Forest Management Recommendations to Long-Term Water Augmentation Committee

Bruce Hallin (SRP) and Marcos Robles (TNC)

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Arizona's forests are a critical source of water supply for the Salt and Verde Rivers and contribute almost half of the water supply in the Phoenix Metropolitan Area. Ponderosa pine forests occupy only 20% of the Salt and Verde watersheds but produce 50% of the flow [1]. Long-term, sustained production of healthy streamflow is currently in jeopardy because these forests are overly dense and susceptible to catastrophic wildfires, especially during drought conditions. High severity fires can substantially reduce water quality, damage or reduce the effectiveness of water infrastructure that may result in costly delays, repairs and rehabilitations, and potentially convert forests to vegetation types that produce less streamflow [2].

Current efforts to accelerate forest restoration in central Arizona, including the Four Forest Restoration Initiative, can reduce the severity of wildfires [3] and associated adverse impacts on watershed values and thus help sustain current ranges of water production. Moreover, recent research conducted in or near the Salt and Verde River watersheds indicates that restoration through tree thinning may result in small gains in streamflow production, on the order of 1-8% of annual streamflow production [4–6]. This research is based on empirical data and simulation models and is applicable to ponderosa pine forests in Arizona under current climatic conditions. Realizing these gains, however, would require a four to five-fold increase in the area thinned annually. Streamflow augmentation from thinning diminishes over time as forests and understory vegetation regrow, thus maintaining the potential for increased streamflow would require periodic re-entry with additional thinning treatments or, potentially, prescribed fire.

Ongoing research efforts by SRP, TNC, the state universities, and others is further clarifying the extent by which thinning of a substantial portion of the existing trees across the landscape will produce more water. Given the complexity of the hydrological cycle, SRP has been installing an array of monitoring sites across the Salt and Verde River watersheds, working with all three state universities on research efforts to tease out the intricate relationships among all the various hydrologic and climatologic variables that impact streamflow. These studies are using numerical watershed modeling incorporating technology such as high point density LiDAR that detects to the level of the individual tree the effects of forest thinning on evapotranspiration and sublimation. Complementing the modeling are a number of paired watershed studies that have been collecting data since 2013. These paired watersheds, instrumented with time lapse photography, pressure transducers, staff gages, soil moisture sensors, and rain gages are designed to discern the smallest changes to the local hydrology. These locations have been gathering this data pre-forest treatment. Once forest treatments occur, the instruments and gages will detect, measure and compare any changes in the local hydrology. SRP has also installed a photographic snow transect from essentially 4000 feet to 8000 feet in elevation to observe whether snow levels and snow pack are retreating or advancing, including monitoring vegetative patterns and plant communities, to document conditions and measure over time how these factors are also impacting the watershed hydrology. Additionally, SRP and TNC are supporting work at NAU using remote sensing and ground instrumentation to measure the effects of forest thinning on soil moisture and snowpack which are key predictors of streamflow.

References

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