The NMSU Agricultural Experiment Station supports research that is addressing real-world problems. Research is at the core of NMSU’s mission to improve upon the lives of people globally.

https://morasc.nmsu.edu/
Notice to Users of This Report

This report has been prepared to aid Science Center staff in analyzing the results of the 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 is authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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MISSION

The center aims to advance the understanding of the effects of restoration activities on forested areas in New Mexico through multidisciplinary research, education, and stakeholder collaborations. It also will provide science-based solutions for private, tribal, state, and federal forest managers, who face the threat of catastrophic fires due to overgrown forests and the inability of post-fire plant communities and ecosystems to naturally regenerate after such fires.
NMSU Agricultural Experiment Stations
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Introduction

Reforestation needs in New Mexico are currently estimated to be between 1 to 2.6 million acres, which would require 150 to 390 million seedlings. The current seedling production capacity in the state of New Mexico is approximately 300,000 seedlings per year, well below the needs of the state. The New Mexico Forestry Division, New Mexico Highlands University, New Mexico State University, and the University of New Mexico are collaborating to reforest these burned landscapes through the creation of the New Mexico Reforestation Center. The New Mexico Reforestation Center will be essential to restore the forests of New Mexico by 1) increasing nursery production to 5 million seedlings per year, 2) supporting forest-based economic growth in the state, and 3) using science-based approaches to meet New Mexico's reforestation goals. The mission of the New Mexico Reforestation Center shall be to meet current and future reforestation needs in New Mexico through its comprehensive seed bank, nursery, and planting operations combined with research, education, and outreach activities. In 2021, the partners of the New Mexico Reforestation Center drafted a Memorandum of Agreement (MOA) that outlines the role of each partner in developing and operating the proposed New Mexico Reforestation Center. The MOA will be signed in January of 2022 by all four partners.

Currently, the JTH Forestry Research Center with the Agricultural Experiment Station system at NMSU 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 out-planting). 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 2021, the JTH FRC produced 5 publications addressing: 1) challenges to the reforestation pipeline in the United States, 2) understanding runoff and sediment yield under different thinning operations, 3) genetic and ecological variation factors that influence Cercocarpus montanus restoration, 4) a review of postfire landscape management in southwestern US forests, and 5) provenance variation in Pinus ponderosa in three common gardens.

During the 2021 growing season, the JTH FRC produced approximately 138,000 seedlings for forest restoration purposes for a range of organizations that includes the New Mexico Forestry Division, The Nature Conversancy (Colorado and New Mexico), Northern Arizona University, and Stephen Austin University (Texas). At a planting density of 150 trees per acre, this equates to approximately 920 acres of restored forests in New Mexico.
Meeting the needs of New Mexico

New Mexico's forests supply many valuable resources to its citizens, including 50% to 75% of all water used by municipalities and agriculture. However, forest health in New Mexico and the greater southwestern region is in decline due to a combination of factors that include historic fire suppression, increased fuel densities, increased drought, and a lack of proper forest management. As a result, these dense forests are experiencing some of the most destructive wildfires in history. Many of these forests that succumb to these high-severity fires are not growing back naturally resulting in a loss of forests in New Mexico and the region. Therefore, it is critical to invest in a reforestation program (research, education, outreach, and production) for the state that will help to benefit forest health, water quality and quantity, carbon sequestration, wildlife habitat, recreation, and many other valuable resources. The JTH Forestry Research Center (JTH FRC) with the Agricultural Experiment Station system at NMSU 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 out-planting).
# Financial Summary

**Mora Research Center**  
**Fiscal Year:** 2021  
**Fiscal Period:** 14

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**Total Restricted Funds**  
$1,010,067.45  
$242,258.80  
$767,808.65

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**Total Sales and Service Funds**  
$21,651.25  
$12,100.00  
$73,851.31  
($61,751.31)  
($233,933.94)

* See Note

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**Total State Appropriated Funds**  
$108,578.02  
$112,796.60  
($4,218.58)

Note: "( )" in the fund balance column indicates a positive number
Research and Outreach Projects

A. Evaluating vegetation control and animal protection measures in a post-fire restoration environment – CREST research

Objective

Compare the interaction of animal protection methods and vegetation management intensity to understand the effectiveness of each treatment and the related cost-effectiveness.

Impacts and Results

- Ponderosa pine seedlings were planted at the Philmont Scout Ranch research site in July 2021.
- Aspen research sites have been identified.
- MS student with NMSU continuing work on this research.

B. Optimizing outplanting strategies in a post-fire environment through seedling size, planting windows, and nursery conditioning – CREST research

Objective

Examine the impacts of planting windows, container size, and drought-conditioned seedlings on seedling performance in the field.

Impacts and Results

- Ponderosa pine seedlings were planted at the Philmont Scout Ranch research site in July 2021.
- Aspen research sites have been identified.
- MS student with NMSU continuing work on this research.

C. Using nucleation strategies in post-fire environments – CREST research

Objective

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 seedlings. The long-term objective (10 – 30 years) is to determine which treatment combination will result in a rapid expansion from each nucleus.

Impacts and Results

- Over 8,000 ponderosa pine seedlings were planted in October 2021 at the Philmont Scout Ranch.
- Aspen research sites have been identified.

D. Challenges to the reforestation pipeline in the United States.

Objective

To identify regional limitations and potential solutions in the reforestation pipeline (i.e., seeds, nurseries, outplanting, and post-planting activities).
Impacts and Results

- Publication in *Frontiers in Forest and Global Change* in February 2021.
- This publication received media attention in *National Geographic*.
- Language in this publication was used in US Senate Bill 2836 – *America’s Revegetation and Carbon Sequestration Act of 2021*, sponsored by Senator Joseph Manchin.

### E. Genetic variation in aridity adaptation among *Pinus ponderosa* populations.

**Objective**
The objective of this study is to examine the aridity adaptability of ponderosa pine populations from a range of temperatures and precipitation.

**Impacts and Results**
- One paper was published in 2021 in the journal *Forests*.
- One Ph.D. student, Aalap Dixit, completed their degree in March 2021.

### F. *Pinus ponderosa* provenance test and assisted migration assessment.

**Objectives**
Assess the effects of climatic changes across 75 sources of ponderosa pine on survival, growth, and physiological parameters.

**Impacts and Results**
- Thinned provenance test by reducing 50% of the density
- Collected data on whole tree carbon sequestration for more detailed analyses related to climate change.

*See Appendix A for more details on current research*
Activities and Publications

A. Field Day

On 10 September 2021, the JTH Forestry Research Center held a field day that had 22 participants. The focus of Field Day was to tell the story about the current state of forest management, the impacts of wildfire, the use of reforestation as a tool to restore burned landscapes, and the challenges we face in reforesting these landscapes. One state House Representative, Roger Montoya, attended the Field Day.

B. Tree Planting Training

On 1 September 2021, Dr. Owen Burney conducted a tree planting training with the Forest Stewards Guild, Jemez Pueblo, and Trees, Water, People organizations. About 35 people attended.

C. 2021 Conservation Seedling Production

- 138,000 seedlings were produced during the 2021 growing season.
- These seedlings were produced for:
  - New Mexico Forestry Division, EMNRD (New Mexico)
  - The Nature Conservancy (New Mexico)
  - National Forest Foundation (Regional)
  - Stephen F Austin State University (Texas)
  - Northern Arizona University (Arizona)
  - Ecoculture (Arizona)
  - Philmont Scout Ranch (CREST research)
  - NM Forest and Watershed Restoration Institute (CREST research)
  - The Nature Conservancy (Colorado)
  - Arapahoe Basin Ski Area (Colorado)

D. Media

- Reuters (9 September 2021). “Tree planting efforts aren’t replacing burned US forest – not even close”, by Andrew Hay.
- Wired (6 April 2021). “Reforestation is Great! But we’re running out of seeds”, by Jesse Klein.
- Stateline (5 April 2021). “States are growing fewer trees. Forest owners say that’s a problem”, by Alex Brown.
- Mongabay (12 March 2021). “Scaling up tree nurseries is key to unlocking US reforestation potential: Study”, by Mike Gaworecki.
- National Geographic (2 March 2021). “Planting trees help fight climate change – but we need billions more seedlings”, by Kyla Mandel.

E. Publications in 2021


Faculty and Staff

- Owen Burney, Ph.D., Associate Professor and Director
- Tammy Parsons, Nursery Manager
- Pouli Sikelianos, BS, Research Assistant
- Josh Trujillo, Ag Science Center Laborer
- Donna Ebler, Fiscal Assistant

Cooperators/Collaborators

- New Mexico Highlands University
- New Mexico Forest and Watershed Restoration Institute
- State Forestry Division, New Mexico EMNRD
- Utah State University
- Purdue University
- Northern Arizona University
- University of New Mexico
- The Nature Conservancy
- National Park Service
- US Forest Service
- US Geological Survey
- Institute of Applied Ecology
- International Union of Forest Research Organizations
- Santa Clara Pueblo
- Imerys Minerals
- Philmont Scout Ranch – Boy Scouts of America