PROJECT DESCRIPTION

S. Schmidt; K. Meusburger; P. Panagos; C. Alewell

Soil Erosion Risk Modeling in the Alps –

ERK_Berg as a Prototype of ERK2 for mountain zones III, IV and summering grazing zones

Project funded by the Federal Office for the Environment (FOEN)
Grant numbers N° N222-0350 & N° P182-1535
Duration: March 2015 – December 2018

Soil Erosion on grassland is generally neglected due to the protective character of dense grass vegetation on soil loss. However, recent studies by MEUSBURGER et al. (2010), KONZ et al. (2012) and ALEWELL et al. (2013) show that large amounts of topsoil are mobilized also on grassland in the alpine areas (Fig. 1).

Figures 1: Soil Erosion in the Swiss Alps

A soil erosion modeling approach for arable land (Erosionsrisikokarte ERK2; Prasuhn et al. 2013) was already realized by the Centre for Development and Environment University Bern and Agroscope Reckenholz. To complement the ERK2-results and to create a nationwide soil erosion risk map, a risk assessment for the (alpine) grassland will be realized by geospatial modeling.

According to a comprehensive approach, the model is based on the Revised Universal Soil Loss Equation (RUSLE) by WISCHMEIER & SMITH (1978). The general soil-loss-equation of RUSLE is a function of five factors:

\[ A = R \cdot K \cdot LS \cdot C \cdot P \]

Where A is the mean long-time soil loss in t ha\(^{-1}\) yr\(^{-1}\), R the rain erosivity factor, K the soil erodibility and the parameters L and S describe the length and slope of the relief. C is the cover and management factor, P is a factor for protection and soil conservation.
The main task of the ongoing project is the adaptation of the model parameters which aren’t generally accepted for steep slopes and grassland in alpine areas. Furthermore, the project aims the investigation of spatial AND temporal soil erosion patterns by a dynamic soil erosion risk assessment.

The monthly rainfall erosivity of Switzerland, based on 87 automated gauging stations and a regression kriging approach, revealed spatial and temporal pattern with highest R-factors in summer (Fig.2; SCHMIDT et al. 2016). A proportion of 62% of the total annual sum of rainfall erosivity affects soils within a time period of 4 months (June, July, August, and September) (Fig. 3).

Figure 2: Monthly rainfall erosivity maps for Switzerland derived by regression-kriging (SCHMIDT et al. 2016)

The increase of spatial and temporal resolution of remote sensing datasets enabled the mapping of C-factors on a monthly scale. We used an orthophoto with a spatial resolution of 0.25m (Swissimage FCIR) and a time-series of the fraction of green vegetation cover with a temporal resolution of 10-days (FCover) to calculate the dynamics of the C-factor on Swiss grassland. The annual average C-factor of all Swiss grassland is 0.012 (Schmidt et al. in review a). A national map of Swiss grassland and Swiss permanent grassland was presented for the first time (SCHMIDT et al. in review b).

The national soil erodibility map of Switzerland is based on digital soil mapping with 199 Land Use/Cover Area frame Survey (LUCAS) topsoil samples. The mean national K-factor for Switzerland is 0.033 t ha h ha⁻¹ MJ⁻¹ mm⁻¹ (SCHMIDT et al. in prep.).
Slope length and steepness for Switzerland is based on the Multiple Triangular Flow Direction (MTFD) approach (Seibert & McGlynn 2007) and was extensively tested on plot scale (Bircher et al. in prep.).

Due to the excellent database of Switzerland, the model could be used as a prototype for risk assessment in the European alpine regions. It is envisaged to present the soil erosion risk map for grassland by the end of the year 2018.

Literature:


Bircher, P., Prasuhn, V., Liniger, H.-P. (in prep.): Comparison of different multiple flow algorithms for RUSLE slope-length factor (L) and slope steepness factor (S) calculation in Switzerland.


SCHMIDT, S., ALEWELL, C., MEUSBURGER, K. (in review a): Mapping Spatio-Temporal Dynamics of the Cover and Management Factor (C-Factor) for Grasslands in Switzerland.


SCHMIDT, S., BALLABIO, C., ALEWELL, C., PANAGOS, P., MEUSBURGER, K. (in prep.): Mapping soil erodibility (K-factor) and ist seasonal variability in Switzerland.

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For a detailed description follow this [link](#)
CURRICULUM VITAE

Contact:
Simon Schmidt

http://www.simonschmidt.de
si.schmidt@unibas.ch
Telephone: +41 (0)61 267 04 83

University Basel
Department of Environmental Science
Bernoullistrasse 30 – Room 204
CH-4056 Basel
Switzerland

Research:
PhD student funded by the Federal Office for the Environment (FOEN)
Project title: “Erosionsrisikokarte für das Berggebiet: ERK-Berg – Prototyp der ERK2 für die Bergzonen III, IV und die Sömmerungsgebiete”

Curriculum Vitae:

Education:

2015 – today
PhD Student, University of Basel, Switzerland

2011 – 2015
M. Sc. Physical Geography / Geoecology, University of Leipzig, Germany
Thesis: “Developing of a wind erosion screening-model to estimate the potential susceptibility of soil loss on agricultural fields in Western Saxony”

2011 – 2013
Studies in Soil Science, Martin-Luther-University Halle-Wittenberg, Germany

2010 – 2011
Studies in Geography and GIS, University of Lisbon, Portugal

2008 – 2011
B. Sc. Geography, University of Hamburg, Germany
Thesis: “Implication of deforestation on geomorphological processes – a GIS- based analysis of the spatial dimension of Soil Erosion in Mato Grosso, Brazil”
Employment Information:

2014 – 2015
Internship at German Development Cooperation (GIZ) and Ministry of Environment and Natural Resource Protection Tbilisi, Georgia

2013 – 2014
Employment at Scholz Engineering-Survey GmbH Leipzig, Germany

2013
Internship at the State Office for Geology and Mining Saxony-Anhalt, Germany

2010
Internship at the University of Applied Science of Bragança, Portugal

Publications:

Paper

**SCHMIDT, S., BALLABIO, C., ALEWELL, C., PANAGOS, P., MEUSBURGER, K.:** Mapping soil erodibility (K-factor) and its seasonal variability in Switzerland. in prep.

**SCHMIDT, S., ALEWELL, C., MEUSBURGER, K.:** Mapping Spatio-Temporal Dynamics of the Cover and Management Factor (C-Factor) for Grasslands in Switzerland. in review a.


**Conference Paper**


**Schmidt, S., Meusburger, K., Panagos, P., and Alewell, C.:** Identification of Spatiotemporal Patterns of Rainfall Erosivity as Decision Support to Erosion Control in Switzerland. SSSS Annual Meeting/BGS Jahrestagung 2017, Bern (CH), 09.02.-10.02.2017.


**Schmidt, S., Meusburger, K., de Figueiredo, T., and Alewell, C.:** A Multidirectional Wind Erosion Model for Western Saxony. EGU General Assembly 2016, Vienna (AT), 17.04.-22.04.2016.

**Schmidt, S., Meusburger, K., Panagos, P., and Alewell, C.:** Seasonal variability of rainfall erosivity across Europe and Switzerland. Swiss Geoscience Meeting 2015, Basel (CH), 20.11.-21.11.2015.


SCHMIDT, S.: Developing of a wind erosion screening-model to estimate the potential susceptibility of soil loss on agricultural fields in Western Saxony, 8. Marktredwitzer Bodenschutztage, Marktredwitz (DE), 08.10.-10.10.2014.

Thesis
