Freshwater Crisis and Why Your Land Might Have Something to Do With It

By Kenadee Culver, Alexa Jansen, and Noah Ives
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Abstract

This study is related to freshwater becoming a very big issue for people around our country. This is important because people around the world don’t have access to freshwater, even in some places around the United States . Previous studies have shown more than 2 million people in America don’t have access to clean drinking water in other words 0.6% of the American population. The objective of our study was to create a soil moisture sensor to detect the moisture in soils to show people what to use to conserve the most fresh water. My research objective was that the clay-rich soil will hold the most freshwater for the longest amount of time. This was researched by using a soil moisture sensor to detect the amount of moisture in the four soils. We tested all four of the soils. The data we received from our tests were that the clay soil held freshwater for the longest time in both tests. The times we received from testing the clay soil were fifty-six minutes and thirty-nine seconds in the first test. Then fifty-one minutes and nineteen seconds in the second test.

Introduction:

Around the world there are many towns and cities that struggle with keeping their water clean. You might not know that right now around the world 2 million people in America, don't have access to clean water. In other words, 0.6% of the American population does not have access to clean drinking water (Barbecue Lab, 2022) . Where we live you might not think much about the water we drink or use to bathe in. We don't think about the water we use to boil and cook things in. Unlike some of the other towns and cities in America we have water that is clean and healthy for us to drink. Some of the people in the United states don't have that and haven't had clean water for years or even decades. Some people like the people from Jackson, Mississippi haven't had clean water for decades. For the people from Jackson, Boiling water has become a way of life for them (Jackson Miss, 2022).

Like the people from Jackson many other people around the world struggle with the same things and have the same ways of cleaning their water as they do. Like them they have many struggles with things we do daily. For example bathing, brushing your teeth, filling a water bottle, or even just getting a glass of water. But it's not always the town's fault some people might be using the wrong materials for their daily jobs, for example not using the wrong type of soil for gardening causing you to need more freshwater.

Not having clean water can cause many health problems because of the chemicals, disease causing microbes, and bacteria that can be carried in the water. If people's drinking water has too many contaminants in it, the water can cause health problems, such as gastrointestinal illnesses, nervous system or reproductive effects, and chronic diseases like cancer, cholera, organ damage,

skin discoloration which would be more major. There's also not as major illnesses or side effects like stomach pain, diarrhea, vomiting, headache, and fever. Infectious diseases can also occur after drinking dirty and unhealthy water (“Drinking Water” US EPA). This would affect people's health majorly and could change their lives in many ways because they drank unhealthy water.

The amount of clean water used for farming is not always enough or sometimes too little. To help improve irrigation planning, water savings, planting crops, to have a healthier landscape or field you don't want to water your field too much or too little freshwater and you want to have the correct consistency and the right amount of water in the soil. Without Irrigation system’s people wouldn’t be able to grow crops in the California heat, or in your own garden (USGS, 2018). To help and make it so there is more fresh water for the people around America we should start to try and conserve more water to be able to keep everyone healthy and be able to grow food to supply our grocery stores.

To keep all of the countries up and running we all need to have nice clean water to drink. That is a serious issue with today because many towns or cities are struggling to afford to repair their wells. That means that they have to fully depend on either bottled water or boiling the water that is dirty. The water in irrigation systems is only half reusable. The other half has either evaporated or contaminated by a leaking pipe. Some towns don’t have the money to replace their pipes that contaminate the water making it very unsafe for people to drink out of. Some of the countries' climates around the United States are very hot and humid. The people around those area’s can’t afford to lose a lot of fresh water. So if the people around those areas would know what the best kind of soil that conserved the most water was, they would know what kind of soil to buy so they

wouldn’t waste the fresh water. There are many organizations that help to take care of lint in water. Most of these businesses are all about trying to help towns and cities with water issues so in future generations there's enough water for everyone. They try to help take care of our water issues to ensure that people have clean water. But there are so many people struggling with their water issues that they can't help everyone. For example one of these businesses is NRDC, they say they have continued to fight for clean, safe, and healthy water supplies all around the country. They talk to different towns and cities governments to make sure everyone’s water supplies stay healthy and clean for everyone to use (NRDC, website). That's why if more people started to use water moisture sensors and the right type of soil to help conserve their freshwater like with gardening or watering the grass, then maybe we would have a little more fresh water for the people who don't have any good, healthy, clean water to drink from.

Hypothesis:

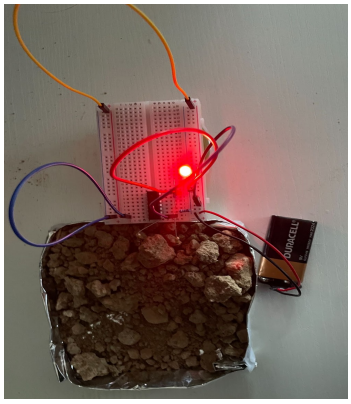
We thought that in our experiment the clay- rich soil will work the best and will hold the most fresh water for the longest amount of time. We thought this because clay soil can hold water up to about 72 hours, and if we water the soils the first time about one ounce then leave all four of the soils in the sun, we can wait and see what soil moisture sensor goes off first to determine what soil conserves the most freshwater to the least fresh water.

Methods:

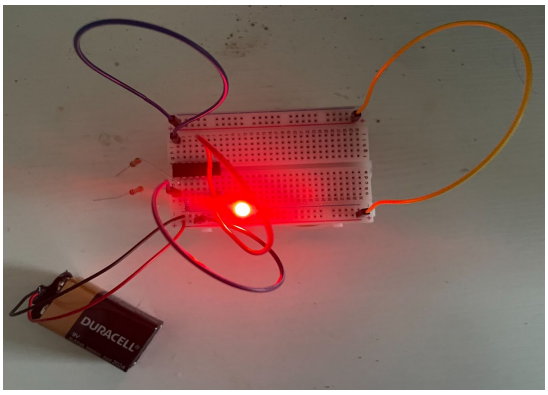
We used one water moisture sensor (shown down below) that we created, to try out four different kinds of soils, silt soil, clay soil, loam soil, and sand soil to see what soil conserves the most freshwater. We timed how long it takes for the LED light connected to the water moisture sensor

to go off to determine how long it took for the soils to dry out. We timed each soil sample on how long it took for it to dry out with a stopwatch, and when the LED turned on we stopped the time for that sample. We gave each sample exactly 1 hour to dry out. To make sure our project worked correctly we weighed the flower pots before with the dry soil in them, then again at the end of the project we weighed the flower pots with the wet soil to make sure that our soil moisture sensors worked the correct way. A water moisture sensor is a machine that can detect the amount of moisture in soil and if it's too dry the light will turn on and if the soil is wet the light will remain off. How we knew to water the soil is we inserted the aluminum foil tongs that are connected to the tongs of the soil moisture sensor by alligator clip leads, into the different soils and depending on the amount of moisture in the soil the light turned on if it's too dry or it remained off if it's too wet. When we first started off our project we started with ½ cup of soil in each small foil pot. Then when we inserted the tongs of the aluminum foil tongs into the soil. We then added one ounce of water to the pot of soil. We gave each soil an hour to dry out. When we finished testing how long it takes for the soils to dry out we compared all four of the times of how long it took each soil sample to dry. Whatever sample took the longest amount of time is the soil that conserved the most amount of freshwater.

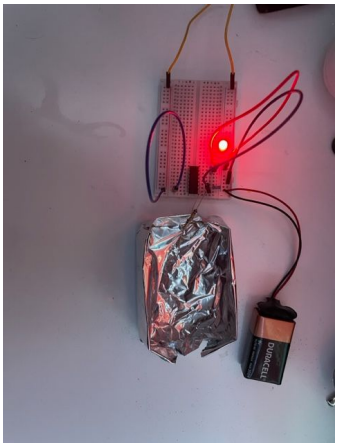
Photos:



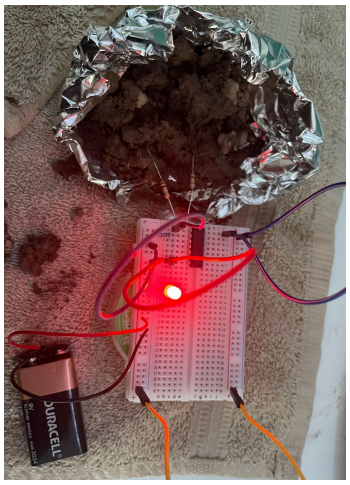
Soil moisture sensor testing clay soil



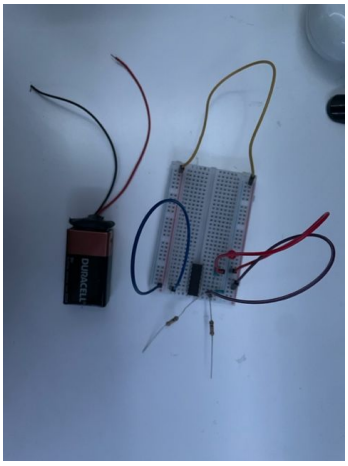
Soil moisture sensor before testing



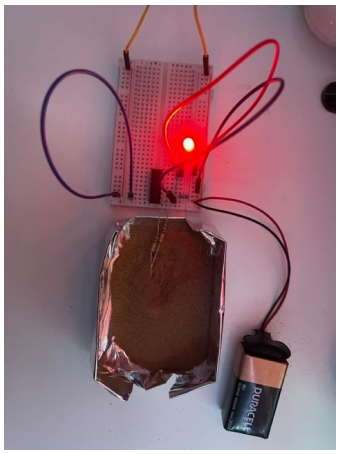
Before adding soil



Soil Moisture sensor testing loam soil



Before plugging in Battery



Soil Moisture sensor testing Silt soil

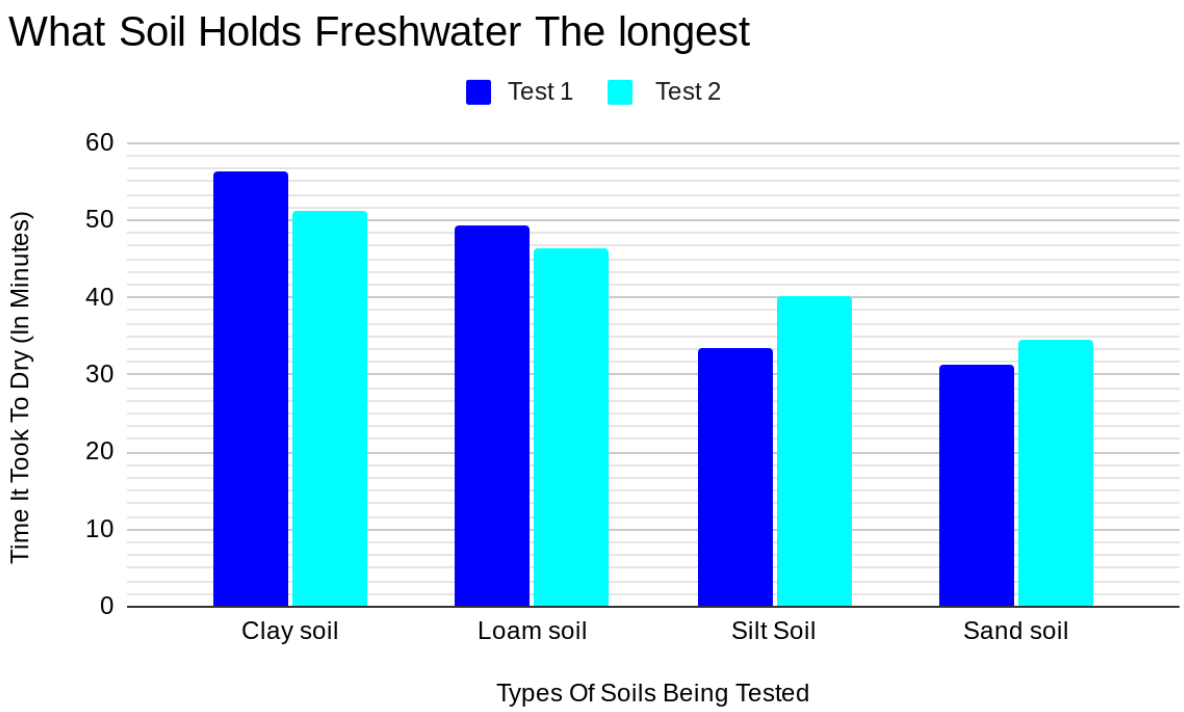
Results:

Data Table:

Time it took to dry (Minutes)	Silt Soil	Loam Soil	Clay Soil	Sand Soil
Test #1	33:57	49:25	56:39	31:42
Test #2	40:21	46:31	51:19	34:53

This data table shows how when we timed how long the soils took to dry out how long it had taken each soil to dry out two separate times. The data in this table is recorded in minutes and seconds.

Graph:



This graph shows that the clay soil has the longest times for both tests. In the first test it took the clay soil fifty-six minutes and thirty-nine seconds exactly to dry out. Then in the second test it took the clay soil fifty-one minutes and nineteen seconds to dry out. Loam soil had the next longest time with forty-nine minutes and twenty-five seconds in the first test, and forty-six minutes and thirty-one seconds in the second test. Then comes the silt soil that held water for thirty-three minutes and fifty seven seconds the first time, then forty minutes and twenty-one

seconds the second time. Finally comes the sand soil that held water for thirty-one minutes and forty-two seconds the first time, then thirty-four minutes and fifty-three seconds the second time. Over all when we looked at all the data the clay soil held the soil for the longest amount of time.

Discussion:

Overall when we were looking at all our data the clay soil held water for the longest time out of clay soil, loam soil, silt soil and sand soil. The soil that held freshwater the longest after clay soil was Loam soil, then was Silt soil and finally was sand soil. We believe that our data came out this way because clay after it gets wet has been proven to hold water up to around seventy-two hours. We thought in the beginning that the clay soil was going to hold the most freshwater for the most time and we were proven to be correct with this project. We got these results because the soils that held water the longest were also the thickest soils we had. For example clay soil. The clay soil we tested in our project had about a 0.68 porosity making it the thickest soil we tested. Loam soil has about a 0.48 porosity level so it's the second highest out of all the soils. Then comes silt soil that generally has a porosity level of 0.37. Then Finally the soil that has a porosity level that can be as high as 0.35. The soils that didn't hold the freshwater for very long were the soils with the lowest porosity level. Those soils allowed the little freshwater to evaporate into the air quicker than the thick soils like clay and loam that had a high porosity level making it harder for freshwater to evaporate.

Limitations:

When we were performing our project we had a few difficulties getting the sensor to work properly. The light when the 9v battery was plugged in would never turn off. It would only turn off when we disconnected some of the parts or moved them around. After trying it a few times

and replacing the parts multiple times it still wouldn't work correctly. Then to try and find a way to resolve our problem we did a little bit of researching to find out why it wasn't working. We tried a few different ways and after a while we were able to get the sensor to properly work. The wires weren't all connected the right ways or in the circuit far enough. We used some of the old parts and replaced some others so that could have affected our data a little bit but we used the same parts for all the tests on all the soils.

Future Studies:

The next logical step in our studies would be to create a larger waterproof sensor that people can use in their yards, flower beds, large flower pots, gardens and more so they detect when they would need to water their property. This would help people to know exactly when they need to water their plants so they don't waste freshwater that other people could use to drink and cook with. This would help to save our freshwater for the future if you or your family ever need it, and for other people who really need the freshwater to survive. If we created a larger waterproof sensor people could plant them where they wanted them and if people around the world started using them we could potentially save much more freshwater for everyone to use when needed.

Literature Cited:

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