Background

The Need for Forest Restoration

There is a need to improve forest health across Arizona. The lack of diversity and the diminishing forest health have resulted in a forest that is less resilient to damage caused by drought, insect outbreaks, climate change, and intense wildfires. The accumulation of large amounts of ground fuels, dense tree growth, interlocking tree crowns, a combination of climate change and reduced water shed, create conditions for intense devastating, high intensity crown fires. These crown fires destroy forest along with ecosystem, and wildlife habitats. To help improve forest health and decrease the chances of a high burn intensity fire, treatments have been designed to manage mature trees. Forest management is accomplished by cutting and removing younger small diameter trees. This process of removing the younger trees will help sustain and manage older trees and provides a much older mature forest structure, and helps reduce the effect of a wildfire on the landscape.

Types of Forest Managing/ Fuel Treatments

There are at least three ways to reduce tree densities and accomplish fuel treatment: wildfire, prescribed fire and mechanical thinning. The first, reliance on wildfires, is impractical. Letting natural fires play their historical role may have unwanted effects in forests that have undergone major stand structural changes over the past years of fire exclusion. In many ponderosa pine forests choked with dense, small-diameter trees, or encroached by shade-tolerant trees, natural fires may no longer play a strategic role (Omni).

The second strategy for restoring these forests is large-scale prescribed burning. This is likely to be effective in stands that have moderate or low tree densities, little encroachment of ladder fuels, moderate to steep slopes which preclude mechanical treatment, and expertise in personnel to plan and implement such large prescribed burns. Large-scale implementation of this strategy will require funding for the planning and implementation over current expenditures and may require modifications to current air quality legislation (Omni).

Mechanical tree removal, the third strategy, works best on forests that are too densely packed to burn, that have nearby markets for small-diameter trees, and areas where expertise and personnel are not available for prescribed burning programs. Mechanical tree removal may be accomplished by many different types of harvest, including pre-commercial thinning, selection or shelter wood harvest coupled with small-diameter tree removal, and thinning from below. The goal is to manage forests for much lower tree densities leaving larger residual trees. Harvests to reduce wildfire hazard will remove small-diameter trees in contrast to traditional timber harvests. Mechanical fuel treatments can be very labor intensive, especially on steep slopes and in remote areas, and may not be commercially attractive due to the small diameter trees that need removal. To make fuel treatments more cost-effective for small-diameter trees, consistent markets are necessary (Omni).

Forest Density and Fire Severity

Numerous recent studies have concluded that some type of fuel treatment results in less severe wildfires. Different levels and types of fuel treatments, also known as forest thinning, result in a forest with much lower density and larger trees. Stands with fewer trees have less continuous crown and ladder fuels. Larger trees generally have crowns higher off the ground and have thicker bark which makes them more fire resistant. This two-fold benefit of treated stands, results in a lower potential for crown fire initiation, propagation, and for less severe fire effects. A recent study looked at aspects of stand structure that affect changes in fire severity since previous studies have inferred that fuel treatment resulting in stand structure manipulations mitigate fire hazard. To determine the fuel treatment's effect on stand characteristics, three variables describing stand structure were measured: stand density (trees/hectare), basal area (meters2/hectare) and average diameter (cm) of trees on the plot. Crown characteristics, such as crown weight and height to live crown, were also measured since they are known to drive crown fire behavior (Van Wagner 1977, Rothermel 1991). To measure fire effects, one rating of fire severity at each plot and percent crown scorch for each tree on the plot was recorded. Fire severity was classified by observing foliage scorch and crown needle consumption (Wagener 1961, Wyant 1986). The following criteria were used to determine fire severity:

- Unburned, fire did not enter the stand
- Light, surface burn without crown scorch
- Spotty, irregular crown scorch
- Moderate, intense burn with complete crown scorch
- Severe, high intensity burn with crowns totally consumed

The results from the study showed the treated plots in this study have lower fire severity ratings and less crown scorch than the untreated plots. From these results we infer that the types of fuel treatments studied reduce fire severity rating and crown scorch. The treated plots burned less severely in terms of below-ground fire severity. Based on the statistical results and field reconnaissance, sites with mechanical fuel treatment appear to have more dramatically reduced fire severity compared to sites with prescribed fire only. Although fire severity ratings and percent crown scorch are lower at treated plots and higher at untreated plots at all sites (Omni & Pollet).