Using X-ray Fluorescence to Analyze Fire Impacted Soil and Vegetation Composition

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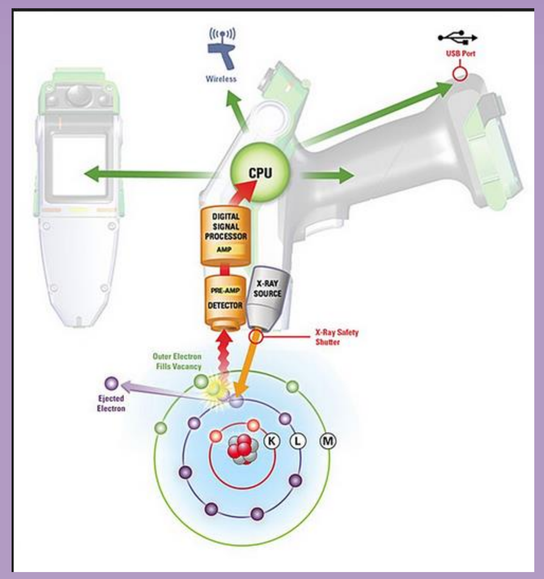
Introduction

Our lab is using a X-ray fluorescence (XRF) to measure the concentrations of metals in sediments from subalpine lakes. Our goal is to measure the biogeochemical consequences of wildfires over the last 2000 years. This study looks at the elemental composition of different lake cores, and vegetation samples from areas of the “Big Burn” fire of 1910. This fire burned across several states in the Rocky Mountain region. With our XRF data we are able to see how the fire impacted the soils and how long after the fire proper soil composition can occur. This study can be used to help understand the impacts of large scale fires on local ecosystems.

Figure 1: XRF Diagram



XRF is an acronym for x-ray fluorescence. This is a process where electrons are displaced from their atomic orbital positions. This releases a burst of energy that is specific to each element. This release of energy is then registered by the detector in then XRF instrument, which in turn categorizes the energies by element.

Potential Impacts

With the increasing intensity and frequency of forest fires in the United States, we hope this study can provide a deeper understanding about the impacts of fire on ecosystem cycles. The composition of soil is telling of overall ecosystem health. If soils are lacking in any of the essential elements it can cause issues for decades after the fire is burnt out. Our study provides information on which elements are affected the most, and in what environments the ecosystem is more likely to bounce back.

Methodology

- Soil and vegetation samples are collected from lakes in several states affected by the Big Burn.
- These samples are then homogenized and weighed before preparing them for the XRF analysis.
- Once a samples weight is recorded they are analyzed by the XRF machine (as seen in Fig 1.) and catalogued for future reference.
- The data is then uploaded to a database for future analysis by our colleagues at the Universities of Wyoming and Montana.

Figure 2: Homogenized Samples

Figure 3: Packed Sample Ready for Testing

Moving Forward

The proposed method relies on a standardized experimentation process to gather relevant data. Initial experimental results have confirmed that the proposed method is capable of gathering the necessary data. This summer our team will be gathering more samples from additional areas to gain a more thorough understanding of the differences between local ecosystems and their respective cycles. In doing so we will continue to add to our understanding of the resiliency of said systems.

Acknowledgments

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