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Sagebrush Steppe
SageSTEP
Treatment Evaluation Project

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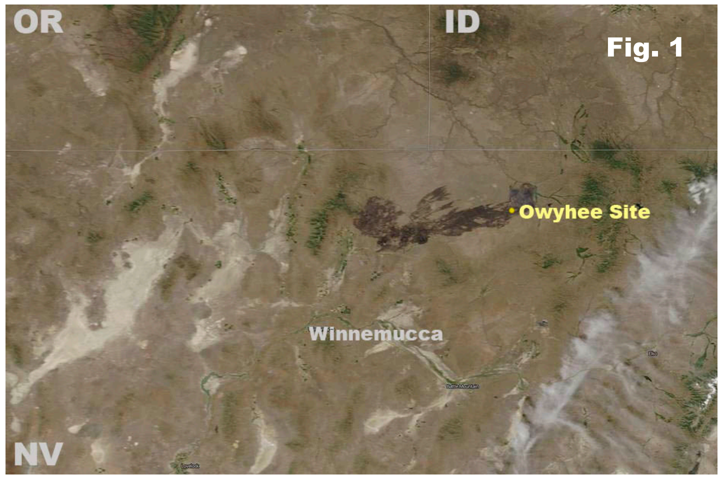
Wildfire and SageSTEP Research: an inevitable collision

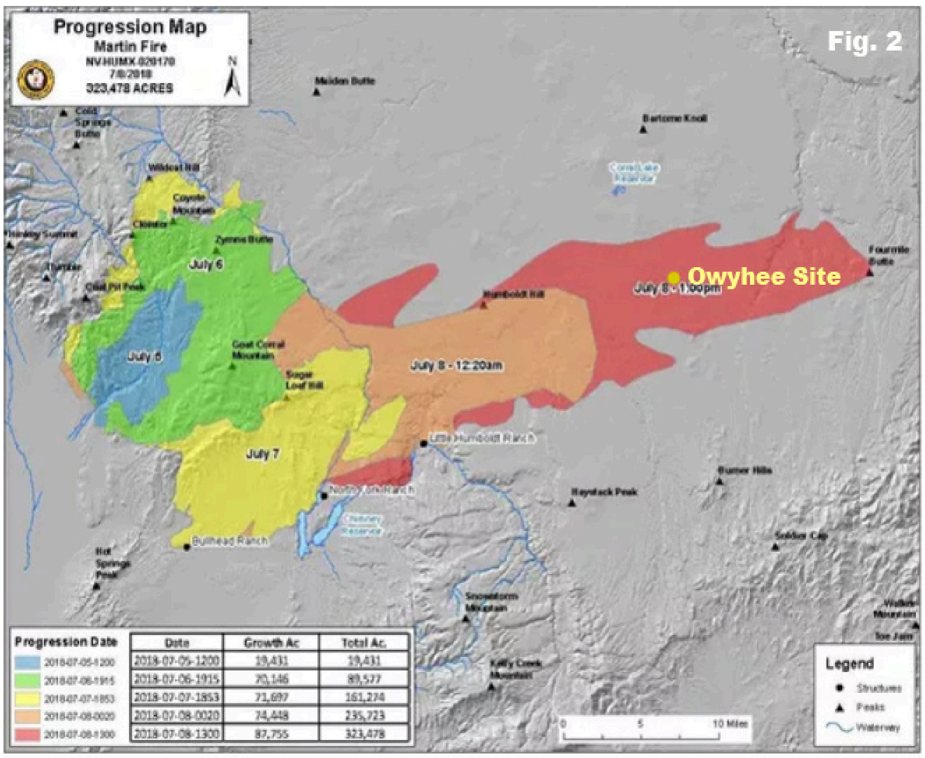
By Jim McIver

In a matter of just hours, the Martin Fire swept down from the Goat Corral Mountains on July 6, 2018 near Winnemucca, Nevada – ballooning by nearly 88,000 acres overnight (figs. 1,2). Over the course of four days, it worked its way, sizzling and smoking, through 700 square miles of land in northern Nevada and was the largest fire in the U.S. at the time. At a staggering 54 miles across from east to west, the fire emitted a column of smoke that could be seen from space.

Although no lives or structures were lost in the massive wildfire, it had scientific implications, especially for SageSTEP. The fire burned completely through all treatment plots of the SageSTEP Owyhee site (fig. 3) one of six remaining treeless sagebrush steppe sites in the study. A satellite image of the burned area shows the Owyhee site well within the burn perimeter (fig. 1). This isn't the first such event for SageSTEP sites. During the summer of 2007, the Castlehead site burned in the Murphy Complex Wildfire, just months before SageSTEP treatments could be applied. Of the sites with fully implemented treatments, Owyhee was the third site burned in wildfire since treatments were applied in 2006, 2007, and 2008 – joining Stansbury (2009 Big Pole Fire) and Roberts (2010 Jefferson Fire) as the next casualty of the seeming inevitable risk facing sagebrush steppe land in much of the Great Basin.

Over the years, other wildfires have burned close to or slightly into other SageSTEP sites. Last year, half of the mechanical plot of the Blue Mountain site also burned in the Steele Fire (46,000 acres burned in total). Over the years, wildfires have burned up to the edge of our Saddle Mountain site (2018 Wahluke Slope and Saddle Mountain Fires), Rock Creek site (2010 Poker Jim Fire), and the





Figures 1-2. Satellite image and progression map of the 2018 Martin Fire near Winnemucca, Nevada and through the Owyhee site.

Onaqui site (2017 Onaqui Complex Fire). All told, of 20 original SageSTEP sites, 8 of them, or 40%, have experienced wildfire, either within or adjacent to their plots in the 12 years since the project began. This certainly demonstrates the primacy of fire in sagebrush steppe country of the interior west, especially in recent years – but what does it mean for the research?

Of the four fully implemented sites that have now experienced wildfire within plot perimeters, one site (Blue Mountain), will remain in the study. This is because only half of one plot (mechanical) at Blue Mt burned, and thus we can continue with our monitoring in the other half of that plot. However, Stansbury, Roberts, and now Owyhee must now be dropped from the original study, because wildfire has erased the initial experimental design, and replaced it with a more severe disturbance. But despite losing these sites as part of the SageSTEP experiment, all is not lost, because much can be still learned from the sites that burned. For example, the Stansbury site burned in the Big Pole wildfire in 2009, just weeks after sampling. The site was treated in the late summer and fall of 2007, and so before the wildfire we had one year of pre-treatment data (2007), and two years of post-treatment data -- year 1 (2008), and year 2 (2009). Furthermore, the prescribed fire treatment was the most effective among all woodland sites, with 95% of juniper trees killed, and nearly all of the down woody material consumed. The mechanical treatments, both clearcut and mastication, were similarly well implemented. Thus, we had a great opportunity to evaluate the effects of a severe wildfire burning through areas treated with 'fuel-reduction' methods. We've written about the results at Stansbury in a previous newsletter, but generally speaking, we discovered that only the prescribed fire treatment significantly reduced wildfire severity: not only did data loggers survive in that treatment compared to the three others, but perennial bunchgrass survival was higher one year after wildfire in the prescribed fire plot. More likely than not, it is the removal of fuel on the ground that explains the significantly lower fire severity in the prescribed fire plot. Other interesting results have been discovered at the Roberts site as well, emphasizing that these burned sites have substantial value in understanding wildfire effects.

SageSTEP scientists have made the decision to continue monitoring all burned sites – even though they can longer be included in the mainline experiment – because of their value in assessing wildfire effects on treated and untreated plots. After all, we've got very robust pre-fire data, and it makes sense to take advantage of that when sites burn.

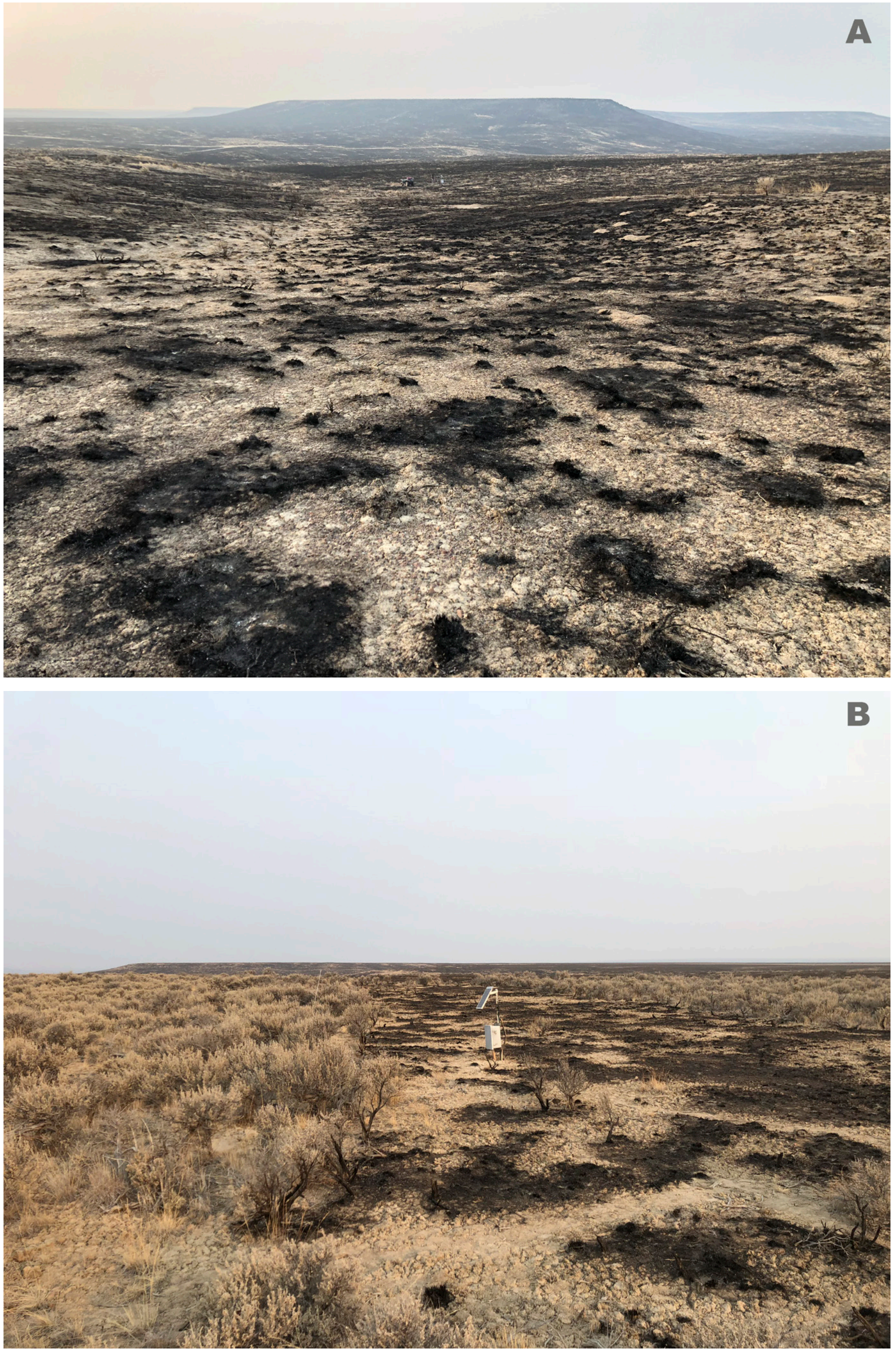


Figure 3. The 2018 Martin fire burned completely through all treatment plots of the SageSTEP Owyhee site – one of six remaining treeless sites in the study. Photos by Bruce Roundy.

Treatment Longevity and Changes in Surface Fuel Loads after Pinyon-Juniper Mastication

By Sam Wozniak

In the Intermountain West, land managers often masticate pinyon pine and juniper trees that have encroached on sagebrush steppe communities. By shredding whole trees into smaller pieces of woody debris, mastication treatments decrease canopy fuels, alter potential fire behavior, and promote the growth of understory grasses, forbs, and shrubs. Although mastication is now a common management tool, there are still many unanswered questions about how treated areas change over time. At three SageSTEP study sites in Utah, researchers documented how surface fuel loads and tree cover changed 10 years after mastication treatments. Researchers measured these variables in sampling plots that had a range of pre-treatment tree cover from 5-50%.

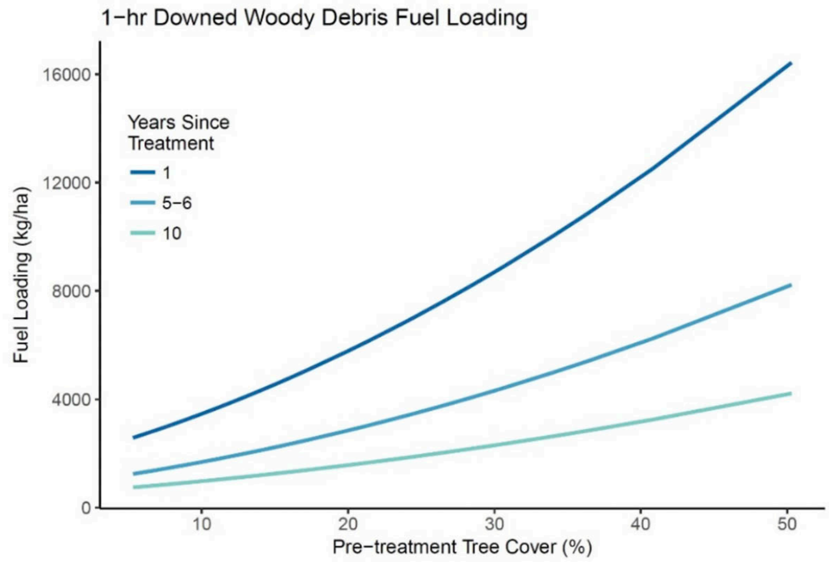


Figure 1. Estimated 1-hour downed woody debris across a range of pre-treatment tree cover and at three time periods.

They found that fine-size fuels decreased during the timeframe of the study, and live fuels (such as grasses and shrubs) increased. Masticated downed woody debris of the 1-hour fuel class (debris with a diameter less than ¼ inch) decreased by five to six years post-treatment, and continued to decrease through 10 years post-treatment (fig. 1). The median decrease in 1-hour downed woody debris fuel loads was 69% by 10 years post-treatment. Researchers did not detect changes in fuel loads of larger downed woody debris classes. Tree litter and duff fuel loading decreased drastically by 10 years post-treatment (fig. 2). The decreases in these fuels were likely due to decomposition (fig. 3).

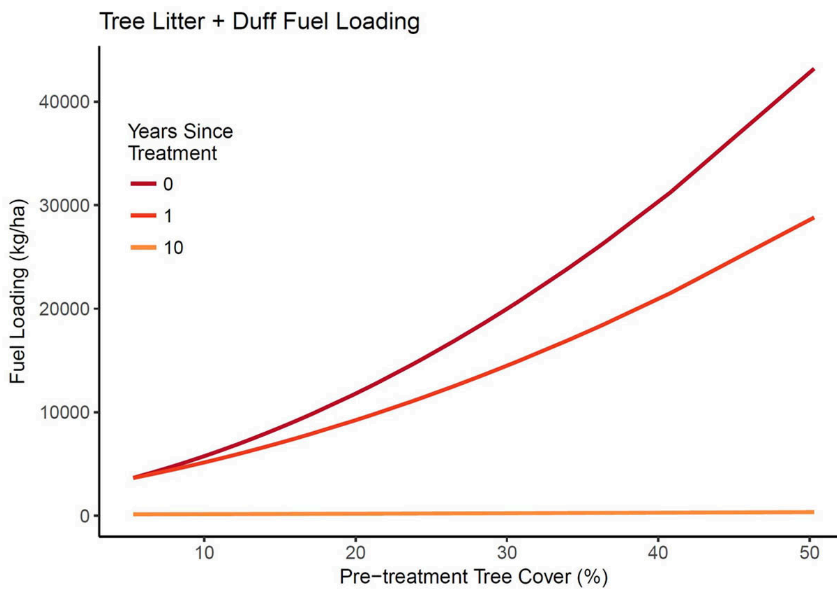


Figure 2. Estimated tree litter and duff fuel loading across a range of pre-treatment tree cover and at three time periods. Note: at 10 years post-treatment, estimated fuel loads are slightly above zero.

Decreases in 1-hour downed woody debris, tree litter, and duff fuel loads are important because the quantity of these fuels can influence fire behavior and effects. When wildfires burn through masticated debris and tree litter and duff, they tend to smolder for long periods of time and release a great amount of heat into the soil. Greater fuel loads of masticated debris, tree litter and duff lead to longer smoldering, greater maximum surface soil temperature, and more severe fire effects (Sikkink et al. 2017; Weiner et al. 2016).

These decreases in fuel loads, however, should be assessed in the context of changes in other surface fuel load components. When pinyon pine and juniper trees are removed, understory plants thrive because they are no longer competing with large trees for water, nutrients, and sunlight. Herbaceous fuel

loads (live and dead standing herbaceous biomass) increased through three years post-treatment and fluctuated thereafter depending on the site. When fires burn through areas that have a high fuel load (and density) of grasses, they tend to have higher rates of spread. Shrub fuel loads decreased one year post-treatment, but returned to pre-treatment levels by 10 years post-treatment.

Researchers also measured tree cover and height as indicators of treatment longevity. At 10 years post-treatment, tree cover ranged from 0-2.6%, and the majority of trees were less than one meter in height. The mastication treatment only targeted trees greater than 0.5 meters in height, so many of the trees measured 10 years post-treatment were trees that occupied the site at the time of treatment, but were too small to be masticated. At 10 years post-treatment, pinyon pine and juniper trees do not seem to be out-competing grasses and shrubs, and there is no risk of canopy fire.

This research demonstrates that changes in surface fuel loads after mastication treatments occur on a time frame that is relevant to fire management. Due to the decrease in the masticated 1-hour downed woody debris, this research indicates that land managers and researchers should explore ways to ensure that a high percentage of woody material is masticated to the finest size possible. Masticated pinyon-juniper surface fuel loads change significantly in 10 years, and to a degree that may alter fire behavior and effects.

Sam Wozniak is pursuing an M.S. in Natural Resources at the University of Idaho. The preceding article summarizes results from a manuscript in preparation (see reference in literature cited).

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Figure 3. Decomposition of masticated 1-hr fuels. Sampling plot at (A) one year, (B) six years, and (C) 10 years post-treatment. Masticated pinyon-juniper surface fuel loads change significantly in 10 years, and to a degree that may alter fire behavior and effects.

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