

Soil erosion

An animated model of the factors affecting soil erosion

Earthlearningidea has provided a simple classroom demonstration of soil erosion, which should be used as a prelude to this activity. See https://www.earthlearningidea.com/PDF/Soil_erosion.pdf

The above hands-on activity can now be complemented by this on-line resource called *Model My Watershed®*. *Model My Watershed®* is a watershed-modelling web app (<https://runoff.modelmywatershed.org/>), accessible from a PC or tablet or smartphone.

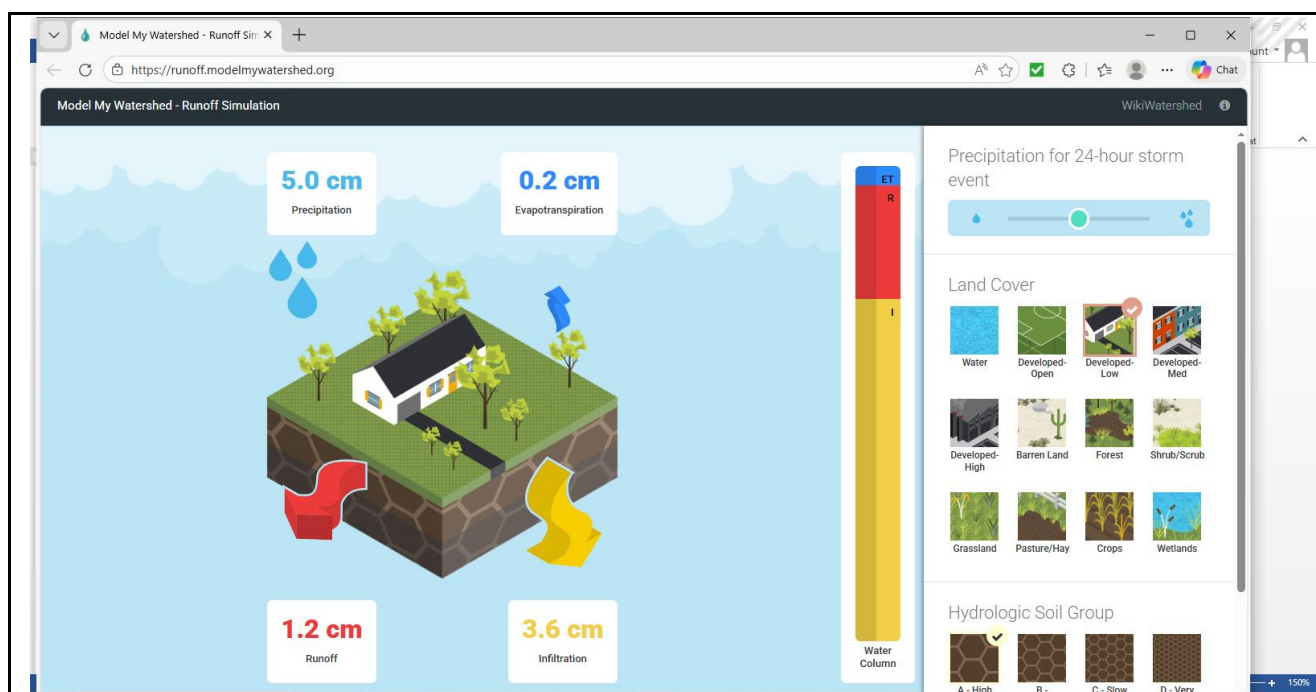


Fig 1. A screen grab of the home page of *Model My Watershed®*

Students can use the simulation in pairs in the computer room or with their own devices. In the simulation, on a 3D model of a land parcel, different types of land cover and hydrological soil group may be selected. Once these land and soil characteristics have been selected, by moving a slider it is possible to visualise the effect of different amounts of rainfall over a 24-hour period. For each type of land cover and hydrological soil group, a definition and examples are provided by clicking on the relative icon. Ask students to read the definitions and – depending on their age - provide further explanations if necessary. For each choice of land cover and soil group, the relative amount of evapotranspiration (in cm) is displayed. The amount of infiltration and runoff (also in cm) increase as the amount of rainfall

increases, until a warning signal indicates that the risk of flooding is occurring. Ask the students whether the risk of flooding is higher for a low-intensity or high-intensity developed area; or for a grassland compared to a cultivated crop area. Other pairs of land cover may also be selected. Students may compare the different amounts of infiltration depending on the different soil groups. After some trials, students will see that different combinations of land cover/soil group, when subject to different amounts of rainfall, are more or less susceptible to flooding. Finally, show students a map of their school or its surroundings. Based on what they have learned from this activity, ask students for some recommendations which they could make, which would reduce flooding in the area.

The back up

Title: Soil erosion

Subtitle: An animated model of the factors affecting soil erosion

Topic: A student-controlled activity in varying the factors affecting soil erosion, via an animated graphic

Age range of pupils: 11 – 18 years

Time needed to complete activity: 30 minutes

Pupil learning outcomes: Pupils can:

- describe what happens when soil is exposed to rainfall under varying conditions;
- explain the relative significance of rainfall, infiltration, evaporation, runoff, land cover and soil characteristics to rates of soil erosion;
- explain why soil needs to be conserved;
- assess the factors which might affect soil erosion in their own vicinity.

Context: The animation provides a visual way of learning the effects of several factors in soil erosion and could be used in lessons in Geology, Geography or Environmental Science.

Following up the activity:

Investigate ways of reducing soil erosion, e.g. by “ploughing” along the contour and not up and down the slope.

- Involve a local farmer or gardener who has suffered loss of soil from the land.
- Find out if any local river or reservoir has been silted up as a result of soil erosion within its catchment.
- Make a case study from the web of a classic region of soil erosion. e.g. Amazon Basin: <https://passel2.unl.edu/view/lesson/5653c03d7cee/7>
Himalayas: https://www.indianfarmer.net/uploads/4_7_2021.pdf

Underlying principles:

- Soil absorption capacity (or infiltration rate) is the maximum rate at which soil can take in precipitation water.
- It is controlled by various factors, such as soil structure and compaction, vegetation cover and presence of virtually impermeable surfaces, such as those of buildings and concrete or asphalt ground coverings.
- When precipitation intensity exceeds this capacity, the soil becomes saturated and additional water remains and flows at the surface as runoff.

- This surplus water is the primary driver of erosion and accelerated weathering.
- Soil erosion is part of the rock cycle, whereby weathered material is eroded and transported away.
- Vegetation has the important effect of protecting the soil from direct impact by rain drops, by slowing down any water flowing over the surface (a baffling effect) and binding the soil together with its roots – resisting erosion.
- Tree roots are particularly good at binding soil particles together. When trees are removed from hill slopes, disastrous soil erosion can result.
- Exposed soil can be removed by wind as well as by water.
- Cohesive soil types are more resistant to erosion than others.
- Eroded soil frequently finds its way into rivers, where it can cause silting up, which often contributes to flooding.

Thinking skill development:

The conditions which will promote or reduce soil erosion will soon emerge from this activity (establishing a pattern).

The properties of some soils may pose an unexpected cognitive challenge, e.g. a clay soil with small particles might be expected to be washed away more easily than a sandy one, yet cohesion between the particles may make it less easily eroded.

Relating the small scale investigation to real landscapes is a bridging skill.

Resource list:

access to the web

access to computers or students' personal devices

Useful links: For *Model My Watershed*® see:

<https://runoff.modelmywatershed.org/>

Images courtesy of Stroud Water Research

Center's Model My Watershed Runoff Simulation, Avondale, PA 19311, USA.

https://www.earthlearningidea.com/PDF/Soil_erosion.pdf

Source: Giulia Realdon, University of Camerino, UNICAMearth group, Italy, and edited by the Earthlearningidea team

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