Restoration Objectives in the Zuni Mountains CFLR Landscape

Forest restoration treatments in the Zuni Mountains show improvements toward restoration objectives, including resilience to fire and drought across the 6,500 acre forest monitoring area

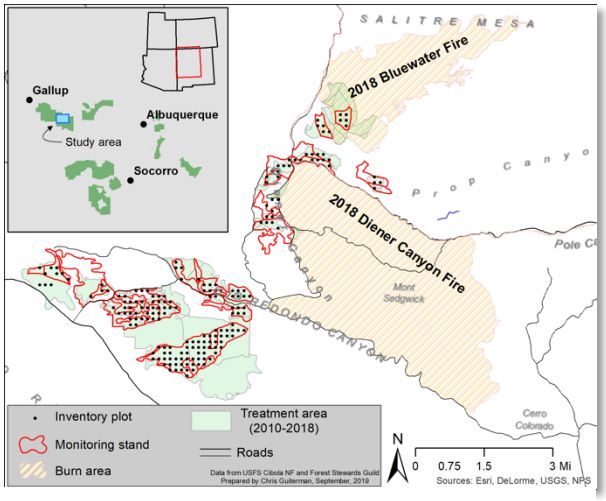

Figure 1: Bluewater project Area of the Zuni Mountain CFLRP

designed to represent this larger landscape pattern. The forest restoration objectives of the landscape included: reduction of uncharacteristic crown fire risk, protection of old and large trees, removal of small trees, and return of fire to the ecosystem at ecologically appropriate intervals.

To monitor progress towards these objectives, analysis focused on six variables: basal area, canopy bulk density, quadratic mean diameter, radial growth, stand density index, and trees per acre. Across the 6,500 acres monitored via circular ground-based plots, each variable signaled progress toward the vegetation management objectives and towards increasing the overall resilience of the project area (Figure 2). Forest restoration treatments in the Zuni Mountains enhanced forest resilience to fire, bark beetle attacks, and drought across the monitoring area by reducing stand densities, decreasing the connectivity of canopy fuels, and preserving large and old trees (Bryant et al. 2019).

At a Glance:

- Trees per acre are within resilience envelope for bark beetle outbreak, crown fire, and drought.
- Average tree diameter increased across the landscape, signaling the protection of large and old trees.
- Canopy bulk density decreased indicating decreased potential for uncharacteristic crown fire.

Forest restoration in the Zuni Mountains Collaborative Forest Landscape Restoration (CFLR) landscape have been focused in the Bluewater watershed for the past 8 years in the Cibola National Forest in central New Mexico (Figure 1). Data to evaluate forest treatments under the CFLR come from two sets of forest monitoring plots across 31 stands, totaling 6,500 acres. The monitoring plots followed the USFS Common Stand Exam protocol and were collected between 2005 and 2018.

Mechanical forest thinning and RX fire treatments were strategically spread across the larger 52,042-acre Bluewater watershed. Over the past 8 years treatments have occurred in different ecosystem niches and the monitoring plan was

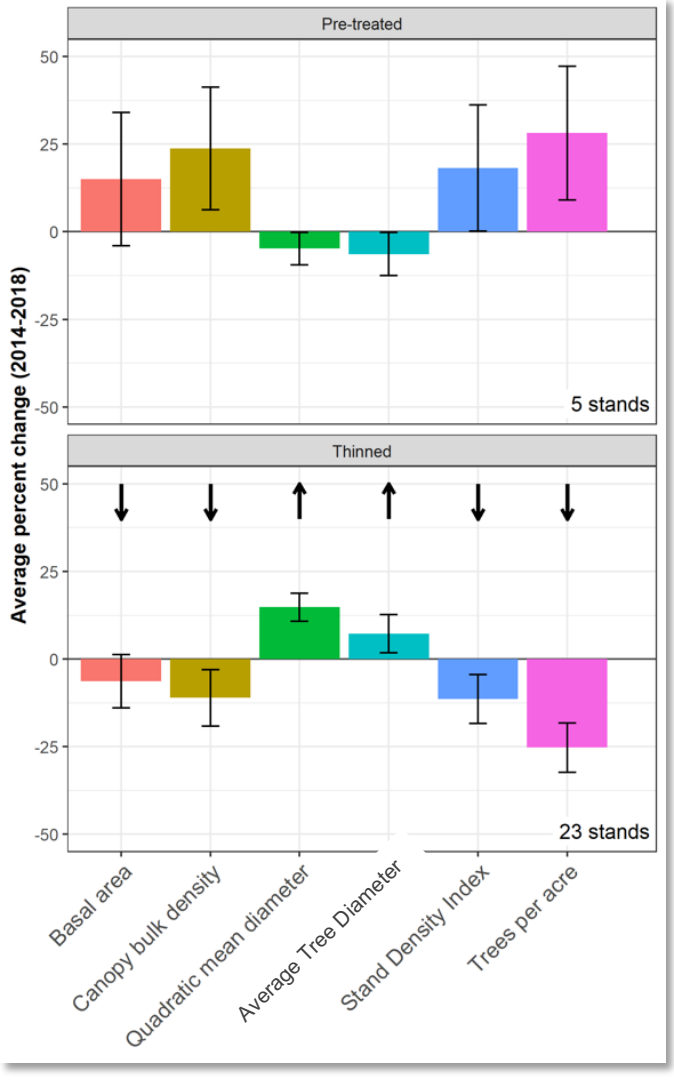

Figure 2: Relative effects of treatments in the Bluewater project area. Resilience variables show improvement when they follow the arrows in the lower tile.

Reduce Uncharacteristic Crown Fire Risk and Return Fire at Ecologically Appropriate Intervals

Where thinning took place, treatments reduced the number of trees per acre (TPA) while increasing the average size of the trees on the landscape (QMD). These two metrics also correlated with a reduction in the canopy bulk density (CBD). Taken as a whole, these changes to stand structure are associated with a reduction in the hazard of crown fire. With fewer small trees, larger trees protected, and with less continuous canopy on the landscape, the risk of uncharacteristic crown fire is substantially decreased.

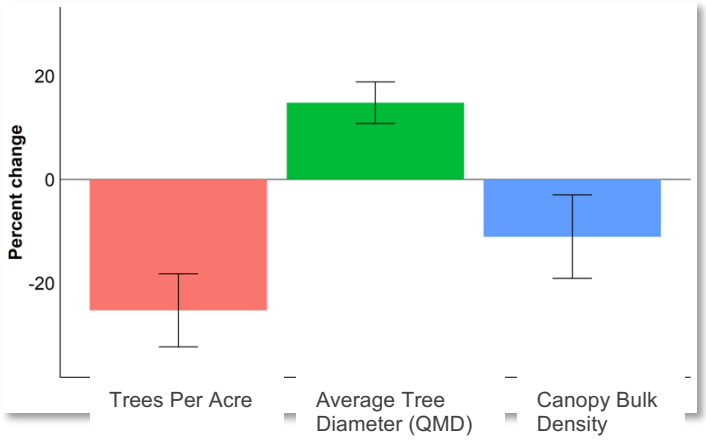

Figure 3: Structural change across 23 stands following thinning.

The return of low intensity fire to the landscape was identified as the highest restoration need in the landscape, particularly in ponderosa pine and mixed conifer forest types. The removal of overabundant small and young trees was a necessary step towards reintroduction of fire through prescribed fire and managed wildland fire. The reduction of small trees is demonstrated by the large reduction in trees per acre (TPA) and the simultaneous increase in average tree size (QMD) across the landscape (Figure 3).

Remove Excess Small Trees and Protect Old and Large Trees

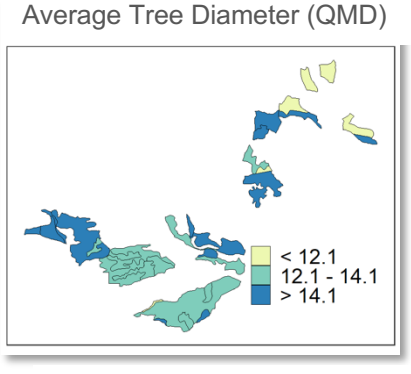

Figure 4: Map of average tree diameter in inches across the Bluewater Project area.

Average tree diameters increased across much of the area, indicative of thinning small trees to reduce ladder fuels (Figures 3 and 4). Stands with QMD <4 inches or >10 inches are outside of the range for most beetle-induced mortality events in the Southwest (Bryant et al. 2019). Furthermore, ponderosa pine with a larger diameter demonstrate a higher resistance to fire induced mortality, increasing their ability to re-colonize post-fire stands, and increasing the overall resilience of the forest to wildfire. Average tree size across the area monitored is predominantly above 12.1", indicating a high resilience to beetle induced mortality and wildfire induced mortality of ponderosa pine (Figure 4). The repeat photos below demonstrate a typical reduction of small diameter trees on one monitoring plot that was thinned and burned.

Figure 4: Plot #63 pre-treatment in 2015

Figure 5: Plot #63 post-treatment in 2018