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MULTIDISCIPLINARY APPROACHES TO SOIL CONSERVATION STRATEGIES

International Symposium, ZALF (Centre for Agricultural Landscape and Land Use Research), Müncheberg, Germany, 11-12 May 2001

The symposium was organised by Dr Katharina Helming on behalf of the ESSC and ZALF and Dr Nicola Fohrer on behalf of the Working Group on Soil Erosion of the German Society for Soil Science (DBG). Excellent warm spring weather had been carefully arranged so that breaks for refreshments could be taken outside in the very congenial surroundings of the centre. Only voracious flying mosquitoes (eager for fresh international blood) and non-flying Lufthansa planes (pilots on strike – eager for more money) conspired unsuccessfully to try to spoil the efficient organisation. Some 60 scientists from 15 European countries and beyond attended the meeting. The oral and poster presentations were categorised into 3 main themes: soil conservation aims for landscape and land use; socio-economic incentives and obstacles in implementing soil conservation strategies; and case studies illustrating multidisciplinary approaches to soil conservation.

The morning of the first day was devoted to oral presentations dealing with the first theme. The first session was begun by José Rubio (CIDE, València, Spain) reporting various initiatives by international organisations aimed at promoting a global policy for soil conservation. Then, Monica Frielinghaus (ZALF, Germany) outlined the purpose of the European Soil Campaign and the various activities in Germany relating to it. This was followed by Pavol Bielek (Bratislava, Slovak Republic), who presented a GIS approach to identifying areas at risk of soil degradation and reduced water quality. Next, Raimo Kõlli (Erika, Estonia) considered the range of socio-political and physical factors affecting soil humus status in Estonia. For the remaining papers presented, the speakers were presenting the work of two or more contributors. Rick Shakesby (Swansea, UK) questioned whether the *dehesa* and *montado* land uses of the Iberian Peninsula are low erosion-risk as well as high biodiversity options. Harald Kächele (ZALF, Germany) presented an economic assessment of soil protection systems (types of tillage and crop rotation) in north-east Germany. Nicola Fohrer (Giessen, Germany) described the PROLAND predictive agro-economic simulation model in which agricultural economics, and ecological and hydrological factors are combined to produce different scenarios of the influence of land use systems on biodiversity.

The first part of Friday afternoon was devoted to the second theme. The session began with Johannes Schuler (ZALF, Germany) presenting the MODAM model, aimed at maximising economic and ecological efficiency. Then, Helena Posthumus (Wageningen, Netherlands) considered the effectiveness and efficiency of incentives and subsidies for introducing soil conservation measures and improving soil quality in Burkino Faso, and Ayalneh Bogale (Berlin, Germany) discussed sustainable rural livelihood in Ethiopia. Manfred Kaufmann (ETH Zürich, Switzerland) presented a multi-criteria approach to evaluating soil conservation strategies on restored land. The

second part of the afternoon was concerned with the third theme. Matthias Lebert (Braunschweig, Germany) discussed ways of prevention, detection and remediation of soil compaction caused by the use of agricultural machinery. Peter Fiener (Freising-Weihenstephan, Germany) presented the results of eight years of detailed monitoring aimed at comparing the economic returns of conventional versus organic and integrated farming methods. Andreas Meyer-Aurich (Freising-Weihenstephan, Germany) discussed the analysis of the costs and benefits of different measures of soil protection in order to optimise farm management. Next, Ion Ioniță (Perieni-Barlad, Romania) showed how poor soil conservation practices have been reintroduced in eastern Romania after 1990. The final two papers of the day were devoted to modelling. Ádám Kertész (Budapest, Hungary) demonstrated how the USLE gave an approximation of sediment delivery whereas the MEDRUSH model provided a more accurate prediction for different land use types, and Gerard Govers (Leuven, Belgium) discussed modelling of land use change and its effect on regional sediment production and delivery.

In the evening, participants were able to learn more about some of the research undertaken at ZALF by dividing into small groups and joining individual staff in the research "houses", which turned out to be an apt description of the nature of the accommodation. The evening was nicely rounded off with a buffet meal, which included a wild boar course and other gastronomic delights. The mosquitoes ate less well, thanks to the spray repellent.

Saturday morning was devoted to the formal presentation and discussion of posters. Too often the "poor cousins" of oral presentations, it was refreshing to find that time had been set aside for those responsible for the posters to present their work. Jannes Stolte (Wageningen, Netherlands) presented two posters dealing with two aspects of soil and water conservation on the Loess Plateau, China on behalf of international groups of scientists. On a similar theme, Mattiga Panomtaranichagul (Chiang Mai, Thailand) described alternative practices for soil and water conservation in northern Thailand. Then, Zbigniew Klimowicz (Lublin, Poland) presented a poster dealing with protection problems of loessic soils subject to agricultural use. Franz-Ferdinand Groeblichhoff (Paderborn, Germany) presented work concerned with a comparison of soil conservation measures based on large experimental erosion plots. Svetla Rousseva (Sofia, Bulgaria) presented two posters on behalf of a number of co-workers dealing with a GIS approach to estimating soil erosion on cultivated land in Bulgaria and an ecological approach to maximising income on irrigated land. Claudia Sattler (ZALF, Germany) described an interdisciplinary approach to the diffusion of knowledge about soil erosion minimisation. Kirsten van der Heiden (ZALF, Germany) dealt with the experience of a participatory project concerned with enhancing sustainable land use. This was followed by Detlef Deumlich (ZALF, Germany) who described research characterising areas for soil and water conservation at different scales. Next, Ryszard Debicki (Lublin, Poland) considered plant yield and soil loss with different soil conservation practices in an area of eroded loess in Poland. Mike Fullen (Wolverhampton, UK) presented work carried out by a large international group, which was concerned with multidisciplinary approaches to soil conservation in the

highlands of South China and Thailand. Anja Klisch (German Aerospace Centre (DLR), Neustrelitz, Germany) dealt with the usefulness of remote sensing as a resource for producing physically-based soil erosion models. Gergely Tóth (Vezprém, Hungary) discussed the advantages of an automated complex land information system in land use planning. Finally, Gwendolyn Gyssels (Leuven, Belgium) considered the impact of the sowing density of wheat on erosion in the form of rills and ephemeral gullies in areas of concentrated overland flow.

On Saturday afternoon, a field trip led by Monika Frielinghaus and Claus Dalchow (ZALF, Germany) was arranged to visit sites in the local area relating to some of the themes of the symposium. The first stop was near Seelow to learn about the development of the agricultural landscape of the Oderbruch river lowland from Lothar Müller (ZALF, Germany). The next stop was Golzow Agricultural Farm where Gerd Schellpeper kindly gave up part of his Saturday afternoon to talk about large-scale conservation tillage practices and to show participants the bulky machinery with which the various tasks were carried out. The third stop was at Batzlower Mühlenfließ where Monika Frielinghaus and Roger Funk (ZALF, Germany) discussed the monitoring and impacts of wind and water erosion in the landscape and the conservation measures adopted, while the participants were able to satisfy their thirst and afternoon pangs of hunger with some thoughtfully provided refreshments. On the way to the final stop, Claus Dalchow proved to be a font of knowledge on some of the more bizarre and amusing anecdotal information about local historical characters. One such character during the eighteenth century was Albrecht Daniel Thaer, who besides being blessed with a rather large nose, was responsible for the introduction of sustainable land management and food production to this part of north-east Germany. The final stop at Möglin was a museum devoted to him. It had displays of agricultural implements and both writings by him and about him, and it also exhibited copies of various paintings and lithographs which, despite artistic licence, could not disguise the fact that he was indeed "nasally challenged"!

On returning to their hotels, participants were able to reflect on an excellently organised meeting with a variety of stimulating papers and posters and thought-provoking discussion undertaken in very pleasant surroundings.

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SNOWMELT EROSION AND RELATED PROBLEMS

COST 623 Meeting, 28-30 March 2001, Oslo, Norway

Local organizer

Norwegian Centre for Soil and Environmental Research (Jordforsk) and the Norwegian Department of Soil and Water Sciences (NLH)

In co-operation with:

COST-action 623: Soil Erosion and Global Change

ESSC: European Society for Soil Conservation

IGU: International Geographic Union, Commission for Land Degradation and Desertification

Supported by:

The Norwegian Research Council

The Norwegian Ministry of Agriculture

Specific goals

The overall objective of the symposium on 'Snowmelt erosion and related problems' was to highlight issues of particular importance for soil erosion processes in northern regions. Specific symposium themes were:

- 1) Hydrological processes and properties in frozen or partly frozen soils.
- 2) Methods and equipment for measurement of soil physical properties during the winter period, both in the laboratory and in the field.
- 3) Alteration of soil physical and mechanical properties by freezing and thawing.
- 4) Soil erodibility during winter periods.
- 5) Scale issues in relation to field measurements and modelling.
- 6) Modelling soil erosion under winter conditions.
- 7) Potential effects of climate change.

Paper topics

During the first session on *Hydrological processes in frozen or partly frozen soils*, symposium themes 1-3 were addressed. The infiltration of water in frozen soils was certainly the most intensively discussed topic within this session. Several papers discussed the actual study of the infiltration process in frozen soils: what are the measuring techniques available, how can we improve these measuring methods and what are the key-problems related to measuring infiltration in frozen soils. Some papers went beyond the measuring problems by 1) discussing the mechanisms related to the distribution and redistribution of groundwater in the topsoil under a freezing-thawing regime and 2) reporting the effects on soil characteristics (e.g. hydraulic conductivity, soil roughness) of freeze-thaw cycles.

The session on *Soil erosion measurement, processes and influencing factors* looked into more detail at symposium themes 4 & 5. For areas where snowfalls occur regularly, snowmelt seems to be a significant erosion process, although it is often not the main contributor to the total erosion budget. An important observation that appeared from the field studies is that traditional erosion-reducing techniques are not (always) applicable to conditions where snowmelt erosion prevails. It became also clear that more long-term (at least seasonal) and large-scale (at least watershed) data are needed to assess the snowmelt erosion process in more detail and to be able to provide to winter erosion models/modellers with accurate validation data.

Finally the session on *Modelling: infiltration, runoff and soil erosion during winter periods* covered symposium themes 6 & 7. With respect to modelling, the key issues identified were:

- 1) we need more basic information on the behaviour and evolution of snow cover;
- 2) the process of water release from snow has not yet uniformly been described;
- 3) it is not completely clear how snow and frost influence soil parameters;
- 4) the infiltration of water into a frozen soil has not yet accurately been described; and
- 5) the initiation of runoff and formation of preferential flow pathways when snow starts to melt is not sufficiently investigated.

All these issues together mean that accurate snowmelt erosion modelling requires more basic research to be done. Consequently current models often perform poorly, though some promising initiatives like the heat balance approach, 3D-modelling and the use of simple empirical prediction tools, were presented.

With respect to the application of snowmelt erosion models, there is a need for studies dealing with:

- 1) risk evaluation (expressed as probabilities);
- 2) relative changes in erosion rates as a function of soil treatment, crop type, and crop cover;
- 3) quantitative analysis of the processes active under snowmelt conditions on the catchment scale; and
- 4) long term perspectives (global change).

In addition to the presentations (both oral and poster) there was a one-day field trip during which the measurements required to monitor snowmelt erosion, both on the plot-scale and at the outlet of a catchment, were clearly illustrated. The impact of recent land levelling on the Norwegian agricultural land was also made clear. Through a poster and field illustrations it was shown that levelling the land comprises more than just flattening the topography. A major challenge related to land levelling is the management of the newly created hydrology system.

Unfortunately, the afternoon section of the planned field trip had to be cancelled due to an unexpected traffic jam that paralysed the excursion buses on the road between Vormsund (where we had a delicious lunch) and the Bjørnebekk erosion plot experiment. The missed excursion stop, however, could not dampen the great atmosphere of the dinner at the Agricultural University of Norway. On the whole, the excursion was a great success, as it gave many of us a unique opportunity to get in touch with the specific problems, practical and theoretical, related to snowmelt and snowmelt erosion.

Important conclusions

The COST 623 meeting on 'Snowmelt erosion and related problems' made certainly clear that erosion due to snowmelt requires a significantly different approach compared to erosion on driven by rainfall on agricultural land. Especially with respect to infiltration, runoff generation, runoff concentration and erodibility of a thawing soil conditions are entirely different from the situations in temperate and (semi-)arid climates that have been studied more extensively. Therefore a need for more basic research, especially on the catchment scale and on the medium to long term are required. Only then accurate snowmelt erosion prediction tools can be developed. Judging from these important conclusions, it is clear that this symposium was a real success. It is an understatement to stay that all this wouldn't have been possible without the efforts of the local organizer and especially Lillian Øygarden and her team. Therefore, many thanks.

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UNESCO HYDROLOGY DATA BASE

UNESCO, in collaboration with IHE Delft and UNAM Mexico, has taken the initiative to build a data base on courseware related to hydrology which is available electronically. The data base will form the basis of a catalogue which will be accessible free of charge from the UNESCO web site.

If you have released, heard about or use relevant courseware in electronic format that could be included in the data base, please

either look at <http://www.courseware.ihe.nl> and register the material

or contact Dr Ir Ioana Popescu, International Institute for Infrastructural Hydraulic and Environmental Engineering, Delft, The Netherlands (tel: + 00 - 31 - (0)15 - 2151803).

NEW PUBLICATIONS

Elmholt, S., Stenberg, B., Grønlund, A. and Nuutinen, V. (eds) 2000. *Soil stresses, quality and care*. Danish Institute of Agricultural Sciences Report No. 38.

The report represents the proceedings from NJF Seminar 310 held in Ås, Norway, 10-12 April 2000 and contains eighteen papers concerned with methods for assessing the quality of soils and key indicators of soil health. Keynote presentations are included from Dr Johan Bouma on *The land quality concept as a means to improve communications about soils* and Drs Douglas Karlen and Susan Andrews on *The soil quality concept: a tool for evaluating sustainability*. The topics covered by the report are: (1) definition of soil quality and soil degradation; (2) soil quality studies - for what and for whom do we need them? (3) is there a basis for common Scandinavian approach to soil quality issues? (4) how to assess and evaluate soil quality.

The report is available from the Danish Institute of Agricultural Sciences, Research Centre Foulum, PO Box 50, DK-8830 Tjele, Denmark.

Arnalds, O., Þorarinsdóttir, E.F., Metusalemsson, S., Jonsson, A., Gretarsson, E. and Arnason, A. 2001. *Soil erosion in Iceland*. Soil Conservation Service / Agricultural Research Institute.

The publication is a result of a national assessment of erosion in Iceland. Soil erosion is one of the most active geomorphological processes shaping the surface of Iceland. Land degradation has severely damaged the country's ecosystems, destroying woodlands and creating deserts. The report demonstrates the poor status of Icelandic ecosystems and gives clear and detailed information about the type and severity of erosion in all the local communities and on the common grazing lands. The assessment is the foundation for soil conservation planning. The report shows how a complete survey of erosion was demonstrated to the Icelandic public, land users, administrators and law makers. It also retains information of interest to the many scientists who visit Iceland and want more detailed data than can be given in general publications on the country. The project received the Nordic Nature and Environmental Award in 1998. The report is an English translation of *Jarðvegsrof á Íslandi*. Danish and German versions will be available on www.rala.is/desert.

Mirtskhoulava, Ts.E. 2000. Водная эрозия почв. Metsniereba, Tbilisi. (In Russian with short English summary).

In this work, the author attempts to show the interconnection between erosion indices and the parameters which characterise erosion processes, to systematise the regularity of erosion processes, to develop approximate engineering models for erosion

prediction and to investigate the behaviour of soil when affected by natural and artificial factors. On the basis of extensive theoretical, laboratory and field studies, the mechanisms of water erosion are described and the main factors causing the process are systematised. Using erosion fatigue theory and estimates of soil stability, limiting minimal velocities of sheet flow at which erosion begins are obtained. Erosion can then be forecast in relation to slope, rainfall, vegetation cover and agro-technical methods. Numerical examples are provided to demonstrate the simplicity of the operational procedure. Using mathematical reliability theory, estimates are made of the longevity of soil under different erosion conditions. Mathematical models to evaluate different soil protection methods are proposed.

NEW PhD THESES

Gully initiation and development in Mediterranean environments

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Throughout Mediterranean Europe gully erosion is a widespread form of soil degradation which is highly sensitive to climate and land-use changes, acting as an important indicator of desertification in Mediterranean environments. The first part of this study presents topographical threshold conditions for gully initiation in cultivated fields and in rangelands for six different Mediterranean study areas, based on field measurements of local slope of the soil surface (S) and drainage-basin area (A) at the gully initiation point. The empirical threshold relationships between S and A suggest that gully initiation in the study areas is dominated by Hortonian overland flow and to some extent influenced by subsurface flow and landsliding at steeper slopes. A comparison of all collected datasets for gully initiation with literature data and amongst each other reveals that vegetation type and cover at the time of gully incision is the most important environmental factor determining the topographical threshold level rather than average climatic conditions. The data also indicate that a high rock fragment cover or content of the topsoil at the gully head or in the catchment tends to increase the topographical threshold level. The initiation of ephemeral gullies seems to be influenced by soil structure and soil moisture conditions before the gully initiating event. Threshold slopes for gully sedimentation are relatively steep due to a high rock fragment content of the topsoils.

The second part of this study investigates the development of bank gullies at different time scales in two areas in south-east Spain, and the influence of environmental factors on the erosion process. The studied bank gullies are formed where concentrated flow crosses an ephemeral river bank. Bank gully headcut retreat is measured in the short term by field monitoring, and in the medium term by (i) a newly developed dendrochronological method and (ii) a combination of high-altitude air-photo analysis and field measurements. Only a few significant differences are found between the average volumetric gully-head retreat rates (per unit drainage-basin area) obtained by the three methods. Combining the medium-term datasets results in a higher average value compared to the short-term dataset, but the difference is not significant. However, an important difference is found between the frequency distributions of gully-head retreat rate per unit drainage-basin area at the two time scales. Statistical analysis shows that the original drainage-basin area (A_o) explains most of the variation in short-term and medium-term headcut retreat rates, and in total bank gully volume or the overall result of long-term erosion activity. Moreover, the importance of A_o increases from the short term to the long term. Finally, it is shown that a gully can be mathematically modelled as a wedge or as a truncated pyramid. The truncated-pyramid-model can be used to calculate, for a given linear gully retreat, the total

eroded volume as well as the relative contributions of gully-head erosion and sidewall erosion.

Effects of cultivation techniques on maize productivity and soil properties on hillslopes in Yunnan Province, China

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The rapid population increase in China from 556.7 to 1226.7 million during the past 50 years means China has one-sixth of the world's population. This population growth has imposed high pressures on Chinese agriculture. Crop production and productivities have more than doubled, for example mean maize yields have increased from 1.54 to 3.91 t ha⁻¹ from 1960 to 1998. Despite this, food shortages remain major problems. These pressures have also led to intensive cultivation of sloping lands, making China the country with the most serious soil erosion problems in the world. Yunnan Province, south-west China, has some 70% of its total of 6.53 million hectares of cultivated fields located on sloping land, most of which suffers from soil erosion. Furthermore, traditional downslope cultivation of these upland fields produces increased soil loss and runoff and threatens agricultural sustainability. Crop yields on sloping land in these areas have decreased by 30-60% in the last century because of soil erosion and in 50-100 years most topsoil may have been removed. There is an urgent need to develop more productive and sustainable cropping systems and the dual aims of this project were to investigate ways of increasing productivity of maize on sloping land, while conserving soils.

This investigation was carried out in Wang Jia Catchment (25°28'N, 102°53'E), selected as a representative area of fragile slopes in Yunnan Province. Five treatments (1) Traditional + Downslope planting (control), (2) Traditional + Contour planting, (3) Traditional + Contour + Straw mulch, (4) Minimum tillage + Contour + Straw mulch and (5) Traditional + Contour + Polythene mulch, were selected for evaluation and established on replicated field plots in 1998 and 1999. An additional experiment in 1999 investigated the effects of irrigation on crop yield. Although there were variations during the growing season and between years, straw mulch with contour planting increased soil moisture (0-20 cm depth) and was associated with lower soil temperatures. Polythene mulch improved soil moisture retention when applied after early season rainfall or irrigation and caused increases in soil surface temperature of up to 4-5°C. These increases in soil moisture and temperature were associated with increases in Green Leaf Area Index, Green Leaf Area Duration and standing biomass. Grain yield was increased up to 51.6%, compared to un-mulched plots. Straw mulch increased yield by 14.0 and 20.7% (non-irrigated treatment), compared with the control in 1998 (5.0 versus 4.3 t ha⁻¹) and 1999 (6.2 versus 5.3 t ha⁻¹), respectively. Furthermore, straw mulch appeared to be beneficial for maintaining soil fertility and improving soil structure.

Irrigation improved early vegetative growth and final yields when early season rainfall was unreliable and maize grain yield increased by 39.5 to 59.6% in 1999, compared with the corresponding non-irrigated treatments. Polythene mulch and contour planting combined with early irrigation produced the highest maize yields. The results are compared with other published work, including research in erosion plots, where the effectiveness of mulches in reducing runoff and erosion has been evaluated. A cultivation technique combining polythene mulch, straw mulch, contour planting and early season irrigation is considered likely to be highly effective for increasing productivity and improving soil conservation on sloping land. This project is part of a larger programme, which aims to establish and evaluate a demonstration model at a catchment scale for more sustainable crop production systems in the highlands of South-East Asia.

Relationships between surface crusts and erosion in the Tabernas Badlands, Almeria, S.E.Spain

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The Tabernas Badlands in Almeria Province, south-east Spain, constitute the driest area in western Europe. The current eroding geological parent material is fine-grained mudstone of marine origin, which readily weathers to form a regolith of shards and mainly silt-sized particles. The surface is differentiated into a mosaic of surface types, including, at the pioneer stage, a bare mineral crust, brown algal crust and lichenised crust. Landscape readjustment by dissection is severe, due to the nature of the parent material, the semi-arid climate and the resultant paucity of higher vegetation cover to ameliorate erosive forces. Pedestals, rills and gullies are major erosion features within the landscape. A significant amount of research has been performed on runoff processes, but there are no data on the effects of raindrop splash on pioneer surfaces.

A research project was initiated in 1997, investigating the physical and chemical characteristics of badland pioneer surfaces at the El Cautivo field site, on the southern margins of the Tabernas Basin. Two main hypotheses were tested: (i) that erosion is inversely related to crust biological development, and (ii) that the three crusts represent a sequence of biological succession. Samples of mineral, brown algal and lichenised crusted surfaces and substrate were collected for laboratory analysis. A replicated splash collection field experiment, utilising 15 splash cups, was established. Three, 2 m length photographic transects were also delineated, incorporating the three crust types. Additionally, 220 erosion pins were placed on the slopes of the study area to measure changes in surface elevation. The splash cups were emptied on 10 occasions during 22/05/97-19/05/99. The transects were photographed and the erosion pins measured on five occasions throughout the study period. Laboratory analysis included aggregate stability (by the falling drop technique), loss-on-ignition, pH, electrical conductivity, X-ray fluorescence spectroscopy and scanning electron microscopy.

The largest mean amount of splash sediment (mean = 18.65 g, $n = 5$) was collected from mineral crust during the first collection period. Generally, as precipitation amount increased, sediment amount increased (*e.g.* on lichenised surfaces, $R^2 = 0.83$, $p < 0.01$, $n = 10$). The sediment yields (\log_{10} transformed data) differed significantly between the three crust types using two-way ANOVA with replication ($p < 0.001$, $df = 2$). Interaction between rainfall and crust type was also significant ($p < 0.001$, $df = 18$). Across the three crust types, there was a sequential decrease in cumulative mean splash sediment yield, in the direction *mineral-brown-lichen* (mean 29.02, 10.75 and 3.29 g, respectively for the period 03/10/97-19/05/99). Loss-on-ignition analysis performed on the same sediment indicated increased percentage organic matter in the same direction (mean 0.9, 1.8 and 5.6% respectively, $n = 5$). The actual amount of organic matter collected, however, decreased (mean 0.26, 0.20 and 0.18 g, respectively, $n = 5$), due to the sequential decrease in sediment yield.

Laboratory analyses indicated an increase in the incidence of microbiotic organisms and biological diversity in the direction *mineral-brown-lichen*, and suggested that the three crust types represented a successional series. Chemical differences in the crusts and substrate followed the same trend and indicated incipient pedogenesis. The differences included sequential decreases in surface pH and electrical conductivity and sequential increases in subsurface pH and surface loss-on-ignition values in the direction *mineral-brown-lichen*. It is postulated that rills, gullies and valleys provide niches for the proliferation of pioneer crust organisms on north-facing slopes, giving rise to very high densities of terricolous lichens. The organisms thrive in a cooler microclimate, which receives less direct insolation than south-facing slopes. South-facing slopes are more arid and erosion is more severe. The interactive and mutually adjusting effects of biological crusts on landscape readjustment are discussed.

A spatial and temporal analysis of the characteristics, importance and prediction of ephemeral gully erosion

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Supervisor: Prof. J. Poesen

Cosupervisor: Prof. G. Govers

Ephemeral gully erosion is a significant water erosion process, accounting for about 50% of the total sediment production in agricultural catchments in the Belgian loess belt. Yet, during the last decades most soil erosion research has mainly been focused on standard runoff plots. As a consequence, interrill and rill erosion were intensively studied, while little attention was paid to soil erosion processes operating at larger spatial units such as for instance ephemeral gullying. This study, therefore, aimed at:

- 1) describing spatial and temporal variations in ephemeral gully characteristics,
- 2) extending the existing studies on the importance of ephemeral gully erosion in space and time,
- 3) investigating strategies for the optimization of ephemeral gully prediction tools, and
- 4) evaluating the medium to long-term evolution of an (ephemeral) gully.

Descriptive statistics for ephemeral gullies in three contrasting environments, i.e. Belgian loess belt (central Belgium), Guadalentín (SE Spain) and Alentejo (SE Portugal): (1) provided a characterization of ephemeral gullies, both in terms of their topographical position and their morphology; (2) showed the significant ($P = 0.05$) spatial variations in ephemeral gully characteristics between the considered study areas and (3) stressed the temporal (seasonal) variability in ephemeral gully erosion in the Belgian loess belt.

High-altitude stereo aerial photographs (HASAP) were used to assess ephemeral gully volumes. The establishment of a correction factor overcame limitations related to this assessment technique. Overall, ephemeral gully volumes obtained from HASAP corresponded very well with volumes reported for field surveys. HASAP are, therefore, a useful alternative for field surveys, especially when extrapolations in space and/or time are envisaged.

Testing existing ephemeral gully prediction technology showed that for none of the three study areas could reasonable predictions be obtained. Therefore, a dual strategy for ephemeral gully erosion modelling was proposed. In a first option, procedures based on empirical relationships to predict successively the initiation and sediment deposition point of an ephemeral gully, the ephemeral gully length and the ephemeral gully volume, were proposed. In a second option, this study contributed to physically-based erosion modelling through the establishment of (1) a flow width – flow discharge relation in order to link the hydrology component to the erosion component and (2) a dynamic approach of the soil erodibility concept for loess-derived soils, as an alternative for a constant soil erodibility value that is related to steady soil characteristics.

Finally, the medium to long-term evolution of a gully on agricultural fields was investigated. It appeared that rates of change in gully length, surface area and volume followed a negative exponential relation. Yet, at a given moment in time, the gully volume was observed to start decreasing due to sediment deposition in the gully. The gully is expected to fill in almost completely, which is in agreement with reported traces of large gully systems filled in with colluvium in a loess area in eastern Belgium. Large open gully systems are nowadays only found under forest, where they are cut off from a sediment source, so that they can not be filled.

FORTHCOMING MEETINGS

13-17 August 2001
International SWAT conference
Giessen, Germany

The purpose of the meeting is to bring together model users and developers. There will be sessions for paper presentations as well as open forum to discuss modelling issues with the team from Texas and the SWAT group from Giessen involved in joint research project SFB299. Two days of the meeting will be taken up with a hands-on training workshop on SWAT 2000 for which separate registration is required.

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Also visit: <http://www.uni-giessen.de/SWAT.htm>

17-21 September 2001
Third international conference on land degradation
Rio de Janeiro, Brazil

Sessional themes are: (1) conceptual frameworks; (2) the land resource base; (3) land degradation assessment; (4) case studies of land degradation; (5) monitoring land quality and global climate change; (6) conserving the land; (7) rehabilitating degraded land; (8) regulating sustainable land use.

Deadlines:

Last call for abstracts: 23 April 2001

Further details from:

Dr Beáta Madari, ICLD3 Conference Secretary, Embrapa Solos, Rua Jardim Botânico 1024, 22460-000 Rio de Janeiro RJ, Brazil.

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Also visit: <http://www.cnps.embrapa.br/ICLD> (case sensitive!!)

20-22 September 2001

The significance of soil surface characteristics in soil erosion

Université Louis Pasteur, Strasbourg, France

COST Action 623 Soil Erosion and Global Change Workshop combined meeting of Working Group 1 (Linking processes across temporal and spatial scales) and Working Group 2 (Key thresholds for soil erosion). Meeting organised by RIDES Group (National Research Programmes for Hydrology - PNRH; and for Soil Erosion - PNSE) and a network of research groups in CNRS, INRA, IRD and universities. Supported by PNRH, BRGM, ESSC, INRA, UNESCO, Université Louis Pasteur.

The meeting aims to provide a forum for presentation and discussion of recent developments in understanding the influence of soil surface characteristics on infiltration, the hydraulics and spatial organisation of runoff, and sediment transport in catchment systems. It is anticipated that issues of spatial and temporal scaling of processes and parameter measurements will be addressed. The meeting will explore how soil surface characteristics control hydrodynamic properties; the organisation of micro- and macro-porosity at the soil surface; and the dynamics of soil surface characteristics in relation to interactions between climate, land use, biological activity, depression storage, overland flow and related parameters at scales from less than 1 m² to small catchments (< 1 km²).

Further details from:

the COST 623 web site: <http://www.cost623.leeds.ac.uk/cost623/>

or

Paul van Dijk, CEREG, Université Louis Pasteur, Faculté de Géographie, 3 rue de l'Argonne, F-67083 Strasbourg Cedex, France

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23-28 September 2001

**Seventh international meeting on soils with Mediterranean type of climate:
preserving Mediterranean soils in the third millennium**

Valenzano-Bari, Italy

The aim of the meeting is to enhance understanding of the soil ecosystem in Mediterranean environments with respect to soil formation, relationship with parent material, and the effects of present climate, biota and human influence. The main topics are: organic fertilisation of soils; organic agriculture; soil quality indicators; soil use and management; soil genesis, classification and cartography; soil management and agronomy; soil fertility and plant nutrition; soil degradation and conservation; soil

physics; soil pollution and environmental protection. A pre-meeting tour to Campania to see volcanic soils in the district of Naples is available. The mid-meeting tour will visit typical *terra rossa* soils in the Tavoliere delle Puglie and other typical soils of Apulia. A post-meeting tour will also be organised.

Language: English.

Deadlines:

Extended abstracts (no exceeding three A4 pages, single-spaced) in MSWord must be submitted by 31 May 2001.

Registration: Members of IUSS and SISS: 450,000 It Lira before 30 June 2001 (500,000 It Lira thereafter). Non-members: 500,000 and 550,000 It Lira respectively. Students 200,000 and 250,000 It Lira respectively.

Further details (including registration form, methods of payment, lists of hotels, costs of pre- and post-meeting tours) from:

<http://www.iamb.it/news/7imsmtc.html>

21-24 April 2002

Drought mitigation and prevention of land desertification

Bled, Slovenia

Papers and poster presentations are invited on: (1) the impact of climate change on central and eastern Europe and Mediterranean countries; (2) drought as a complex phenomenon (social, economic and environmental impacts of drought); (3) national strategies and national action programmes to mitigate drought including combatting desertification and land degradation; and common methodologies for drought preparedness including forecasting, early warning systems, risk assessment and indicators for characterisation of drought severity; (4) international cooperation for solving drought and related problems. Meeting organised by the Slovenian National Committee on Irrigation and Drainage (SINCID), European Regional Working Group of International Commission on Irrigation and Drainage (ERWG ICID) and European Regional Work Team on Drought (ERWTD).

Deadlines:

Registration and abstracts (1 page): 30 April 2001

Further details from:

Prof Dr Brane Maticic, SINCID, c/o IZVOR, Preradoviceva 44, 1000 Ljubljana, Slovenia

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Fax: + 386 - 1 - 4335104
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22-25 May 2002
Second international symposium on gully erosion under global change
Chengdu, China

The meeting is a GCTE-SEN symposium, following on from the COST meeting in Leuven, Belgium, April 2000. The aim is to review further understanding of, report progress on and identify priorities for future research on impacts of global change on gully erosion. Topics include: field monitoring and experimental investigations; sub-processes of gully erosion; critical thresholds for initiation, development and infilling of gullies; factors controlling rates of gully erosion; contribution of gully erosion to soil degradation at a range of temporal and spatial scales; mountain hazards induced by gully erosion; historical reconstruction of gully erosion; interaction between gully erosion and other land degradation processes; modelling gully erosion; gully erosion control measures.

A four-day pre-conference field excursion is available to visit research sites in the Minjiang River watershed (one of the most famous scenic spots in the world) and the Jiuzhaigou protected area on the Tibetan Plateau in the Upper Yangtse catchment.

Language: English.

Deadlines:

Receipt of abstracts: 30 November 2001
Payment of registration fee: 1 February 2001

Registration:

US\$ 150.00. Fee covers mid-symposium (one-day) tour, banquet and conference materials. It does not cover hotels or other meals.
Pre-conference field excursion: US\$ 250.00 including all tickets to scenic spots, hotel, meals and transport fees.

Further details from:

Yong Li / Jianhui Zhang, Institute of Mountains Hazards and Environment, Academia Sinica, PO Box 417, Chengdu 610041, PR China.
Tel & fax: + 86 - 28 - 5238973
e-mail: htalent@mail.sc.cninfo.net / Yongli32@hotmail.com

26-31 May 2002

**Sustainable utilisation of global soil and water resources. Twelfth International Soil Conservation Organisation Conference
Beijing, China**

The conference is designed to provide a forum for participation and discussion of experts from all over the world on themes related to the conservation of soil and water. Researchers, educators, sociologists, administrators, representatives of public institutions and NGOs will exchange experiences. Presentations are invited on the following topics: (1) soil and water conservation regional policies and actions; (2) processes of soil erosion and their environmental impact; (3) technology and method of soil and water conservation; (4) dynamic monitoring, forecasting and evaluation of soil erosion. During the conference participants will visit a demonstration area of small watershed conservation in Miyun County near Beijing and the Great Wall. There will also be a technical exhibition. A tourist programme will be arranged for accompanying persons.

Pre-conference study tours to: (1) Southwest karst area; (2) Northwest wind erosion area (the Silk Road). Post-conference study tours to: (1) Northwest wind erosion area (the Silk Road); (2) Yangtze River (Three River Confluence and Three Gorges Reservoir).

Language: Chinese and English.

Deadlines:

Abstracts (less than 800 words): 31 August 2001.

Full papers must be presented on floppy disc during the Conference.

Registration: US\$ 300.00 if paid before 31 January 2002 and US\$ 400.00 thereafter. Fee includes technical excursion during the conference, conference documentation, banquet, refreshments and conference proceedings. It does not include meals, accommodation, travel or the pre- and post-conference tours.

Download the registration form from:

www.swcc.org.cn/isco2002/registration.htm

Further details from:

China National Administration Center for Seabuckthorn Development, Jia 1, 6th floor,
Fuxinglu, Beijing 100038, PR China

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Fax: + 80 - 10 - 63204359 / 63202841

e-mail: isco2002@swcc.org.cn

Please visit: <http://www.swcc.org.cn/isco2002>