Quarrybrook
EXPERIENTIAL EDUCATION CENTER

Program Title: **Soil Science**

Audience: 4th-9th grade students

Program Theme: Soil is much more than "dirt." Soil is a mixture of inorganic and organic ingredients, and it is the link between the bedrock of the Earth and the plant and animal life on its surface.

Program Goals: Students will investigate soil composition and formation, and compare and contrast some of the different soil types found at Quarrybrook. Using methods employed by soil scientists, students will identify soil horizons, measure soil characteristics, and collect data from soil profiles. Students will also investigate how healthy soil communities protect water quality and reduce erosion with a rainfall simulation model.

Next Generation/Common Core Connections:

Topics: 4-ESS2 Earth's Systems
MS-ESS2 Earth's Systems
MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

Dimensions: Patterns, Cause and Effect, Scale Proportion and Quantity, Systems and System Models, Stability and Change

Program Outline:

Activity 1: SOIL DEFINITION AND COMPOSITION (20 min.) – To begin, we will collect soil and distribute a sample to everyone to investigate using their multiple senses. As a group we will discuss a definition for soil, and determine its "ingredients."

The activities will be explained and demonstrated first by the Quarrybrook Instructor, and then teachers and chaperones will be asked to lead their own smaller sub-team through the investigations and help manage their group.

Objective: Students will recognize that soil is a mixture of weathered rock, mineral, and organic matter (living and humus), and water, air, and time.

Intended Outcomes: Students will be able to define soil and explain how it differs from dirt. Students will provide examples of the main soil components, and include both inorganic and organic ingredients.

Activity 2: FIELD INVESTIGATION (80 min.) – Students will dig a soil profile to learn about different soil horizons and their formation. Students will learn about the role that topography plays in how soil is formed and in its properties. We will investigate different land features, such as a rocky hilltop, slope,

wetland, etc. In their teams, students will collect a soil sample from each location and measure soil properties such as color and texture.

Teachers are always welcome to make any classroom-connecting comments that contribute to student understanding.

Objectives: Students will observe and measure soil properties in different horizons, at different sampling sites. Students will notice the differences and the similarities between soil samples, based on their location and topography.

Intended Outcomes: Students will be able to compare/contrast soil properties at different locations with differing topography. Students will identify soil horizons and quantify properties of a soil profile, by filling out the data table.

Conclusion/Wrap-up: We will conclude the program with a rainfall simulation model demonstrating rates of erosion in vegetated versus bare-soil watersheds.

Activity 3: SOIL EROSION MODEL (20 min.) – The valuable ecosystem services provided by plant roots and healthy soil communities will be demonstrated with a model. Students will simulate rainfall and collect runoff from two watersheds: one with a healthy soil and plant community, and one where vegetation has been removed leaving the topsoil unprotected. A quick observation of the runoff collected from the two watershed models will set the stage for discussion points, allowing for an active visualization to review the day's topic.

Objectives: Students will use a rainfall simulation model to make observations about the rate of erosion on a vegetated versus an un-vegetated surface. Students will observe the ecosystem benefits provided by plant roots in reducing soil erosion and runoff pollution, and in flood protection.

Intended Outcomes: Students will be able to explain how a healthy soil and plant community reduces erosion. Students will be able to explain how construction and development activities that remove plant cover can contribute to soil erosion and degraded water quality.

Successful completion of this program will help support your students' proficiency in NGSS Performance Expectations:

4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.