INFILTRATION AS AN INDICATOR OF EROSION SUSCEPTIBILITY

by Teja Singh

Infiltration, the entry and movement of water through the soil surface, is a reliable indicator of erosion hazards. The capacity of land to absorb water is an important site characteristic directly related to its erosion potential.

Any major use of forest land is likely to cause soil disturbance in some form. Such use may cause soil compaction, thereby resulting in reduced infiltration capacity. Reduced infiltration capacity means that only limited amounts of water received at the soil surface will be transmitted through the soil mantle. The unabsorbed portion will result in flow over the land surface. Overland flow, in heavy rain, can detach soil particles and cause severe erosion when sustained over long periods of time.

The overland flow resulting from impaired infiltration capacity is thus directly related to the erosion potential of a forest site. As overland flow is itself a function of infiltration capacity, determination of the latter is a practical indicator of the potential erosion hazards at a given site.

There is need for a simple technique to measure infiltration capacities so that areas of high erosion susceptibility can be identified. A field infiltrometer that has been used in Canada to provide such measurements is described below.

CONSTANT-HEAD DOUBLE-RING INFILTROMETER

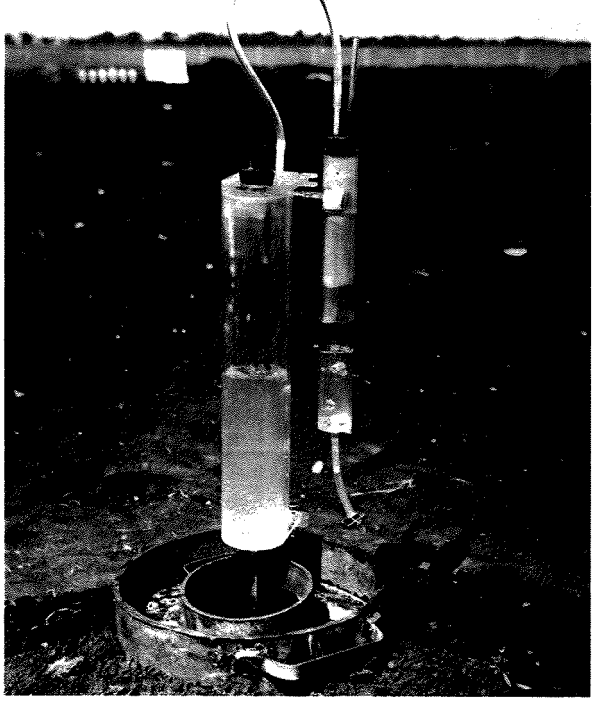
The infiltrometer consists of two concentric rings: (1) the infiltration ring, 8 inches in diameter, and (2) the buffer ring, 20 inches in diameter. Each ring has metal handles, welded on opposite sides, for portability. To keep costs low, the rings can be cut from hot-water tanks available from local scrap metal yards. A power hack saw can be used to obtain 12-inch sections.

The inner ring provides for determining the depth of water that is actually infiltrated into the soil. The outer ring serves as a buffer against lateral movement of water. Both rings are driven 8-9 inches into soil by a 15-pound solid steel hammer. A steel plate 0.5-inch thick is placed on top of the inner ring to facilitate uniform driving into the soil.

The depth of water in the inner ring can be observed by a simple point gauge or hook gage. Alternatively, a constant-head regulator can be used for regulating and maintaining the desired head or water level in the inner ring and to provide more accurate infiltration determinations.

It takes time for an infiltration rate to stabilize; it usually begins at a high rate and then decreases rapidy as infiltration progresses over time. The length of time for infiltration rates to stabilize differs among sites, but one hour is often sufficient to attain nearly steady infiltration rates.

An arbitrarily selected water level or head (usually 1-2 inches) is maintained in the rings during infiltration determinations. The amount of water used to maintain the selected water level in the inner ring during the second hour is carefully recorded and used for determining the equivalent depth



This constant-head double-ring infiltrometer is used to obtain field measurements of infiltration rates. The larger tube of the head regulator serves as a reservoir for the water which infiltrates the soil inside the inner ring.

(in inches) of water over the surface area occupied by the inner ring.

The inches of water used by the inner ring during the second hour of an infiltration run is a good indicator of the steady infiltration capacity (inches/hour) of the site on which infiltration measurements are made.

FIRST APPROXIMATIONS OF EROSION HAZARDS

Forest soils usually vary in edaphic characteristics over local areas. It is therefore essential to replicate infiltration determinations and use their average.

The infiltrometer measurements obtained in this way may be used as first approximations for the inherent erosion susceptibility of a site. In general, high infiltration rates indicate low erosion susceptibility and low infiltration rates imply high susceptibility.

The first approximations can be further improved by taking into consideration the modifying influence of other site factors such as rainfall intensity, hydrologic depth of soil, antecedent soil moisture, slope, and ground cover on the land surface.

Other infiltrometers being used are rain simulators, i.e. they attempt to create conditions similar to actual rainfall. Although these simulators have the advantage of assessing the impact of raindrops on land surface, often they are limited to use on easily accessible and less steep areas. The infiltrometer described above is more portable and practical to use. It is generally sufficient for determining the potential of a site for infiltration and erosion.

REFERENCE

Singh, T. 1983. A proposed method for preliminary assessment of erosion hazards in west-central Alberta. Information Report NOR-X-251. Northern Forest Research Centre. Edmonton, Alberta.

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