

PN-ABW-228

95309

COMMON TERMS AND DEFINITIONS USED IN WATERSHED MANAGEMENT

By

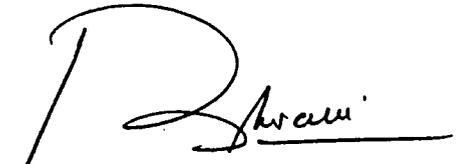
**Bashir Ahmed Wani, Ph.D
Deputy Inspector General of Forests**

**Forestry Planning and Development Project
Ministry of Food, Agriculture & Livestock
Government of Pakistan
Islamabad**

May 1994

PREFACE

The term watershed management in the context of major land use in the northern mountain uplands is frequently used by foresters and also quite well understood by people living in catchment areas. Even a layman in Hazara and Azad Kashmir is aware of the basic concepts of watershed management and to some extent the related terminology used locally in watershed related development activities. The subject is taught at Pakistan Forest Institute, Peshawar to the students at B.Sc. and M.Sc. levels. Over the years lot of improvements such as availability of better qualified staff and reading material for the trainees have taken place at PFI. However, it is felt that there is still dearth of reading materials. During their studies and as field managers they come across a number of technical terms pertaining to watershed management. To help students and the professionals have quick access to definitions of relevant technical terms, an effort has been made to prepare a glossary. I owe my gratitude to Dr. Charles R. Hatch, Chief Of Party, Forestry Planning and Development Project, Islamabad, for providing valuable suggestions. The list is not complete by any means. I would request the readers to contribute some more terms which they may come across in literature to further update this publication.



(Dr. Bashir Ahmed Wani)
Deputy Inspector General Forests

Islamabad
May, 1994

COMMON TERM AND DEFINITIONS USED IN WATERSHED MANAGEMENT

ACTINOMETER

Actinometer and radiometer are the general names of instruments used to measure the intensity of radiant energy.

ALBEDO

Albedo is the ratio of the amount of solar radiation (or visible range of radiation) reflected by a surface to the amount incident on it, also expressed as a percentage. The albedo of snow is 85 percent. The albedo of bare dry soil is 10 to 25 percent.

ALLUVIAL FANS

An alluvial fan forms where a stream flows into a larger main valley. Suddenly free to spread out, the stream slows down, loses energy, and deposits much of its load of sediment. The deposit builds up in the shape of a fan radiating outward from the point where the tributary enters the main valley.

ALLUVIUM

Material deposited by flowing water is called alluvium. Alluvial deposits occur in such land forms as floodplains, terraces, fans, piedmonts, and deltas. Alluvial land is desirable because it tends to have smooth topography, deep, fertile, permeable soils, and more readily available water than most of other land.

ANEMOMETER

Anemometer is the instrument which measures wind speed.

ANTICYCLONE

An anticyclone is an area of relatively high pressure in which the winds tend to blow spirally outward in a clockwise direction in the northern hemisphere.

AQUICLUDE

Aquiclude is a formation which contains water but can not transmit it rapidly enough to furnish a significant supply to a well or spring.

AQUIFER

A geologic formation which contains water and transmits it from one point to another in quantities sufficient to permit economic development is called an aquifer.

AQUIFUGE

Aquifuge is a formation which has no interconnected openings and cannot hold or transmit water.

AVAILABLE MOISTURE

The difference between the moisture content at field capacity and at wilting point is called available moisture. It represents the useful storage capacity of the soil and the maximum water available to plants.

CAPILLARY WATER

Soil moisture may be present as gravity water in transit in the larger pore spaces, as capillary water in the smaller pores, as hygroscopic moisture adhering in a thin film to soil grains, and as water vapor. Gravity water is in a transient state. After a rain, water may move downward in the larger pores, but this water must either be dispersed into capillary pores or pass through the vadose zone to the groundwater or to a stream channel. Hygroscopic water, on the other hand, is held by molecular attraction and is not normally removed from the soil under usual climatic conditions. The important variable element of soil moisture, therefore, is capillary water.

CHECK DAM

A check dam is a hydraulic structure that alters the flow of water in a way that the speed is reduced and the suspended silt is deposited faster.

CANOPY INTERCEPTION LOSS

Canopy interception loss is the rainfall retained on standing vegetation and evaporated without dripping off or running down stems.

COLLUVIUM

Colluvium is the material moved downslope by gravity.

CONSUMPTIVE USE

Consumptive use is the total evaporation from an area plus the water used directly in building plant tissues. The distinction between the two terms is largely academic, falling well within the error of measurement, and they are now generally treated as synonymous.

CYCLONE

A cyclone is a more or less circular area of low atmospheric pressure in which the winds blow counter-clockwise in the northern hemisphere.

DELTAS

Deltas form where stream empty into bodies of water instead of into larger valleys. A small delta may be only a few meters, but large ones continue for hundreds of kilometers. Small deltas formed in lakes are quite sandy because the finer sediments are carried farther into the lake. Rivers flowing into the ocean produce finer textured deltas because salt water flocculate clay particles and makes them settle out.

DEW

Dew is defined as " water condensed onto grass and other objects near the ground, the temperature of which have fallen below the dew point of the surface air due to radiational cooling during the night, but are still above freezing."

DEW POINT

Dew point is the temperature at which the space becomes saturated when air is cooled under constant pressure and with constant water-vapor content.

DRAINAGE BASIN/CATCHMENT/WATERSHED

A drainage basin is the area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel. The term is synonymous with watershed in American usage and with catchment in most other countries. The boundary of a drainage basin is known as the drainage divide in the United States and as the watershed divide in other countries. The drainage basin can vary in size from that of the Amazon River to one of a few square meters draining into the head of a gully.

DRAINAGE DENSITY

Drainage density is defined as the length of all channels in the drainage basin divided by the basin area. Areas with high drainage density are associated with high flood peaks, high sediment production, steep hillslopes, general difficulty of access, relatively low suitability for agriculture, and high development costs for the construction of buildings and the installation of bridges, roads, and other facilities.

EFFLUENT STREAMS

Streams intersecting the water table and receiving groundwater flow are called effluent streams. Perennial streams are generally effluent through at least a portion of their length.

EOLIAN DEPOSITS

Sands which are deposited by wind are called eolian deposits. Desert areas eroded by wind often accumulate a surface layer of gravel and pebbles as the wind carries away the finer soil particles. This gravel layer, called desert pavement, protects the area from continued wind erosion.

EROSION

Erosion is the wearing away of the soil by water, wind and other forces.

EVAPORATION

The loss of water from open water bodies like streams, lakes, rivers, oceans, ponds, etc. is called evaporation.

EVAPOTRANSPIRATION

The loss of water from the vegetation and soil surface, ponds, lakes and rivers is called evapotranspiration.

FIELD CAPACITY

Field capacity is defined as the moisture content of soil after gravity drainage is complete. The field capacity is essentially the water retained in soil at a tension of $1/3$ atmosphere ($1 \text{ atm} = 1.013 \text{ bar} = 1.033 \text{ kg/cm}^2 = 14.7 \text{ lb/in}^2$).

FLOODPLAIN

Floodplains are plain areas which are developed when alluvial material is deposited near valleys. Water floods across these areas during period of runoff and deposits the fresh layer of alluvium. The deposition produces a nearly flat surface on floodplain except for places cut by stream channels.

FRONTAL SURFACE

A frontal surface is the boundary between two adjacent air masses of different temperature and moisture contents. Frontal surfaces are actually layers or zones of transition. The line of intersection of a frontal surface with the earth is called a surface front. If the air masses are moving so that warm air displaces cold air, the front is called a warm front; conversely, it is called a cold front if cold air is displacing warmer air. If the front is not moving it is called stationary front. Cold fronts move faster than warm fronts and usually overtake them. This process is called occlusion, and the resulting surface front is called occluded front.

GABIONS

Gabions are cage-like baskets constructed of non-corrosive wire and filled with rock. A gabion structure can be used for channel control or for forming a bar or dike in stream protective works.

GEOLOGICAL EROSION

Geological Erosion is the wearing away of the earth's surface by the forces of water and wind. It occurs in an environment largely unaffected by the activities of people. Geological erosion usually occurs very slowly.

GEOMORPHOLOGY

The study of earth's surface forms, and of the process that shape them, constitutes the field of geomorphology.

GLACIAL TILL

The material deposited by glaciers is called glacial till.

GROSS RAINFALL

Gross Rainfall is the rainfall per storm measured in the open or above the vegetative canopy.

GREENHOUSE EFFECT

The term greenhouse effect is frequently used in discussions of the possible impact of various pollutants on the earth's radiative balance. Water vapor, carbon dioxide, some of the chlorofluoro-methanes and other materials of organic origin are transparent to short wave radiation, but are effective absorbers in the thermal infrared region of the electromagnetic spectrum. Hence, any increase in the concentration of these substances in the atmosphere is expected to increase global temperature

through a trapping of the terrestrial longwave radiation. The analogy has been made with the behavior of a "greenhouse" or "glasshouse" since glass is permeable to radiation in the visible waveband but impermeable to infra red radiation.

GROUND WATER

Water that accumulates in the ground after it has passed through the surface is called ground water.

GULLY

A gully is a surface drainage channel made by the downhill movement of accumulated surface runoff water. The channel is developed entirely by the movement of water that comes from the surface of the surrounding land. A gully only conveys surface runoff.

GULLY EROSION

Erosion channels that are too large to be erased by ordinary tillage are called gullies. The slope of the gully walls depends on the angle of repose characteristic of the material. Deep, relatively straight-sided channels develop where the soil material is uniformly friable throughout the profile. In deep loess soils the walls are almost vertical, forming U-shaped channels, but most other soils have less steep side slopes. Broad V-shaped channels often develop where cohesive, tight subsoil that resists cutting underlies friable surface soil. Gullies are considered to be active as long as erosion keeps the sides bare of vegetation, and inactive when they have been stabilized by vegetation. Gullies are further described as small, medium, or large according to depth, with medium-sized gullies being between 1 and 5 m deep.

HYDROGRAPH

The instrument used to measure humidity is called hydrograph.

HYDROLOGY

Hydrology is the science which deals with the waters of the Earth, their occurrence, circulation, distribution, their chemical and physical properties, and their reaction with their environment, including their relation to living things.

HYGROMETER

The instrument used to measure water vapor content is called hygrometer.

INFILTRATION

The movement of water into the soil is called infiltration.

INFILTRATION CAPACITY

The maximum rate at which the soil in a given condition can absorb water is called infiltration capacity. Infiltration rates are expressed in units of depth per unit time, the same as rainfall intensities.

INFLUENT STREAMS

Streams contributing to groundwater are called influent streams.

ISOHYETES

The points on the topographic map having similar precipitation are called as Isohyetes.

JETTIES

A jetty is a structure built to direct the current of a stream away from the bank.

LACUSTRINE DEPOSITS

Lacustrine deposits also called lake-laid clays are composed mostly of the fine material carried beyond deltas into the main body of water. The texture of the material usually varies from silt of sand during seasons of high runoff to fine clay during cold or dry seasons, thus producing a layered effect.

LAPSE RATE

The rate of change of temperature with height in the free atmosphere is called lapse rate or vertical temperature gradient. The mean lapse rate in the lower troposphere is a decrease of $0.7\text{ }^{\circ}\text{C}$ per 100 meter increase in height.

LITTER INTERCEPTION LOSS

Litter Interception Loss is rainfall retained in the litter layer and evaporated without adding to moisture in the underlying mineral soil.

LOESS

Loess is wind-deposited material dominated by silt-size particles. Loess deposits are the most extensive form of wind deposits because silt particles are easier to detach from a mass than clay particles and easier to transport over long distances than sand particles.

LYSIMETERS

An instrument/device used for measurement of evaporation is called lysimeter

MASS WASTING

The material that a stream removes from its valley reaches the stream by mass wasting. This broad term includes several processes by which gravity moves downslope. The movement may be rapid and dramatic as in land slides and mud flows or it may be a slow process as in soil creep. Water acts as a lubricant promoting movement by weakening the mass but is not the actual transporting agent.

MESOPHYTES

Mesophytes are the plants of the temperate zones, have some ability to reduce transpiration during periods of drought.

MILLIBAR

The millibar is the unit of pressure commonly used in meteorology. It is equivalent to a force of 1000 dynes/cm².

MULCHING

Mulching is the application or creation of any soil cover that constitutes a barrier to the transfer of heat or vapor. It is done to conserve moisture in the soil.

NET RAINFALL

Net Rainfall is water that enters the mineral soil after penetrating the forest canopy and litter, sometimes called "effective rainfall".

OVERLAND FLOW

Rain that is not absorbed by the soil remains on the surface of the ground, fills small depressions, and eventually spills over and runs quickly downslope as overland flow. Overland flow often generates floods.

PERCOLATION

Percolation is the movement of water through the soil.

PHREATOPHYTES

Phreatophytes are plants having long root systems reaching to the water table and transpire at rates largely independent of moisture content in the zone of aeration.

PIEDMONT

A piedmont is a plain formed at the base of some mountain range. It forms in a manner similar to that of alluvial fans but on a larger scale.

POROSITY

The ratio of the pore volume to the total volume of the formation is called porosity.

POTENTIAL EVAPOTRANSPIRATION

When a vegetated surface is losing water to the atmosphere at a rate unlimited by deficiencies of water supply, the process is known as potential evapotranspiration.

PRECIPITATION

Precipitation is the total supply of all forms of moisture emanating from clouds and falling on the ground.

PRECIPITATION FORMS

Drizzle: Sometimes called mist, consists of tiny liquid water droplets, usually with diameters between 0.1 and 0.5 mm (0.044 and 0.02 in), with such slow settling rates that they occasionally appear to float. Drizzle usually falls from low stratus and rarely exceeds 1 mm/hr (0.04 in/hr).

Glaze: Glaze is the ice coating, generally clear and smooth, formed on exposed surfaces by the freezing of supercooled water deposited by rain or drizzle. Its specific gravity may be as high as 0.8 to 0.9.

Rime: Rime is white, opaque deposit of ice granules more or less separated by trapped air and formed by rapid freezing of supercooled water drops impinging on exposed objects. Its specific gravity may be as low as 0.2 to 0.3.

Snow: Snow is composed of ice crystals, chiefly in complex, branched hexagonal form, and often agglomerated into snowflakes, which may reach several inches in diameter.

Hail: Hail is precipitation in the form of balls of ice, produced in convective clouds.

Hailstone: Hailstones may be spheroidal, conical, or irregular in shape and range from about 5 to over 125 mm (0.2 to over 5 in.) in diameter.

Sleet: Sleet consists of transparent, globular, solid grains of ice formed by the freezing of raindrops or refreezing of raindrops or refreezing of largely melted ice crystals falling through a layer of subfreezing air near the earth's surface.

PRECIPITATION TYPES

Cyclonic Precipitation: Results from the lifting of air converging into a low-pressure area or cyclone. Cyclonic precipitation- may be either frontal or non-frontal.

Frontal Precipitations: Results from the lifting of warm air on one side of a frontal surface over colder, denser air on the other side

Warm-front Precipitation: Formed in the warm air advancing upward over a colder air mass.

Convective Precipitation: Caused by the rising of warmer, lighter air in colder, denser surroundings. Convective precipitation is spotty, and its intensity may range from light showers to cloudbursts.

Orographic Precipitation: Results from mechanical lifting over mountain barriers. In rugged terrain the orographic influence is so marked that storm precipitation patterns tend to resemble that of mean annual precipitation.

PSYCHROMETER

Psychrometer is the instrument used for the measurement of air temperature.

PYRANOMETER

Pyranometer is the instrument used for measuring shortwave radiation.

PYRGEOMETER

Pyrgometer is the instrument used for measuring longwave radiation.

PYRHELIOMETER

Pyrheliometer is the instrument used for measuring direct solar radiation.

RANGELAND HYDROLOGY

Rangeland Hydrology or Rangeland Watershed Management, is the study of hydrologic principles as applied to range ecosystems.

REFLECTIVITY

Reflectivity is the ratio of the amount of electromagnetic radiation (within any specified range of radiation) reflected by a body to the amount incident on it, commonly expressed as a percentage.

RELATIVE HUMIDITY

The relative humidity is the percentage ratio of the actual to the saturation vapor pressure and is therefore a ratio of the amount of moisture in a given space to the amount the space could contain if saturated.

RELIEF RATIO

Relief Ratio is defined as the difference in elevation between the highest and lowest points of the basin divided by the length of the basin in a line roughly parallel to the major drainage. A second measure is the gradient of the stream channel.

REVTMENT

A revetment is a structure which may be built to protect the bank from erosion.

RILL EROSION

Rills are erosion channels small enough to be obliterated by normal tillage operations. Most rill erosion occurs on recently cultivated soils where runoff water concentrates in streamlets as it passes downhill. This water has greater scouring action than sheet flow and it removes soil from the edges and beds of the streamlets. Rills frequently occur in relatively straight lines between crop rows or along tillage marks. After smoothing by tillage, the long-term effect of rill erosion is similar to that of sheet erosion, but because it is more obvious, action is more likely to be taken to control it.

RIVER

A river is a surface drainage channel that is also made by the downhill movement of water. However, a river obtains much of its water from below the surface of the river banks. A river conveys sub-surface ground water and surface runoff.

RIVER STAGE

River stage is the elevation above some arbitrary zero datum of the water surface at a station. The datum is sometimes taken as mean sea level but more often is slightly below the point of zero flow in the stream.

RUN-OFF

Run-off is the portion of the total amount of rain water that does not enter the ground but runs away over the surface.

SATURATION VAPOR PRESSURE

In a mixture of gases each gas exerts a partial pressure independent of other gases. The partial pressure exerted by the vapor is called vapor pressure. The maximum amount of water that can exist in any space is a function of temperature. When the maximum amount of water vapor for a given temperature is contained in a given space, the space is said to be saturated. The pressure exerted by water vapor in a saturates space is called saturation vapor pressure.

SHEET EROSION

Sheet Erosion is the removal of thin layers of soil by water acting over the whole surface. Raindrop splash and surface flow cause sheet erosion, with splash providing most of the detaching energy and flow providing most of the transporting capacity. Soil loss by sheet erosion is insidious because it is so difficult to see or measure.

SLOPE ASPECT

Slope Aspect is the direction the slope faces.

SLOPE GRADIENT

Slope Gradient (steepness) is described and measured in units of vertical fall either per single horizontal unit (decimal) or per hundred horizontal units (percent). Increasing slope gradient increases the speed of water moving downhill and therefore increases the erosive force of flowing water.

SLOPE LENGTH

Slope Length is the distance from the crest of a knoll or hill to the point where either slope steepness decreases enough so deposition of transported material starts, or the runoff enters a natural or prepared waterway. Slope length in terraced field is the distance from the ridge top of one terrace to the center of the channel of the terrace immediately below.

SLOPE SHAPE

Slope Shape can be straight, convex - with increasingly steeper slope downhill, or concave - with slopes progressively smaller downhill. Many slopes are convex at the top and concave at the bottom.

SOLAR CONSTANT

The rate at which the solar radiation reaches the upper limits of the earth's atmosphere is called solar constant. The value of the solar constant ranges between 1.89 to 2.05 Ly/min. The abbreviation Ly stands for Langley; 1 ly = 1 cal/cm².

SPLASH EROSION

Splash Erosion is caused by the kinetic energy of the falling rain drops. The rain drops break the bonds between soil particles and splash them a short distance. The particles are then much more vulnerable to erosion by water flowing over the surface.

STAFF GAGE

Staff gage is a scale set so that a portion of it is immersed in the water at all times. The gage may consist of a vertical scale attached to a bridge pier, piling, wharf, or other structure that extends into the low-water channel of the stream.

STEMFLOW

Stemflow is that part of the gross rainfall which directly reaches the litter or mineral soil by running down the stems.

STREAM ORDER

Robert Horton proposed a system of stream ordering, later modified by Strahler. the smallest stream of the network, which have no tributaries, are called first-order streams. When two of these first-order streams coalesce they form a second-order stream and further along its course this stream may join another second-order channel to form one of the third-order, and so on.

TENSIOMETER

A Tensiometer consists of a porous ceramic cup which is inserted in the soil, filled with water, and connected to a manometer.

THIESSEN WEIGHTED AVERAGE

Thiessen weighted average is one of the methods of computing average precipitation of a drainage basin where the distribution of gauges is not uniform and where precipitation gradients are strong.

THROUGHFALL

Throughfall is that part of the gross rainfall which directly reaches the litter through the spaces in the vegetative canopy and as drip from leaves, twigs, and stems.

TOTAL INTERCEPTION LOSS

The rainfall (per storm) retained by the canopy and litter, and evaporated without adding to moisture in the mineral soil.

TRANSPIRATION

The loss of water from the cuticle or the stomatal openings in the leaves of plants into the atmosphere is called transpiration.

UNIVERSAL SOIL-LOSS EQUATION

Wischmier and Smith (1965) proposed an equation for estimating sheet and rill erosion losses from cultivated fields. This has been called the Universal Soil Loss Equation (USLE). The equation is:

$$A = RKLSCP$$

where

- A = soil loss (tons per acre)
- R = the rainfall erosivity index
- K = the soil erodibility index
- L = the hillslope-length factor
- S = the hillslope-gradient factor
- C = the cropping-management factor
- P = the erosion-control practice factor

VAPORIZATION

The process by which liquid water is converted into vapor is called vaporization or evaporation. The transformation from ice to vapor and vice versa is called sublimation. The process by which vapor changes to liquid or solid state is called condensation.

WATER INTAKE

Water intake is the portion of the total amount of rain water that enters the ground.

WATERSHED/CATCHMENT/DRAINAGE BASIN

A drainage basin is the area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel. The term is synonymous with watershed in American usage and with catchment in most other countries. The boundary of a drainage basin is known as the drainage divide in the United States and as the watershed divide in other countries. The drainage basin can vary in size from that of the Amazon River to one of a few square meters draining into the head of a gully.

WATER TABLE

The surface of the ground water is called the water table.

WATERSHED MANAGEMENT

Watershed Management is the process of formulating and carrying out a course of action involving the manipulation of resource in a watershed to provide goods and services without adversely affecting the soil and water base. Watershed management must consider the social, economic and institutional factors operating within and outside the watershed area.

WEATHERING

The physical and geochemical processes by which rock minerals are broken up and decomposed are known collectively as weathering.

WEATHER MODIFICATION

Sometimes referred to as weather control, is the general term for efforts to alter artificially the natural meteorological phenomena of the atmosphere.

WILTING POINT

Moisture content at which permanent wilting of plant occurs. The wilting point represents the soil-moisture level when plants cannot extract water from soil. It is the moisture held at tension equivalent to the osmotic pressure in the plant roots.

WIND PROFILE

The variation of wind speed with height is called wind profile.

XEROPHYTES

Desert plant species, which have fewer stomata per unit area and less surface area exposed to radiation, transpire relatively little water.

WSTERMS.1