

The Effects of Forest Fire on the Release of Mercury from Soil



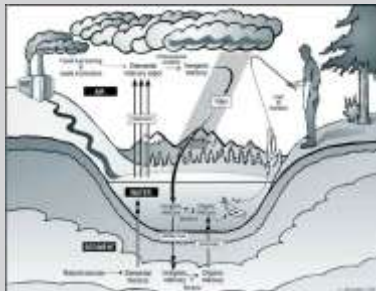
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Overview

- Background information
- Analysis Methods
- Results
- Conclusion/Further work
- Questions

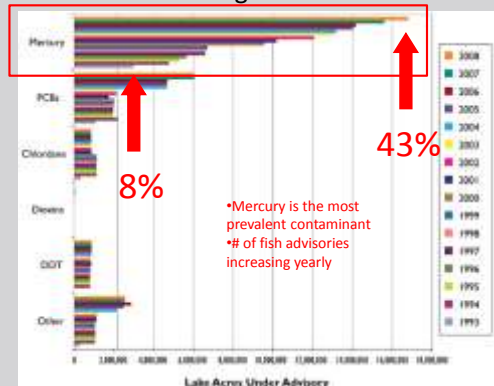
Background

Mercury Cycle



- Mercury poses human and ecological health risks
- Methylmercury (MeHg) is a neurotoxin
- Fish absorb by bioaccumulation and are the main exposure of mercury to humans
- It can be accumulated to toxic levels in humans

Background



8%
43%
•Mercury is the most prevalent contaminant
•# of fish advisories increasing yearly

Background

Mercury in the West

- Mercury is a global contaminant but also a local contaminant
- Coal fired-power plants in the United States release about 20-50 kg y⁻¹ of mercury per plant (EPA , 1997)
- Mesa Verde: 416 ng/L
- We are interested in the distribution of mercury in watersheds

Background

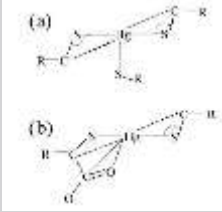
- Study the release of mercury in forest fire
- In aquatic environments mercury can be methylated and is accumulated in fish which humans then consume
- Vallecito Reservoir
- We think one problem for mercury transport is forest fire
- Arid region= Increasing fire



Background

- The strong association between mercury and organic matter is reduced sulfur. Forest fire may be oxidizing sulfur and reducing bond strength.

- (a) Strong binding of mercury with reduced sulfur
- (b) Weak binding of mercury with reduced sulfur and oxygen or nitrogen



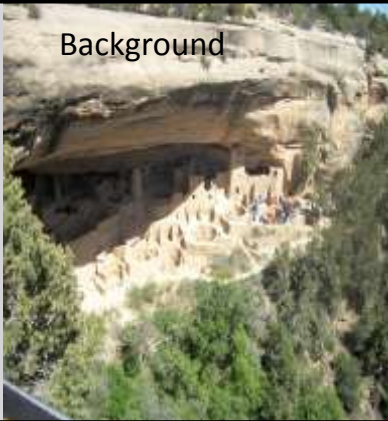
Oxidation = ?

Background Power Plants Near Mesa Verde NP

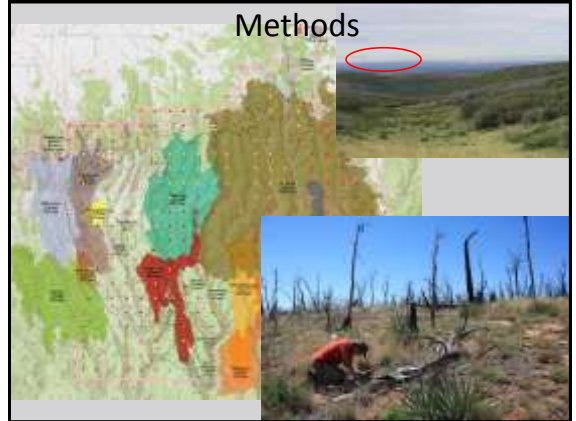


- Home of the ancient ruins of the Anasazi Indians
- Mesa Verde has 600 cliff dwellings
- Covers 52,000 acres
- World Heritage Site

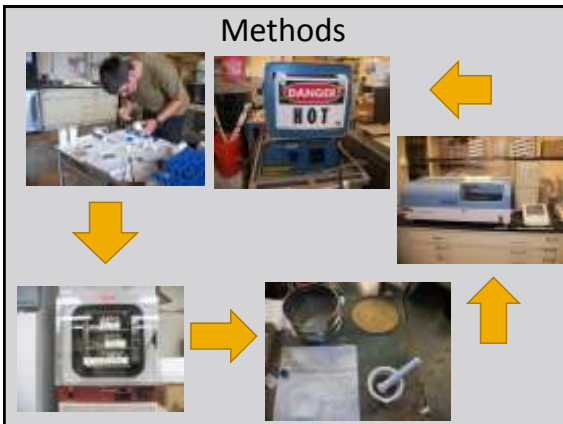
Background



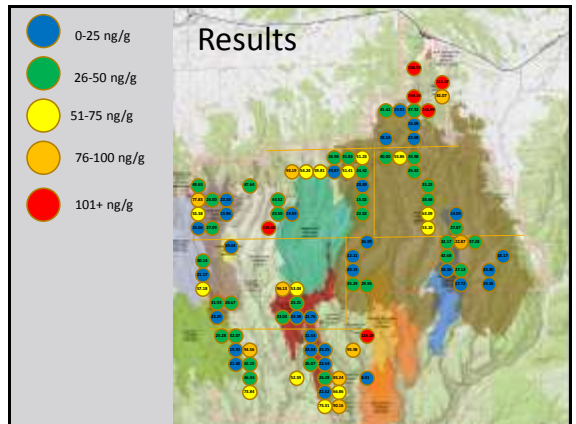
Methods

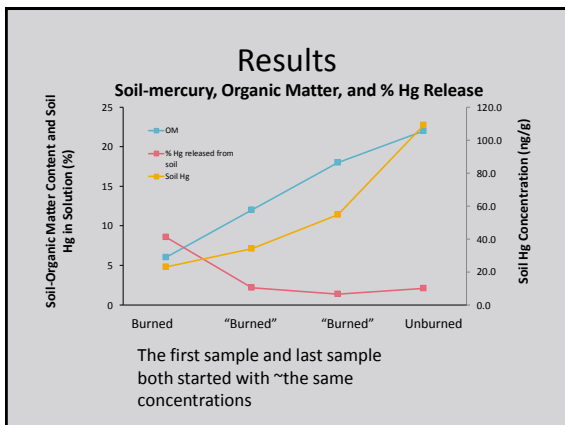
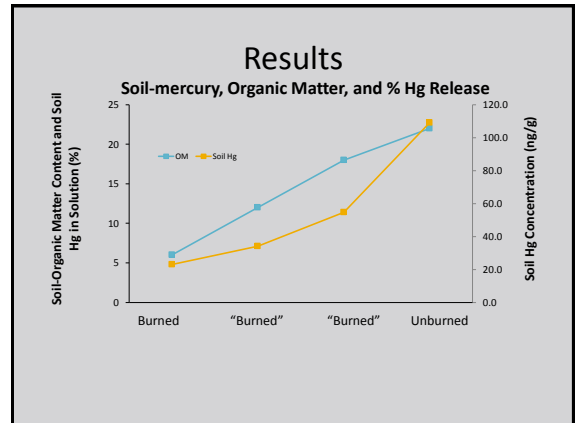
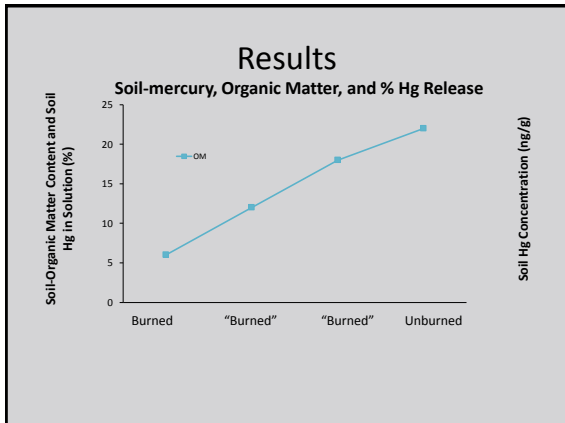
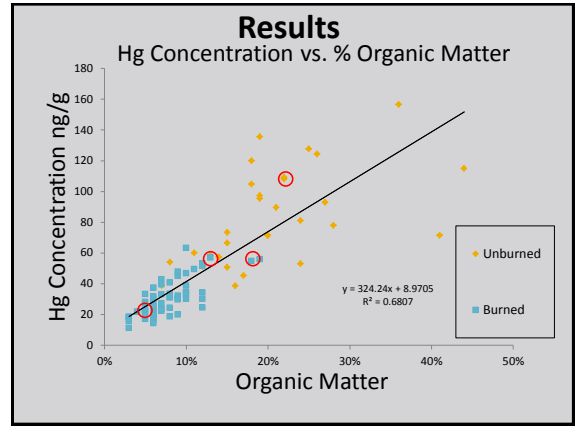
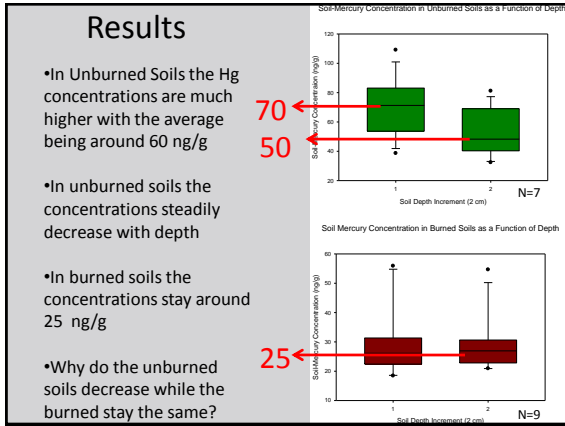


Methods



Results





Conclusions

- There is a strong correlation between Organic Matter and Hg concentrations.
- Areas that are burned have lower mercury concentrations and unburned areas have higher concentrations.
- Preliminary release experiments show that high burn areas have the highest percent release

Implications

•Mercury is staying in the soils and being transported to surface waters



•When weak binding occurs, more mercury is likely to dissociate and become more available for uptake

Future Work

- Continue release experiments to determine if greater mercury release is caused by greater fire intensity.
- XANES(X-ray absorption near edge spectroscopy) to determine if sulfur oxidation is responsible for weaker Hg-OM binding.
- Determine what the Hg-OM binding constants are in fire affected soils.

Funding

- National Science Foundation
- National Park Service George Melendez Wright Climate Change Fellowship
- REU Environmental Engineering Summer Program

References

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QUESTIONS?