Thirty-one circular plots were cut into the burn unit – distributed randomly in visually homogenous areas of fuel. The circles were 3.66m (12 feet) in diameter. Fuel was completely removed from a randomly selected 10 circles (labelled N1-N10) and replaced with pine straw of known mass and depth. The intent here was to create fuel patches with precisely known pre-fire characteristics so that mass loss could be determined following the fire. The remaining circles (labelled G1 – G21) were cut to a height of 15cm (6 inches) with a string trimmer and the grass was distributed uniformly across them (e.g., the fuel depth and bulk density of the grass circles was changed without changing their mass and particle properties). The characteristics of G1-G21 are the same as the circles in CropCircles 1 experiment from 2020.

Fuels were destructively sampled in the 10 circles (N1-N10) to produce estimates of pre-fire grass dry mass and to inform how much pine litter to place. A randomly placed 0.5mx0.5m PVC rectangle was clipped in each circle, the grasses were bagged, and dried for 24 hours at 100C in CHCB drying oven. The dry mass from these samples was extrapolated to the area of the respective circles by multiplying the measured dry mass per unit area by the area of the circles. The average dry mass of grass per circle was 5782g (StdDev = 1520g).

To approximate 5782g of dry fuel per circle, 7000g of pine needles (~25% moisture) were evenly distributed in each bare circle (5600g dry weight, assuming 25% moisture). There was some variability in moisture content of the pine needles, caused by the interior of the pile being wetter than the outside. Additionally, we used a DMM600 (Campbell Scientific) to measure moisture content in real-time and experienced some variability from sample to sample. This caused us to try to mix the samples during the weighing process to get similar moistures in each. The measured moistures from the DMM600 were distributed in the mid-20s and 25% is a reasonable estimate. The takeaway is that we have to assume constant pre-fire dry mass/moisture of needles in each circle.

Needles were a mixture of ponderosa pine and eastern white pine, with ponderosa being pine dominant (estimated 70% PIPO). They were collected just to the east of the USFS Forest Sciences Lab on Beckwith Ave, transported to Bandy Ranch and stored in a pile in a hayshed adjacent to the burn site.

Measured fuel bed depth of the needles after they were distributed in the circles was (cm): 7.62, 7.62, 3.175, 6.35, 7.62, 2.54, 3.81, 2.54, 5.08, 5.08, 3.81,3.81,2.54, 5.08, 5.08 (mean: 4.78cm; stddev: 1.779; range: 2.54 – 7.62)

After the burn, the residual pine needles from each plot were collected and bagged. They were dried at weighed at the Missoula Fire Sciences Laboratory.

Plot N10 was used in a test fire independent of the rest of the unit. Post-fire fuels were not collected here and data are not used in the experiment. This leaves nine plots (N1-N9) with 7000g of wet pine needles at 25% moisture content that were burned and residual fuels collected, dried, and weighed post burn.

**fuel\_mass\_measurements.xlsx** – calculates the grass mass removed from each N-plot and extrapolates that mass to the area of the circles. Dry mass is also calculated across a range of moistures (2-25%) so that we could select a representative wet mass in the field to correspond to a dry mass of 5782g (mean of dry grass mass removed) when we weighed the wet fuels.

**Post\_burn\_dry\_mass\_all.xlsx** – dry mass of residual pine needles collected from each circle after burn.

**heights\_loads\_allplots.xlsx** – grass heights and load classes (with notes) for all plots. The heights are native heights before any cutting. After cutting, the heights were 15cm (6 inches). Moran estimated load class for all plots. The actual loads for each class can be described with the dry mass measurements from fuel\_mass\_measurements.xlsx. Note that all measurements are for GRASS fuels except N10 which shows heights of needle fuels. Note that N10 was in the heavy load class before grass was removed from the experiment

**Summary\_mass\_data.xlsx** – summary of dry mass of grass before clipping, dry needle mass before and after burn (N1-N9) expressed per plot and per m2.

**FuelMoistureSamples.xlsx** – calculates the fuel moisture just prior to burn from field measurements (clipped fuels in cans, dried and weight at FireLab). Locations distributed arbitrarily in burn unit. Top is a fuel sample containing the top (standing) grass. Bottom is a fuel sample directly below Top at the interface of the litter layer. Observationally, Bottom was generally wetter than Top. ‘Needles from shed’ are moisture content of needles in circles just prior to burn.

**kestrel\_weather\_obs\_10212021.xlsx** – are weather observations prior to and during the burn, taken with a Kestrel 2500 by field observer. Ignition began at 1450 and ended at 1520.