AZ Wildfire INITIATIVE

NAU NORTHERN ARIZONA UNIVERSITY
School of Forestry

SOUTHWEST FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

How does understory veg respond to fuel treatments?

FACT SHEET // MARCH 2025

SUMMARY

There is a notable lack of research on the long-term benefits of fuel reduction treatments to the grasses and forest understory in southwestern forests. Treatments aimed at reducing the amount of fuel (i.e. trees and litter) also affect the understory vegetation, which is crucial for biodiversity and forest resilience. ***These grasses, shrubs, and wildflowers provide habitat and forage for wildlife and insects, contribute to soil stabilization and carbon sequestration, and hold cultural significance for Indigenous communities.*** *Recognizing the importance of understory vegetation and understanding the long-term effects of prescribed burn and thinning treatments on these communities is paramount to forest resilience. This knowledge equips land managers and policymakers with the information needed to make decisions that address the complex challenges posed by uncharacteristically severe wildfires and shifting climate patterns in the Southwest. This fact sheet is based on a study conducted through a partnership between Northern Arizona University, the Rocky Mountain Research Station, University of Arizona, and the Pueblo/Four Winds Fire Ecology Program with monitoring led by NAU graduate student Meagan Dreher and funding provided by the Rocky Mountain Research Station.*

Looking Beyond the Canopy: Long-Term Understory Responses to Fuel Treatments

Uncharacteristically severe wildfires are at the forefront of western forest management priorities today. Forest thinning and prescribed burning can mitigate the risk of high intensity wildfire and promote biodiversity and vital ecosystem services. The impacts of fuel treatments on overstory tree communities and the short-term effects on understory herbaceous communities are well-studied. However, there is much to be learned about the long-term (greater than 10 years) effects on understory vegetation. By understanding the dynamics of fuel reduction treatments, particularly the long-term effects on understory grasses and forbs, land managers and policymakers can prioritize ecosystem health in the face of a continuously warming and drying climate.

This fact sheet reviews data collected from the Monument Canyon Research Natural Area (MCRNA) in the Jemez Mountains of north-central New Mexico. Established in 1932 as a Research Natural Area by the USFS, MCRNA is in the historical and contemporary use area of the Jemez Pueblo. The elevation ranges from 8,000-8,500 feet and it supports a dry mixed-conifer and ponderosa pine ecotype. MCRNA is split between two sites: Cat Mesa, the untreated, control site, and San Juan Mesa, the site treated by mastication (2006) and prescribed burning (2012).

A native butterfly pollinating a thistle eleven years post treatment on a site in New Mexico. The butterfly, as well as the native vegetation in the background of the photo, depicts a positive recovery after treatment and shows how the understory provides a vital habitat to native species. Photo by Meagan Dreher.

Measuring Change: Tracking Understory Responses Over Time

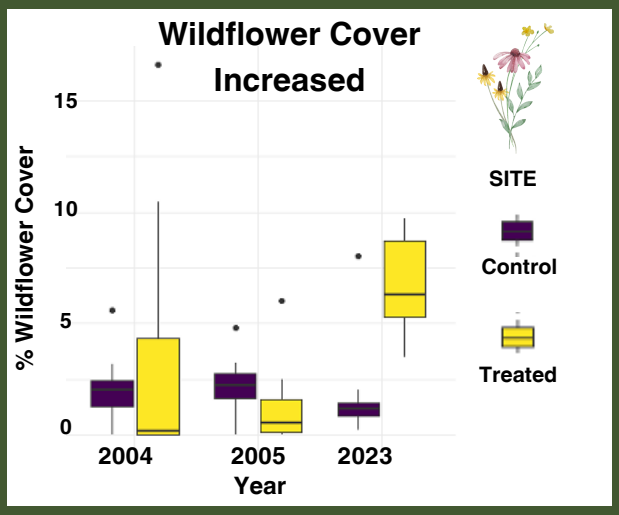
Prescribed burn and thinning treatments have emerged as promising tools for land managers to mitigate climate-induced stressors on southwestern ecosystems. To properly analyze the effects of these treatments on understory vegetation, pre-treatment data is collected to establish a baseline. Then, post-treatment data is collected repeatedly at varying intervals depending on the monitoring plan (the Pueblo/Four Winds Fire Ecology Program, follows the protocols in the Fire Monitoring Handbook, which conducts monitoring one-, two-, five-, and ten-years following treatment) and compared against the baseline.

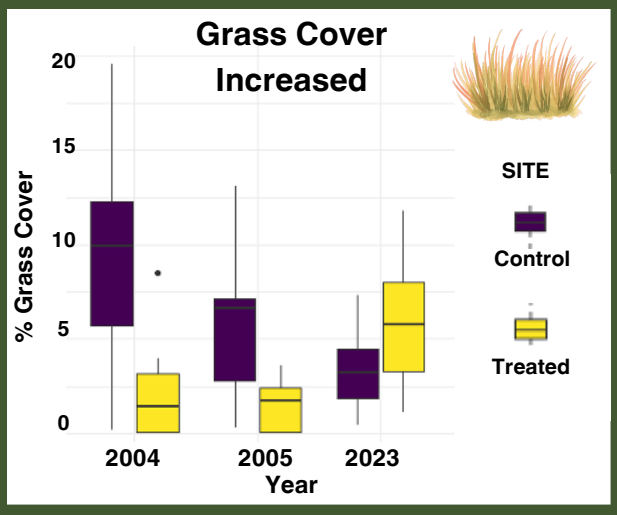
This study used datasets that were collected through two different methods (nested quadrants, or ocular estimates of cover, and line point intercept) to monitor the understory community in MCRNA. Analysis shows significant differences in lifeform cover, species richness, and litter and soil cover, indicating that prescribed burn and thinning treatments have a positive impact on understory communities.

Recovery trajectories

Native species typically recover in abundance within five to ten years following a treatment, while non-native species peak in abundance three to five years post treatment, emphasizing the complexity of ecological dynamics. The long-term recovery of native plant species and subsequent increase in cover and diversity highlights the positive effects of treatments, and while non-native species are found present on the landscape after treatments, the amount they cover remains low when analyzed over the long-term.

Prescribed fire and thinning treatments can help understory plants thrive by giving them access to sunlight, soil, and important nutrients allowing them to regenerate communities that were on the landscape when forests were at their healthiest before anthropogenic impacts (such as fire suppression) created unhealthy conditions. The varying responses in forbs (flowering plants), graminoids (herbaceous plants with a grass-like structure), shrubs, and trees from more than a decade after a prescribed burn depict a nuanced trajectory in vegetation recovery. The persistence of variations in community composition highlights the lasting effects of treatments—especially given that graminoids, shrubs, and forbs all increase in cover through time.





The above graphs shows the change in wildflower and grass cover from pre-treatment (2004 and 2005) to eleven years after mastication and prescribed fire treatment (2023). The control site is represented by the purple boxes and the treated site is shown in yellow. Researchers found that the control and treated sites had similar communities before treatment (grass being an exception). After treatment, the site had significantly higher cover of wildflowers, grasses, and shrubs, while the untreated site had significantly higher cover of trees and litter. A massive increase in wildflower cover was seen on the treated site in 2023, indicating that fuels reduction treatments are highly beneficial for wildflower cover. Before treatment, grass cover was higher in the control site. Eleven years post-treatments, the treated site showed higher grass cover than the control, indicating that these treatments were beneficial for stimulating grass growth. Graphs for trees, litter, and shrubs not shown.

Implications for ecological management

Thinning and burning treatments can mimic the natural, historical reference conditions that allowed our ponderosa pine and mixed conifer forests to thrive. Long-term comparisons between pre and post treatment datasets emphasize the importance of sustained monitoring and collaborative efforts and communication between land managers and researchers.

In the study reported here, two methods were used in two different datasets to help paint the picture of changes through time. The results were similar from both datasets, indicating that regardless of data collection method, there are long-term effects on understory communities from fuels reduction treatments. The synthesis of both datasets allows research to contribute to the overall understanding ecosystem responses to treatments, laying the groundwork for sustainable forest management in the face of escalating climate change impacts

A plot in the treated site that burned more severely shows post-fire regeneration of New Mexico locust (Robinia neomexicana), along with a mix of native and invasive plant species (i.e. Mullein, native thistles, and more) and other downed coarse woody debris. Photo by Meagan Dreyer.

KEY FINDINGS & MANAGEMENT IMPLICATIONS

- Treatments are good for trees and that's not all: Prescribed burning and thinning treatments have a positive impact on ecosystems in the southwestern United States by enhancing biodiversity and ecosystem resilience. Researchers found that the understory vegetation increased in diversity and plant cover following fuel reduction treatments. This emphasizes the potential for future treatments to increase or maintain important ecosystem functions and watershed health over time, while also meeting any objectives related to biodiversity and habitat.
- Treatment effects can be slow to appear: This study found positive understory plant response over a decade after treatment. Understanding the long-term effects of treatments is crucial for land managers considering various treatment methods. The evidence presented here supports decisions that both reduce future wildfire severity while also maintaining biodiversity and ecosystem function, but it's important to know it can take 10+ years for the effects to be fully realized on the land.
- Importance of collaboration and monitoring: Information on the long-term effects of treatments is lacking. The collaborative research conducted in this study is an important example of how we can learn about the effects of management decisions so that managers can include the importance of plant recovery post-treatment to their management plans.

Citation Dreher, M. (2023). ***Rooting for the little guys: Understory vegetation response to fuels reduction treatments*** **(Order No. 30818992). Available from ProQuest Dissertations & Theses Global. (2908186411).**

*The **Southwest Fire Science Consortium** (SWFSC) is a regional organization that facilitates knowledge exchange and disseminates wildland fire research and information across agency, administrative, and state boundaries in the Southwest. The SWFSC is one of 15 Fire Science Exchange Networks funded by the Joint Fire Science Program.*

*The **Arizona Wildfire Initiative** (AZWI) at the Northern Arizona University's School of Forestry supports Arizona's wildland fire needs by enhancing workforce development and education, communicating science, and increasing resilience to Arizona's communities. AZWI is funded by the state of Arizona.*