



2022 Report

# 2022

# ANNUAL

# REPORT

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JOHN T. HARRINGTON  
FORESTRY RESEARCH CENTER

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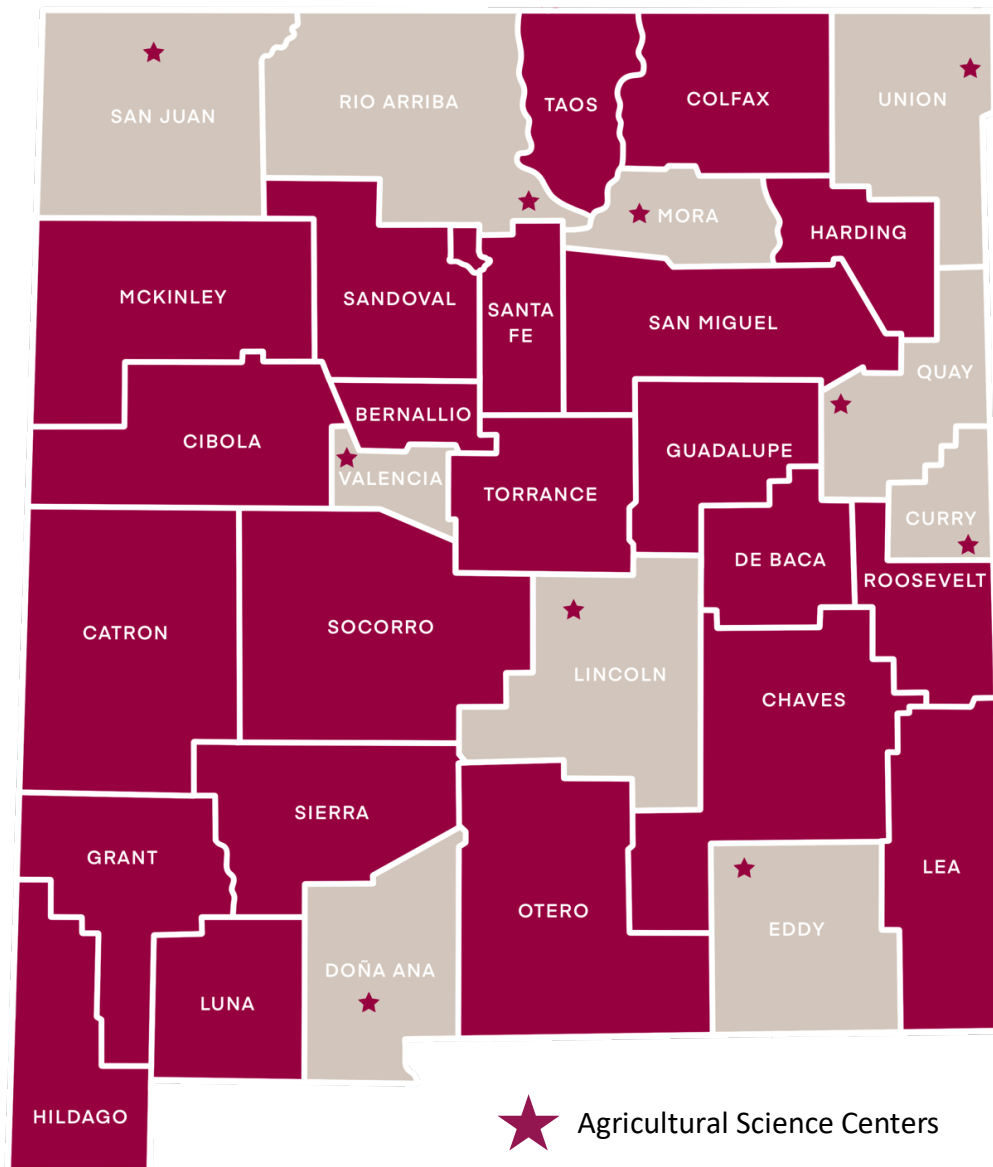
## Notice to Users of this Report

This report has been prepared to aid Science Center staff in analyzing the results of various research projects from the past year and to record data for future reference. These are not formal Agricultural Experiment Station Report research results. The reader is cautioned against drawing conclusions or making recommendations as a result of the data in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report. Although staff members have made every effort to check the accuracy of the data presented, this report was not prepared as a formal release.

None of the data are authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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# Agricultural Science Center Locations Map



## Table of Contents

<b><i>Notice to Users of this Report</i></b> .....	<b>2</b>
<b><i>Agricultural Science Center Locations Map</i></b> .....	<b>3</b>
<b><i>Executive Summary</i></b> .....	<b>5</b>
<b><i>Research Projects</i></b> .....	<b>6</b>
<b><i>Grants and Contracts</i></b> .....	<b>11</b>
<b><i>Research Publications</i></b> .....	<b>11</b>
<b><i>Cooperators and Collaborators</i></b> .....	<b>12</b>
<b><i>Outreach Activities</i></b> .....	<b>13</b>
<b><i>Advisory Committee</i></b> .....	<b>14</b>
<b><i>Personnel</i></b> .....	<b>14</b>

## Executive Summary

The largest fire in New Mexico's history started on April 6, 2022, near Las Vegas, NM. With the threat of the fire moving towards the JTH Forestry Research Center (JTH FRC), the staff of the JTH FRC mobilized to move the entire seed bank (approximately 3 million seeds) twice, once to Las Vegas and the second time to Los Lunas AES. Staff were all evacuated from the property on April 24th. Six days later on May 1, the fire had grown to over 98,000 acres and finally reached the property of the JTH FRC. We were unclear about the status of the center and the 90,000 seedlings that were still at the facility with no one there to care for them. On May 3, we were granted special access with a police escort to rescue as many seedlings as possible. With the help of Dr. Leslie Edgar, Shad Cox, the entire JTH FRC staff, and staff from EMNRD's Forestry Division, our team came to Mora with 4 trailers and were able to rescue 70,000 seedlings. These seedlings were taken to Santa Fe where they were housed in a greenhouse for the next month plus while we all waited out the fire. In total, the Hermit's Peak / Calf Canyon Fire burned 341,735 acres. Additional forest fires in New Mexico made 2022 one of the most destructive in history with a total of 904,422 acres.

Since 2002, including the recent fires of 2022, over 5.6 million acres have burned in New Mexico. As a result of these devastating fires, reforestation needs in the state and the entire western US have grown significantly. This backlog will continue to grow because the area burned by high-severity fire is predicted to increase. Currently, the USDA Forest Service and other national and state programs do not have the capacity to meet reforestation needs due to significant gaps across the entire reforestation pipeline. The USDA Forest Service, Region 3 (New Mexico and Arizona) currently needs 5 million seedlings per year for the next 10+ years (Jim Youtz, USDA Forest Service, R3 Regional Silviculturists, personal communication, May 2022). Capacity limits across the reforestation pipeline, however, affect the ability to meet defined needs (Youtz, pers. commun.). Region 3 has minimal seed collection and seed banking, no federal nursery, and an increasing number of acres that require reforestation.

To help meet these reforestation demands in the state and region, the New Mexico Reforestation Center (NMRC) was officially formed in 2022. The NMRC is a formal partnership between New Mexico State University (NMSU), New Mexico Highlands University (NMHU), University of New Mexico (UNM), and the Forestry Division of New Mexico's Energy, Minerals, and Natural Resource Department (EMNRD FD). The NMRC's mission is to meet current and future regional reforestation needs through its comprehensive seed bank, nursery, and planting operations combined with research, education, and outreach activities. The NMRC is currently exploring federal and state funding options to support the creation of the infrastructure and supporting resources that will address all reforestation needs for the state.

Currently, the JTH FRC is the only program in the four corner states (NM, UT, AZ, and CO) focusing research efforts along the entire reforestation pipeline (seed, nursery, and outplanting). It is also only one of five programs in the entire country dedicated to researching the reforestation pipeline, making it extremely competitive to respond to reforestation challenges, locally and nationally. In 2022, the JTH FRC produced 2 publications addressing: 1) the water use efficiency of ponderosa pine seedlings and 2) identifying alternatives to fencing for forest restoration: tube shelters outperform mesh shelters. Research continues to focus on critical topics such as assisted migration and seed transfer guidelines in response to climate change, seedling-based aspen restoration, planting strategies that promote long-term improvements to water resources, and drought-conditioning seedlings during nursery products.

## Research Projects:

Evaluating vegetation control and animal protection measures for post-fire reforestation of ponderosa pine – Investigators: Dr. Owen Burney (PI) and Dr. Joshua Sloan

Optimizing outplanting strategies of ponderosa pine in a post-fire environment through seedling size, planting windows, and nursery conditioning – Investigators: Dr. Owen Burney (PI) and Dr. Joshua Sloan

Using nucleation planting strategies for ponderosa pine post-fire reforestation – Investigators: Dr. Owen Burney (PI), Dr. Joshua Sloan, and Dr. Aalap Dixit

Comparison of aspen planting densities under a nucleation planting strategy – Investigators: Dr. Owen Burney (PI), Dr. Joshua Sloan, and Dr. Aalap Dixit

Comparison of stock size and drought conditioning treatments of outplanted aspen seedlings in a post-fire environment – Investigators: Dr. Owen Burney (PI), Dr. Joshua Sloan, and Dr. Aalap Dixit

Assessing log and snag microsites for reforestation of aspen in a post-fire environment – Investigators: Dr. Owen Burney, Dr. Karen Mock, and Dr. Larissa Yocom (PI)

Physiological and morphological responses of *Pinus ponderosa* seedlings to moisture limitations in the nursery and their implications for restoration – Investigators: Dr. Owen Burney, Dr. Joshua Sloan, and Dr. Jeremy Pinto (PI)

*Pinus ponderosa* carbon modeling and provenance test – Investigators: Dr. Owen Burney (PI) and Dr. Aalap Dixit

## Evaluating vegetation control and animal protection measures for post-fire reforestation of ponderosa pine

**Investigators:** Dr. Owen Burney (PI) ([oburney@nmsu.edu](mailto:oburney@nmsu.edu)) and Dr. Joshua Sloan

**Project Overview:** The focus of this study is to compare planted ponderosa pine seedlings under an interaction of animal protection methods (fencing and tree shelters) and vegetation management intensities (none, partial, complete control) to improve reforestation success. Additionally, this research will examine the cost-effectiveness of these treatments.

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** NSF/CREST



## Optimizing out planting strategies of ponderosa pine in a post-fire environment through seedling size, planting windows, and nursery conditioning

**Investigators:** Dr. Owen Burney (PI) ([oburney@nmsu.edu](mailto:oburney@nmsu.edu)) and Dr. Joshua Sloan

**Project Overview:** The focus of this study is to optimize seedling performance by comparing stock size (10 and 30 cubic-inch containers), planting window (summer, fall, spring), and use of drought condition treatments in the nursery

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** NSF/CREST

## Using nucleation planting strategies for ponderosa pine post-fire reforestation

**Investigators:** Dr. Owen Burney (PI), Dr. Joshua Sloan, Dr. Aalap Dixit

**Project Overview:** The short-term objective (0 – 5 years) is to understand what combination of nucleation size and planting density promotes greater survival and growth for individual ponderosa pine seedlings. The long-term objective (10 – 30 years) is to determine which treatment combination will result in a rapid expansion from each nucleus

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** NSF/CREST



## Comparison of aspen planting densities under a nucleation planting strategy

**Investigators:** Dr. Owen Burney (PI) ([oburney@nmsu.edu](mailto:oburney@nmsu.edu)), Dr. Joshua Sloan, Dr. Aalap Dixit

**Project Overview:** The short-term objective (0 – 5 years) is to understand which planting densities promote greater survival and growth for individual aspen seedlings. The long-term objective (10 – 30 years) is to determine which densities will promote successful reforestation

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impacts:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** NSF/CREST





## Comparison of stock size and drought conditioning treatments of outplanted aspen seedlings in a post-fire environment

**Investigators:** Dr. Owen Burney (PI) ([oburney@nmsu.edu](mailto:oburney@nmsu.edu)), Dr. Joshua Sloan, and Dr. Aalap Dixit

**Project Overview:** The focus of this study is to optimize seedling performance by comparing stock size (10 and 30 cubic-inch containers), planting window (summer, fall, spring), and use of drought condition treatments in the nursery

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth



**Funding Acknowledge:** NSF/CREST

## Assessing log and snag microsites for reforestation of aspen in a post-fire environment

**Investigators:** Dr. Owen Burney, Dr. Karen Mock, Dr. Larissa Yocom (PI) ([larissa.yocom@usu.edu](mailto:larissa.yocom@usu.edu))

**Project Overview:** The focus of this study is to understand the influence of log and snag microsites (i.e., soil moisture, shading, etc) on outplanted aspen seedling performance

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** NSF/CREST, USDA McIntire Stennis

## Physiological and morphological responses of *Pinus ponderosa* seedlings to moisture limitations in the nursery and their implications for restoration

**Investigators:** Dr. Owen Burney, Dr. Joshua Sloan, Dr. Jeremy Pinto (PI) ([Jeremiah.Pinto@usda.gov](mailto:Jeremiah.Pinto@usda.gov))

**Project Overview:** The objective of this study was to examine the effects of reduced water delivery during the nursery growth phase on the structure and function of *P. ponderosa* to improve survival and growth on dry, harsh outplanting sites. Additionally, this study assessed, to a limited extent, the potential interactions between seed source (i.e., genetic influence) and water limitations during nursery production (i.e., environmental influence)

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** USDA McIntire Stennis

## *Pinus ponderosa* carbon modeling and provenance test

**Investigators:** Dr. Owen Burney (PI) ([oburney@nmsu.edu](mailto:oburney@nmsu.edu)) and Dr. Aalap Dixit

**Project Overview:** Assess the effects of climatic changes across 75 sources of ponderosa pine on survival, growth, physiological parameters, and carbon sequestration over 10 years of growth

**Meeting the Needs of New Mexico:** This research will benefit all communities of New Mexico due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources

**Impact:** Results from this research are and will continue to be used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth

**Funding Acknowledge:** USDA McIntire Stennis

## Grants and Contracts

- CREST Center for Forest Restoration Triangle; Sponsor: NSF; Amount: \$1,057,671; Status: Funded; Burney, O. (Principal); (December 15, 2019 – December 15, 2024).
- Tree Improvement and Forest Plan; Sponsor: EMNRD; Amount: \$8,000; Status: Funded; Burney, O. (Principal); (July 1, 2021 - June 30, 2022)
- Seedling Conservation for EMNRD Forestry Division; Sponsor: EMNRD; Amount: \$53,964; Status: Funded; Burney, O. (Principal); (December 9, 2021 - March 31, 2023)
- Climate-smart reforestation after severe fire in New Mexico; Sponsor: TNC; Amount: \$142,000; Status: Funded; Haffey, C. (Principal), Bradley, A. (Co-Principal), Burney, O. (Co-Principal); (January 1, 2020 – December 31, 2022)
- McIntire Stennis; Sponsor: USDA; Amount \$30,000; Status: Funded; Burney, O. (Principal); (October 1, 2022 – September 30, 2023)
- Climate-modeling for reforestation in the SW; Sponsor: USDA/UNM; Amount: \$12,600; Burney, O. (Principal); (January 1, 2022 – December 31, 2022)
- Colorado Reforestation; Sponsor: TNC; Amount: \$12,000; Status: Funded; Burney, O. (Principal); (January 1, 2022 – December 31, 2022)
- Urban Tree Improvement Program; Sponsor: EMNRD; Amount: \$2,137; Status: Funded; Burney, O. (Principal); (January 1, 2022 – December 31, 2022)

## Research Publications

- Dixit A, Kolb T, Burney OT (2022) Trade-off between growth rate and water use efficiency in southwestern ponderosa pine provenances. *Forest Ecology and Management*, doi.org/10.1016/j.foreco.2022.120239 (Contributions: Design, Implementation, Writing, Review)
- Thyroff EC, Burney OT, Oliet JA, Redick CH, Jacobs DF (2022) Toward identifying alternatives to fencing for forest restoration: tube shelters outperform mesh shelters for deer browsing protection of live oak, *Quercus virginiana*. *Land*, doi.org/10.3390/land11070966 (Contributions: Design, Implementation, Writing, Review)
- Pinto JR, Sloan JL, Ervan G\*, Burney OT (2022) Physiological and morphological responses of *Pinus ponderosa* seedlings to moisture limitations in the nursery and their implications for restoration. *Frontiers in Plant Science*. Submitted. (Contributions: Design, Implementation, Analysis, Writing, Review)

## Cooperators and Collaborators

### **Other Universities**

- New Mexico Highlands University
- Utah State University
- Colorado State University
- Purdue University
- Northern Arizona University
- University of New Mexico
- University of Hawai'i
- University of Alberta

### **State of New Mexico**

- New Mexico Forest and Watershed Restoration Institute
- State Forestry Division, New Mexico EMNRD

### **Federal Agencies**

- National Park Service
- US Forest Service
- US Geological Survey

### **Non-government Organizations**

- Institute of Applied Ecology
- Philmont Scout Ranch – Boy Scouts of America
- The Nature Conservancy
- International Union of Forest Research Organizations

### **Tribal**

- Santa Clara Pueblo
- Jemez Pueblo

### **Industry**

- Imerys Minerals

## Outreach Activities

- Forestry Roundtable (October 13, 2022) – Invitation to Mora/San Miguel County community members to discuss post-fire responses including reforestation. The roundtable consisted of Dr. Owen Burney, Dr. Joshua Sloan, USDA Forest Service Chief Randy Moore, USDA Undersecretary Homer Wilkes, USDA Undersecretary Robert Bonnie, and State Forester Laura McCarthy.



## Advisory Committee

- Owen Burney, New Mexico State University
- Josh Sloan, New Mexico Highlands University
- Alan Barton, NM Forest & Watershed Restoration Institute
- Matt Piccarello, The Nature Conservancy
- Linda Nagel, Utah State University
- Lindsay Quam, NM State Forestry Division
- Daniel Denipah, Santa Clara Pueblo
- Jim Youtz, USDA Forest Service
- Eytan Krasilovsky, Forest Stewards Guild

## Personnel

- Dr. Owen Burney - Professor, and Director
- Tammy Parsons - Nursery Manager
- Pouli Sikelianos - Research Assistant
- Josh Trujillo - Ag Science Center Laborer
- Donna Ebler - Fiscal Assistant
- Marisol Martinez - Student Intern