ASSESSING SOIL EROSION

Modelling catchment soil losses due to climate change, land use management and erosion control development

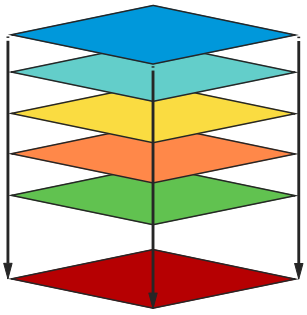
Soil erosion is a serious global issue caused by short-sighted land use management, poor erosion control and more frequent high-intensity rainfalls as a result of climate changes. Today, we see an increasing demand for tools able to assess quantitative changes of catchment-scale soil losses. Since detailed soil and sediment data are scarce in many places, however, robust and appropriate soil loss assessment tools are essential. These tools can assist decision makers with assessing changes in soil and sediment load from river catchments in various climate change and land use scenarios – even if available data is limited.

USING RUSLE IN MIKE POWERED BY DHI

Revised Universal Soil Loss Equation (RUSLE) is a lumped, empirical model that is widely used to describe soil erosion caused by rainfall and the associated overland flow. The RUSLE model predicts potential annual catchment-scale soil losses based on six factors:

- rainfall erosivity
- soil erodibility
- slope length
- steepness based on the catchment topography
- land-use management
- erosion control

Mean annual soil loss = R * K * LS * C * P



R = Rainfall erosivity
K = Soil erodibility
LS = Slope length and steepness
C = Land use management
P = Erosion control

The Revised Universal Soil Loss Equation (RUSLE) model © DHI

CLIENT

- Municipalities
- Water and land use managers
- Farmers and the agricultural industry
- Local and national authorities
- Universities and research institutions

CHALLENGE

Assessing catchment-scale soil losses variations due to climate change and land use management

SOLUTION

Using a MIKE Powered by DHI planning tool to simulate relative changes in soil erosion rates from river catchments.

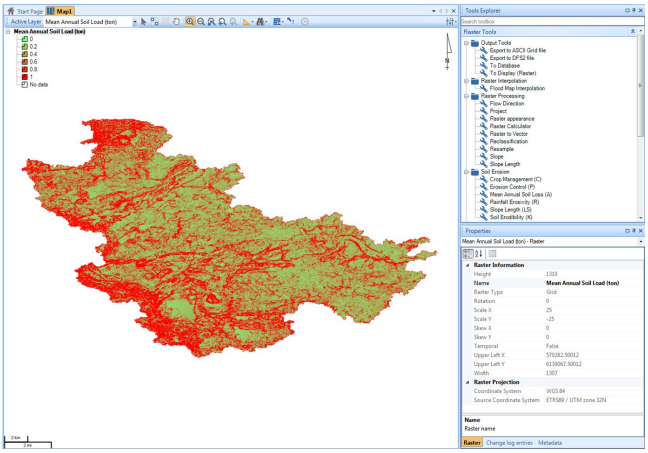
VALUE

- Enables efficient and reliable desktop analysis of changes in rainfall-driven soil erosion due to climatic and human impacts on precipitation and landscape
- Provides storage of soil, land use, topographical and climate data in a MIKE database for straightforward:
  - conversion to Revised Universal Soil Loss Equation (RUSLE) factors
  - setup of various climate and land-use scenarios
- Simulates erosion-driven particle migration from river catchments

Input data from the user includes local rainfall time series, soil and land use data in vector or grid format, and topographical data.

The output is a risk map that shows the spatial distribution of potential annual erosion losses from the catchment. By using the integrated temporal disaggregation tool in MIKE, the total soil and sediment yields can be distributed temporally. This makes it possible to calibrate the model against observed sediment yield time series, if available.

The RUSLE model is a robust soil loss assessment tool that is well-suited to addressing how changes in landscape and climate affect erosion potential within a catchment. The RUSLE model can simulate relative changes in sediment yields from a catchment (for example, between two different climate scenarios). As such, the input data required by RUSLE is accessible in most of the world's regions compared to other more, complex soil erosion models.



Tool output showing the spatial distribution of potential annual soil losses. Data above courtesy of Research and Evaluation, Auckland Council. © DHI

ASSESS SOIL LOSS CHANGES FROM VARIOUS LAND USE MANAGEMENT AND CLIMATE CHANGE SCENARIOS

By bringing RUSLE into MIKE, you get a powerful tool for estimating the changes in soil and sediment yield from river catchments under various land use management, erosion control development and climate change scenarios.

Because of this, RUSLE can now be used as part of a more comprehensive planning and Decision Support System. The user can easily select each of the six RUSLE factors as a varying parameter and study the impacts on the catchment's sediment yield, for example, if:

- rain storms intensify during the summer due to climate changes
- new soil erosion control structures are constructed
- deforestation occurs
- the landscape changes due to urbanisation, mining and so forth

We can help you assess catchment-scale soil losses variations by simulating relative changes in soil erosion rates from river catchments. Photo: iStock © Dan Barnes

In the future, the RUSLE model in MIKE will be extended to simulate the migration of particles bound to soils and sediments, such as particulate phosphorous. The RUSLE method is available as a soil erosion tool in MIKE and a consultancy service. We can assist you with:

- identifying high-potential erosion zones
- assessing climate change and land use management impacts on soil erosion and losses
- quantifying erosion-driven particle migration from river catchment

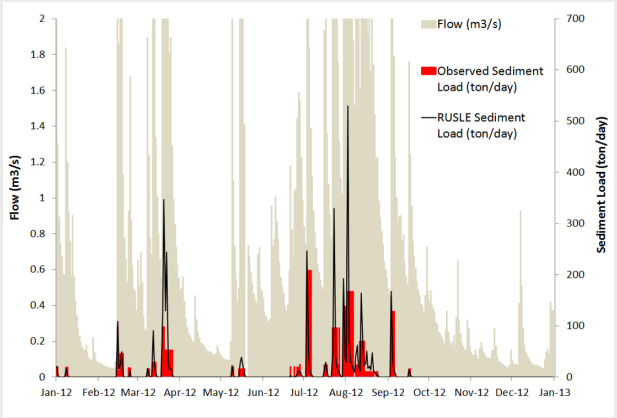
REFERENCE

The sediment load from the Kaukapakapa River catchment in New Zealand was estimated using RUSLE in MIKE.

The estimated annual loads were disaggregated in time according to the river discharge to simulate the individual peaks of sediment loads observed at the river catchment outlet.

This model was run with constant land use, erosion control and soil conditions. The variations in sediment loads were driven by changing rainfall intensities.

For more info on this study, please contact: Simon Funder at sigf@dhigroup.com.



Data above courtesy of Research and Evaluation, Auckland Council.

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For more information, visit: www.dhigroup.com