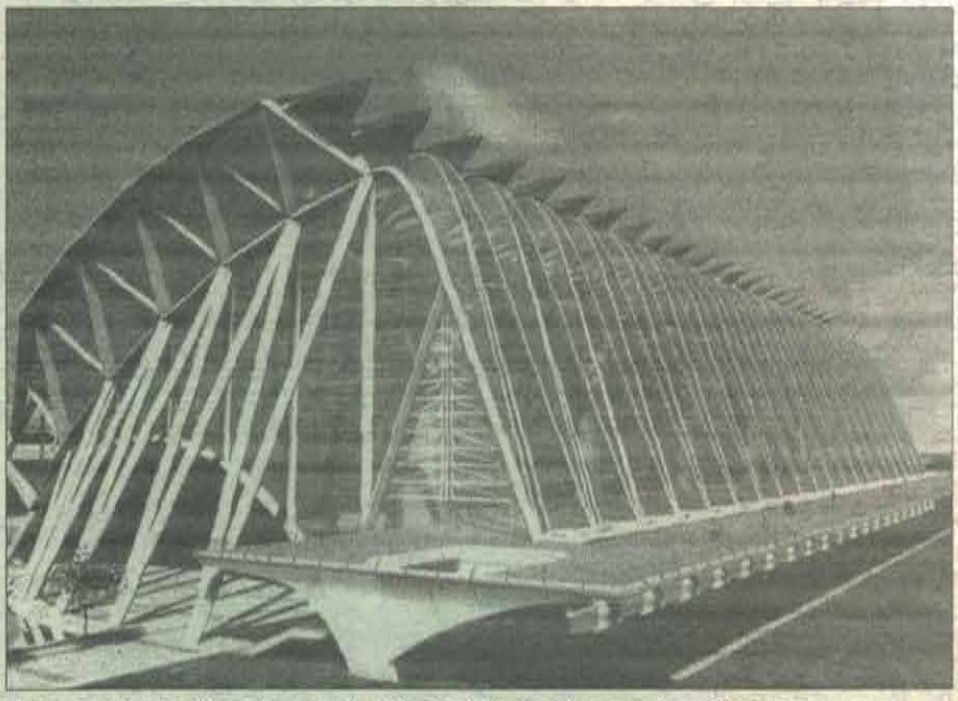
NEWSLETTER 1/2000

ESSC EUROPEAN SOCIETY for SOIL CONSERVATION

Valencia 2000

28 March - 1 April



Museo de las Ciencias de la Ciudad de las Artes y las Ciencies, Valencia

Home of our Third ESSC Congress

E.S.S.C. NEWSLETTER 1/2000

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Third International Congress

ESSC EUROPEAN SOCIETY for SOIL CONSERVATION

MAN AND SOIL AT THE THIRD MILLENIUM

28 MARCH - 1 APRIL 2000

Valencia, Spain

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A PRESIDENTIAL VIEWPOINT

Dear Colleagues

It is my pleasure to communicate with all of you and to comment on some facts and trends of our Society, including with also some aspects which we need to improve.

During 1999 the Society has been very active. We had an excellent meeting in Bratislava (*Soil conservation in large-scale land use*, May 1999) which was very well organized by our colleagues from the Slovak Republic and where we took the opportunity to hold a Council Meeting. In the previous month the Society was present in Manila at the *First Asia-Pacific conference on ground and water bioengineering for erosion control and slope stabilization*, organized by the International Erosion Control Association (IECA) which kindly provided the ESSC with a place on the Exhibition Booth and time at the Plenary Session. We were able to promote our Society and also to strengthen links with an international association with a focus on applied research.

In June of last year the ESSC President was invited to make a presentation in the Inauguration Meeting of the Gaia Centre, which is a new and interesting museum and research centre located in Athens and focusing mainly on soils.

The ESSC was co-sponsor of the Sixth International Meeting on Soils with Mediterranean Type of Climate (Barcelona, July 1999) where the President was invited to introduce the Society to the very-well attended meeting. Similarly ESSC was a collaborating institution in the ISCO'99 Conference held in Purdue, May 1999. The organizers provided us with generous room at the Plenary Session for an ESSC presentation. One of the important outputs of this Conference was to reinforce the linkages and opportunities for collaboration between the ESSC and other international associations like the World Association of Soil and Water Conservation.

In October of last year the ESSC organized a Congress on *Soil conservation on volcanic islands*, kindly prepared by our colleagues from the Azores.

Together with other international soil institutions/associations the ESSC was also present at Firenze (October, 1999) for a Congress on Soil Vulnerability, organized by our colleagues of the Italian Society of Soil Science.

Implementing a decision of a previous Council meeting, the ESSC is starting to be present at the international initiatives related to global environmental problems where we are actively working for a better consideration and appraisal of soil-related issues. In this respect the Society has been officially accredited as an independent scientific NGO to the UN Convention to Combat Desertification. As a result the ESSC President

participated in the Third Conference of the Parties of this UN Convention (Recife, November 1999) and was also invited to make a presentation in a workshop jointly organized with the IUCN. The Society has also request to be accredited at the UN Convention on Biodiversity and on the UN Framework Convention on Climate Change.

In another essential aspect of the Society we also have good news. All of you will know that we lost members from our peak of 658 members in 1996 to only 474 members in 1998. Happily we are now recovering and we have 531 members coming from 47 countries. We must all make a continued effort to build on this recovery.

But not everything is positive. I am convinced that the Society has great potential to promote the work of its members on the scientific, environmental and societal aspects related to soil but, at present, there are important gaps in our activities. We need to reflect on these and either develop new initatives or reactivate work which seems to have ceased. Let me underline the following for discussion and reflection:

- ESSC Task Forces
- More active ESSC country representatives
- Incorporation of soil problems into the global environmental agenda
- New ideas for the ESSC Newsletter
- Ameliorating the ESSC financial situation
- Better consideration of soil problems by the general public
- More involvement in practical/applied solutions
- Collaboration with similar international scientific societies
- Relationships with international institutions (EU, European Parliament, UNEP, FAO, UICN, NGOs)
- ESSC publications, monographs, reports

The next ESSC Congress (Valencia, 28 March-1 April, 2000) will be an excellent opportunity to present, exchange and discuss scientific technological information on the above and other subjects and, more importantly, for all ESSC members to participate in the decisions of the way we want our Society to be function in the future.

On behalf of the Third ESSC International Congress Organizing Committee we extend a warm welcome to Valencia with wishe you all worthwhile and successful Congress.

Jose L. Rubio
ESSC-President

ELECTIONS OF THE E.S.S.C. COUNCIL 2000-2004

The following regulations are based on the ESSC Statues and on the rules laid down by the first ESSC Council (see Newsletter 1991/2). They are the same as the regulations used to elect the ESSC Council for the period 1996-2000.

1. Regulations

Every European country with 5 or more members of the ESSC may be represented on Council. Those countries with 20 or more members of the ESSC may be represented by two council members.

The Executive Committee of the ESSC hereby publishes the call for nominations.

Every ESSC member may nominate either him/herself or other members as a candidate. Nominations must be sent in writing to the Secretary by **March 17th 2000.** No nominations will be accepted after this date. The list of nominated candidates for each country will be published on an ESSC Notice Board at the Third International Congress to be held in Valencia, 28 March - 1 April 2000.

Elections for the Council will be organised at the ESSC General Assembly in Valencia on Thursday 30th March at 17.30 hours. Elections will be conducted in the following way:

1). The Council members for each country will be elected by the ESSC members of that country who are present at the General Assembly.

2). If only one candidate (or two candidates in the case of those countries eligible for two members of Council) has been nominated as a country's representative on Council, that candidate will be the elected member.

3). If no members from a country are present at the General Assembly, the Assembly will elect a representative for that country from the list of nominated members.

4). In addition to the country representatives on Council, the former Council will nominate up to six members to serve on the new Council.

5). After the country elections have been held, the complete list of members for the new Council will be presented to the General Assembly for ratification. The Assembly will decide to accept or reject the new Council in its entirety by a simple majority of votes.

6). The Council has the right to coopt additional representatives on Council in the period between General Congresses.

7). No country can have more than four members on Council.

Duties of members of Council

1). Contribute to the collective wisdom of the Council in reaching decisions on matters relating to the Society;

2). Promote the Society within their country, e.g. encouraging new members, publicising its activities;

3). Report to the President on activities within their country which are of interest to the Society and its members;

4). Attend Council meetings.

Before standing for Council, candidates should ensure that they have sufficient time to undertake these activities and that they have sufficient funds to attend the majority of the Council meetings (held annually). It is very important that the Society has an active Council.

Council Membership

Based on the regulations, the following vacancies will exist for the Council 2000-2004:

Country	Number of seats on Council
Austria	1
Belgium	1
Bulgaria	1
Czech Republic	1
Denmark	1
Estonia	1
France	1
Germany	2
Greece	2
Hungary	1
The Netherlands	1
Norway	1
Poland	1
Portugal	1
Romania	2
Russia	2
Slovakia	1
Spain	2
Sweden	1
Switzerland	1
United Kingdom	1
Ukraine	2

Deadline for nominations: 17 March 2000

THE *FASCINATION OF SOIL* AT THE EXPO 2000

During the EXPO 2000 (1 June to 31 October 2000), the project called *Fascination of Soil* can be visited in the OBE region located between Osnabrück and Oldenburg about 100 km west of Hannover. Eight sub-projects will be represented:

- A *Soil Adventure Park* allows visitors to see, smell, hear, feel and understand soils
- The *Desealing of Traffic Areas* restores soil functions in urban environments
- The *Brogberg Ponds* revitalise lowland moors and alder swamps and cross-link biotopes to create a landscape rich in flora and fauna
- At the *Archaeological Park, Kalkriese,* one of the biggest defeats of the Romans, the Battle of Varus, is excavated, demonstrating the ability of soils to serve as an archive of nature and human history
- The *Environmental Awareness and Conservation Project* in the Osnabrücker Land shows how to maintain the current diversity of nature
- The *Piesberg – A hill through time* demonstrates the long-lasting impact of mining activity for coal and rocks on the landscape
- At the *Botanical Gardens, University of Osnabrück,* the restrictions of salinised soils on plant growth are overcome
- At the *Old Deposits, Osnabrück –Wüste,* residents of the suburb of Wüste are working on finding meaningful solutions to the issue of dangerous waste accumulated in the past and reprocessing it as never before. The *Old burdens – New paths* Exhibition is an eventful trip underneath the soil surface where a walkable soil profile with its many features can be experienced, enlarged to a scale of 100:1

Additionally the grammar school, 'In der Wüste', built on old deposits, gives pupils, teachers and parents the opportunity to experience the fascination of soils in many facets and in multimedia.

As part of the EXPO Conference series, *Going Environmental*, the German Environmental Trust will be hosting a conference in Osnabrück City Hall from 14 to 17 September 2000 on the subject, *New paths to sustained soil management.* In conjunction with the International Union of Soil Science, the German Soil Science Society and the Alfred Toepfer Academy of Nature Conservation, there will be a comprehensive range of conferences, an exhibition and a variety of field trips for specialists and practitioners, amateur enthusiasts and interested visitors.

Finally, a scientific conference will be organised by the Soil Science Society of America and the German Soil Science Society from 18 to 22 September 2000, covering *The role of soils in agro-ecosystems.* Themes will be:

- sustaining soil functions in agro-ecosystems
- soil degradation and its impact on environmental quality
- evaluation of soils and land management and associated risks at different landscape scales
- disciplinary soil research for agro-ecosystems and information transfer between scales.

Further information on the EXPO Project, *Fascination of Soil*, can be found on the web site (www.obe2000.de). Information on the scientific conference organised by the Soil Science Society of America and the German Soil Science Society is given at http://members.aol.com/dbges/2000.htm

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THE OCCURRENCE OF SOIL HYDROPHOBICITY IN THE UK: PRELIMINARY FINDINGS

Introduction

Soil hydrophobicity (water repellency) is an important factor in soil erosion and land degradation as it can alter the resistance of soils to erosion in a variety of ways. The changes can affect soil aggregate stability (Giovannini et al. 1983), reduce infiltration capacity (DeBano, 1971), enhance overland flow (McGhie and Posner, 1980), make the soil more susceptible to wind erosion (Carter, 1990) and increase both rainsplash (Terry and Shakesby, 1993) and soil erosion (Osborn et al. 1964). In the past decade or so it has become apparent that soil hydrophobicity is not restricted to some unusual combinations of soils, climate and vegetation, but affects a wide variety of soils in many areas of the world (Wallis and Horne, 1992). In part as a result of the lack of awareness of hydrophobicity and in part because of uncertainties about its likely distribution, its temporal regime and the difficulties involved in isolating its hydro-geomorphological effects, however, it has been a focus in relatively few investigations of soil erosion, land degradation and land management (Shakesby et al. in press). Such studies as there have been on this topic have tended to focus on areas where the effects of hydrophobicity on plant growth and on soil degradation are generally regarded as at their most developed. Such locations include fire-affected scrub and forested terrain, sandy forest and scrub terrain recently converted into agricultural land, and recreational greens constructed using soil with a large sand component (Doerr et al. in press).

In response to these research gaps, the global EU-supported research project *Water Repellent Soils* was launched in March 1999 with the aims of broadening our knowledge of the distribution and effects of soil hydrophobicity world-wide and of developing more efficient and environmentally-friendly amelioration practices for affected land. This project is coordinated by the Alterra Green World Institute in The Netherlands and involves experts from a range of institutions in Europe, Australia and the USA (for further information see: www.alterra.wageningen-ur.nl/water-repellency). This short report presents preliminary findings on the occurrence and distribution of soil hydrophobicity in the UK and its implications for present and future soil erosion hazard.

Soil hydrophobicity in the UK

Hydrophobicity has been virtually unreported for soils in the UK. To the authors' knowledge, UK studies in which soil hydrophobicity has been reported have been limited to burnt heathland (e.g. Mallik and Rahmann, 1985) and golf greens (York, 1993). To assess whether hydrophobicity occurs more widely in the UK, an exploratory study was undertaken during summer 1999. Soils were sampled along a transect across the mainland stretching from south-west Wales in the west to the coast of East Anglia in eastern England. This included elevations ranging from near sea level up to more than 300 m and areas with mean annual rainfall ranging from less than 400 mm to more than 1400 mm. Some 171 bulk surface (0-5 cm) and subsurface (5-10 and

20-25 cm) soil samples were obtained from 41 sites representing the most common UK land use types which included sandy, loamy, clayey and also peaty soils (Table 1). These samples were tested for hydrophobicity using the WDPT (Water Drop Penetration Time) method, with the median time for water droplets to infiltrate the soil under field-moist and air-dry conditions taken as being representative of the corresponding levels of hydrophobicity (Doerr, 1998). In addition, wetting rates of air-dry undisturbed soil (24 h-water uptake rate for 5 x 5 cm soil columns with a water head of 2 cm applied at the bottom of the sample) were established for cores from all 41 sampling sites.

Occurrence and severity of hydrophobicity

The maximum hydrophobocity levels obtained from 3 surface soil samples for different land-use types investigated are presented in Table 1.

Table 1: Maximum WDPT categories measured on 3 samples taken at 0-5cm depth for 41 land-use types. Figures represent the number of sites where samples were taken in each soil/land-use category.

Soil type	Forest			Rough pasture moorland, other uncultivated		Permanent pasture	Arable land			
	coniferous	broad-leaved		erica type	bracken type		maize	other cereals	potatoes	root crops
clayey	1	1		ns	ns	1	ns	1	ns	ns
loamy	2	1		3	2	1	1	1	1	1
sandy	3	1	1	2	2	2	2	2	1	2
peaty	1	1	1	ns	1	ns	ns	1	1	ns

Hydrophilic (WDPT < 5s)	Slightly hydrophobic (WDPT 5-60s)	Strongly hydrophobic (WDPT > 60s)

ns = no sample

Key findings are:

- more than half of the soil/land-use types investigated exhibit hydrophobicity
- hydrophobicity is not restricted to sandy soils but occurs throughout the whole textural range investigated as well as in peaty soils
- extreme hydrophobicity (= WDPT > 5 h, a level amongst the highest recorded world-wide (Doerr et al. in press) is present at 10 out of 41 sites (data not shown)
- hydrophobicity is largely confined to the top few decimetres of the soil (data not shown)

- most permanently-vegetated land-use types are affected, but on cultivated, tilled land, only the peaty soil site is hydrophobic.

The influence of soil moisture on hydrophobicity

Soil hydrophobicity is generally considered to be most pronounced when soils are dry (e.g. Dekker and Ritsema, 1994). The results of this study show that the soils investigated can exhibit relatively high levels of hydrophobicity even at moderate soil moisture contents. WDPTs > 1 h were recorded for volumetric soil moisture contents (field moist status) up to:

- 22 per cent for sandy soil
- 20 per cent for loamy soil
- 24 per cent for clayey soil
- 58 per cent for peaty soil

The impact of hydrophobicity on the wetting behaviour of soils

Although the WDPT test is a widely used method to quantify the hydrophobicity of soils, it is not clear how well this test reflects the wetting behaviour of a bulk soil, which in turn determines the hydrological response of the soil to rainfall or irrigation. Thus the determination of wetting rates was included in this study, examples of which are given in Figures 1 and 2.

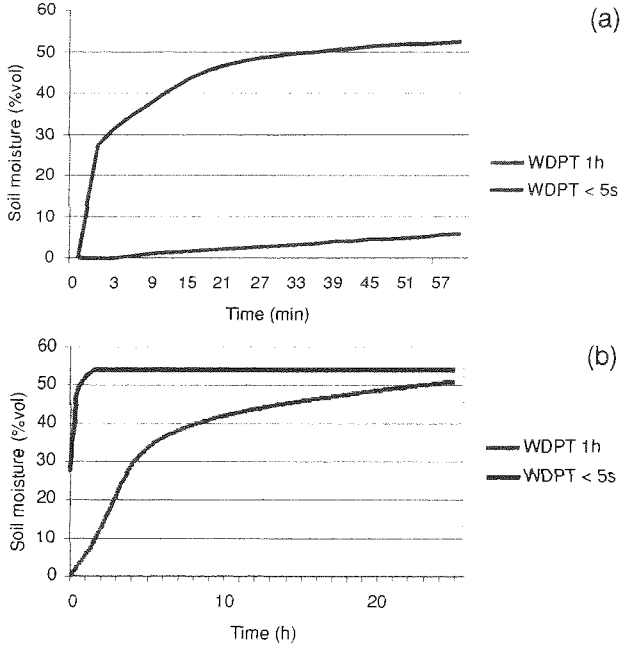

Figure 1: Wetting rate for a hydrophilic (WDPT < 5 s; upper line) and a severely hydrophobic (WDPT > 1 h; lower line) sandy loam for 1 h (a) and 24h (b) periods.

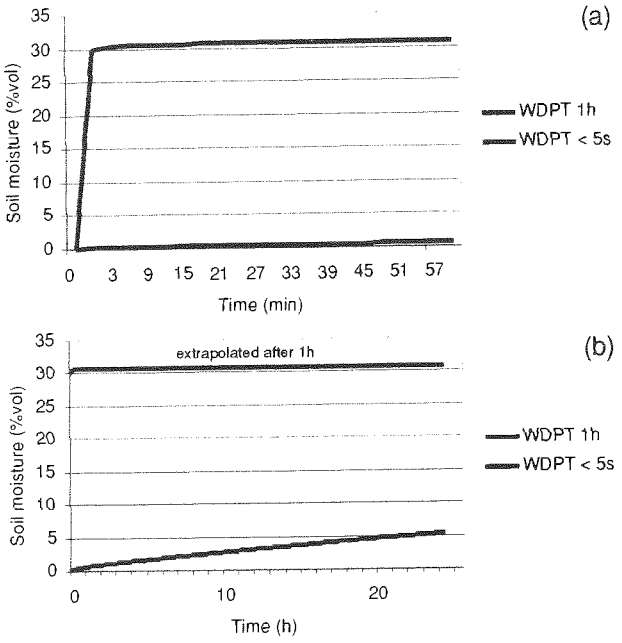

Figure 2: Wetting rate for a hydrophilic (WDPT < 5 s; upper line) and a severely hydrophobic (WDPT > 1 h; lower line) sand for 1 h (a) and 24 h (b) periods.

The data presented in Figures 1 and 2 demonstrate that hydrophobicity levels of WDPT > 1 h can reduce the wetting rate of soils by an order of magnitude for periods exceeding one hour or even for as long as 24h. WDPTs > 1 h were measured for 37 per cent of all samples taken from sites where hydrophobicity occurred.

Preliminary conclusions

Although the sample size of this exploratory investigation is clearly too small to allow detailed quantitative statements about the occurrence of hydrophobicity in the UK, it does, nevertheless, indicate that (a) soil hydrophobicity is not an uncommon soil property in the UK, (b) it apparently occurs mainly on permanently vegetated land, (c) the levels of hydrophobicity encountered can equal those reported from the most severely affected areas world-wide, and (d) hydrophobicity may exist at moderate and not just very low soil moisture levels. These findings could have important implications for land degradation and soil erosion. Owing to the reduced rate of wetting of soils under hydrophobic conditions, the development of Hortonian overland flow is likely to be enhanced during rainfall events. This may be of particular importance for summer storm events with their typically high rainfall intensities, which often follow relatively long dry periods when soils have low moisture contents, but also for other intense rainstorms following moderately dry weather. The resulting enhanced overland flow could cause accelerated soil erosion on susceptible land.

Types of land use at particular risk include ploughed yet hydrophobic land (e.g. peaty soils) and other hydrophobic land-use types where the protective vegetation cover is reduced or at times during the year when vegetation growth is minimal. This could be due to drought, grazing and physical impact (vehicles, trampling) or caused by the removal of vegetation by fire or during land-use changes. Furthermore, the influence of soil hydrophobicity may increase in the foreseeable future in view of the recent climate change scenario predictions for the UK (Hulme and Jenkins, 1998). Not only is the frequency of extreme rainfall events expected to increase, but prolonged dry periods are also expected to be more frequent, which in turn would increase the occurrence and duration of periods when soil hydrophobicity is generally at its most acute.

In summary, this preliminary work suggests that soil hydrophobicity is neither uncommon nor inconsequential in the UK, and may become more widespread and intense under predicted global warming scenarios.

Authors' note:
Given the undeveloped nature of this topic in the UK, the authors would be grateful for any comments or observations relating to soil hydrophobicity in the UK or elsewhere in Northern Europe.

Acknowledgements
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INTERNATIONAL CONGRESS SOIL VULNERABILITY AND SENSITIVITY, FIRENZE, 18-21 OCTOBER 1999

The Congress was organised jointly by the Italian Society of Soil Science (SISS) and the European Soil Bureau of the European Commission (ESB) with the purpose of stimulating the debate about international and Italian experiences concerning soil vulnerability and sensitivity.

On the first day, invited speakers from IUSS, OECD, FAO, ISRIC, ESSC and University of Cagliari tried to emphasise the arguments concerning the problem at international level. Further presentations dealt with ongoing experiences at international level, in relation to the scientific and the normative aspects. Sample case studies from different European organisations were presented.

The presentations included:

- *Soil resilience, the capacity of soil to react on stress.* W.E.H. Blum. Secretary General IUSS.
- *Measuring the environmental impacts of agriculture: soil related areas.* Y. Yokoi. OECD Paris, France.
- *Soil vulnerability evaluation and location fragility assessment.* F. Nachtergaele. AGLS FAO, Rome.
- *Soil degradation status and vulnerability mapping in Central and Eastern Europe: the SOVEUR Project.* N.H. Batjes. ISRIC, Wageningen, The Netherlands.
- *Soil degradation and conservation in the Mediterranean environment: Indicators approach.* J.L. Rubio. President ESSC.
- *Soil vulnerability in relation to the urban and industrial development: the case of Sardinia.* University of Cagliari.

The second day was devoted to the Normative Aspects (the Italian law on soil protection) and some Italian experiences at different scales of detail, among which:

- the municipal level (town planning in relation to soil vulnerability)
- the provincial level (soil suitability to the spreading of the livestock effluents, land evaluation)
- the regional and watershed level (the masterplan of the Po river)
- and also experiences in park and natural areas.

There were 13 oral communications and 20 posters.

Pre-congress scientific excursions went to *Crete Senesi, Argille di Volterra*, Military

Survey Office of Florence, and the Natural Park of *Migliarino San Rossore Massaciuccoli*.

Over 200 participants attended the Congress, and this encourages in going ahead with this kind of meeting to increase knowledge of the soil and the environment.

The publication of the proceedings is expected by March 2000 in the *Bollettino della Società Italiana della Scienza del Suolo*.

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President of the Italian Society of Soil Science

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BUNDESVEREINIGUNG BODEN UND ALTLASTEN BVBA (FEDERAL UNION FOR SOIL AND CONTAMINATED SITES) FOUNDED IN GERMANY

The Federal Union of Soil and Contaminated Sites was founded on 18 March 1999 in Berlin. It is a roof organisation of the Federal Association of Soil (Bundesverband Boden) and the Association of Contaminated-Sites Engineering (Ingenieur-technischer Verband Altlasten).

Contact address of the Federal Union of Soil and Contaminated Sites is: BVBA, Pestalozzistrasse 5-8, 13187 Berlin, Germany.

This roof organisation corresponds to the German Soil Protection Law, which covers precautionary soil protection and remediation together. This law was released in 1998 and came into force on 1 March 1999. The text of the ordinance may be obtained from: http://www.bmu.de/infos/download/dateien/bbsg_398.EXE

An English version is available under: http://www.bmu.de/english/soil/index.htm

The Soil Protection Law was substantiated by an Ordinance on Soil Protection and Contaminated Sites (Bodenschutz- und Altlastenverordnung) in 1999. The ordinance is in force since the 16 July1999. The text of the ordinance may be obtained from: http://pollux.edv.agrar.tu-muenchen.de/bk/bvb/BodSchV.doc

An English version will be available at the beginning of this year.

A Scientific Board for Soil Protection was founded as well to advise the Ministry for Environment. The secretariat is located at the Federal Environmental Agency, Berlin.

Some German Länder like Bavaria or Lower Saxony have already released their own laws to set into practice the regulations of the federal law. Other Länder like North-Rhine-Westfalia will follow soon. The text of the Bavarian regulation may be obtained from
http://pollux.edv.agrar.tu-muenchen.de.bk/bvb/BayBodSc.doc

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SOIL EROSION AS AN ELEMENT OF SOIL QUALITY IN THE MEDITERRANEAN REGION

In order to meet the needs of increasing populations, agricultural practices of the past have taxed the resilience of soil and natural processes to maintain global balances of energy and matter (Bhagat, 1990; Sagan, 1992). Mechanical cultivation and the continuous growing of row crops has resulted in soil loss through erosion, decreases in soil organic matter content and the concomitant release of CO_2 to the atmosphere (Houghton et al. 1983). Intensive crop production has also resulted in excessive loss of topsoil through wind and water erosion.

In countries around the Mediterranean Basin, the degradation of soil resources due to erosion is a serious threat for human welfare and the natural environment. A study of the spatial distribution of various soil erosion processes in the Mediterranean belt reveals soil erosion by water to be the most important desertification process. The main natural factors controlling the intensity of the erosion processes are climate, soil type, topography and vegetation. Often, man accelerates soil erosion intensity by modifying these factors (Poesen, 1993). Mediterranean countries are highly vulnerable to erosion owing to the mountainous terrain. The shape of the terrain and the sequential steep grades cause favourable conditions for the emergence of torrents (Zalidis et al. 1999).

Soil erosion is caused by several macro- and micro-scale factors that are characteristic of Mediterranean regions and it has impacts not only at the site where soil is lost but also in aquatic systems, natural and human-made, where the soil material accumulates (Zalidis et al., 1999). About 20 per cent of the land surface in Greece and 10 per cent in Italy is subject to high erosion risk (CORINE, 1992). Local costs of erosion include diminished infiltration and water availability, loss of organic matter and nutrients and an ultimate loss of production potential (Hillel, 1991). Downstream impacts include disrupted or lower quality water supplies, siltation that impairs drainage and maintenance of navigable river channels and irrigation systems, and increased frequency and severity of floods (Pimentel et al. 1995). Tillage, overgrazing, deforestation and land reclamation have led to a rate of erosion 2 to 30 times greater than its highest tolerable limit. Deforestation for agricultural needs and overgrazing on well drained loamy and clayey soils have led to severe erosion in the past. The occurrence of frequent fires and summer droughts on these systems have led to irreversible desertification (UNEP, 1987). The problem of degradation by overgrazing is particularly severe in the Mediterranean. In Portugal, for example, more than 20% of the current agricultural land is highly erodible (Gardner, 1990).

Soil quality is a critical component of sustainable agriculture. While the term soil quality is relatively new, it is well known that soils vary in quality and that soil quality changes in response to use and management. The soil system is characterised by properties that both range within limits and interrelate functionally to each other. Therefore, these properties can be used to quantify soil quality (Larson and Pierce,

1994). Additionally, soil is an open system, with inputs and outputs, that is bounded by other systems collectively termed environment (Jenny, 1941). Sustainability then, while multidimensional, is certainly focused on the quality of the soil resources base, the relations between its use and management, and the environment (Larson and Pierce, 1994).

Soil quality is defined by Doran and Parkin (1994) as "the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant and animal health". Doran and Parkin proposed the following index of soil quality as a function of six specific soil quality elements:

$$SQ = f(SQ_{E1}, SQ_{E2}, SQ_{E3}, SQ_{E4}, SQ_{E5}, SQ_{E6})$$

where the specific soil quality elements (SQ_{Ei}) are defined as follows: SQ_{E1} = food and fibre production; SQ_{E2} = erosivity; SQ_{E3} = groundwater quality; SQ_{E4} = surface water quality; SQ_{E5} = air quality; and SQ_{E6} = food quality.

Erosivity as well as the other soil quality elements in this index will be evaluated with regard to five specific soil functions, which define the capacity of soil to (1) provide a medium for plant growth and biological activity, (2) regulate and partition water flow through the environment and (3) serve as an effective environmental filter (Larson and Pierce, 1994; Doran and Parkin, 1994).

The evaluation of erosivity (SQ_{E2}) will take the form of a functional relationship that describes how the five soil functions listed below impact the specific element:

$$SQ_{E2} = f(SF_1, SF_2, SF_3, SF_4, SF_5)$$

where: SF_1 = ability to hold, accept and release water to plants, streams, and subsoil (water flux); SF_2 = ability to hold, accept and release nutrients and other chemicals (nutrient and chemical fluxes); SF_3 = ability to promote and sustain root growth; SF_4 = maintain suitable soil biotic habitat; and SF_5 = ability to respond to management and resist degradation.

Factors, such as the management and the land use at a watershed or a farm scale, will affect the soil quality within a region. Therefore, the agricultural impacts on the soil and water resources of a region should be studied within the context of the characteristics and particularities of the broad area in which these activities take place. The way that these activities have modified soil quality is not well documented in the countries of the Mediterranean region, at either the farm or the watershed scale. Many agricultural practices cause alteration of soil properties that result in soil malfunction and, ultimately, in the degradation of soil quality. The soil functions should be classified hierarchically in order to minimize the risk of soil erosion. One of the major

objectives of soil quality assessment is to predict, from the knowledge of soil properties, the soil resistance to erosion in order to support specific quality/health functions for the crop, animals-humans and water target systems. Therefore, the development of a Minimum Data Set (MDS) of soil properties which takes into account Mediterranean conditions is a *sine qua non* tool for the soil quality assessment and the conservation of the soil resources. This minimum data set should include physical, chemical and biological soil properties, which will permit the evaluation of the pre-classified soil functions.

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THE STATE OF RESEARCH AND PERSPECTIVE ON IMPLEMENTATION OF MINIMAL SOIL TILLAGE IN THE UKRAINE

The system of mechanical soil tillage used in the Ukraine is characterised by deep ploughing with up to 20 passes of the tractor over a field in the period between pre-sowing and crop harvesting. This method is adopted universally throughout the country, resulting in high expenditure of energy and almost general degradation of soil properties (Medvedev, 1997).

The scientific base for deciding on tillage depth depends on the difference between real and optimum parameters of soil bulk density in the tilled later. If these values are equal or close, the tillage depth can be minimum. On lands free from weeds or when herbicides of high efficiency are used, it is possible to avoid carrying out mechanical tillage (Medvedev, 1988; Gordienko et al. 1997).

A great deal of experimental material has been accumulated which indicates that the present system of soil tillage should be revised both from the scientific and economic points of view. In some cases, there is a need to change from mouldboard ploughing to non-mouldboard and, in many climate zones, to adopt minimum tillage for the cultivation of cereals and other crops.

Investigations aimed at reducing primary tillage depth and changing to non-mouldboard ploughs have been conducted on the dominant soil types in almost all climatic zones (Grabak, 1984; Zuza, 1984; Kotovrasov et al. 1990; Golodnyi, 1991). They include work on the possibility and advisability of minimising pre-sowing and inter-row tillage (Kolomietz et al. 1976; Iltchenko and Ivanetz, 1978; Malienko et al. 1992) and improving the organisation of mechanised operations of crop growing and harvesting (Medvedev et al. 1987; 1989).

Analysis of the experimental data shows that the minimisation of primary soil tillage results in the same crop yields as traditional tillage. With winter wheat, rye, oats and barley there is even a 10-30 per cent increase in crop yield with minimum tillage. A decrease in the number of pre-sowing and inter-row tillage operations to 1 or 2 instead of 5 or 6, or even their complete elimination, does not reduce the crop yield of maize, potato or sugar beet on a well-cultivated soil. Minimum tillage has a number of undisputable advantages over traditional tillage: saving of manpower (1.5-3 times); decreased fuel costs (30-80 per cent); and reduced time of field operations. The most important positive aspect of minimum tillage is its contribution to soil protection; it reduces overcompaction and water erosion (1.5-3 times) and deflation (6-10 times).

Any soil tillage system should meet the requirements of creating favourable physical parameters for crop development, increasing soil fertility, soil protection, conserving energy and effective weed control. It is evident that it should produce soil physical

conditions which are close to the optimum for crops.

Studies of minimum tillage in practice on chernozem soils reveal that the bulk density of the sowing and under-sowing soil layers are close to those required for grain crops at time of emergence, i.e. a loose seed layer and a compacted under-seed layer. During crop growth, the difference in bulk density between the layers decreases and, under some crops (winter wheat, barley and winter rye) the two layers become homogeneous. Continuous non-mouldboard tillage results in a clear differentiation of the upper layer in terms of bulk density, physico-chemical properties and higher values of agrochemical indices. Minimum tillage gives advantages in soil water discharge and more effective utilisation of nutrients by plants owing to soil mulching by the plant debris.

On soils where minimum tillage is constantly used the root systems of cultivated crops develop superficially. This undesirable phenomenon can be eliminated by optimising the application of mineral fertilisers in the soil. An important factor restricting the use of minimum tillage on some soils is the high potential for weed growth; effective use of minimum tillage is then only possible with the use of effective herbicides.

It is possible to implement minimum tillage in the main geographical zones of the Ukraine under cultivation of a number of crops. It is recommended for the cultivation of winter wheat after silage maize, peas or perennial grass in the Forest-Steppe zone on chernozems and dark grey soils over some 2.5 million hectares; in the Polesiye on soddy podzolic loamy sands over 1.0 million hectares; and in the Northern and Central Steppe on ordinary chernozems of loamy composition over 0.8 million hectares. It is not proposed in the Forest-Steppe zone for the 3.0 million hectares of podzolised and eroded soils.

Minimum tillage is advisable under winter rye cultivation after lupin in the Polesiye on 1.0 million hectares of soddy podzolic soils and on 0.4 million hectares of podzolised soils in the Northern Forest Steppe. It cannot be used under winter rye on slopes. For barley it is possible to use minimum tillage on 3.5 million hectares of ordinary and typical chernozems in the Forest Steppe and Steppe. It is not recommended, however, for barley on podzolised and eroded soils. Zero tillage is possible in the same zones as minimum tillage if herbicides are used.

Under potato cultivation on soddy podzolic soils in the Polesiye, the number of inter-row tillage operations can be reduced or eliminated completely on 0.3 million hectares on field free from weeds or where herbicides are used. Under sugar beet it is also possible to reduce the number of inter-row tillage operations on 2.0 million hectares of typical chernozem soils in the Polesiye and on 0.3 million hectares of similar soils in the Steppe (Table 1).

It is necessary to carry out research on the possibility of adopting zero tillage for crop cultivation in the main soil-climatic zones of the Ukraine. At present, such studies are

rare. They need to take account of the physico-mechanical properties of the soil and the minimisation of expenditure.

Table 1. Recommended areas of arable lands (million hectares) in the Ukraine for minimum tillage

Soil-climatic zone	Soil	Crop	Tillage method	
			surface (disc and other)	zero
Forest	Soddy podzolised	Winter wheat	1.00	-
		Winter rye	1.00	-
	Loamy sand ungleyed	Oats	-	0.40
Forest-Steppe	Chernozems typical, dark grey and grey	Winter wheat	2.50	1.00
		Barley	2.25	0.75
		Maize	0.70	0.30
		Oats	-	1.00
		Winter rye	0.20	0.20
Steppe	Chernozems ordinary, southern	Winter wheat	1.50	1.00
		Barley	2.00	1.00
Total			11.15	5.65

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Modélisations numérique et expérimentale du ruissellement. Effet de la rugosité sur les distances de transfert

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La morphologie de la surface du sol conditionne le ruissellement et réciproquement. Cette étude a été menée dans le but de mieux comprendre les mécanismes de contrôle et leurs interactions. Elle s'est focalisée sur le ruissellement diffus de type inter-rigoles. Ce travail s'appuie sur un modèle numérique basé sur la technique des marcheurs conditionnés. La dynamique du stockage de l'eau en surface est finement analysée en termes de genèse et de propagation du ruissellement.

Nous montrons que la propagation du ruissellement, considérée comme un développement de connexions entre dépressions, peut être assimilée à un processus de percolation. Une relation formelle entre la taille du système et la dynamique du ruissellement est proposée. Des surfaces numériquement générées permettent l'examen des dynamiques externes, à partir du calcul du coefficient de ruissellement, et internes, à partir d'un calcul de la distance de transfert. La distance de transfert est une mesure pertinente pour comprendre le comportement du système, le coefficient de ruissellement n'y suffisant pas. Les effets des différentes rugosités dépendent principalement de leurs amplitudes. La corrélation observée à courte distance ne modifie pas le développement des connexions.

En étant le moteur des redistributions de particules, l'écoulement d'eau aboutit à des évolutions non triviales de la géométrie des surfaces. Ce sont les processus affectant localement la morphologie de la surface qui ont les plus fortes conséquences sur le déclenchement du ruissellement. Toutefois, les méthodes courantes ne peuvent pas mettre en évidence ce type de modifications. Essentiellement focalisée sur les transferts d'eau et de particules, la redistribution de substances dissoutes est aussi abordée.

FORTHCOMING MEETINGS

16-19 April 2000
International symposium on gully erosion under global change
Leuven, Belgium

Meeting sponsored by European Union Cost Action 623 and ESSC. The symposium is designed to review current understanding of, report progress in and identify priorities for future research on the impacts of global change on gully erosion.

Topics include:

- monitoring techniques and experimental investigations of various gully types
- subprocesses of gully erosion
- critical thresholds for the initiation, development and infilling of gullies
- factors controlling gully erosion rates
- contribution of gully erosion to soil degradation and sediment production
- historical studies of gully erosion
- interaction between gully erosion and other land degradation processes
- modelling rates of gully erosion
- on-site and off-site impacts of gully erosion
- gully prevention, control and restoration

Language of the symposium is English.

A mid-conference excursion will be organised to see the results of studies on land degradation processes in the Belgian loam belt.

Registration: € 150.00.
Registration fee covers mid-symposium tour, banquet and conference materials. It does not include meals and hotel costs.

Further details from:
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AIMS OF THE SOCIETY

The ESSC is an interdisciplinary, non-political association, which is dedicated to investigating and realising soil conservation in Europe. The ESSC pursues its aims in the scientific, educational and applied sectors

- *by supporting investigations on soil degradation, soil erosion and soil conservation in Europe,*
- *by informing the public about major questions of soil conservation in Europe,*
- *by collaborating with institutions and persons involved in practical conservation work in Europe*

The ESSC aims at coordinating the efforts of all parties involved in the above cited subjects: research institutions; teachers and students of geosciences, agriculture and ecology; farmers; agricultural planning and advisory boards; industries and government institutions.

ZWECK DER VEREINIGUNG

Die ESSC ist einer interdisziplinäre, nicht politische Vereinigung. Ihr Ziel ist die Erforschung und Durchführung des Schutzes der Böden in Europa. Die ESSC verfolgt dieses Ziel auf wissenschaftlichem, erzieherischen und angewandtem Gebiet

- *durch Unterstützung der Forschung auf den Gebieten der Boden-Degradierung, der Bodenerosion und des Bodenschutzes in Europa,*
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- *durch Zusammenarbeit mit Institutionen und Personen, die an der Praxis des Bodenschutzes in Europa beteiligt sind.*

Die ESSC will alle Personen und Institutionen zusammenführen, die sich für die genannten Ziele einsetzen: Forschungsinstitutionen, Lehrer und Studenten der Geowissenschaften, der Landwirtschaftswissenschaften und der Ökologie, Bauern, landwirtschaftliche Planungs- und Beratungsstellen, Industrieunternehmen und Einrichtungen der öffentlichen Hand.

BUTS DE L'ASSOCIATION

L'ESSC est une association interdisciplinaire et non politique. Le but de l'association est la recherche et les réalisations concernant la conservation du sol en Europe. L'ESSC poursuit cette finalité dans les domaines de la recherche scientifique, de l'éducation et de l'application:

- *en encourageant la recherche sur la dégradation, l'érosion et la conservation du sol en Europe,*
- *en informant le public des problèmes majeurs de la conservation du sol en Europe,*
- *par la collaboration avec des institutions et des personnes impliquées dans la pratique de la conservation du sol en Europe.*

L'ESSC souhaite favoriser la collaboration de toutes les personnes et institutions poursuivant les buts définis ci-dessus, en particulier: institutions de recherche, professeurs et étudiants en géosciences, des agriculteurs, des institutions de planification et des conseil agricole, de l'industrie, et des institutions gouvernementales.

OBJECTIVOS DE LA SOCIEDAD

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- *promocionando la investigación sobre degradación, erosión y conservación de suelos,*
- *informando al público sobre los principales aspectos de conservación de suelos,*
- *colaborando con instituciones y personas implicadas en la práctica de la conservación de suelos.*

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