Soil Testing with Micro:bit (Indigenous ways of Knowing)	Grade 3 - Earth and Space Systems

Lesson Plan

Coding Tool	Micro:bit (V2 preferably)
Cross-curricular	STEM Skills and Connections

Big Ideas

- Healthy soil helps keep communities, plants, and the environment healthy.
- When we take care of the land, it takes care of us in return.
- Technology can help us understand and care for the natural world.
- Coding allows us to create digital tools like a moisture detector to support environmental stewardship
- Indigenous ways of knowing remind us that Earth gives us many gifts.

Specific Expectations

- **E1.1** assess the importance of soils for society and the environment
- **E1.2** assess the impact of human activity on soils, and describe ways in which humans can improve the quality of soils and/or lessen or prevent harmful effects on soils

Description

This lesson explores the importance of water through both Indigenous ways of knowing and scientific investigation. Students learn that soil is alive, connected to all living things, and essential for a healthy environment. Together, the class explores how soil provides water, nutrients, and support for plants and how caring for soil helps the land give back to us. Students then use a micro:bit to build a simple soil-moisture detector. Using block coding, they program the micro:bit to react to moisture levels by showing a happy face when the soil is healthy and a sad face with a sound when the soil is too dry. This activity connects coding and environmental science.

Materials	Computational Thinking Skills
• 1 micro:bit (preferably V2) • 1 battery pack • 2 alligator clips • 2 nails or two pieces of solid wire (your “soil probe”) • A plant with soil, with a pot big enough for the 2 nails to be 2-3 cm apart	• Conditional statements • Variables

Introduction

Many Indigenous communities see the Earth, and everything on it, as living and having a spirit. That means soil isn’t just “dirt.” It’s alive, and it’s connected to us in many different ways. Soil is way more important than some people realize. It’s a home for so many living things, like worms, insects, and tiny organisms we can’t even see. It gives plants the nutrients and water they need to grow. It filters and cleans our water as it moves through the ground. It grows all our food, helps trees and grasses take root, and plays a huge role in the health of the whole environment.

Because soil takes care of us, we need to take care of it in return. When we respect and maintain the land and soil, they give back to us. They give us healthy trees that help us breathe, yummy foods that help us grow strong, and the stable ground that supports our homes, our schools, and our roads. When we care for the soil, we care for our community, our future, and the Earth itself.

Action

Soil moisture testing with microbit

To test soil moisture using a Micro:bit, nails, and alligator clips, you'll need to create a simple circuit that measures electrical conductivity, which is affected by water. Higher moisture results in higher conductivity. You'll connect the Micro:bit to two nails acting as probes using alligator clips, and then code the Micro:bit to read the conductivity of the solution.

1. Go to https://makecode.microbit.org/

2. Prepare the Micro:bit
   - Probes: Attach two nails securely to the ends of two alligator clips.
   - Connections: Connect one alligator clip to Micro:bit pin 0 and the other to the GND pin.

3. Plug Micro:bit into computer.

4. Make sure the plant has enough soil for the nails and the nails can be 2-3 cm apart.

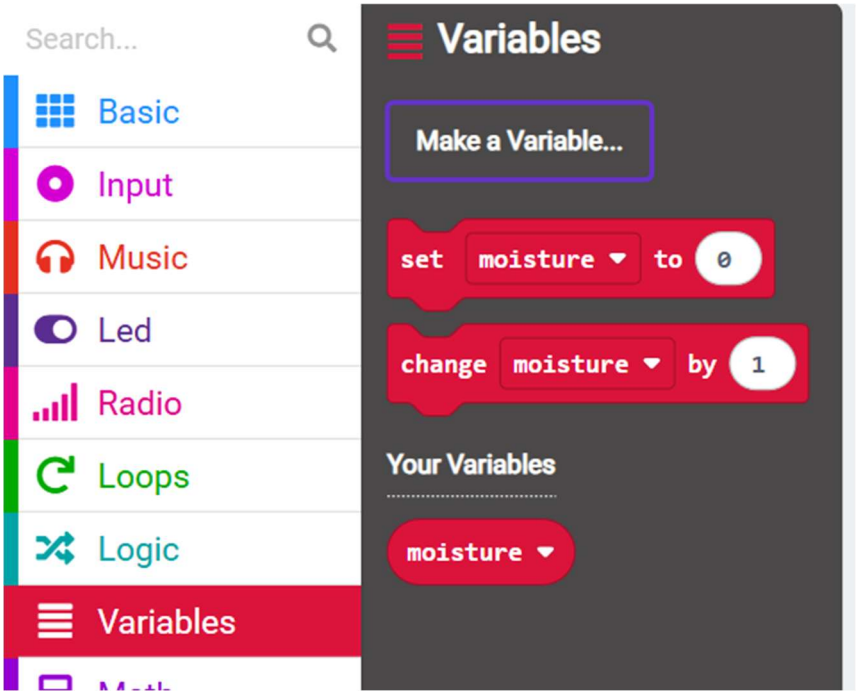
5. Refer to coding below.

You can choose to code this project together as a whole class or give each student their own micro:bit. If you only have **one class plant**, students don't each need their own set of nails and alligator clips. You only need **one set of materials** for the plant you're testing, and students can take turns connecting their micro:bits to it.

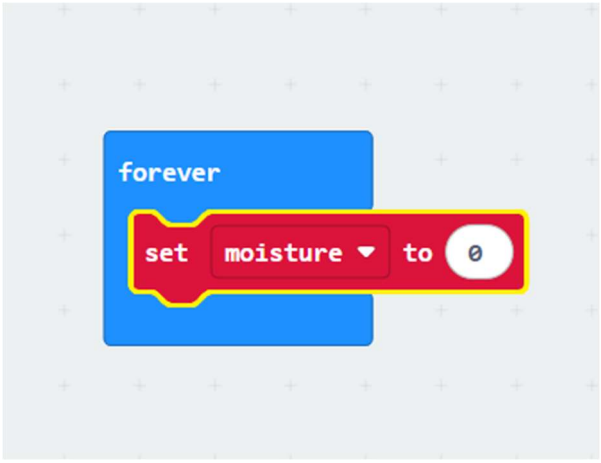
Coding microbit to react to moisture levels.

1. Connect the first Microbit via the USB and go to makecode.microbit.org to start a new program. Before starting to code the program, pair the Microbit by clicking on the gear symbol and selecting Pair -> Pair Device -> Select Microbit -> Connect

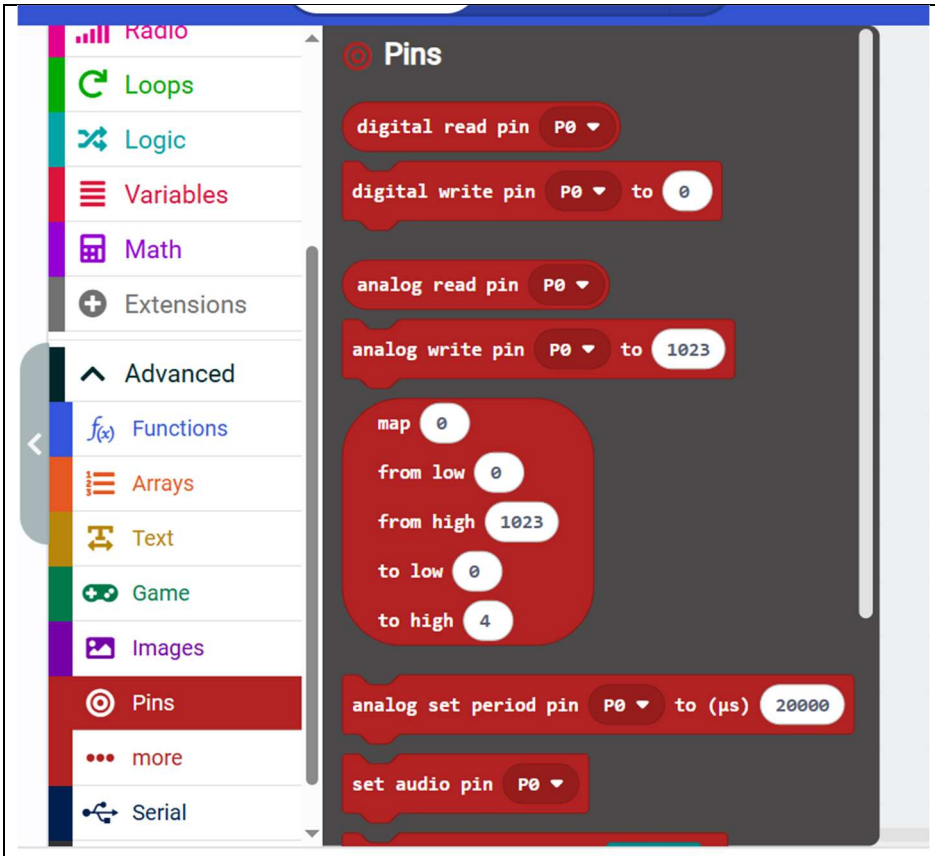
2. Students will only need the **forever** block, you can delete **on start.**
3. We will have to make a variable, in the **Variables** tab, click, “Make a Variable” and name it “moisture”.



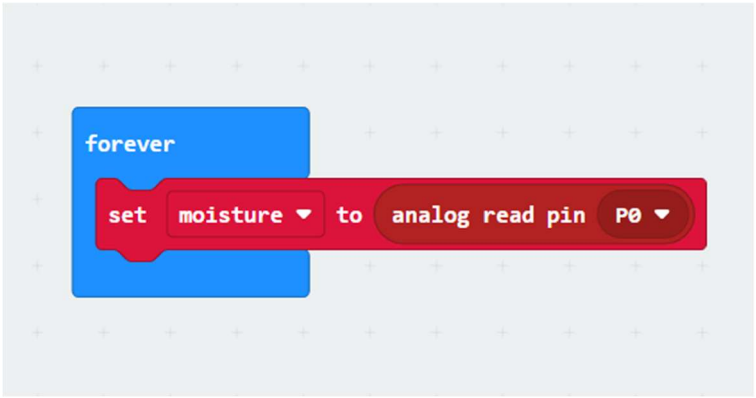
4. In the **Variable** tab, select and drag “set ‘moisture’ to 0”



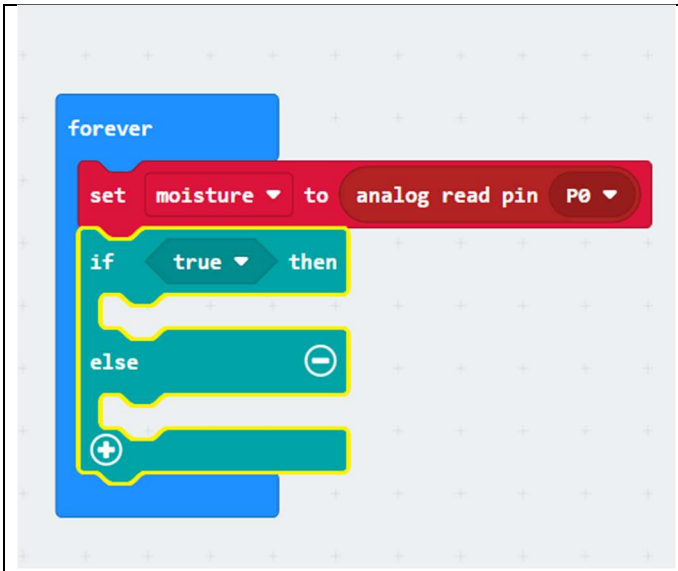
5. Click the **Extension** tab -> Select the **Pins** tab



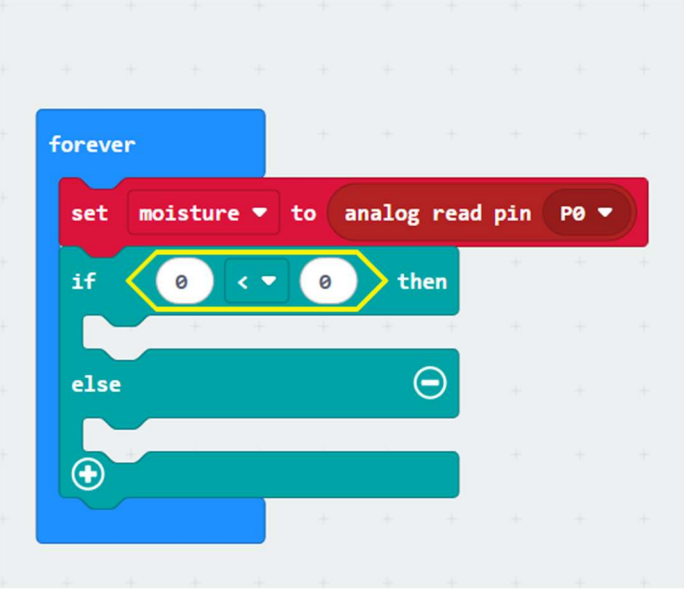
6. Under the **Pins** tab and select and drag “analog read pin P0” into the “0” circle.



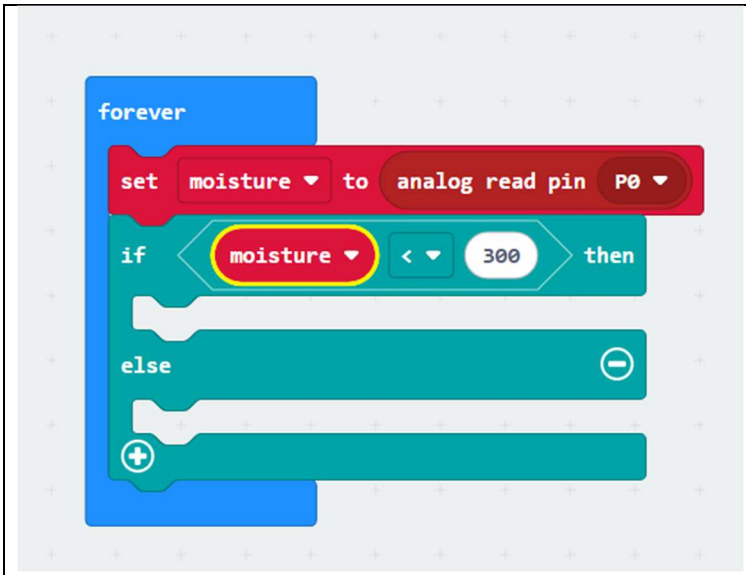
7. In the **Logic** tab select and drag the conditional statement “if true then else” block and place underneath the “set moisture to analog red pin 0” block



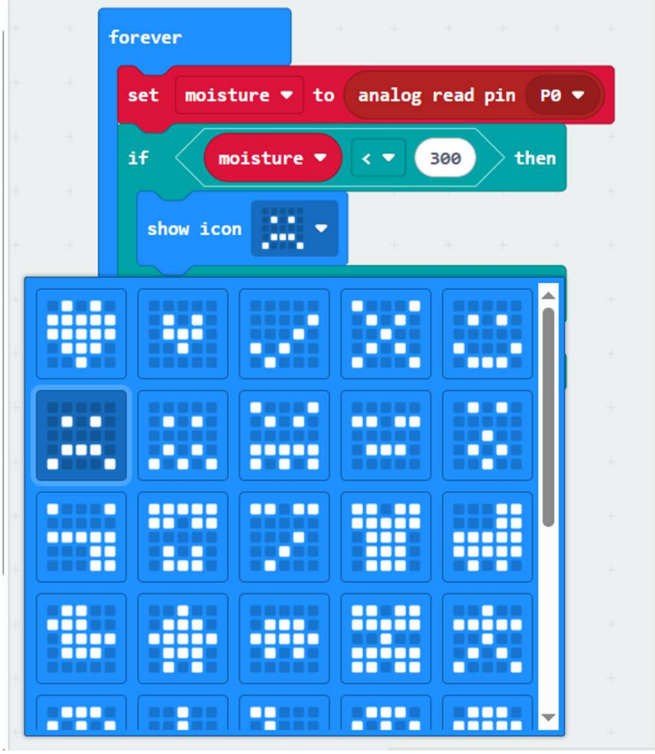
8. In the **Logic** tab under comparisons, you will select and drag the “0 < 0” block and place into the “true” slot in the conditional statement.



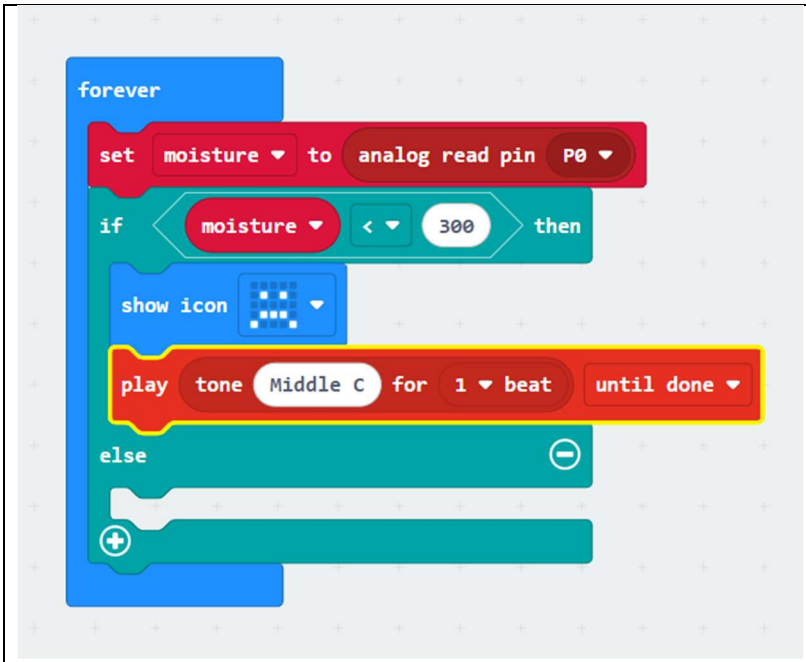
9. In the **Variables** tab you will select and drag the “moisture” block and place into the first 0 in the comparison. In the second 0 you will change the number to “300.”



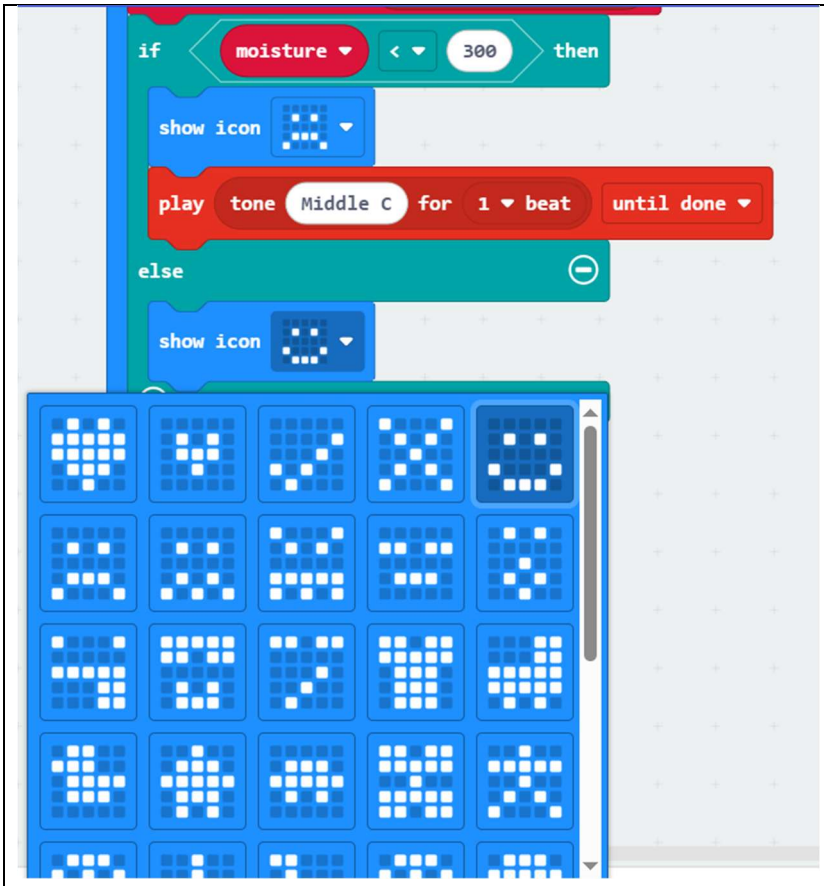
10. In the **Basic** tab you will drag and select “show icon” and place that in the conditional statement. Once done, you’ll select the sad face in the icon drop down section.



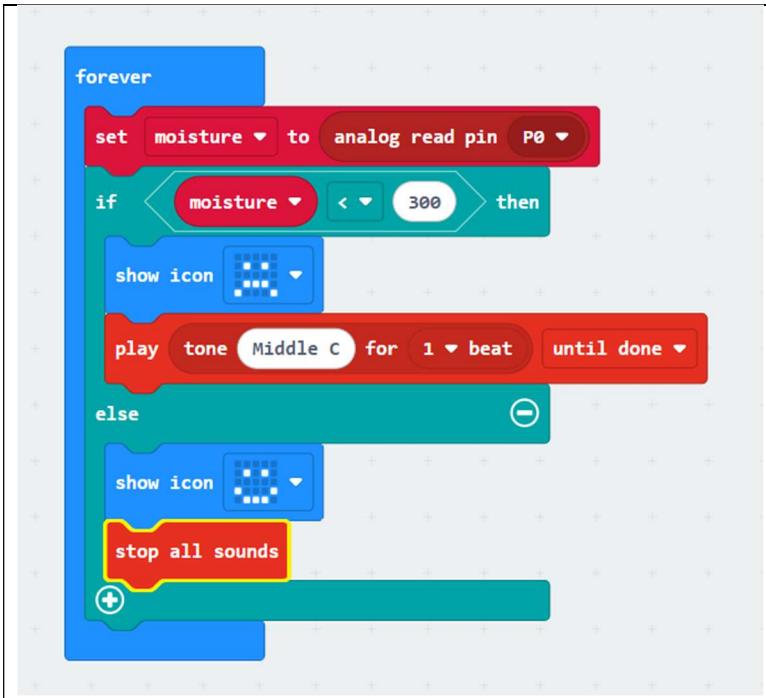
11. In the **Music** tab select and drag the “play tone middle C for 1 beat until done” block and place underneath the “show icon ☹” block.



12. In the **Basic** tab you will drag and select “show icon” and place that after the “else” in the conditional statement. Once done, you’ll select the happy face in the icon drop down section.



13. In the Music tab you will select and drag the “stop all sounds” block to place underneath the “show icon 😊" block.



14. Hit "**Download"** to send the code to the micro:bit and then you can test the code! If you'd like to use the micro:bit unplugged from the computer, you can attach a battery pack to it.

Consolidation/Extension

To bring everything full circle, choose a class plant that gives something back, like an herb or another plant with a useful part. This helps reinforce the idea that when we take care of the land and our plants, they give back to use in return.

Assessment

Observation:

- Students participation during discussions about soil and Indigenous perspectives
- Students ability to help build or explain the moisture detector
- Students understanding of how soil affects plant health

Questioning

- Why does a micro:bit show a happy or sad face?
- What does moisture tell us about a plants needs?
- How does taking care of soil help us?

Reflection

- Why is soil so important?
- How does micro:bit help us take care of our plant?
- What does it mean to take care of the land?