Joint Research Centre

www.jrc.ec.europa.eu

Predicting water erosion

at the regional scale in Africa

Authors: Olivier Dewitte, Claudio Bosco, Arwyn Jones, Luca Montanarella

Context: Soil erosion by water is regarded as one of the most widespread forms of soil degradation in Africa, and as such, poses potentially severe limitations to sustainable development. In most of the regions, the evaluation of the impact of soil erosion is difficult due to a lack of up-to-date and relevant data. A step forward for improving our knowledge would be the ability in most of the regions to locate at the regional scale the most sensitive areas.

Aim: The aim of this research is to provide some clues about this issue through a concrete application that shows how soil erosion can be predicted at the regional scale with freely available datasets. A application at 1 km resolution is proposed for Morocco with the empirical RUSLE model. Most of its territory lies in the Mediterranean region, which is particularly sensitive to erosion due to its climate characterized by dry summers followed by intense autumn rainfall and often a steep topography with fragile soils.

The model: **Revised Universal Soil Loss Equation** (RUSLE)

$$A = R\ K\ L\ S\ C\ P$$

Where:
A = Average annual soil loss
R = Rainfall erosivity factor
K = Soil erodibility factor
L = Slope steepness factor
S = Slope length factor
C = Cover management factor
P = Support pratice

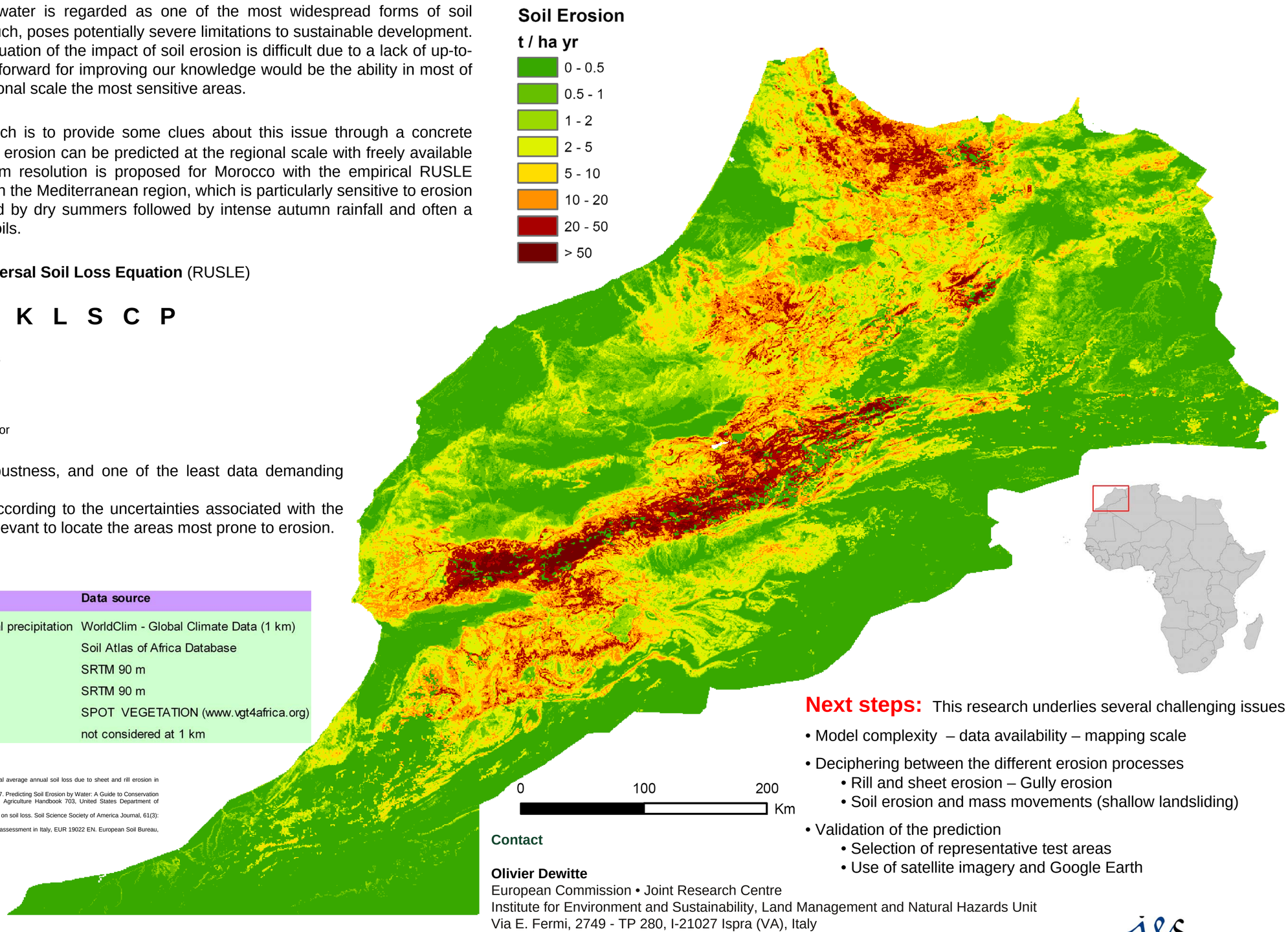
Advantage: simplicity and robustness, and one of the least data demanding erosion models.
Limit: At this resolution and according to the uncertainties associated with the input data, this model is only relevant to locate the areas most prone to erosion.

The dataset:

Parameter	Data	Data source
R (Ref. 1)	Average monthly and annual precipitation	WorldClim - Global Climate Data (1 km)
K (Ref. 2)	Topsoil silt, clay, sand %	Soil Atlas of Africa Database
L (Ref. 3)	Elevation	SRTM 90 m
S (Ref. 3)	Elevation	SRTM 90 m
C (Ref. 4)	NDVI (average 2008)	SPOT VEGETATION (www.vgt4africa.org)
P	= 1	not considered at 1 km

References

(1) Arnoldus, H.M.J., 1977. Methodology used to determine the maximum potential average annual soil loss due to sheet and rill erosion in Morocco. FAO Soils Bull., 34: 39-51.
(2) Renard, K.G., Foster, G.R., Weessies, G.A., McCool, D.K. and Yoder, D.C., 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE). Agriculture Handbook 703, United States Department of Agriculture(USDA), Agricultural Reserch Service.
(3) Nearing, M.A., 1997. A single, continuous function for slope steepness influence on soil loss. Soil Science Society of America Journal, 61(3): 917-919.
(4) van der Knijff, J.M., Jones, R.J.A. and Montanarella, L., 1999. Soil erosion risk assessment in Italy, EUR 19022 EN. European Soil Bureau, Joint Research Center of the European Commission, 54 pp.



Next steps: This research underlies several challenging issues

- Model complexity – data availability – mapping scale
- Deciphering between the different erosion processes
  - Rill and sheet erosion – Gully erosion
  - Soil erosion and mass movements (shallow landsliding)
- Validation of the prediction
  - Selection of representative test areas
  - Use of satellite imagery and Google Earth

Contact

Olivier Dewitte
European Commission • Joint Research Centre
Institute for Environment and Sustainability, Land Management and Natural Hazards Unit
Via E. Fermi, 2749 - TP 280, I-21027 Ispra (VA), Italy
Tel. +39 0332 789316 • Fax +39 0332 786394
E-mail: olivier.dewitte@jrc.ec.europa.eu

JRC EUROPEAN COMMISSION

Institute for Environment and Sustainability