TOPOGRAPHICAL IMPACTS ON WIND AND WATER EROSION

[Evaluation of Surface Runoff Generation Processes Using a Rainfall Simulator: A Small Scale Laboratory Experiment]

https://www.rainfallsimulator.com/simulators/

Introduction

Slope and wind or water breaks, such as the use of trees, contour tillage, buffer strips, terraces, or riprap, are topographical changes which impact wind and water erosion. Wind erosion may be simulated using fans while water erosion may be simulated with a rainfall simulator. The equipment used for collecting and holding the soil and creating slopes is the same for both the wind and water erosion measurements. This test is primarily to examine the impacts of topographical changes on erosion. Simulators have been used in studies dealing with the landslides and the impact of land management practices on a hydrological response and the impacts of weather conditions.

Materials

- Shovel/garden trowel
- Fan(s)
- Shims and/or blocks or an adjustable frame for the soil box
- Sheet
- Newspaper or Kraft or butcher paper
- Weigh boats or weighing container
- Scale/balance
- Plastic or metal box with holes or mesh in the bottom or no bottom
- Water collection boxes for collecting runoff and run through
- Benchtop rainfall simulator, optional

https://www.rainfallsimulator.com/shop/expos/jumbo-2-expo-rainfall-simulator-wocase/

Method

Soil Collection:

1. Using a shovel or garden trowel collect a soil sample about the same size and depth as the box.
2. Place the soil in the box keeping the surface soil at the top. Make sure there is enough soil to fill the box to the top lip.
3. If possible, use the metal soil cutter from the benchtop rainfall simulator or a similar device. Make sure that the soil is to the top lip.

Wind Erosion:

(https://www.rainfallsimulator.com/shop/accessories/wind-erosion-simulator/)

1. Use shim or blocks to create different degrees of slope under the box holding

the soil.
2. Place the fans at the top of the slope (i.e. upslope) to blow on the soil surface.
3. Position the sheet or screen at the other end (i.e. downslope) with one end under the soil box or blocks. Make sure that the screen is upright at least 3" higher than the height of the summit.
4. Start the fan and run for at least 5 minutes.
5. Shake the dirt collected on the sheet or screen onto a newspaper or piece of butcher or Kraft paper.
6. Pour off the paper into a weigh boat or container and measure and record the weight.
7. Compare to additional measurements below.
8. Additional measurements:
    a. Repeat on samples from different sites – soil types or management practices.
    b. Repeat on additional samples from the same site at different degrees of slope.
    c. Repeat on additional samples from the same site at different fan speeds.
    d. Repeat on additional samples from the same site where different simulated erosion breaks (i.e. crop residue; living plants at different crop heights and crop densities; stir sticks or straws; and horizontal strips of plants or cuts in the soil to simulate buffer strips, contour tillage or terracing) are used.

Water Erosion:

1. Use shim or blocks to create different degrees of slope under the box holding the soil.
2. Place container on the downslope end to collect runoff.
3. Use a sprinkler or watering can to simulate rainfall on the soil. Simulating rainfall also may be done by pouring the water into a box with holes on the bottom or a mesh screen which will allow the water to fall simultaneously over the entire surface of the soil at the same rate.
4. Apply the water at a level equivalent to 1" hitting the surface soil.
5. Measure the volume of water that runs off the surface.
6. Evaporate the water by drying in an oven to collect and measure the amount of soil that runs off.
7. Compare to additional measurements below.
8. Additional measurements:
    a. Repeat on samples from different sites – soil types or management practices.
    b. Repeat on additional samples from the same site at different degrees of slope.
    c. Repeat on additional samples from the same site where different simulated erosion breaks (i.e. crop residue; living plants at different crop heights and crop densities; stir sticks or straws; and horizontal strips of plants or cuts in the soil to simulate buffer strips, contour tillage or terracing) are used.

Tips and Tricks

1. Calculate the degree of slope by dividing the run (i.e. the distance between the bottom of the slope – toeslope or base – to the rise) by the rise (i.e. the height of the summit) and multiplying by 100.
2. Adjust the degrees of slope to match the regional topography.
3. Try to keep the soil sample as intact as possible.