Creating a Chemical to Rehydrate Soil After a Wildfire

Kelsey Dearing[1], Mr. Shen[1], and Luke Corsbie[2]
[1]LBHS, [2]Student

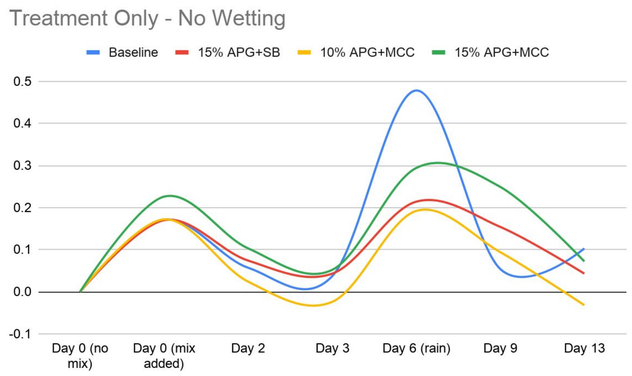
INTRODUCTION

Wildfires are incredibly common and end up devastating residents. After a fire the soil it left dry and hydrophobic for weeks. Then comes the rainy season, the only problem is there's nothing to hold up the soil when a heavy rain comes. The soil is weak and creates a major landslide that devastated communities right after the previous problem. The hydrophobicity of the soil creates a waxy layer which forces rain to b ounce of the soil instead of absorb causing a major downward force, plus now that the soil is so dry it is impossible for plants to grow. The plants create roots that hold together the soil. My project aims to permanently rehydrate the water to reduce the risk of landslides. In my project, I created a chemical that will rehydrate soil effectively so that landslides will not occur after a wildfire. I am very lucky to have gotten my samples from a controlled burn in riverside.

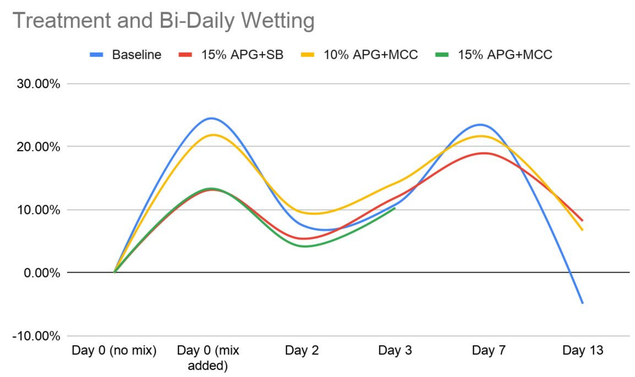
RESEARCH METHODOLOGIES

I will be creating a chemical surfactant called an Anchored APG. I will measure quantitative data through a experiment, comparing the mass of burned soil with APG to that of untreated burned soil and measuring the absorbance. I will complete this over an 2-week period measuring every 2 days, ensuring the APG remains effective. My Data will be the mass comparison from the start to the end. I am going to study only burned soil, which I retrieved from a controlled burn done by the Forestry Service in Riverside.. I will select my sample by identifying a compact area that is safe to burn, which I will determine in consultation with the fire department. The substances I used were, 15% APG and sodium bentonite, 10% APG and MCC clay, and 15% APG and MCC clay.

DATA AND FINDINGS



- The first data point on each graph is dry soil with nothing added, day 0 is when the mixture or water is applied at roughly 1ml per 100g of soil.
- The y axis shows what percent above the current mass is from the original dry weight, so a higher value means more water was placed in the soil.



- The two crests on each graph represent water being absorbed and the troughs represent water being lost, the space between them is what matters.
- A large amplitude meaning a big spike followed by a deep drop means the soil soaked up water and then lost it all quickly, which is exactly what you want to avoid.
- The ideal treatment has the smallest amplitude and longest wavelength, meaning it absorbed water moderately and held onto it for as long as possible rather than losing it fast.

DISCUSSION, ANALYSIS, AND EVALUATION

- 15% APG+MCC is the clear winner, flattest curve and longest wavelength meaning it held water the best and longest.
- Baseline performed the worst, huge spike right after wetting then dropped off fast, basically just acted like untreated soil.
- 10% APG+MCC was decent but lost water too quickly toward the end, even going negative in the averaged trial.
- 15% APG+SB was pretty similar to baseline, only moderate improvement so not really worth it.
- The Avg 1/2 data is the more reliable of the two graphs since it averages out dosing inconsistencies and still points to the same conclusions.

CONCLUSIONS AND IMPLICATIONS

After a wildfire the soil becomes water repellent, so any rain that comes just runs off and takes the topsoil with it which causes erosion and mudslides. this is a huge problem especially in places like southern california where heavy rain often follows fire season. what this data suggests is that 15% APG+MCC could be applied to burned areas to help the soil actually absorb and hold onto water instead of just letting it run off. the long wavelength and low amplitude means the soil would stay moist for longer, which gives plants a real chance to start regrowing and their roots would then further stabilize the soil over time. the day 6 rain event in the data is pretty much a perfect simulation of that post-fire rain scenario and 15% APG+MCC handled it the best by far. if this could be scaled up and sprayed over burned hillsides before the first rains hit it could potentially reduce mudslide risk and speed up ecosystem recovery significantly.

ACKNOWLEDGEMENTS / REFERENCES

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