# Exploring the Use of Silver Film to Detect Sulfide in Wetland Soils: Adding a Silver Lining to Working in Challenging Terrains

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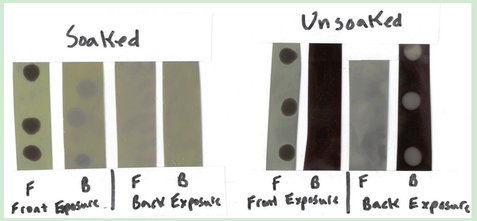
Niwot Ridge LTER
UNIVERSITY OF COLORADO **BOULDER**

## Introduction

- The sulfur cycle is a key biogeochemical cycle that has been greatly manipulated by human activity, and directly affects the health of humans and wildlife.
- Traditional methods for detecting sulfide in soils are labor and time intensive and provide many opportunities for error.
- Use of silver halide film to map sulfide has been used in other environments, but hasn't been tested in wetland soils.
- Goals:
  - -Explore this method as a complimentary method of detecting sulfide that can be adapted to alpine wetland environments.
  - -Make it portable and easy to deploy.
  - -Provide a visual understanding of where sulfate reduction is occurring in wetland soils.
  - -Create a standard operating procedure (SOP) for INSTARR lab at CU Boulder.

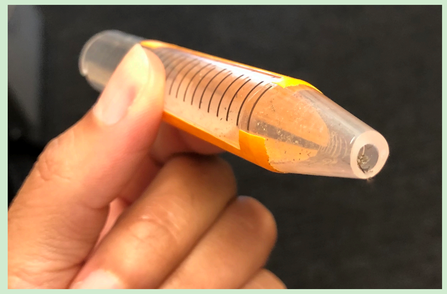
## Experimental Design & Preliminary Work

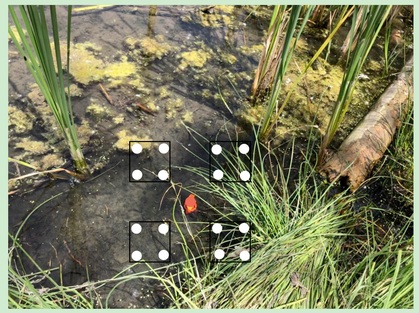



Preliminary experiment using 5mM/L solution of sodium sulfide demonstrated the need to soak films before exposure.

Field site was selected based on ease of access and presence of gleyed soil.

## Field Method (adapted from Fike et al.)





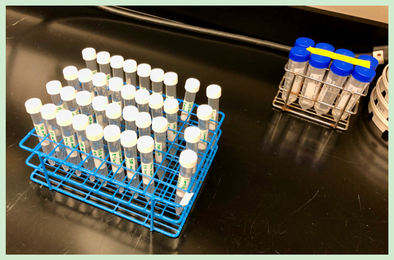
Film was prepared and mounted on modified 15 mL centrifuge tubes in a dark room.

4 films per time point (16 total) were inserted in the soil in the bottom of a wetland marsh. The total sample area was approximately 30 cm by 30 cm.

Upon end of exposure time, films were taken out of the soil and immediately inserted in light-protected tubes filled with MQ water.

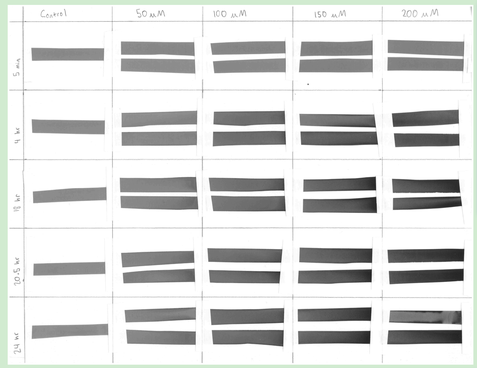
Films were rinsed and dried in dark room before visual analysis.

## Methods for Creating Concentration Matrix (Adapted from Fike et al.)



Concentrations of sodium sulfide solution ranging from 50 to 200 $\mu$M/L were divided into 15 mL centrifuge tubes. Strips of film were dropped in and exposed for a specific time before they were removed, rinsed, then photographed.

## Discussion of Results

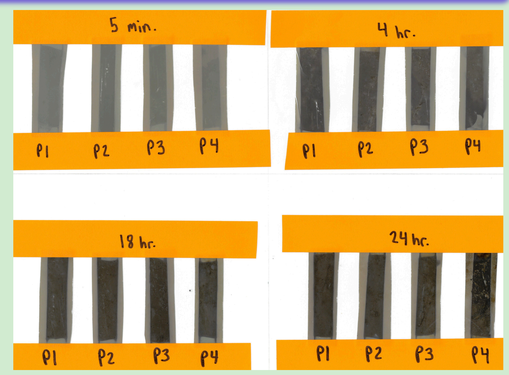



**Results from concentration matrix:**

- Suggests that sulfide is less detectable below a certain concentration threshold.
- Demonstrates that continuous exposure to detectable levels of sulfide results in coloration of the film that roughly correlates to a specific concentration of sulfide (as indicated in Fike et al.).
- Film appears to react with sulfide in an inconsistent manner, producing variations in coloration along length of film strip.

**Results from wetland study:**

- Demonstrates link between exposure time and concentration as indicated by coloration (as indicated in Fike et al.).
- Suggests that sulfate reduction is happening continuously throughout areas of wetland soils.
- Points to potential detection of upper threshold of sulfide concentration in a particular area of soil.




## Conclusions and Future Work

- This method has proven to be a simple and effective way of quickly detecting whether sulfide is present in the soil, so long as it is above a particular concentration.
- Because this method has now been adapted from use in sediments for use in alpine wetland soils, this method will be used in the Niwot Ridge LTER in the near future.
- More needs to be known about how to optimize the qualitative visual data provided by the films, due to what appears to be an inconsistent reaction between the silver halide film and sulfide in controlled lab settings.

## Limitations

- Verification of sulfide levels in soil was not performed via traditional means (isotopic analysis, spectroscopy, colorimetry).
- The effects of light exposure on the films' ability to detect sulfide is not clearly understood.

## Acknowledgements

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## References

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