**Methods**

**Study Site**

This study was conducted within and immediately adjacent to the perimeter of the 2019 Museum Fire, located approximately 1.6 km north of Flagstaff, Arizona, USA (35.252169, -111.634913 WGS84). This fire burned in late July of 2019, with a total of 793.6 hectares burned. The Museum Fire was a mixed-severity fire, characterized by patches of varying severity, including very low-, low-, moderate-, and high-severity patches present (USDA Forest Service, 2019). No post-fire seeding treatments were implemented within the research site.

The canopy is dominated by *Pinus ponderosa* and *Quercus gambelii* with *Juniperus deppeana*, *Pinus strobiformis*, and *Pseudotsuga menziesii* interspersed. Elevations within the burn scar range from approximately 2240 m to approximately 2760 m above sea level. Our research plots were monumented at lower elevations within this range, between 2251 and 2328 m above sea level. All plots were located on slopes with a southeasterly aspect, with slopes between 20 and 30 degrees. Soils are based on mixed igneous parent material, with both Alfisol and Mollisol soil orders.

The precipitation averages 52.17 cm (National Weather Service 2025), with a bimodal precipitation regime. An average of 28% of annual precipitation falls in winter, while 34% occurs in summer due to the southwestern monsoon (Hereford 2007). The thirty-year (1993-2023) average maximum, minimum, and average temperatures are 33.33°C, -20.56°C, and 8.28°C, respectively (National Weather Service 2025). See Appendix S1: Table S1 for annual weather data.

Plot Establishment

Plots were established in May of 2020, 10 months following the fire. We established 60 4 m × 4 m research plots across the burn severity gradient, with 20 plots located within unburned (U), low-severity (L), and high-severity (H) burn areas. Unburned plots were located immediately outside of the burn perimeter and no further than 470 m from the edge of the fire perimeter. Burn severity classifications for these research plots were initially derived from the USDA Burned Area Emergency Response (BAER) map, which is based on Burned Area Reflectance Classification remote-sensing data that have been verified by field crews  (Parsons et al. 2010; Noll and Malis-Clark 2020). BAER classifications are based on relative change in soil organic matter and soil structure due to fire (Keeley 2009). We confirmed burn severity classifications for each plot by visually assessing first-order fire severity effects in May 2020 including vegetation cover within plots, the presence of bare mineral soil within plots, and overstory mortality within an approximately 25-m radius of the center of each research plot. Indicators of low severity fire included extant understory vegetation, low bole scorch height, and less than 50% overstory mortality. Indicators of high-severity fire included more than 50% bare mineral soil and more than 90% overstory mortality. Each research plot was subdivided into four 1-m2 subplots located 1 m apart. For this study, one 1-m2 subplot was used per plot. See Taber and Mitchell (2023, 2024) for more information on experimental design and concurrent research projects.

Data collection

Community composition

Community composition and abundance data were collected in the 1-m2 subplots in the second week of September for four consecutive years, beginning in 2020 (approximately 13 months post fire). Individuals were identified to the species level and absolute species cover was recorded to the nearest 0.25% using a modified Daubenmire method. Species accounting for less than 0.25% of cover on a given plot were recorded with a value of 0.2% cover. All nomenclature follows the USDA NRCS Plants Database (https://plants.usda.gov/) accessed in 2025.

      Three plots were lost during the 4 years of data collection: 2 in low-severity, 1 in high-severity. These 3 plots were removed from our data for the years they were missing, bringing the total number of plots to n = 57. Plots that had no vegetation cover in year 1 after fire were also omitted from analysis for that year (low-severity: n = 1; high-severity: n = 8), but they were included in analyses in years when they had vegetation cover (Appendix S1: Table S2).

Plant traits

We analyzed three plant traits: SLA (mm2 g−1), LDMC (g g−1), and height (m). Our species pool contains 60 species (Appendix S1: Table S3). For 21 species (19 of which accounted for 85% of species cover), traits were measured from individuals on-site. All measurements followed standardized collection protocols (Garnier et al. 2001; Cornelissen et al. 2003; Pérez-Harguindeguy et al. 2013). Measurements on individuals were collected regardless of sun exposure, slope, or aspect, but only mature, healthy leaves were measured. Height was measured for 20–25 individuals per species. For species with <20 individuals, height was recorded for all individuals present. The height of *Quercus gambelii* was measured as the median height of 20 understory (<2m) individuals. The median was used instead of the mean because *Q. gambelii* is a canopy species at maturity and therefore the height of individuals in the understory is skewed rather than normally distributed. To measure SLA and LDMC, one leaf sample was taken from individuals of each species. For species with <20 individuals, we collected between 3 and 10 leaves from an individual, aiming for a total of 20 leaves per species. Leaf area for all samples was determined using a CID-203 leaf area meter (CID Bio-Science; Camas, Washington USA). All fresh samples were rehydrated by placing petioles in distilled water for at least 6 h before being scanned and weighed following Garnier et al. (2001). After leaf area and fresh mass were measured, leaf samples were dried at 70 °C for 72 h, then reweighed. SLA and LDMC were then calculated from the area and mass data for each sample.

When species were too rare outside of sample plots for trait collection, data were collected from the TRY database and from primary literature sources (n = 33 species). Where trait values could not be found for a given species, values of close congeners were used when available (n = 5 species). For all remaining trait values, we used the average trait values of the observed genus (e.g. trait values for *Linum neomexicana* were calculated as the average trait values for all *Linum* species in Laughlin et al. (2010)) or the average trait value for the observed plant family (n = 6 species) See Appendix S1: Table S3 for the detailed trait table.

References

USDA Forest Service. (2019) Museum Fire Incident Information [WWW Document]. Available from: <https://inciweb.nwcg.gov/incident/6450> [Accessed 12th April 2025].