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# Can you build on quicksand?

Soil aggregate stability refers to the ability of soil particles to bind together and resist breaking apart or disintegrating.



VS





- Aggregates form through natural forces and organic substances, for example microbial by-products, cementing particles into micro- and macroaggregates.
- MICP stands for Microbially Induced Calcite Precipitation. It is a biogeochemical process in which certain bacteria, often belonging to the genera Bacillus and Sporosarcina, are used to precipitate calcium carbonate in the presence of Calcium.

### Microbial-Induced Calcite Precipitation



cemented with Calcium Carbonate

It influences the engineering properties of soil, impacting factors such as compaction, shear strength, and permeability.



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Forest fire remediation and the stabilization of coastal soils are applications that could benefit from a novel method to increase aggregate stability. Which is why our research focused on two treatments, burned and unburned soil.



Left to right, samples collected in the field, Oven for soil burning, our burned and unburned samples.

## Stimulation of Native Microflora to Stabilize Soils After Wildfires Christopher Legón, Pablo Robles, Mohamed Ismail, Ellithy Ghada, Hugo Castillo



This study hypothesizes that amendment of soil with Urea will enrich the natural population of ureolytic bacteria which upon the addition of Calcium Chloride will result in the stabilization of soils.





### Two Treatments: Burned and Unburned





### Enrich Native Population



## **Determine Urease Activity**

25°C in the dark



ate individual colonies and screen for

#### Quantify Calcium **Carbonate Precipitation**



(8) Drain media and weigh sample

#### Enrich on a Macro-scale and determine aggregate stability change





Collect sample and test physical properties

(4) Plate dilutions of cells



Enrich sample with
Urea and Calcium rich media

## Hypothesis





Enrich with Urea rich media and incubat



(3) Pellet cells



λ = 560 nm







- (6) Read absorbance of dilutions of Isolates
- l to dissolve Calcium Carbonate and weigh difference









Content



sample.





## Results

#### • This research is ongoing and funded by an Undergraduate Internal Grant.



• A urease activity assay was carried out and grassy soil was chosen as the primary soil sample to investigate during the subsequent tests.

• The samples behaved predictably as the autoclaved sample showed little to no growth and only the first four dilutions of the live burned soil demonstrated a positive reaction with an absorbance above .1 at  $\lambda = 560$  nm.

• The soil samples were treated with the same media as prior with a .27 M Calcium Chloride solution added over the course of three weeks.



• The samples were washed with 1 M HCl to determine their Calcium Carbonate

## Ongoing Research

The next steps entail identifying the ideal treatment duration by comparing the increase in compressive strength with the duration of treatment. Following this, the modified water flume will be employed to evaluate the stability change of the