Physical Properties of Post-Fire Shallow Soils: A Closer Look at the Pepperwood Preserve

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Abstract

A significant body of evidence suggests that wildfires affect the chemical and physical properties of shallow soils, including their capacity to absorb water. The Tubbs Fire of 2017 in Santa Rosa, CA partially burned the Pepperwood Preserve oak woodland, chaparral, and mixed evergreen forest at varying temperatures. We investigated the shallow (top 20 cm) soil profiles for visual evidence of fire, including variations in density and color. Samples were collected across different landscape positions and burn temperatures across varying forest cover types at Pepperwood. Soil samples were then disturbed and water droplets were administered to the soil surface with a small pipette. The time to complete water absorption was recorded for each sample. Preliminary results indicate the presence of hydrophobic soil in the higher temperature burn areas, while visual inspection shows an ash layer in the top two centimeters.

Materials & Methods

We conducted our research in three different areas at the Pepperwood Preserve. In the first two areas, we collected soil samples in severely burned regions of the preserve. The last sample was taken 15 minutes away from the preserve passing the fire line.

- We used a soil profiler to capture a clean rectangular cut of the soil to see if we can identify any evidence of an ash layer.
- We used our smart phones as GPS trackers as well as a camera to document our data.
- After visual observations were made we then collected small samples of soil into separate bags for further testing.
- To test for hydrophobic soil we added some drops of water into the bag and timed how long it took for the water to dry up.

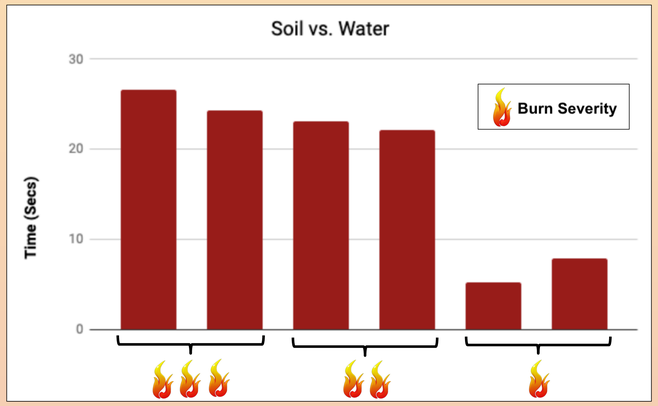

Figure 4: Soil water intake timed in seconds

Results

- Each soil profile observed located in the burned areas at Pepperwood Preserve had a thin surface layer of ash.
- All four samples in the burned areas of the preserve had a mixture of black and red color in the surface layer.
- In the burned areas tested for hydrophobic soil, it took between 22 to 26 seconds for the water to be less visible.
- In areas not affected by the fire, the soil absorbed the water between 5-7 seconds.

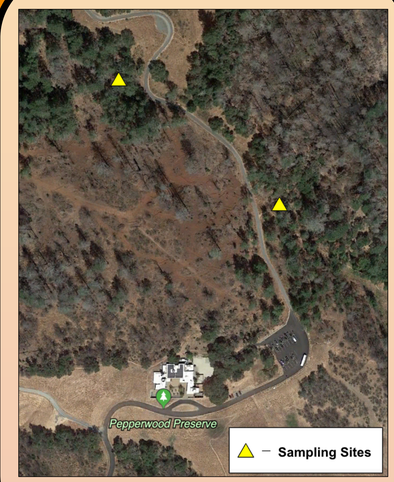

Figure 5: Sampling sites one and two

Figure 1: Low Burn

Figure 2: Medium Burn

Figure 3: High Burn

Discussion

The Tubbs fire did leave behind physical evidence of an ash layer on the surface of the soil at Pepperwood Preserve. In addition, the fire also left behind traces of hydrophobic soil symptoms. Having hydrophobic soil means that the soil is repelling water not allowing it to soak in as well as it should be. Vegetation in those areas will lack the proper levels of nutrients it needs to thrive regularly. Our findings concluded with the idea that a fire that happened in 2017 can still leave both physical and chemical traces behind affecting the soil and vegetation. When comparing results from area one and two, where the fire was more intense, compared to area three, where the soil sample was taken by the edge of the fire zone, there is a significant change in the physical aspect of the soil based on the darkness of soil color. These samples are a great way to understand how the soil itself was affected by a destructive fire that happened over a year ago.

Acknowledgements

We would like to thank Pepperwood Preserve for kindly letting us explore their preserve as well as Robin Glas for guiding us throughout this experience.

References

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