Changes in Soil Porewater Chemistry Due to Fire Damaged Soil

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Introduction and Background

After a wildfire, there is an increase of nitrate and ammonium put into the soil that can negatively affect an ecosystem. Since we learned that after rainfall the soil porewater could contain nitrate and ammonium, we intended to research the chemistry of soil porewater after the fire damage caused by the Tubbs Fire and Nuns Fire that occurred over a year ago in Sonoma County. We hypothesized that the soil porewater in areas burned by these fires will have a slightly increased amount of nitrate, ammonium, and pH than the areas unaffected by fire. After taking soil samples at Pepperwood Preserve and Crane Creek Regional Park, we extracted the soil porewater to test for nitrate, ammonium, and pH levels. From our data we found that all eight samples had a similar pH; meanwhile Crane Creek sample results showed higher nitrogen levels than the Pepperwood Preserve samples. If more research is conducted on the effects of fires on soil porewater, we will have a better understanding of post-fire ecosystem resilience.

Research Methods

Data Collection:

- 2 sampling sites: Pepperwood Preserve and Crane Creek Regional Park
- Collect 8 soil samples (8 ounces)
- 8 samples: 2 burned areas/2 non-burned areas at Pepperwood Preserve, 2 burned areas/2 non-burned areas at Crane Creek Regional Park

Sample Processing:

- Transfer soil into cheesecloth
- 80 mL of 100% distilled water added to each soil sample and left to saturate for 24 hours
- Squeeze out water and test for nitrate, pH, and ammonium using probes

Figure 1: Soil collection at Crane Creek Regional Park.

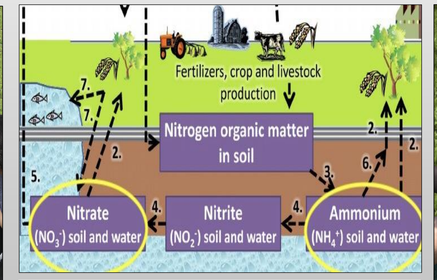

Diagram from: Bednarek, Agnieszka. (2014). Nitrogen pollution removal from areas of intensive farming- comparison of various denitrification biotechnologies. *Ecohydrology and Hydrobiology*, 14(2). Modified.

Figure 2: The nitrogen cycle showing how the form of nitrogen changes.

Figure 3: Soil collection at Crane Creek Regional Park.

Sample Locations and Results

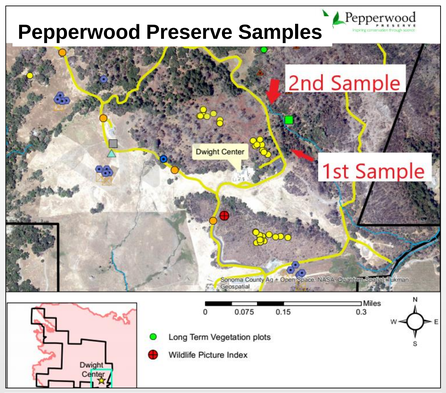

Figure 4: Map of Pepperwood Preserve sampling sites 1 and 2.

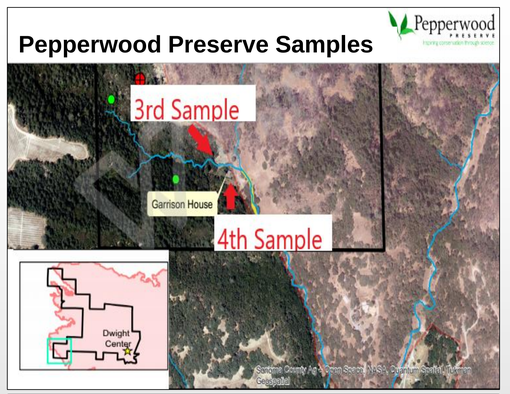

Figure 5: Map of Pepperwood Preserve sampling sites 3 and 4.

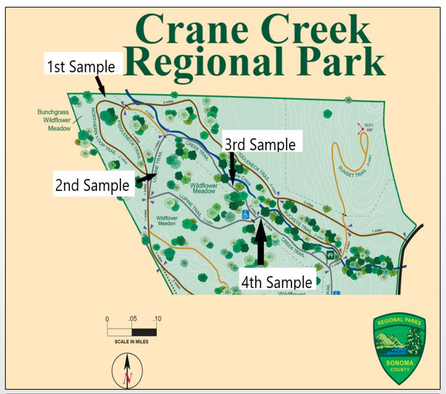

Figure 6: Map of Crane Creek Regional Park sampling sites.

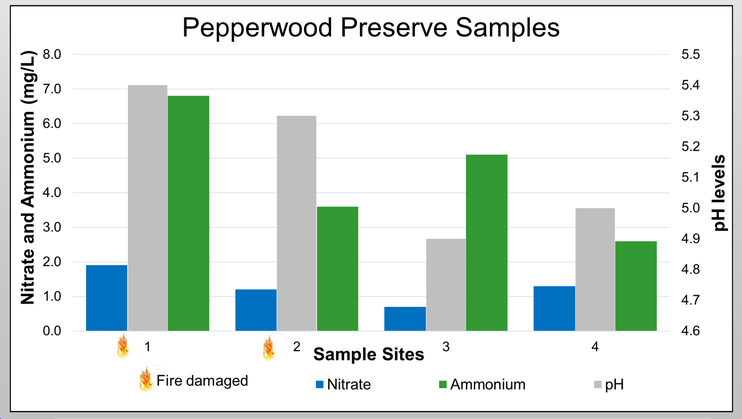

Figure 7: Levels of nitrate, ammonium, and pH from all the samples taken at Pepperwood Preserve.

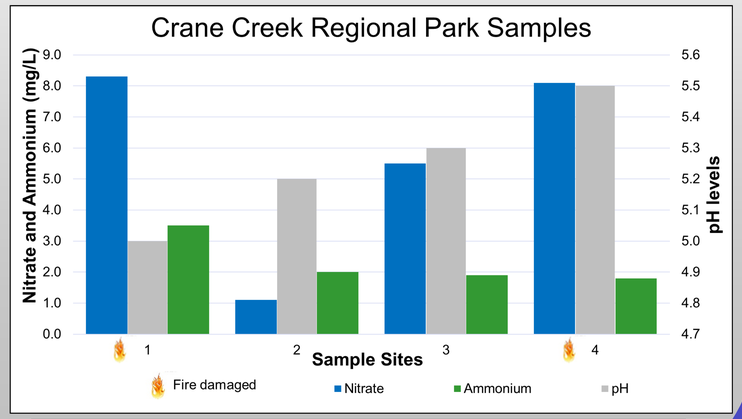

Figure 8: Levels of nitrate, ammonium, and pH from all the samples taken at Crane Creek Regional Park.

References

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Conclusion/Discussion

- Lower levels of nitrate with higher levels of ammonium at Pepperwood Preserve
- Higher levels of nitrate with lower levels of ammonium at Crane Creek Regional Park
- All sites had consist acidic pH levels (range: 4.9-5.5 pH)
- We would expect high nitrate immediately following a fire and up to three years later and high ammonium up to a year later
- Ammonium is still significantly high at Pepperwood Preserve a year later
- Nitrate at Pepperwood Preserve has returned to normal levels
- We speculate that the nitrate levels were a lot higher soon after the fire since the ammonium is still at high levels (ammonium is mostly converted to nitrate)
- High nitrate levels at Crane Creek Regional Park due to the land use (cattle grazing)
- Cattle grazing is a far stronger control of soil nitrate than fire