages 34° F and 70° F in July. Soils are volcanic, derived from basalt parent material. Vegetation on all three landscapes is dominated by ponderosa pine, with lesser amounts of Gambel oak, Utah juniper, pinyon pine, and New Mexico locust.

A large portion (~3000 acres) of the landscape was treated with restoration-based tree thinning 1996 – 2002. Prior to treatment, tree density and basal area (BA) of the landscape averaged 318 trees per acre (TPA) and 142 ft<sup>2</sup> acre<sup>-1</sup>, respectively. Treatment prescriptions were based on site-specific reference conditions as evidenced by old trees, snags, logs, and stumps. Old (presettlement (1870); > 127 years) and large (>27.5 inches diameter at breast height (4.5 ft)) live trees were retained. In addition, an average of 1.5 - 3 younger, smaller trees per each dead presettlement tree structure (snag, logs, and stumps) (i.e. estimated to have been alive in 1870). These so-called “replacement” trees were selected by proximity to dead presettlement structures in order to precisely emulate historical spatial arrangement. Following thinning, treated units were burned with prescribed fire to manage slash and woody surface fuels. After treatment, tree density and BA averaged 162 TPA and 82 ft<sup>2</sup> ac<sup>-1</sup>, respectively. A smaller portion of the landscape (~900 acres) was left as an untreated control. The control showed tree density of 353 TPA and BA of 142 ft<sup>2</sup> ac<sup>-1</sup> in 2003.

## **ITEMIZED USE OF FUNDS:**

### Special Big Game License Tag Funds

#### **Personnel**

Ecological Restoration Institute Staff and Field Technicians

YR 1: \$76,854

YR 2: \$78,668

#### **Materials and Supplies**

YR 1: \$3,400

YR 2: \$400

#### **Travel**

YR 1: \$12,900

YR 2: 11,900

#### **Indirect Costs**

YR 1: \$9,315

YR 2: 9,097

### Cost Share or Matching Funds (for volunteer labor rates please refer to the worksheet below)

#### **Personnel**

Ecological Restoration Institute Staff and Field Technicians

YR 1: \$31,610

YR 2: \$47,110

**Materials and Supplies**

YR 1: \$3,400

YR 2: \$400

**Travel**

YR 1: \$12,900

YR 2: 11,900

**Indirect Costs**

YR 1: \$64,038

YR 2: 69,100

Total Project Cost

YR 1: \$214,417

YR 2: \$228,575

**LIST COOPERATORS AND DESCRIBE POTENTIAL PARTICIPATION:**

Tim Burke, District Manager, Arizona Strip District, Bureau of Land Management

- Administrative support to project.

Brian Bock, Fire Ecologist, Grand Canyon Parashant National Monument, Bureau of Land Management

- Logistical support, treatment data layers, treatment details.

Mark Rosenthal, Fire Management Officer, Grand Canyon National Monument, Bureau of Land Management

- Logistical support, treatment details, communication

**WOULD IMPLEMENTATION OF THIS PROJECT ASSIST IN PROVIDING, MAINTAINING, OR FACILITATING RECREATIONAL ACCESS?**

YES[] NO[X] N/A[]

**PROJECT MONITORING PLAN:**

This proposal is specifically for habitat monitoring. Please see

**PROJECT MAINTENANCE:**

This project will require little maintenance. EM plots markers and tree tags will be re-established in the field. Data will be archived in MS Access databases maintained by the Ecological Restoration Institute at Northern Arizona University. Metadata, images, technical reports will be stored and on computer servers at the Ecological Restoration Institute. All electronic files are regularly backed up and archived in a secure location.

**PROJECT COMPLETION REPORT TO BE FILED BY:**

David W. Huffman

**WATER DEVELOPMENT PROJECTS (please use the worksheet below):**

N/A

**TREE CLEARING/REMOVAL PROJECTS (please use the worksheet below):**

N/A

**ATTACHMENTS:**

(Please provide cultural clearance documentation from land management agency, e.g., FONSI, Inventory Standards, etc. Also attach any project pictures)