Table S1. Summary of major soil erosion estimation models.

Models	Brief description	Advantages and disadvantages	Ref.
USLE (RUSLE, MUSLE)	USLE is an empirical model for annual estimate of soil erosion and was further modified as MUSLE and RUSLE. It is a simple model for predicting soil erosion considering rainfall, soil erodibility, land cover, topography and flow rate (for MUSLE) data.	USLE is not event-based and cannot quantify the events that are likely to result in large-scale erosion. The use of slope length factor in RUSLE enables the prediction of soil loss due to overland flow but is mostly applied to agricultural land of gentle slope angle not more than 25° and does not estimate gully- or stream-channel erosion caused by raindrops.	[8,15, 16]
WEPP	Physical model for predicting spatial and temporal distribution of soil loss, sediment yield, sediment size characteristics, run-off volume, and soil–water balance.	Predictions of the locations of sediment deposition and detachment are very effective, but the large computational data requirement of the model limits its applicability.	[17]
SWAT	Physical model for predicting the impact of land management practices on hydrology, sediment, and contaminant transport in large river basins over a long period with integration of drainage, topography, soil, land use, and rainfall information.	Has different applications such as climate change, land-use change, evapotranspiration assessment, ground or soil water impact, snowmelt process, etc. Although storm event–based, high and peak flows are not well simulated by the model.	[18]
AGNPS (Ann AGNPS)	AGNPS is a mix of empirical and physical models used to evaluate runoff, peak discharge, sediment load and nutrient discharge, and chemical oxygen demand transport. The modified Ann AGNPS is a physically based model for predicting surface runoff, suspended load and nutrients from medium-sized river basins at a daily time step.	Computational complexity and greater data requirements of these models provide a better modelling capability but limit its applicability. These models fit agricultural land better than hilly regions for modelling erosion and pollution control.	[19,20]
ANSWERS	A physical model that includes landform information, soil, land use, and channel description for runoff and sediment transport calculation.	The model is mainly designed for agricultural catchment. Its applicability is limited in many catchments by the large spatial and temporal data requirements.	[21]

Models	Brief description	Advantages and disadvantages	Ref.
CREAMS	A physically based model for predicting erosion, deposition, and sediment transport into slope profile and channels integrating precipitation, monthly air temperature, solar radiation values, and soil and crop type data.	It takes into account the gully erosion and deposition along with overland erosion sources. The catchment being modeled is assumed to have uniform soil topography and land use, which may prove unrealistic in some cases.	[22]
EUROSEM	A physical model simulates erosion, sediment transport and deposition, and runoff. Rainfall, soil, crop, channel morphological information are main inputs for this model.	This model is able to predict yearly runoff and soil loss, while it performs better in predicting run-off rate than sediment discharge.	[23]
PESERA	A physically based model designed to predict hill slope erosion and transport of sediment at a range of small catchment to national scale with land cover, soil, topography, and climate data.	It calculates the runoff on a daily basis using daily rainfall data, soil storage, and vegetation interception capacity. Its application is mainly limited to European scale.	[24]
E_{30}	An empirical model derived to predict soil erosion rate at catchment scale using rainfall, vegetation, and topographic information.	This model is applicable to hilly regions with undulating topography and steep slopes. The main drawback is that it does not take into account the soil information as input data, which is an important factor for estimating soil erosion.	[25]
WATEM/ SEDEM	A physically and raster based model. It calculates hill slope erosion, sediment transport capacity of channels and sediment routing using rainfall, runoff, sediment, land use, and soil data.	This model is effective in quantitative assessment of erosion and deposition with a small number of parameters. The grid size selected by the model user is a major factor influencing sediment yield calculation for the model. It is necessary to ensure that the resolution chosen for modeling is adequate for the task.	[26]
EROSION 3D	A process-based model for calculating runoff, channel routing, and transportation and deposition of sediment.	Its requirement for few data and its compatibility with GIS make it flexible in estimating erosion. Because the calculation is based on a regular grid, the disadvantage of this model is similar to that of WATEM/ SEDEM.	[27]
TREX	A physically based model capable of estimating runoff, channel flow, soil erosion, and stream sediment transport.	It can simulate sediment transport from upper to lower catchment areas during severe rainstorms. The application of this model is limited to watershed scale and requires large amounts of hydrologic data.	[28]

Models	Brief description	Advantages and disadvantages	Ref.
SEDD	An empirical approach for calculating sediment delivery ratio to stream channels.	This model is mainly applicable to estimate stream channel erosion and is limited to watershed scale. It does not estimate overland flow in hilly regions.	[29]
MCE (AHP /WIO)	MCE is a qualitative assessment process. It is a probability weighted approach that allows a linear combination of probability weights of several thematic maps. The weightages of individual themes and feature scores are fixed and added to the layers by considering its role in soil erosion.	It is an integrated assessment approach used for identifying a solution with respect to multiple complex problems. It can provide a rationale for making the best decision. The model uses scoring factors and assigns a weighted index to several variables affecting erosion risk according to their influence in erosion based on expert knowledge. Selection of variables in such approaches are not scientific enough and only based on assumptions.	[30-32]