

Riders of the Storm

Kristin Shelton

8th-grade Integrated Science

RAF Lakenheath Middle School, DoDEA Europe

Mentors: Dr. Edward Kavazanjian, Farideh Ehsasi, Xi Yu, Logan Tsosie



Riders of the Storm

Thank RET Teacher Team 2023

Especially to my Excellent Lab Team

Anju Kharbanda, Ana Marti- Subirana

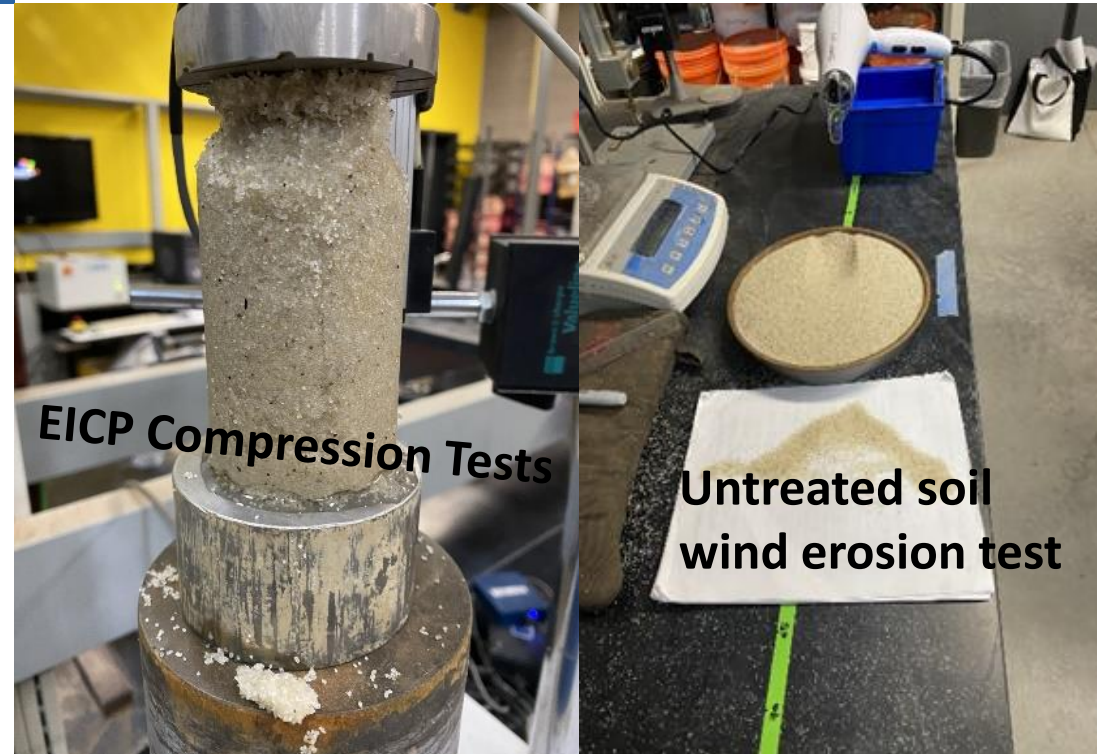


RET Lab Experience Research Summary

Research Background

Dust particles in the air ride erosion storms of wind and/or water and causes harm to humans, our environment, and industry practices.

‘Riders of the Storm’ refers these tiny dust particles that get caught in wind or water erosion processes and cause so much damage.



RET Lab Experience Research Summary

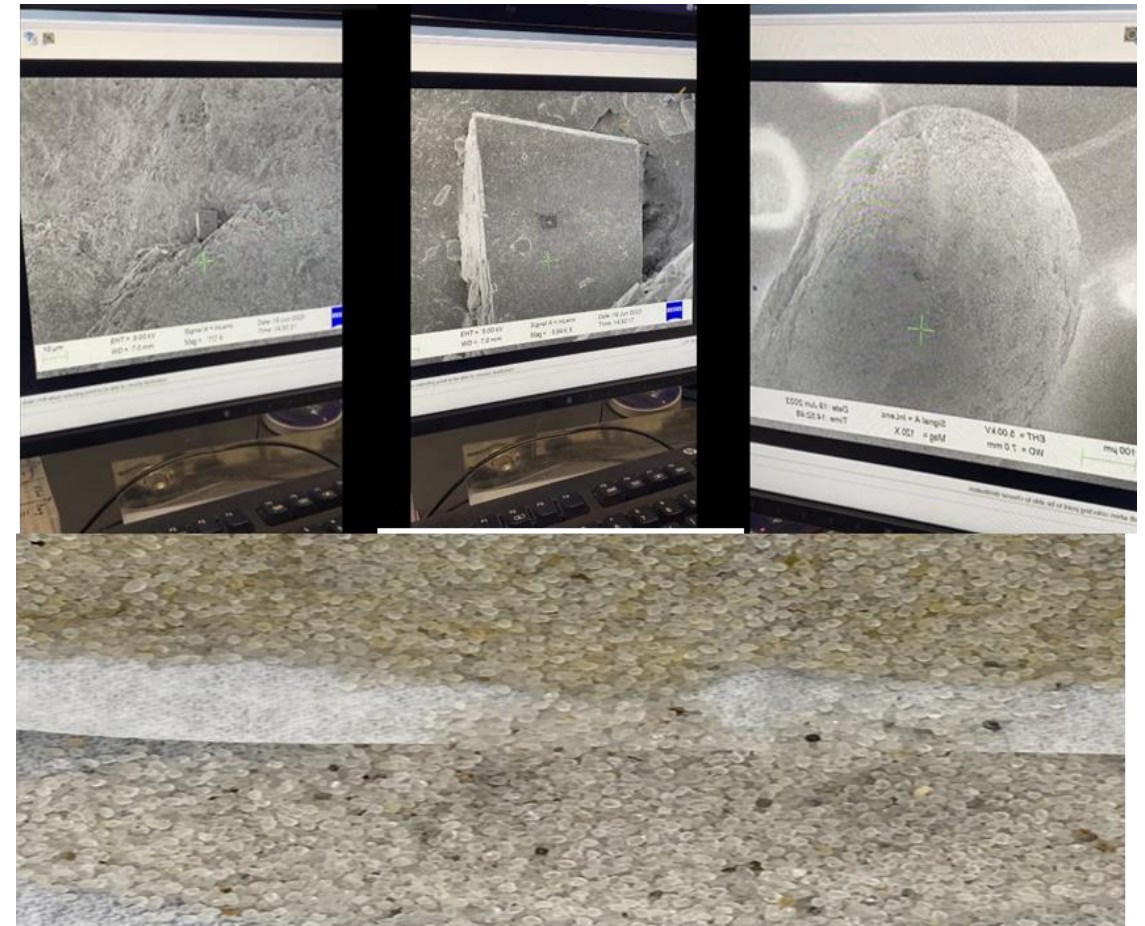
Research Background

CBBG (Center for Bio-Mediated and Bio-Inspired Geotechnics) researches and demonstrates successful methods to reduce dust pollution for mainstream practices. Bio-mediated soil is developed by adding an enzyme to the soil to toughen its structure without harming the environment. EICP (Enzyme Induced Carbonate Precipitation) alters Earth's surface to strengthen and stabilize the soil. EICP turns sand into sandstone.

RET Lab Experience Research Summary

Research Objectives

- How Does EICP Create an Effective Soil Crust?
- Determine soil by grain size.
- Create EICP treatment in the lab.
- Measure EICP carbonate and ammonia concentrations
- Explore treated/untreated sand using an Electron-Microscope.
- Test soil strength using a penetrometer, compression, and mock wind erosion techniques.



RET Lab Experience Research Summary

Research Conclusions

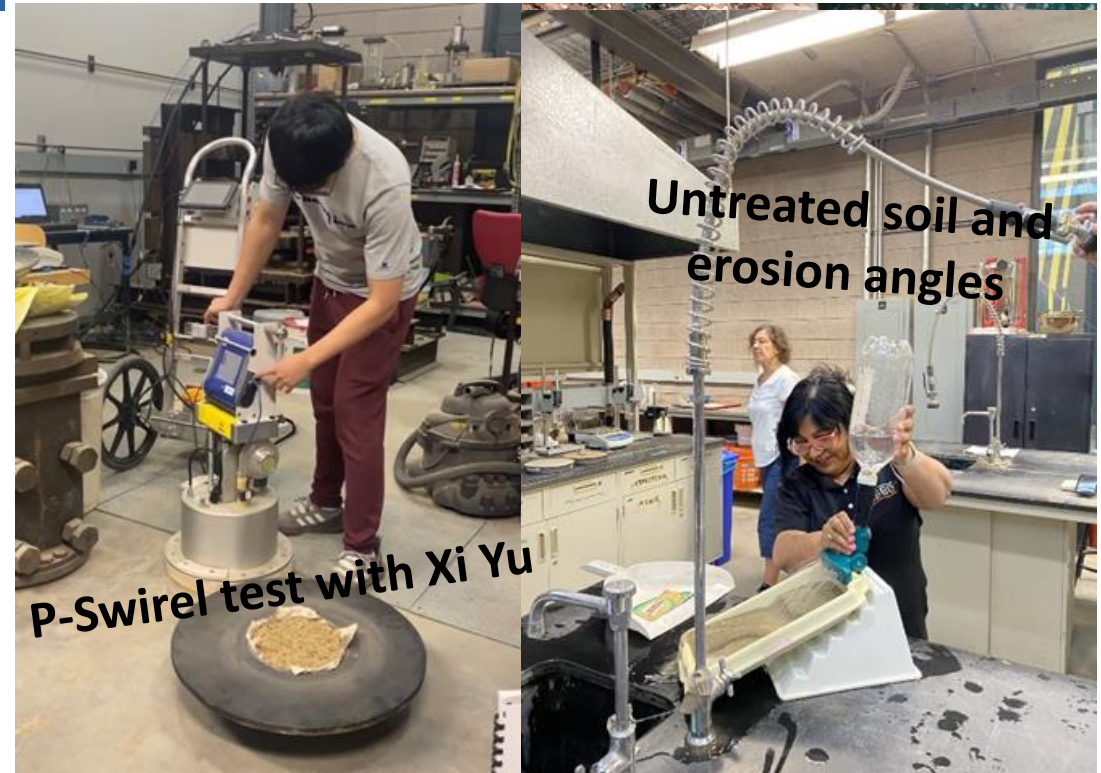
Soil loss occurred more in fine-grained sand than in heavier sand particles.

Steep angles of soil produce easier erosion paths than smaller angled slopes

EICP treatment is 3-4 times stronger in penetration tests compared to untreated soil.

Ammonium is present at less than .01% in the treated soil

Carbonate is ____% present in the treated soil



RET Instructional Lesson Implementation

Lesson Description

*This unit is designed for 4 - 80 min. classes. **Focus: Lesson 3 of 4***

Turn fine-sand into sandstone. Students will test bio-mediated products to strengthen the soil crust.

***Unit: Problem-Solving** - Identify constraints and criteria of a problem, brainstorm solutions, select a solution, develop the solution, test, evaluate, improve, and communicate results.*

RET Instructional Lesson Implementation

Lesson 1 of 4 Description

Students will determine how ‘dust storms’ impact humans, society, and communities.

Students will understand how EICP penetrates and strengthens soil.

Students will review and follow our class procedure: ‘Engineering Processes for Problem-Solving’

RET Instructional Lesson Implementation

Lesson 2 of 4 Description

Students will explore a variety of mixtures to treat soil (household products, water, EICP).

Students will create the EICP solution components.

Students will discuss rubric criteria of at least 3 different parameters to measure strength of treated soil against erosion from wind and water.

RET Instructional Lesson Implementation

Lesson 3-4 Description

Students will strengthen soil against erosion using household products, water, EICP.

Students will implement their team's treatment on fine-grained soil surfaces

Students will finalize their team rubric, and build the 3 different strength tests.

RET Instructional Lesson Implementation

Lesson 4-4 Description

Students will perform 3 strength tests on treated, soil against erosion from wind and water. *(student-designed rubric)*

Students will evaluate their team's findings

Students will communicate their team findings in writing and aloud.

RET Instructional Lesson Implementation

Lesson 3 Description

Lesson 3: Riders of the Storm CER (Claim, Evidence, Reasoning)

Question: What bio-mediated mixtures would be effective to create a soil crust that can be tested for strength against wind and water erosion? Why?

Directions: Use the prompt to clearly state your team's claim, evidence and reasoning.

Hypothesis: ex: *“An effective solution effective to strengthen soil crust is (claim) because when measured for strength against erosion (evidence) we expect (reasoning)”*.

RET Instructional Lesson Implementation

Lesson Objectives

Lab 1:

Students will choose from a variety of mixture options: household products, water, EICP to strengthen soil to be tested against wind and water erosion

Lab 2:

Students will finalize their team rubric

Students will write procedures on how to build 3 different strength tests for the next class use.
(materials, procedures and data collection).



RET Instructional Lesson Implementation

Lab 1: Brainstorm/Research

How Could Soil Strength Be Tested Against Wind and Water Erosion?

Directions Describe the procedures to perform 3 separate quantitative measurements your team will use to collect data to test a soil's crust strength.

Test 1-3 (wind or water erosion?)

Strength Test Title/Name 

(test name)

Bar Graph

Materials (item and amount):

Procedures:

Data chart (x and y axis) titles and units:





RET Instructional Lesson Implementation

Lesson Description

Lab 2: Preparing Test Solutions

Question:

How Could Soil Strength Be Tested Against Wind and Water Erosion?

Directions:

Students will prepare and deploy their team's solution(s) for strengthening soil (for later testing).

RET Instructional Lesson Implementation

Lesson Description



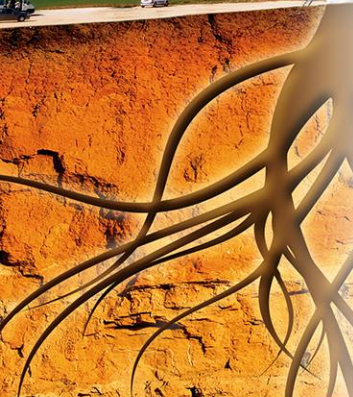
Soil Grain Sorting Pans



Measuring EICP
Treated sand columns



Applying EICP to
soil samples



RET Instructional Lesson Implementation

Lesson Description

Lab 2: Preparing Test Solutions (continued)

Once your team completes a mixture(s), treat the fine-grain sand container immediately, and then document the exact ingredients name, amounts, and procedures for each mixture your team creates.

Clearly label all soil containers include a 'control' sample.
Leave, undisturbed in the area discussed

RET Instructional Lesson Implementation

Lesson Description



**Thank you!
Questions?**

**Kristin Shelton
kristin.shelton@dodea.edu**