A global initiative to combat desertification

A publication from the DESIRE project - funded by the European Union's 6th Framework Program 'Global Change and Ecosystems'

2011 - 4

Newsletter 5

DESIRE celebrates the hard work and enthusiasm of the PhD students

DESIRE students are at the cutting-edge of research

Prof. Victor Jetten and Dr. Simone Verzandvoort welcome the Ph.D students to a conference at ITC

DESIRE scientists and students enjoyed a productive plenary meeting in Turkey in 2008

Postgraduates are at the centre of new research developments in large integrated projects such as DESIRE. There are more than 30 Ph.D students working in the project's 16 study sites: collecting and analysing data to support state-of-the-art ideas and hypotheses. Many of them have had the opportunity to attend the annual DESIRE plenary meetings to meet other scientists and exchange ideas. This Newsletter (5) provides some examples of the questions that are being answered and covers: a decision support system for selecting sustainable land management strategies; linking farming systems with agro-ecosystem services; assessing desertification at the catchment scale; erosion and landscape evolution in SE Spain; and the effectiveness of soil and water conservation in Mediterranean areas. More examples follow in Newsletter 6.

Each page is from a DESIRE PhD student:

G Schwilch (CDE, Berne; WUR), N Jones (WUR-LDD Wageningen, UTL-ISA Portugal), M Vanmaercke (K U Leuven), J E M Baartman (WUR, Wageningen), W Maetens (K U Leuven)

Edited by Nichola Geeson, January 2011

For more information and contact details see:

• The DESIRE Harmonised Information System: www.desire-his.eu and DESIRE website: www.desire-project.eu

The DESIRE project (2007-2012) is funded by the European Commission, VI Framework Program, 'Global Change and Ecosystems' and the governments of France, the Netherlands, Italy and Spain. It brings together the expertise of 26 international research institutes and non-governmental organisations (NGOs). This project is coordinated by ALTERRA – Research Institute for the Green Living Environment, the Netherlands.

Website: **www.desire-project.eu**
Contact DESIRE coordinator: Coen.Ritsema@wur.nl
Contact DESIRE Communications: ngproject3@googlemail.com
Contact EU Scientific Officer: Marie.Yeroyanni@ec.europa.eu

ALTERRA WAGENINGEN UR

A global initiative to combat desertification

SIXTH FRAMEWORK PROGRAMME

Decision support for selecting SLM strategies

by Gudrun Schwilch

UNIVERSITÄT BERN
CDE CENTRE FOR DEVELOPMENT AND ENVIRONMENT
WAGENINGEN UR For quality of life

Identifying sustainable land management strategies

Strategies to mitigate desertification are often comprised of selected technologies of SLM together with a suitable implementation approach. They are ideally identified together with the involved stakeholders. However, the process of finding appropriate strategies as well as their appraisal regarding applicability, usefulness and impact requires expert knowledge and scientific research. The aim of this research was to develop a methodology and tools to support this process.

Methodology development for participatory decision making

First, a framework was designed which allowed integrating participatory learning approaches with the identification, documentation and evaluation of existing best practices to mitigate desertification and land degradation. Secondly, a tool was created supporting the process of selection, comparison and decision of potential strategies. This tool is embedded into a participatory workshop where stakeholders negotiate and decide upon the solution to be used for test implementation.

Part I – Identification
of existing and potential strategies with a participatory learning approach (stakeholder workshop 1)

Part II – Assessment
Evaluation, documentation and sharing of strategies with standardised questionnaires

Part III – Selection
of the most promising strategies with a decision support tool (stakeholder workshop 2)

3-part methodology

This methodology was successfully applied in all the DESIRE study sites, where the SLM technologies resulting from the selection process were then also implemented and monitored. The usefulness and effectiveness of the methodology has been analysed based on the workshop reports, the documented technologies and approaches, enquiry and talks with study site researchers and further in-depth interviews with stakeholders in Portugal and Morocco.

Joint and mutual learning of land users, forest authorities, NGOs and researchers in Portugal

In addition, monitoring the implementation of mulching and minimum tillage in Morocco with soil moisture and evaporation measurements are giving insights into the environmental impact of one selected technology

Schwilch G, Bachmann F, Liniger HP. 2009. Appraising and selecting conservation measures to mitigate desertification and land degradation based on stakeholder participation and global best practices. Land Degradation & Development 20: 308–326.

Schwilch G., Bestelmeyer B, Bunning S., Critchley W., Herrick J., Kellner K., Liniger H.P., Nachtergaele F., Ritsema C.J., Schuster B., Tabo R., van Lynden G., Winslow M. 2011. Experiences in Monitoring and Assessment of Sustainable Land Management. Land Degradation & Development

For further information email Gudrun.Schwilch@cde.unibe.ch

DESIRE
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Linking farming systems and agro-ecosystem services

by Nádia Jones

Hinc patriam sustinet
Instituto Superior de Agronomia
Universidade Técnica de Lisboa
Land Degradation & Development group

Assessment of land use changes in Portugal

This research is focused on the impact assessment of land use changes on land degradation and conservation in two areas in Portugal. After an expansion of arable land until the mid 1960s, a gradual abandonment of grain production has been taking place. About 16% of the total land area has since been converted into forest (5%) and permanent pasture (11%). The nature of this change has been analysed in more detail for two research areas located in the Centro and Alentejo regions of Portugal.

Land use change has favoured degradation

The analysis, based on national statistics, CORINE Land cover information and RUSLE soil loss estimates, points out that the dynamics of the recent land use changes (1990-2006) has favoured land degradation in both research areas. This is in the Centro mainly as a result of forest fires, and in the Alentejo because of the afforestation of miscellaneous dense shrub land. An article has been recently submitted about this analysis.

Initiatives to support soil conservation

The research is now directed towards an investigation of the changes of traditional and resilient farming systems and their contribution to soil conservation as a result of CAP agri-environmental support measures. About 80 farmers and 10 farmer associations and forestry organizations will be involved in this analysis. The results are important for understanding the implications of agri-environmental policy and its contributions for agro-ecosystems goods and services.

Pinus pinea afforestation in the Alentejo research area

Vegetative cover on olive orchard in the Alentejo research area

Contour tillage in the Alentejo research area

For further information email nadia.jones@wur.nl

Assessing Desertification at the catchment scale

by Matthias Vanmaercke

DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES
K.U.LEUVEN - BELGIUM

Changing perspectives

In attempts to mitigate desertification, scientists have paid a lot of attention to 'on site' erosion processes at the hillslope scale. Generally, a large part of the eroded sediment is redeposited again before it reaches a river. Therefore, it is generally expected that the annual amount of sediment that reaches a catchment outlet (i.e. the 'sediment yield' of a river) is smaller than the total annual amount of on-site erosion that occurs in the catchment. As a result, catchment sediment yield has received relatively little attention in studies that assess the causes and impacts of desertification. Based on the analyses of a large recently compiled database containing thousands of measurements of both catchment sediment yields and on-site erosion rates in Europe, we found that this focus on on-site erosion processes is not always justified.

Different regions, different processes

Whereas sediment yields are indeed usually smaller than on-site erosion rates in most temperate regions of Europe, a different trend was found in the Mediterranean region where catchment sediment yields are generally much higher than would be expected from the on-site erosion rates. Soils on Mediterranean hillslopes are often very shallow and stony, making them relatively less susceptible to erosion. However, the water that runs off from these hillslopes can cause serious erosion problems further downstream due to other processes such as gully erosion, landslides and riverbank erosion.

Why it matters

High catchment sediment yields can cause various problems. One of the most important is the storage capacity loss of reservoirs, since large volumes of sediments are often trapped in reservoirs. Hence, high catchment sediment yields can threaten future water supplies. Although the importance of these other erosion processes differs from catchment to catchment, these results clearly indicate that not only on-site erosion but also catchment sediment yield should be considered as an important desertification indicator.

Runoff from hillslopes leads to the formation of gully channels and causes important capacity losses of reservoirs.

(Photos: Mamoro, Morocco, October 2009)

For further information email Matthias.Vanmaercke@ees.kuleuven.be

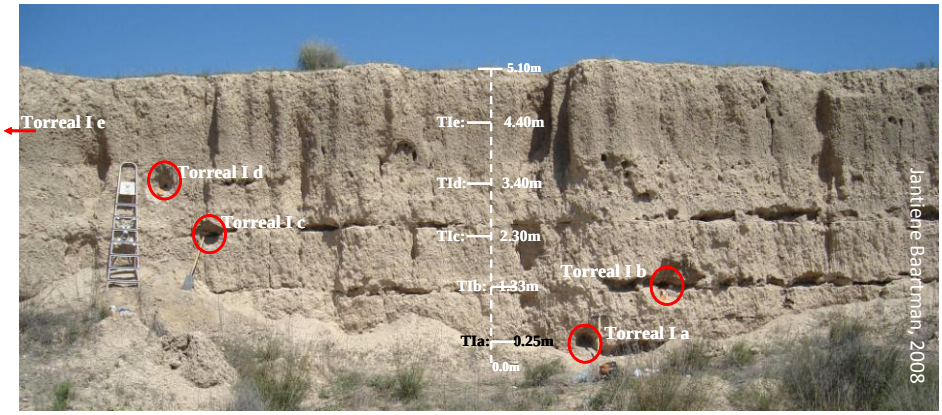
Erosion and landscape evolution in SE Spain

by Jantiene E.M. Baartman

Erosion in the longer-term landscape evolution context

This PhD research addresses erosion and sedimentation in the context of longer-term landscape evolution. In many erosion studies only contemporary erosion is assessed, often assuming this to be the direct or indirect effect of human action. In geomorphology, erosion is viewed as a naturally occurring process in the context of landscape evolution. In this research, we aim to bridge the gap between these contrasting views. Research questions that are addressed include:

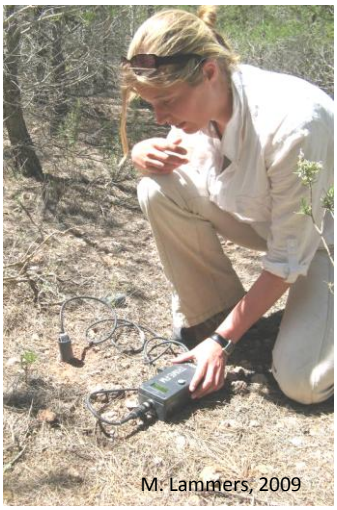
- ❑ What is the role of prolonged or heavy (extreme) rainfall events on the longer term? Do these events have a lasting influence in the landscape or not?
- ❑ What is the influence, in terms of erosion, of humans and how has human influence evolved, compared to natural erosion?
- ❑ If measures against erosion are taken, are they effective in the long term as well as the short term?



Dating sediments in a gully side-wall

Geomorphology and conceptual model

A geomorphological study has been carried out in the Upper Guadalentín Basin, SE Spain, describing and dating the sediment archives. A conceptual model of erosion and sedimentation was made. One important tool to help answer the above questions is an erosion model. The event-based erosion model openLISEM has been tested and calibrated for the Prado (sub)catchment for rainfall events of different magnitudes. Subsequently, work is ongoing to calibrate the LAPSUS landscape evolution model with the dated sediments.



Measuring soil moisture content

Combining event-based and long-term evolution models

This model will be used to model the longer-term erosion, and assesses the question of human influence. Finally, we aim to combine both the event-based and landscape evolution models to be able to quantify the role of extreme events on the longer term.

Stream discharge after a rainfall event

For further information: jantiene.baartman@wur.nl

How effective are soil and water conservation techniques in the Mediterranean?

by Willem Maetens

DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES
K.U.LEUVEN - BELGIUM

Quantifying the effects of soil and water conservation techniques

Runoff and soil loss caused by interrill and rill erosion are widely recognized as important desertification processes with both on- and off-site consequences, and are listed as one of the main desertification processes by 8 out of 16 DESIRE study sites. Effective and sustainable reduction of runoff and soil loss can be achieved either by land use changes or the application of soil and water conservation techniques (SWCT). The objective of this study is to quantify the effects of SWCT on runoff and soil loss. Such a quantitative assessment has a large potential for use in the design of SWCT in the field or use in erosion models like PESERA. Furthermore, most of the existing review studies and models focus on soil loss. Nevertheless, runoff reduction is equally important, especially in semi-arid areas where water is a valuable resource.

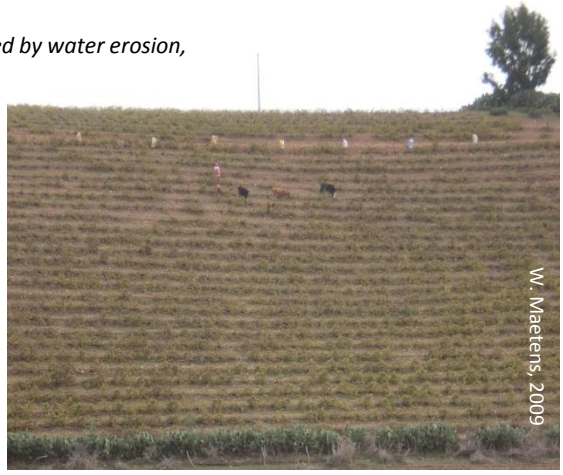
Database of runoff plot data

Many experimental runoff plot data on the effectiveness of SWCT in reducing runoff and soil loss in Europe exist, but due to the limitations of these studies, both in time and space, and the dispersion of results in scientific literature, no overview has been made so far. In this study, a large database comprising 9 582 plot-years from 260 sites throughout Europe and the Mediterranean was compiled to assess the effects of land use and SWCT on runoff and soil loss and to study the relations with environmental parameters like annual precipitation, land use, soil type, slope gradient and slope length. The large size of this database allows general conclusions that cannot be made from single study sites.

Landscape affected by water erosion, Sehoul, Morocco

Reducing runoff and soil losses

A first analysis of the database indicates that effects of land use and SWCT application on soil loss are larger than the effects on runoff. Hence, large reductions in soil loss can be obtained by SWCT that only result in a moderate decrease in runoff. This should be considered whenever runoff reduction and water retention are also goals of SWCT application.



Contour cultivation, Sehoul, Morocco

Testing of geotextiles, Hungary

Effectiveness of measures

Furthermore, there are clear differences in effectiveness between different types of SWCT. SWCT which provide a permanent soil cover (e.g. cover crops, mulches) are more effective in reducing soil loss and runoff than techniques that only modify the soil structure (e.g. no-tillage or conservation tillage). For more information email willem.maetens@ees.kuleuven.be