

GLASOD CLASSIFICATION OF SOIL DEGRADATION

Classifications

There is a great need for common classifications and methodology to organise existing data and to direct future efforts. In 1991, a first world map on the status of human-induced soil degradation was published by ISRIC, in co-operation with FAO and UNEP (Oldeman *et al*, 1991). In preparation of the map, a general classification was developed, referred to as the GLASOD (**G**lobal **A**ssessment of **S**oil **D**eterioration) classification. In the Annex, the classification of type, severity and cause has been reproduced. Methodology for storing and processing data into maps is provided by SOTER (Global soils and terrain digital database) (Van Engelen *et al*, 1993).

GLASOD CLASSIFICATIONS (OLDEMAN, 1991)

Table A. Type of soil degradation

<i>TYPE</i>	
W	Water erosion
Wt	Loss of topsoil
Wd	Terrain deformation/mass movement
Wo	Off-site effects
	Wor Reservoir sedimentation
	Wof flooding
	Woc Coral reef and seaweed destruction
E	Wind erosion
Et	Loss of topsoil
Ed	Terrain deformation
Eo	Over-blowing
C	Chemical deterioration
Cn	Loss of nutrients or organic matter
Cs	Salinisation
Ca	Acidification
Cp	Pollution
Ct	Acid sulphate soils
Ce	Eutrication
P	Physical deterioration
Pc	Compaction, sealing and crusting
Pw	Water-logging
Pa	Lowering of water table
Ps	Subsidence of organic soils
Po	Other physical activities such as mining and urbanisation
B	Degradation of biological activity

Table B. Degree of degradation

<i>DEGREE OF DEGRADATION</i>	
Light	Somewhat reduced agricultural productivity
Moderate	Greatly reduced agricultural productivity
Strong	Unreclaimable at the farm level
Extreme	Unreclaimable and impossible to restore

Note : Generalised degree of degradation as used for the World map. ISRIC (1988) gives separate classifications for water erosion, wind erosion, salinisation, and nutrient decline.

Table C. Causative factors in soil degradation

<i>CAUSATIVE FACTORS</i>	
f	Deforestation and removal of natural vegetation
g	Overgrazing
a	Agricultural activities
e	Overexploitation of vegetation fore domestic use
i	(Bio)industrial activities

DEFINITIONS OF GLASOD CLASSIFICATIONS

Types of soil degradation are represented in the database by a two-letter code, the first capital letter giving the major degradation type, the second lower case letter giving the subtype. In some cases a third *lower case* letter can be used for further specification (see examples below). Most of the following codes are the same as the ones used on the GLASOD map, but some extra ones have been added, and for others the definition has been changed slightly.

- Wt** *Definition:* loss of topsoil by sheet erosion/surface wash
Description: a decrease in depth of the topsoil layer (A horizon) due to more or less uniform removal of soil material by run-off water
Possible causes: inappropriate land management especially in agriculture (insufficient soil cover, unobstructed flow of run-off water, deteriorating soil structure) leading to excessive surface run-off and sediment transport
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 Although erosion of upstream areas may lead to pollution (with pesticides etc.), this is considered as an off-site effect of erosion rather than a type of pollution.
- Wd** *Definition:* "terrain deformation" by gully and/or rill erosion or mass movements
Description: an irregular displacement of soil material (by linear erosion or mass movements) causing clearly visible scars in the terrain
Possible causes: inappropriate land management in agriculture forestry or construction activities, allowing excessive amounts of run-off water to concentrate and flow unobstructed
- Wo** *Definition:* off-site effects of water erosion in up-stream areas
Description: Three subtypes may be distinguished: sedimentation of reservoirs and waterways (Wos), flooding (Wof), and pollution of water bodies with eroded sediments (Wop)
Possible causes: see Wt and Wd
- Et** *Definition:* loss of topsoil by wind action
Description: a decrease in depth of the topsoil layer (A horizon) due to more or less uniform removal of soil material by the wind
Possible causes: insufficient protection by vegetation (or otherwise) of the soil against the wind; insufficient soil moisture; destruction of soil structure
- Ed** *Definition:* "terrain deformation"
Description: an irregular displacement of soil material by wind action, causing deflation hollows, hummocks and dunes
Possible causes: as with Et
- Eo** *Definition:* off site effects of wind erosion
Description: covering of the terrain with wind borne soil particles from distant sources ("overblowing")
Possible causes: see Et and Ed

- Cn** *Definition:* Fertility decline and reduced organic matter content
Description: a net decrease of available nutrients and organic matter in the soil
Possible causes: a negative balance between output (through harvesting, burning, leaching, etc.) and input (through manure/fertilizers, returned crop residues, flooding) of nutrients and organic matter
- Cp** *Definition:* pollution
Description: a distinction is made between "contamination", indicating the mere presence of an alien substance in the soil without significant negative effects, and "pollution", signifying soil degradation as a consequence of location, concentration and adverse biological or toxic effects of a substance. In this context only the latter is relevant. Both local source pollution (waste dumps, spills, factory sites, etc. (Cpl)) and diffuse or airborne pollution (atmospheric deposition of acidifying compounds and/or heavy metals (Cpa)) are considered under this category.
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Possible causes: draining of soils containing pyrite which will produce very acid sulphate soils ("cat-clays" (Cta)). Planting of acidifying vegetation (e.g. fir) may also lower the soil pH (Ctf). NB acidification by airborne components is considered as pollution!
- Ce** *Definition:* Eutrophication
Description: An excess of certain soil nutrients, impairing plant growth
Possible causes: Imbalanced application of organic and chemical fertilizer resulting in excess Nitrogen, Phosphorus; liming.
- Pc** *Definition:* compaction
Description: deterioration of soil structure by trampling by cattle or the weight and/or frequent use of machinery
Possible causes: repeated use of heavy machinery, having a cumulative effect. Heavy grazing and overstocking may lead to compaction as well. Factors that influence compaction are ground pressure (by axle/wheel loads of the machinery used); frequency of the passage of heavy machinery; soil texture; soil moisture; climate.
- Pk** *Definition:* sealing and crusting
Description: clogging of pores with fine soil material and development of a thin impervious layer at the soil surface obstructing the infiltration of rainwater
Possible causes: poor soil cover, allowing a maximum "splash" effect of raindrops; destruction of soil structure and low organic matter.
- Pw** *Definition:* waterlogging
Description: effects of human induced hydromorphism (i.e. excluding paddy fields)
Possible causes: rising water table (e.g. due to construction of reservoirs/irrigation) and/or increased flooding caused by higher peakflows.
- Ps** *Definition:* lowering of the soil surface
Description: subsidence of organic soils, settling of soil
Possible causes: oxidation of peat and settling of soils in general due to lowering of the water table (see also Pa); solution of gypsum in the sub-soil (human-induced?) or lowering of soil surface due to extraction of gas or water

- Pu** *Definition:* loss of productive function
Description: soil (land) being taken out of production for non-bio-productive activities, but *not* the eventual "secondary" degrading effects of these activities.
Possible causes: urbanization and industrial activities; infrastructure; mining; quarrying, etc.
- Pa** *Definition:* aridification
Description: decrease of average soil moisture content
Possible causes: lowering of groundwater tables for agricultural purposes or drinking water extraction; decreased soil cover and reduced organic matter content
- Sn** Stable under natural conditions; i.e. (near) absence of human influence on soil stability, and largely undisturbed vegetation. NB: some of these areas may be very vulnerable to even small changes in conditions which may disturb the natural equilibrium.
- Sh** Stable under human influence; this influence may be passive, i.e. no special measures had or have to be taken to maintain stability, or active: measures have been taken to prevent or reverse degradation.
- W** "Wasteland": land without vegetation and with (near) absence of human influence on soil stability, e.g. deserts, high mountain zones. Natural soil degradation processes may occur!
Possible causes: bio-industrial sources, dumping, spillage 3
- Cs** *Definition:* salinisation/alkalinization
Description: a net increase of the salt content of the (top)soil leading to a productivity decline.
Possible causes: a distinction can be made between salinity problems due to intrusion of seawater (which may occur under all climate conditions: C_{ss}) and inland salinisation, caused by improper irrigation methods and/or evaporation of saline groundwater (C_{si}).
- Ct** *Definition:* Dystrification
Description: the lowering of soil pH through the process of mobilizing or increasing acidic compounds in the soil.