NEWSLETTER

2/2014

ESSC EUROPEAN SOCIETY for SOIL CONSERVATION

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Retention pond in the Skuterud Catchment, Aas, Norway (photo by Lillian Øygarden).

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CONTENTS

This issue of the ESSC Newsletter presents the 23rd of our 'Guest Editorials.' This is an opportunity for leading authorities in the soil science community to offer their perspectives on issues relating to soil conservation. This contribution is from Lillian Øygarden (Bioforsk, Aas, Norway).

Catena Verlag has kindly agreed to publish a book based on Guest Editorials. This will be entitled 'Global Perspectives on Soil Conservation.' This will form part of the Catena 'Advances in GeoEcology' series. In principle, it is agreed that there will be future volumes, associated with the four year cycle of Congresses of the ESSC. Work on Volume 1 is progressing well.

Soil Conservation in Norway

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The soil resources of Norway

Norway is situated between 58 – 71 °N and 5 – 31 °E. A north-south mountain range, with an elevation of ≤2469 m, divides the country into a steep western side and a more gently sloping eastern side. The North Atlantic Drift (Gulf Stream) has an ameliorating impact on the climate. Yearly precipitation ranges from 278 – 3575 mm and mean annual temperature ranges from +7.7 °C (south-west) to –3.1 °C (Finnmarksvidda in the north). During several glacial periods Norway was covered with glaciers. After the ice melted, the south-eastern part of the Country was covered by a marine transgression. The most important deposits in Norway are bare rock, marine sediments, till, fluvial and glacial river deposits. The marine deposits are dominated by clay and silt and these are also the areas with highest erosion risk. The dominant soil types reflect the acid origin of the soil. The dominant soil types are Leptosols and Podzols.

Mountains and lakes cover 75 % of Norway, productive forests 22 % and farmland 3 %, whereas built-up areas cover <1 %. The most important agricultural crops are grass, cereals, oil-seed and potatoes. Fruit, berries and vegetables are produced locally if climate and soil conditions allow. Cereals and oil seed constitute 30 % of total cultivated land and cultivated grassland 65 %, while potatoes, fruit, berries, vegetables, root crops and green fodder constitute 5 % (SSB, 2014).

In Norway, only 3.3 % of the total area is agricultural and one-third of this is suitable for cereal production. In 2008, 0.22 ha agricultural area was available per person, while in 2012 it was calculated to be 0.162 ha per person. It is calculated the mean needs to be 0.32 ha to cover the amount of products consumed nationally today. Therefore, Norway depends on

imports of several products. The available agricultural area of ~3 % of total land area is much lower compared to other countries (e.g. the mean for the OECD countries is ~40 %) (Landbruks og matdepartementet, 2011). Much of the best agricultural area is located around cities. Norway has large contrasts in climate, soil resources and agricultural production systems. This gives large variations in the length of the growing season and possibilities for agricultural production. In north Norway grassland is often harvested once per year, while in south-west Norway grassland can be harvested 3 – 4 times. Future climate changes are expected to increase the length of growing seasons. However, the wetter and warmer climate can also influence the status of soil organic matter.

In 2012, with 5 million people, there was a mean of 0.163 ha available soil per person. It is expected that the population in Norway will exceed 6 million within the next 25 years, with a mean available agricultural area of 0.135 ha per person.

At present, available soil resources, soil quality and soil conservation issues have come into the public and daily policy debate in Norway. This is partly because of pressure on agricultural areas, especially where urbanization and construction of highways expand onto agricultural areas. In addition, the new government has approved some of the controversial plans for increased urbanization around cities. It is debated whether such cases should be decided locally or at the national level. Another area of debate in Norway is whether it should restrict cultivation of new peat-lands, where there are conflicting interests between farmers and the target of reducing greenhouse gas emissions. The occurrence of some extreme events with flooding and landslides has put focus on soil resources and the need for soil conservation. In agricultural production the stagnation of agricultural yields, especially cereals, is partly explained by soil conditions, especially soil compaction and insufficient drainage. Therefore, improved agronomic management is given priority in new research projects.

Threats

Since available soil resources are so limited in Norway, several plans for new highways and increased urbanization during recent years has put more focus on annual losses of agricultural areas. The total agricultural area in Norway in 2013 was 0.99 m ha. Available soil resources for new cultivation are ~0.12 m ha (Strand and Bekkhus, 2008). In the White Pater to Parliament No. 9 (Landbruks og Matdepartementet, 2011) it is a political goal to increase agricultural production by 20% by 2030 to follow the expected increased population. Grønlund (2013) calculated the need for new cultivation of an area of 0.10 – 0.15 m to achieve this. The best soil resources are already cultivated and very little of the area for possible new cultivation is suitable for grain production. One-third of the area is peat and half of the area is forest.

Official registration of the decline in agricultural areas commenced in 1976. The last 50 years in total 0.1 million ha of the agricultural area has changed land-use. Between 1994 – 2003, the mean annual losses of agricultural area were 1160 ha of cultivated soil and 640 ha of the area suitable for cultivation. In 2004, the government set the goal to reduce the annual loss of agricultural area by 50 % by 2010. Still, in 2006 the annual agricultural losses were ~1400 ha (Landbruks og matdepartementet 2007). In the White paper to Parliament No. 9 (2011 – 2012) it was stated a political goal was to reduce annual loss of agricultural areas to <600 ha, which is a 50% reduction in annual losses compared to 2004. Before agricultural areas can be used for other purposes, permission for land-use change is required. Municipalities can decide on these plans according to national regulations and laws. If the municipalities give permission for land-use change, the decision must be approved again at county level and by the 'Minis-

try of Local Government and Modernization.' This Ministry is responsible for the Planning and Building Act relating to urban development, municipal land-use planning, environmental impact analyses and county planning. The 'Ministry of Agriculture and Food' and the 'Ministry of Climate and Environment' are involved in land-use changes, agricultural production, planning and environmental issues. Many plans with high conflict levels between agricultural areas for production or land for urbanization and highways have been sent to Ministerial level for final decisions. The present government has stated that more decisions should be taken at municipality level and that soil conservation cannot be the only subject to be considered when cities need to expand and land-use changes are suggested on agricultural areas. It has to be balanced with the other needs of society. They have also stated that a new strategy for soil conservation and land-use changes will be developed soon.

Figure 1 show the development in the annual loss of agricultural area, both loss of cultivated area and loss of area possible for future cultivation. The dotted line shows the political goal of an annual limit of loss of agricultural area <600 ha. Most of the area recently lost was located in three counties: Rogaland, Sør-Trøndelag and Østfold, mainly for new highways and urbanization.

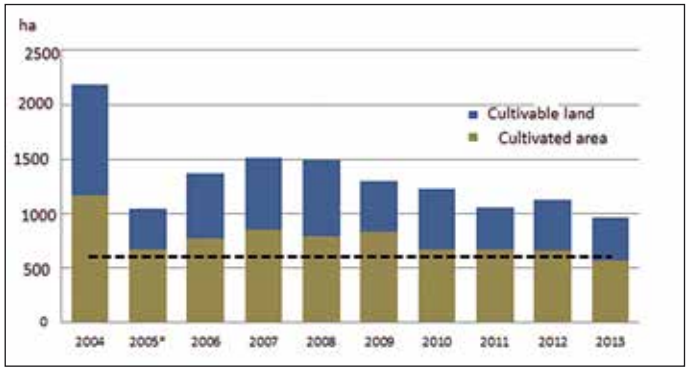

Figure 1. *Overview of annual loss of agricultural area. Green = cultivated area. Blue = Cultivable area. The dotted line represents the political goal of reduction of agricultural area to <600 ha.*

The statistics show that in 2013 the loss of agricultural area was the lowest since registration started, with 562.0 ha cultivated area and 401.9 ha cultivable areas. The losses are also concentrated around 20 municipalities and the main reasons are urban expansion and construction of new highways (Norwegian Agricultural Authority, 2014). These areas are also the areas with the best soil quality. Below examples are given on current activities to decrease annual losses of agricultural areas.

Remove and replace the topsoil

One option for soil conservation is to remove the topsoil and transport the soil to another area to improve soil quality there. This can considered as re-establishment of cultivated areas using soil material from agricultural areas exposed to heavy construction work. This is occurring with the construction new highways, such as in Akershus County. Another situ-

ation is now under consideration in Vestby Municipality in Akershus County, south-east of Oslo. The Ikea Company has applied to build on 3.5 ha of agricultural area, classified as one of the best soil quality areas in Norway. The plans have been processed and approved both by the Municipality and at national level. This case has turned into a principal debate and promoted public awareness of soil conservation issues, that is the value of agricultural areas versus the wishes of companies and municipalities for good locations for building houses and warehouses. For this location, the option to remove the topsoil, transport it and construct a new soil profile on another area is under evaluation. Such an experiment of soil transportation has not been done earlier at such a large-scale and followed up by research. Some earlier experiences with removing and replacing soil have been reported by Haraldsen (2012). This focus on this specific area for building this store, remove and replace the soil has led to intense public involvement and has featured in political election campaigns. Soil quality, soil conservation and planning processes in municipalities are now subject to public debate.

Soil quality maps

For planning purposes in the municipalities there was a need for better maps and planning processes to find alternative areas to be used for building purposes. This has also led to new focus on the quality of agricultural areas to secure the most valuable soils for agricultural use. The 'Norwegian Forest and Landscape Institute' (Skog og Landskap) has presented new maps for these purposes. These include a map of available soil resources possible for cultivation and a map of soil quality suited for different crops available at:

www.skogoglandskap.no/kart/kilden

It has been suggested that when agricultural areas are taken for construction of highways these areas should be replaced by cultivating twice the area lost. This is because the

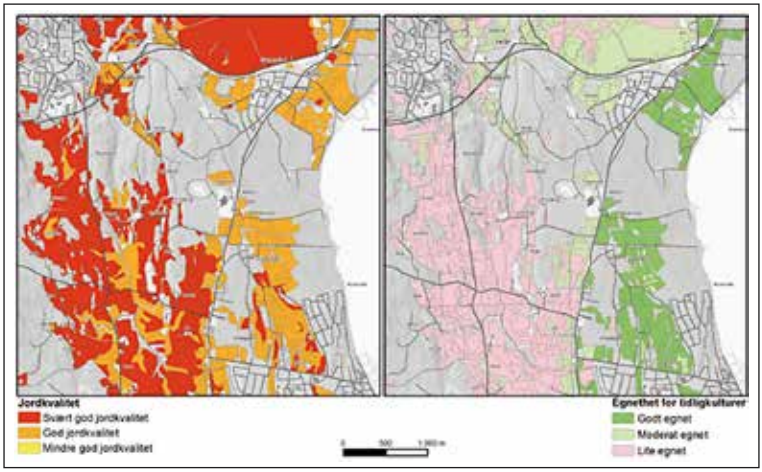

Figure 2. *Map of soil quality and soil properties and soil suitability for different crops in Vestfold County. Map on the left show areas with very good soil quality for cereal production (red), while the map on the right shows areas unsuitable for early vegetable production (pink). The green areas (right) are highly suitable for early cultivation, including vegetables.*

best soil resources are already cultivated and cultivating new soil will not have the same quality. Therefore, it cannot be compensated by cultivating the same size of area. The proposal for new regulations has been published and comments invited from the public.

The 'Norwegian Forest and Landscape Institute' produces maps of soil quality related to suitability for specific crops. They also produce maps where the soil resources are classified and mapped in terms of soil properties that restrict agricultural production (Nyborg and Olsen, 2014). However, a property that restricted one crop might be beneficial for another crop. Soil with drought problems can be well suited for early vegetable production in the best climate zones. An example from Vestfold County illustrates this (Figure 2). When evaluating alternative options for the location of a highway, a map showing land "not well suited for agricultural production" was used. This classification was based on such soil properties as drought vulnerability for cereal growth. However, local farmers claimed the classification was poorly suited for the actual land-use of the areas with early vegetables, harvested before the drought period. Furthermore, irrigation possibilities could make the areas more valuable. This has led to new maps concerning classification of suitability for different crops and information about the restricting properties. The information about which properties that can be limiting are drought, land levelling and shallow depth.

Soil erosion

Agricultural activities and environmental effects have received much attention from the mid- 1970s. Research on water erosion causing loss of particles and phosphorus (P), leading to pollution and eutrophication of rivers and lakes became a major focus from the early 1980s. The Agricultural Environmental Monitoring Programme was established in 1991: **http://www.akademikaforlag.no/content/agriculture-and-environment-long-term-monitoring-norway.**

The information is also presented at:
www.bioforsk.no/jova

Classification of the status of water quality has shown that 51 % of Norwegian water-bodies are at no risk with regards to the requirements, 22 % at possible risk, 25% at risk and 2% not defined (SSB, 2010). In Norway, work on decreasing pollution from agricultural areas started in the decades before the 'Water Frame Directive' (WFD). By the end of the 1980s there were major episodes of algal blooms in the North Sea. The countries surrounding the North Sea made a political agreement: 'The North Sea Declaration' to decrease the runoff of nitrogen and P by 50 % compared to the 1985 loadings. Erosion research was supported, especially on tillage methods to decrease erosion. Research in Norway on agricultural activities and environmental effects have led to the introduction of several types of payments in the early 1990s to encourage more sustainable agricultural production. Since the policy changed soil erosion has decreased. Thus, farmers' behaviour and soil erosion in Norway are strongly influenced by agricultural and environmental policies. Therefore, activities related to the WFD are a continuation of earlier work started in the 1980s and 1990s. It is the same kind of measures needed, but the differences lies in the regulations, political instruments, economic incentives and the time-frame set by the WFD to achieve better water quality.

After the 'North Sea Agreement' work on the soil mapping programme intensified and led to the production of erosion risk maps. Erosion risk maps are produced based on soil and slope characteristics and the USLE (Universal Soil Loss Equation) adapted to Norwegian

conditions (Hole, 1988; Lundekvam, 1990; Arnoldussen, 1999). Soil mapping activity has concentrated on the grain production areas in southern and south-eastern Norway and the Trondheimsfjord area in mid-Norway, where ~50 % of the agricultural area is mapped. The areas with cereal production and marine sediments are most prone to erosion. Most of the area which is drained to the North Sea is mapped (Øygarden *et al.*, 2006). This includes most of the areas assumed to have some erosion risk.

Four erosion risk classes are distinguished on the erosion risk maps. Some 22 % of the mapped soil mapped falls in the low erosion risk class (<0.5 tonnes ha^{-1} $year^{-1}$), 54 % in the medium class (0.5 – 2 tonnes ha^{-1} $year^{-1}$), 18% in the high risk class (2 – 8 tonnes ha^{-1} $year^{-1}$) and 6 % in the very high erosion risk class (>8 tonnes ha^{-1} $year^{-1}$). The soil erosion risk maps are used directly by farmers, advisory services and government agencies for planning soil conservation measures and as a basis for allocating subsidies. For instance, farmers receive subsidies when they reduce tillage and the level of subsidy is related to the erosion risk class of the land. In some areas, there are requirements for buffer-zones or runoff control measures for surface runoff on areas with high erosion risk (e.g. areas designated for winter wheat tillage). Subsidies are also given for sedimentation ponds and grassed waterways. These maps are now under revision for better adaptation to topography and local climatic conditions, based on adaptation of the PESERA model.

Farming practices directly influence the occurrence of erosion (Table 1). Soil erosion in Norway mainly occurs in autumn and spring. In autumn, heavy rainfall on saturated soil can cause soil loss through surface runoff. In spring, erosion is caused by heavy snowmelt, sometimes in combination with a frozen (sub)soil (Lundekvam and Skøien, 1998; Øygarden 2000; Lundekvam, 2002) (Plate 1). However, in mild winters with unstable weather, erosion can be very high even in December, January and February, which normally have little erosion because of cold weather and snow cover (Lundekvam and Skøien, 1998; Øygarden, 2000; Bechmann *et al.*, 2012).

Serious soil erosion from arable land over the last 25 years has been a major concern in relation to the pollution of inland and coastal waters. Measurements of the effects of various tillage systems on soil erosion have been conducted in Norway in field experiments since 1980 (Lundekvam and Skøien, 1998) and modified by later experiments and model evaluations (Lundekvam, 2002, 2007; Børresen, 2011; Skøien *et al.*, 2012). On the basis of these studies, tillage systems have been ranked according to their relative erosion risk. Ploughing in autumn was used as the reference, because it has traditionally been the most common tillage practise in Norway. Studies have shown that the best way to prevent soil erosion is to avoid tillage operations in autumn. Winter wheat cropped on ploughed soil has a variable effect on soil erosion, depending on the degree of crop development in autumn. Direct drilling of winter wheat normally gives low erosion risk.

Table 1. Relative erosion risk associated with different soil tillage systems. The two numbers for relative erosion risk on one row reflect soils with high erodibility (small numbers) and low erodibility (larger numbers) (Øygarden and Børresen, 2011)

Tillage system	Time of sowing	Relative erosion risk
Ploughing in autumn	Spring	1.00
Harrowing in autumn	Spring	0.50 – 0.70
Ploughing in spring	Spring	0.14 – 0.35
Harrowing in spring	Spring	0.12 – 0.30
Direct drilling	Spring	0.11 – 0.25
Ploughing	Autumn	0.70 – 1.2
Direct drilled	Autumn	0.20 – 0.50

Soil erosion in Norway is particularly associated with autumn ploughing, which makes the soil especially vulnerable during snow-melt in spring and during rainy periods in late autumn. Thus, there is widespread public opinion that autumn ploughing should be abandoned. In order to motivate farmers to adopt conservation tillage practises, the agricultural authorities started to give support to those who leave the soil untilled during winter. This action was initiated in 1990 and has since then become more developed and targeted.

Plate 1. *Snowmelt on agricultural land in Skuterud Catchment, Aas, south-east Norway (photo: Lillian Øygarden).*

Erosion research has resulted in several governmental actions involving subsidies, new regulations and information. Subsidies are given for tillage practises with low erosion risk, establishment of buffer zones, catch-crops and grass covered waterways, sedimentation ponds

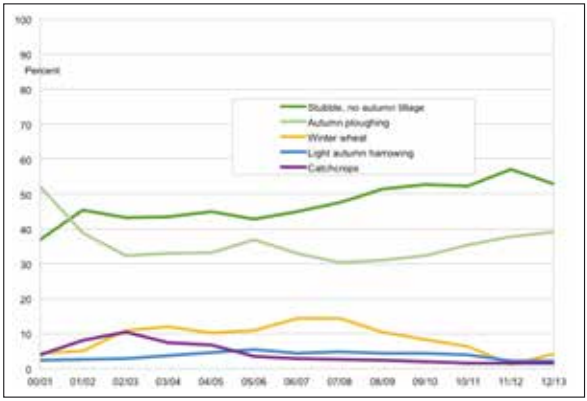

Figure 3. *Development of the area with stubble, autumn ploughing, winter wheat, autumn harrowing and catch crops for the period 2000 – 2013 (SSB 2014).*

and repairing erosion damage on levelled land. The government has set as a priority the reduction of the area under autumn ploughing in regions susceptible to erosion. The amount of compensation is related to the erosion risk level of the respective areas. Autumn ploughing is still permitted, but farmers' receive no financial support. Since 2003, each Norwegian farmer is obliged to have an Environmental Plan for the farm and measures to decrease erosion are an integral component. In some catchments, especially those used for drinking water, farmers are obliged to use specific management practises to receive the general production support. The regulations are especially focused on the need for decreasing tillage during autumn in areas with a high potential erosion risk or exposed to flooding. During autumn in areas with a high potential erosion risk or exposed to flooding, farmers are not allowed to perform any autumn ploughing and need to establish buffer zones along open waters. Winter wheat with autumn tillage is only permitted on areas with low erosion risk and farmers must have control over surface runoff and establish buffer-zones. The farmers in these catchments with strong regulations receive more economic support than in other catchments.

Payments for no autumn tillage were introduced in 1991, irrespective of erosion risk. After 1993 these subsidies were targeted on areas with significant erosion risk; the highest rate is given to areas with the highest risk class. In 2013, ~53 % of the grain area was tilled only in spring compared to 37 % in 2005 (Figure 3). Some 39 % of the area was ploughed in autumn 2012 compared to 52 % in 2000 and 2 % was harrowed in autumn (SSB, 2014). Current support is given at annual rates of €50 – 180 per hectare and varies with erosion risk, with 90 % of the support being given to areas with medium to extremely high erosion risk. In exposed catchments special regulations are implemented to improve water quality. For example, the Morsa Catchment in Østfold County (south-east Norway), which is used for drinking water for ~60,000 people.

In 2005 the national support regime was changed to Regional Environmental Programmes. Each county develops their own environmental support programme, both what measures should be supported and the level of support. Participants include local authorities, farmers' organizations and extension services. The programmes are approved by the Agricultural Authorities. In 2012, €21.3 m were given as environmental support for measures on

0.183 million ha of agricultural land. The total area used for grain production was 0.3 million ha. In 2012, the scheme was given economic support for €2.77 m for 424 km of grassed waterways, 1,232 km of buffer-zones and 5,770 ha of other grass-covered areas. Areas with cover-crops have varied between 35,000 ha and 4,400 ha (2012). In the period 1994 – 2012, 941 sedimentation ponds and wetlands were built with economic support (70 % of the costs).

Soil conservation and improved agronomic methods are also important themes in ongoing projects, including:

AGROPRO- Agronomy for increased food production. **www.agropro.org** and RECARE-EU Project. **http://www.recare-hub.eu/**

References

Arnoldussen, A.H. (1999). Soil Survey in Norway, p. 123 – 128 In: P. Bullock, R.J.A. Jones and J. Montanarella (Eds). Soil Resources of Europe. Research Report 6, European Soil Bureau.

Bechmann, M. (2012). Effect of tillage on sediment and phosphorus losses from a field and a catchment in south eastern Norway. Acta Agriculturae Scandinavica, Section B - Soil & Plant Science 62, Supplement 2, Special Issue: Soil Erosion in the Nordic Countries, 206 – 216. DOI:10.1080/09064710.2012.715183.

Børresen, T. (2011). Erosion studies in plot field experiments with different tillage systems in Norway, p.153 – 169 In: K. Banasik, L. Øygarden and L. Heiduk (Eds) Prediction and Reduction of Diffuse Pollution, Solid Emission and Extreme Flows From Rural Areas- Case Study of Small Agricultural Catchments. Warsaw University of Life Science Press,

Grønlund, A., Svendgård-Stokke, S., Hoveid, Ø. and Rønning, L. (2013). Grunnlag for prioritering av områder til nydyrking. Bioforsk Report Vol. 8. No 151, 97 pp. (ISBN 978- 82 – 17-01165 – 1).

Haraldsen, T.K. (2012). Flytting av oppdyrket jordsmonn for reetablering av jordbruksarealer. En oversikt over erfaringsgrunnlag og vurderinger av risiko for spredning av skadelige organismer. Bioforsk Report. Vol. 7, No. 181.

Hole, J. (1988). Primær rapport om Stofftapsmodell brukt på Jæren og Romerike. Norwegian Institute of Land Inventory, Ås. Report 1988, 17 pp.

Landbruks og Matdepartementet (2007). Klimaskifte for jordvernet. Rapport fra Jordverngruppa. Departementenes servicesenter 01/08. No 50, 66 pp.

Landbruks og Matdepartementet (2011). Meld. St. 9 (2011 – 2012). Landbruks og matpolitikken 'velkommen til bords.' Available at: www.regjeringen.no

Lundekvam (1990). Open åker og erosjonsproblem. Foredrag ved konferansen om Landbrukspolitikk og Miljøforvaltning i Drammen 30 – 31 januar, 1990, Ås. 31 pp.

Lundekvam, H., (2002). ERONOR/USLENO – Empirical erosion models for Norwegian conditions. Agricultural University of Norway, Ås. Report number 6/2002.

Lundekvam, H. (2007). Plot studies and modelling of hydrology and erosion in southeast Norway. Catena 71(2), 200 – 209.

Lundekvam, H. and Skøien, S. (1998). Soil erosion in Norway. An overview of measurements from soil loss plots. Soil Use and Management 14, 84 – 89.

Norwegian Agricultural Authority (2014). Kostra-landbruk. Report 18/2014. 54 pp.

Nyborg, Å and Olsen, H. (2014). Begrensende egenskaper for jordbruksdrift. Fakta fra Skog og Landskap H.

Øygarden, L. (2000). Soil erosion in small agricultural catchments, south-eastern Norway. Doctor Scientiarum Thesis 2000:8. Agricultural University of Norway, Ås. 167 pp.

Øygarden, L. and Børresen, T. (2011). Best management practice in Norway to keep good wa-

ter quality of surface water in rural areas, pp.174 – 195 In: K. Banasik, L. Øygarden and L. Hejduk (Eds). Prediction and Reduction of Diffuse Pollution, Solid Emission and Extreme Flows from Rural Areas – Case Study of Small Agricultural Catchments. Monograph, Warsaw University of Life Science Press, Warsaw. (ISBN: 978 – 83-7583 – 330-0).

Øygarden, L., Lundekvam, H., Arnoldussen, A. and Børresen, T. (2006). Norway, p. 3 – 15 In: J. Boardman and J. Poesen (Eds) Soil Erosion in Europe. Wiley, Chichester (ISBN: 13: 978 0 – 470-85910 – 0).

Skøien, S.E., Børresen, T., and Bechmann, M. (2012). Effect of tillage methods on soil erosion in Norway. Acta Agriculturae Scandinavica, Section B - Soil & Plant Science 62, Supplement 2, Special Issue: Soil Erosion in the Nordic Countries, 191 – 198.

DOI: 10.1080/09064710.2012.736529

SSB (2010). Statistics Norway. Snellingen Bye, A., Aarstad, P.A., Løvberget, A., Berge, G., and Hoem, B. (2010). Jordbruk og Miljø. Tilstand og utvikling. Report 48/2010. 122 pp. (ISBN: 978 – 82-537 – 7074-4). (In Norwegian with English Summary).

SSB (2014). Statistics Norway. Snellingen Bye, A., Aarstad, P.A., Løvberget, A.I. and Høie, H. Jordbruk og Miljø. Tilstand og utvikling 2013. Report 2014:10. 131 pp. (ISBN: 978 – 82-537 – 8900-2). (In Norwegian with English Summary). Available at: www.ssb.no/emner/10/40

Strand, G.H. and Bekkhus, R. (2008). Markslagsstatistikk. Dyrka og dyrkbart areal. Ressursoversikt fra Skog og Landskap 03/2008. 30 pp.

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Ecoremediation for Soil Protection in Slovenia

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Ecoremediation

Ecoremediation (ERM) is a term for the repetition of processes in nature. The concept of ERM is based on the protection and restoration of the environment through natural and close-to-natural, sustainable systems. This means that the term ecoremediation refers to: prevention and cure (i.e. protection and restoration) in the context of an ecosystem approach (based on the laws of the operation of several complex wholes, such as ecosystems, both natural ones and close-to-natural ones, because of human modifications). It is this emphasis upon ecosystems that distinguishes ecoremediation from phytoremediation or bioremediation. The basic aims of ERM are to create ecosystems with: (1) a high buffering capacity; (2) a self-cleansing capacity; (3) increased biological diversity; and (4) retention of water. Ecoremediation (e.g. buffer areas and constructed wetlands for water purification) can revitalize degraded areas (e.g. stone quarries and road cuts), reduce excessive nutrient content and purify wastewater (Vovk Korže and Vrhovšek, 2008). By restoring a particular environment we can restore its wider value, and so sustain other kinds of activities, such as areas

that are important in terms of habitat or dimensions of sustainable development (Vrhovšek and Vovk Korže, 2005).

Restoration focuses more narrowly on the remediation of environmental problems (e.g. accumulation of contaminants) through the use of a particular ecosystem (e.g. plant) function (Vovk Korže and Vrhovšek, 2008). ERM brings in the additional goal of achieving wider ecosystem functions and forms, as well as remediation of environmental problems. Thus, ERM has the potential to eliminate long-term environmental impacts (e.g. from non-point pollution, contamination of land by heavy metals or organic pollutants) and to achieve much more. ERM challenges narrow stress on remediation of such impacts through emphasizing a set of other benefits to ecosystem form and function that can also be delivered if the remediation is thoughtfully designed. In effect, ERM methods advocate a wider set of activities that need to be considered when deciding how to manage a degraded environment, ones that enable the operation of ecosystems more generally. There has been a particular emphasis on water, and ways of reducing human impacts as well as the potential effects of hazards (e.g. floods, droughts and avalanches) through seeing space as a 'living space' and harnessing this life in a way that both sustains life and delivers associated societal protection (Plate 1).

Central to ERM is working with natural processes where possible, even if these are impacted upon by human activities (e.g. polluted water supply) so as to assure better use of resources (e.g. water) to mitigate against the adverse effects of pollution and to conserve or increase biological diversity. Fundamental here is the idea that ecosystems involve natural processes that can act as a buffer by retaining, processing or neutralizing unwanted effects, such as rapid runoff in a flood event or organic and inorganic pollutants (Dobravec, 2003). The buffering capacity arises from three important processes: self-cleaning; water retention and biological diversity. First, most natural and quasi-natural elements have a considerable

Plate 1: *Educational experiment for studying soil erosion at the Poljčane Centre.*

self-cleansing capacity. The three main components (substrate, microbes and plants) are capable of decreasing the quantity of nutrients and toxic substances through filtration, different decomposition processes in anoxic or oxic conditions, and with the help of uptake by plant and animal biomass. Firstly, with the right choice of plant species and the correct way of growing them, and with the regular removal of biomass increments, we are able to remove pollutants, and purify soil and water. Secondly, water retention systems may have a dual benefit. If we retain water in a river-floodplain system, we may be able to reduce flood risk. If drought follows, the retained water may be used for irrigation, augmenting baseflow and/or ground-water recharge. Thirdly, ERM may enhance biotic diversity. Biotic diversity is the diversity of life-forms (species diversity), genes (gene diversity) and ecosystems (ecosystem diversity), habitats and ecological processes. Biotic diversity is important because it may create more sustainable natural systems, as greater diversity enables greater ecosystem flexibility. This component of biological diversity is known as ecosystem service. Its other components are biological resources (for food, pharmaceutical and timber industries) and a sociological component, which provides recreational, cultural and aesthetic resources. All of these give additional significance to protecting, restoring and conserving water and waterside systems (Raskin, 2005).

Ecoremediation learning community at Poljčane, Slovenia

The 'Development Centre of Nature' in the Municipality of Poljčane (in eastern Slovenia) is one of the nature learning municipalities with research infrastructure for ecoremediaton in nature. In co-operation with the Maribor Faculty of Arts (International Centre for Ecoremediation) Municipaly Poljčane is a field classroom for ecoremediation. In the years 2009 – 2011 many activities were conducted aimed at establishing conditions for education in this polygon-shaped nature site. Within the same period, renovated curricula for primary and secondary schools have closed and the Bologna study programmes in colleges have increasingly highlighted the need to ensure practical conditions for learning. Since over 60 % of Poljčane Municipality consists of protected areas, the focus on teaching gives the Municipality a new opportunity for development. Europe is based on natural and cultural heritage and this is an important advantage. In Poljčane Municipality we linked together with interested individuals, organizations and Poljčane Municipality. The teaching programmes encourage the stewardship of nature for future generations and inter-generational transfer of experiential knowledge that has been evolving in this area for centuries. Therefore, we continue to strive to register as many projects that build upon both traditional knowledge and new and innovative ecoremediation knowledge as possible. On the surface of eight hectares, the ERM polygon site promotes both research and teaching of ERM.

Ecoremediaton polygon for research and learning in nature on current problems

In the small Municipality of Poljčane, new educational areas are being established. The teaching polygon for ecoremediation is the most visited and productive educational area. It is the result of ideas of the International Centre for Ecoremediation. The idea was supported by the Slovenian Ministry for Schools and the European Union and implemented in early 2009. By 2011 the whole polygon was established and regularly used for educational purposes.

On the teaching polygon for ecoremediation learners meet new approaches to sustainable nature management and it is possible to find very different natural and man-made ecosystems that were put here for educational purposes or have long been here. The field offers three types of woods (flooded, coniferous and deciduous) for the study of natural vegetation and its functions. Water ecosystems are especially versatile and intertwine with other ecosystems. The structure and form is given by the small natural stream, which flows through the valley. There is also an oxbow lake, small pond, lake with fish, wet grassland, natural swamp and visible ground-water. The polygon's waste waters flow through the constructed wetland, which cleans the water to ≤90 % purity. Cleaned water, therefore, can be reused for such purposes as plant watering and washing (Plate 2). The areas of dry grassland exchange with the wet parts of the system, where we can find many rare animal and plant species. The polygon's wide options appear together with its special equipment. It has a laboratory and experimental room, where up to 30 people can work. The educational polygon is provided with all the basic and specialist equipment, whether learners need fishing boots and anoraks to wear or laboratory chemicals for specific analyses. The laboratory building is made of natural Slovenian wood and is therefore environmentally friendly. It offers sleeping facilities for ~12 people. Visitors' needs are covered with the fully equipped kitchen and sanitary facilities.

Visitors of the teaching polygons are able to research and develop their own ideas by exploration of the area. They co-operate in the processes of polygon creation and management, develop new ideas and complete the programme of activities. Self-engagement and power to support creates the idea of importance and usefulness.

Plate 2: *Sand filter for water at the Poljčane Centre.*

Education on ecoremediation in the educational polygon

The key aim of the ERM polygon is to provide the learner with the possibility of identifying crucial environmental problems in space, in the context of individual educational points, by collecting various measurements and analysing them, processing data and making comparisons. The learner is able to uncover the causes and consequences of an environmental problem by his- or her- self, individually and/or with the help of the teacher as a facilitator in the educational process. In the future, the learner will be able to seek solutions for mitigating the problem on the basis of collected data. Once he or she has experienced a conflict of potential solutions, the learner can identify an appropriate response and acquire certain knowledge, while simultaneously learning to evaluate obtained results and substantiate his or her arguments. These skills are important for the future of the learner, who will be exposed to situations where she or he will have to make various decisions, in the continuation of their education, both formal and informal (UNECE, 2005).

The primary purpose of the whole concept of a 'classroom in nature' is the development and enhancement of an individual's ability to recognize and comprehend processes that occur in nature and the environment, to come up with alternative ideas for solving numerous environmental issues, and to make evaluations and decisions in favour of sustainable development, which are also the key principles of the strategy of education for sustainable development. The ERM polygon trains students in observing, analysing and evaluating the consequences of technoscientific development, and encourages them to seek alternative solutions and consider the needs of future generations. In this respect, it prepares students for recognizing and solving environmental problems, for which there is no one single solution, and it leads them to the analysis of positive and negative consequences of current economic and technological solutions.

Students actively affect the workings and appearance of the polygon, since they are able to complete various activities on the premises, for example growing reeds and constructing water-purifying wetlands, maintaining ecoremediation systems (riparian vegetation and hedges) and tracing the effects of natural ecosystems and ERM objects. They also get to know the procedures for preparing documentation, and for installing and fitting ERM objects into other situations.

The concept and design of the ERM polygon enable the development of three key dimensions of students' competences. These are:

(i) Cognitive (acquiring quality knowledge on the basis of understanding processes and phenomena, and applying this knowledge in different situations when facing specific problems).

(ii) Value judgements (when pupils, through recognising and solving environmental problems, develop a positive attitude to nature, learning to discern what is beneficial and what is destructive for nature and the environment).

(iii) The level of direct action, encouraging learners to convert the internalized knowledge and values into action, whereby they can individually contribute to environmental protection (e.g. cleanup actions, separate collection of waste and watching out for illegal waste dumps).

By solving exercises at the ERM polygon, pupils acquire competences and skills needed for effective prevention and solution of problems and conflicts. They become capable of

prudent judgement, aware of the reasons for a particular activity, able to make decisions and critical judgements, and learn how to actively join environmental action. They will be able to integrate the knowledge, learning processes and experiences gained at the ERM polygon in Poljčane into their local environments, they will be able to identify environmental problems in their local environments and seek appropriate responses to them. When solving exercises, they will rely upon key environmentalist and conservationist literature, which will give them insights into where they can find some essential facts, statistical data, analyses and legislative frameworks.

The ERM polygon has become an important education centre of the Biotechnical School (a consortium of Slovenian schools that provide educational programmes in the fields of environmental protection, nature conservation and horticulture) and represents an innovative educational environment for the implementation of internships, optional school activities and practical classes. The education polygon is also an interesting educational environment for studying optional subjects, in primary school and high school curricula of education for sustainable development.

References

Dobravec, J. (2003). Filozofije narave in varstvo narave. Barja in varstvo narave, Prispevki, (Contributions to the Philosophy of Nature and Nature Protection), Trenta, 23 – 25 April 2003, Ljubljana.

Raskin I. (2005). Using plants to remove pollutants from the environment. American Society of Plant Biologists (ASPB), Series on Leading Plant Research.

UNECE (2005). Strategy for Education for Sustainable Development (adopted at the High Level Meeting, Vilnius, 17 – 18 March 2005).

Vovk Korže, A. and Vrhovšek, D. (2008). Ekoremediacije v Sloveniji – zagonski in nadaljevalni projekt (Ecoremediation in Slovenia – start and pilot project). Ministry of the Environment and Spatial Planning. Holder of activity International Centre for Ecoremediation, Maribor (Slovenia).

Vrhovšek, D. and Vovk Korže A. (2005). Izobraževalni pomen ekoremediacij pri pouku geografije (Educational meaning of ecoremediation in Geography classes). Geografija v šoli, Ljubljana (Slovenia).

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Developing and Standardizing Tools and Procedures for Assessment of Soil Biodiversity

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Soil is the reservoir of a high diversity of organisms. This biodiversity plays an important role in ecosystem functioning and nutrient cycling due to the ability of these organisms to degrade organic matter, weather minerals, and fix carbon and nitrogen. However, we are far from fully appreciating this black box of soil system diversity. Most of our present knowledge was established using cultivation-dependent approaches giving access to only a limited portion of this diversity. The development in the last decade of high-density 16S rRNA, 18S rRNA or ITS microarrays, monogenic and shotgun metagenomics has permitted us to greatly improve our knowledge, generating very informative views on the structure and diversity of the soil microbiome.

In the frame of the EcoFINDERS Project, the impact of the type and intensity of land management was tested across Europe in different long-term observatories using amplicon-based metagenomics. The objectives were to decipher the diversity and structure of a wide range of organisms, including archaea, bacteria, fungi (Glomeromycota and Dikarya), protists, and nematodes. This approach was a scientific challenge, because our present knowledge of the diversity and associated molecular markers of the range of organisms are not at the same level. Here, we present the tools to investigate soil biodiversity and we discuss the major results highlighting the diversity of archaea, bacteria, fungi, amoebozoa, flagellates and nematodes in European soils.

For most of the organisms considered, ribosomal genes have been used as marker genes: i) 16S rRNA for archea and bacteria and 18S rRNA for the others. The internal transcribed spacer region (region ITS1) was used to decipher fungal diversity, focusing on the Dikarya sub-kingdom (Basidiomycota and Ascomycota). The same metagenomic DNA samples were used to assess to the diversity of all the soil organisms. After amplification, the sequencing of these marker genes generated a data set containing from 245,867 sequences for the amobozoa to 3 million sequences for the bacteria. The next step was to analyse this large diversity of sequences. To date, several bioinformatic pipelines have been developed, such as RDP (ribosomal data project, Cole *et al.,* 2009), Mothur (Schloss *et al.,* 2009), QIIME (Caporaso *et al.,* 2010) and UPARSE (Edgar, 2013), and most of them have been optimized to

analyse bacterial diversity. As one important task of the project was to analyse the sequences generated for each type of organism in a similar way, different pipelines have been tested and one composite pipeline, named pipeline #1, was at last established to analyse all the sequences (Figure 1).

Bioinformatic analysis of the sequences was performed and several critical points were highlighted:

1) The raw data generated need a flowgram trimming step.
2) ITS analysis needs a specific ITS extraction step, which is not necessary for the ribosomal genes.
3) The trimmed sequences need to be adjusted in a length adapted to the marker gene considered.
4) The clustering step must be adapted in relation to the organisms considered and the inter-specific polymorphism of targeted barcodes.
5) Convenient databases (which are not yet available for all organisms) need to be used for an improved taxonomic affiliation.

Due to the continual development of bioinformatics software and programs, a comparative analysis was performed using pipeline #1 and an adaptation of the recent pipeline 'UPARSE' developed by Edgar (2013), on the same data set randomly subsampled to conserve only 500 sequences per sample. The critical steps of this second analytical pipeline are presented in Figure 2. A detailed comparison of the fungal ITS sequences revealed that pipeline #1 gave a higher richness (based on the number of OTU (operational taxonomic unit)) than

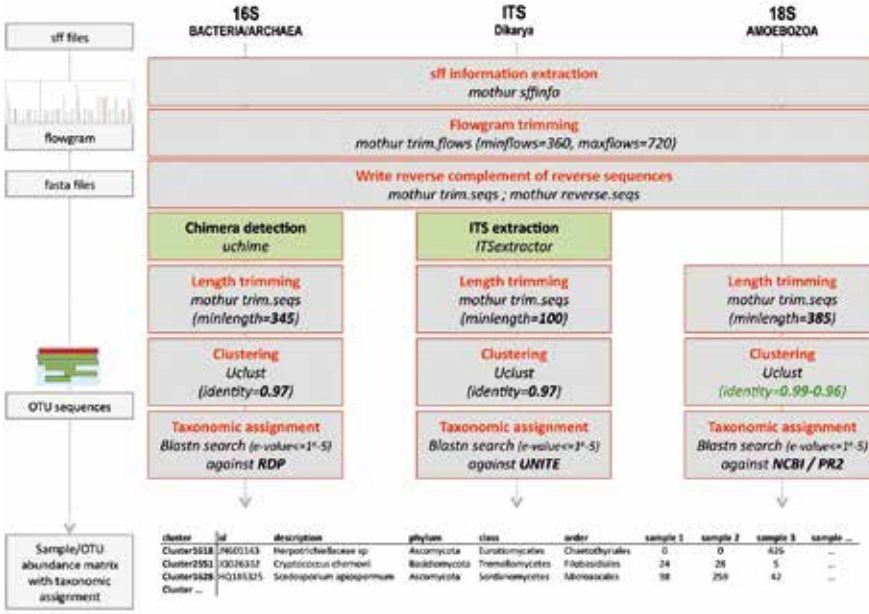

Figure 1. *Description of Pipeline #1. This figure presents the different steps from the sequences extraction from the raw data to the taxonomic assignation using the convenient database.*

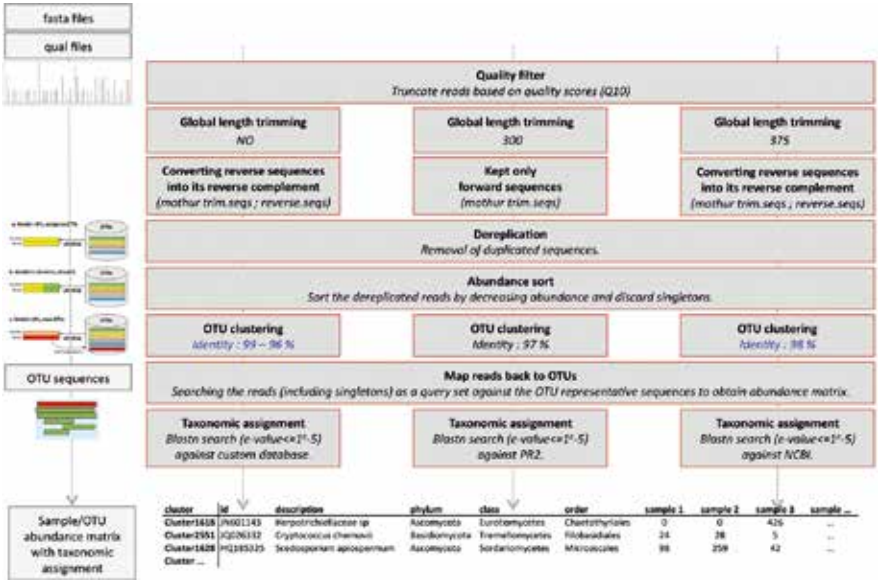

Figure 2. *Description of pipeline #2 based on UPARSE.*

pipeline #22 based on UPARSE (Figure 3A), including a larger proportion of singletons (single read for one OTUs). However, the same trends of richness were observed for the two pipelines. Notably, taxonomic affiliation gave similar results. The multivariate analyses (Figure 3B) performed using the two pipelines gave very similar patterns. Finally, the distribution of the sequences (relative abundance) was very similar between the two pipelines (Figure 3C).

Altogether, these analyses revealed that it is possible to analyse different marker genes (16S rRNA, 18S rRNA and ITS) with the same bioinformatics pipeline. However, adaptations are required to fit with: i) the type of molecular marker, ii) the size and size homogeneity of marker genes and iii): the threshold applied to cluster the barcode sequences in OTUs. This approach permitted us to generate the first comprehensive view of the diversity and structure of the archaea, bacteria, fungi, amoebozoa, flagellates and nematodes in the same soil samples obtained at the different long-term observatories across Europe. The comparative analysis performed using two different pipelines provides a significant contribution in the understanding of the limitations and robustness of the bioinformatics methods. Notably, such comparison showed that richness data need to be interpreted with caution, as they are strongly dependent on the pipeline used. In contrast, similar patterns of distribution of the main taxa (community structure) were obtained with pipelines #1 and #2. We still have some way to travel on our journey to fully appreciate the diversity and structure of soil biota. Multidisciplinary studies linking metagenomic survey and characterization of soil organisms are needed to fully achieve this.

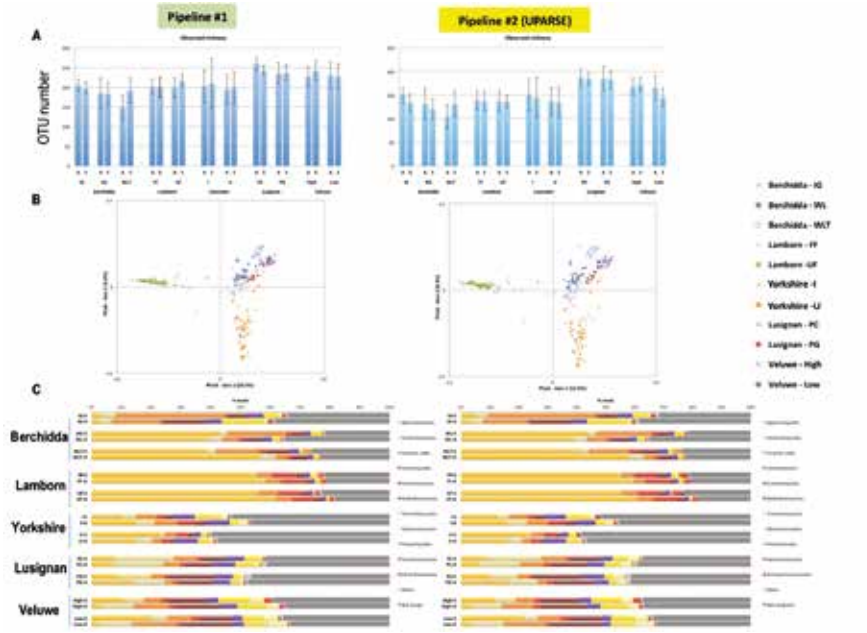

Figure 3: Analysis of the fungal communities occurring across the different LTOs using pipeline #1 (left part) and pipeline #2 (UPARSE) (right part). *For this analysis, the dataset was subsampled to conserve 500 sequences for each sample. A) Richness analysis based on the number of OTUs. A: autumn sampling; S: spring sampling; I: improved management; U: non-improved management. B) Multivariate analysis performed on the relative distribution of the OTUs in taxonomic groups. Geographical location and management type are presented in the legend. C) Relative distribution of the sequences at the class level. Berchidda (IG: improved grassland, WL: wooded land; WLT: forest land), Lamborn (FF: fertilized forest; UF: non-fertilized forest), Yorkshire (UK) (I: improved grassland; U: non-improved grassland), Lusignan (PC: permanent culture; PG: permanent grassland), Veluwe (The Netherlands) (High: long-term abandoned grassland; Low: short-term abandoned grassland).*

References

Caporaso, J.G., Kuczynski, J., Stombaugh, J., Bittinger, K. *et al.,* (2010). QIIME allows analysis of high-throughput community sequencing data. Nature Methods 7(5), 335 – 336.

Cole, J.R., Wang, Q., Fish, J.A., Chai, B. *et al.,* (2009). The Ribosomal Database Project: improved alignments and new tools for rRNA analysis. Nucleic Acids Research. 37 (Database issue), D141eD145.

Edgar, R.C. (2013). UPARSE: Highly accurate OTU sequences from microbial amplicon reads. Nature Methods 10, 996 – 998.

Schloss, P.D., Wescott, S.L., Ryabin, T., Hall, J.R. *et al.,* (2009). Introducing mothur: open-source, platform independent, community-supported software for describing and comparing microbial communities. Applied Environmental Microbiology 75, 7537 – 7541.

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Report on the International Conference of the Egyptian Soil Science Society, Kafrelsheikh (Egypt), 5 – 7 May 2014

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The Soil and Water Department, Faculty of Agriculture, Kafrelsheikh University and the Egyptian Soil Science Society (ESSS), organized an International Conference on 'Climate Changes and Sustainable Development of Natural Resources', which was held in Kafrelsheikh, a town about 134 km north of Cairo, on the Nile Delta of Lower Egypt.

The Conference addressed the impact of climate change on agro-ecosystems (natural and anthropogenic) as well as the mitigation of the change through technological, social, ethical and political responses and strategies for adaptation to climate change. The Conference also aimed to encompass several aspects of these subjects, offered opportunities to explore many current and relevant issues of climate change and natural resource management. It also provided an interactive forum for exchange of ideas and discussion.

Plate 1. *Professor Carmelo Dazzi, President of ESSC, during his welcome address at the International Conference on 'Climate Changes and Sustainable Development of Natural Resources.'*

Plate 2. *Professor Carmelo Dazzi and Professor Omar El-Hady (President of the ESSS) after the signature of the Memorandum of Understanding between the ESSC and ESSS.*

The Conference brought together seven invited speakers and about 150 participants who presented 110 scientific contributions (oral and posters) summarizing their research. In total, five sessions were organized. During the closing ceremony a Memorandum of Understanding (MoU) was signed between the ESSC and the Egyptian Soil Science Society (ESSS) aimed at establishing mutual links and encouraging member awareness of the mutual objectives and activities of both organizations (Plates 1 and 2).

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Report on the 1st European Soil Partnership Meeting, Ispra (Italy), 21 and 22 May 2014

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The 1st European Soil Partnership Meeting was held in Ispra on 21 and 22 May, 2014. After opening speeches (by Maria Betti, Pia Bucella, Andrus Meiner, Ronald Vargas and Jes Weigelt), Ronald Vargas introduced the five pillars of action of the European Soil Partnership (ESP) to contribute to human wellbeing and social equity through improved use and

governance of soil resources. Ronald stressed that the establishment and implementation of the European Soil Partnerships is of significant importance for the Global Soil Partnership (GSP) Secretariat, as it will serve as an example for consolidation and implementation of other partnerships (Plate 1).

Jaroslava Sobocká illustrated the main features of Pillar 1, speaking on "Soil management in Europe: challenges and opportunities." Jaroslava focused on the initiation of the pillar and stressed that it was submitted by the Intergovernmental Technical Panel on Soils (ITPS) for endorsement at the GSP Plenary Assembly in July 2014. Jaroslava highlighted that the goal of pillar 1 is to promote sustainable management of soil resources for soil protection, conservation and sustainable productivity. She emphasized that there is the need to establish an interactive and consultative process with relevant regional institutions, interested national soil entities and active stakeholders to provide practical responses to challenges facing current management of soil resources in Europe.

Arwyn Jones illustrated the main features of Pillar 2 speaking on "A plan of action to rouse society to the value of soil." Underlining that the competition for land should reflect the value of soil, especially in urban environments where vital soil functions should be maintained, Arwyn presented a list of recommendations concerning education on soils, mainly aimed at: i) introducing soil as a theme into the school curriculum from an early stage in order to boost the understanding of its value and functions and ii) promoting soil education to public society and soil users through diverse and current communication channels (e.g. e-learning, distance courses, social networks and web fora).

Jes Weigelt illustrated the main features of Pillar 3 speaking on "Promote targeted soil research." Arguing that pillar 3 is strongly linked to the others four pillars, Jes emphasized that research on soils should not be confined in the issues of agriculture and underlined that soil

Plate 1. *Ronald Vargas, Jaroslava Sobocká and Carmelo Dazzi at the 1st European Soil Partnership Meeting in Ispra, Italy.*

scientists should be encouraged and rewarded to engage with other disciplines to highlight the broad functionality of soil systems.

Allan Lilly illustrated the main features of Pillar 4 speaking on "Soil data and information." Stressing the linkage between pillar 4 and the others pillars, Allan underlined that accessing a subset of national information is a prerequisite for the sustainable management of soil and that regional soil partnerships should facilitate a federal system to deliver soil data for use at the global scale.

Pavel Krasilnikov illustrated the main features of Pillar 5 speaking on "Harmonization of methods and measurement." In particular, Pavel explained that: i) the implementation of pillar 5 should engage and be consistent with current standardization and harmonization activities, in particular those within the IUSS and that ii) the harmonization processes will follow established principles for technical co-operation (commonality, inclusiveness and efficiency) and operations (interoperability, extensibility and scalability).

During the meeting emphasis was placed on the withdrawal of the proposal for a Soil Framework Directive (see Regulatory Fitness and Performance (REFIT) – COM(2013) 685 final). The Commission notes that the proposal has been pending for eight years, during which time no effective action has resulted. It will, therefore, carefully examine whether the objective of the proposal, to which the Commission remains committed, is best served by maintaining the proposal or by withdrawing it, thus opening the way for an alternative in the next mandate. This will be judged on the feasibility of reaching adoption before the elections to the European Parliament.

At the end of the two-day meeting a series of proposal to be discussed in the next Global Soil Partnership meeting were listed. These include:

- Sharing ideas for the 'International Year of Soil 2015' and preparation of a tentative European programme.
- Web site portal of soil awareness: initiative, tools, kits and apps.
- Development of a targeted research agenda bringing in existing networks.
- Raise awareness about ESP activities among existing European networks and relevant stakeholders.
- Development of a strategy for mitigating soil pollution.
- European contribution to the Global Soil Information System.
- Economics of ecosystem services provided by soil.
- Elaboration of a soil quality/health European map on the basis of soil functions.
- Development strategies to minimize land-take.
- Establishment of working groups (WGs) for developing implementation plans.
- Advocate the inclusion of soil in the post-2015 agenda, as appropriate.
- Sharing of ideas for EXPO-2015 in Milan as a contribution to national pavilions.
- Report of soil world resources by ITPS European chapter/data/information.

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'Biogeochemical Processes at Air-Soil-Water Interfaces and Environmental Protection,' Imola, Riolo Terme, Ravenna (Italy) 23 – 26 June 2014

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Introduction

From 23 – 26 June 2014, the Department of Agricultural Sciences of Alma Mater Studiorum, University of Bologna hosted the ESSC International Conference 'Biogeochemical processes at Air-Soil-Water Interfaces and Environmental Protection' (ASWEP) in Imola, Riolo Terme and Ravenna (Italy). The Congress was attended by about 100 scientists from 25 countries of Europe, America and Asia to discuss new advances and challenges in soil science and the impact of the processes at air-soil-water interfaces on environmental equilibria and on human health and well-being.

In the course of the Opening Ceremony several distinguished delegates delivered their opening speeches. These include Gian Luca Galletti (Italian Minister of the Environment), the local authority Davide Tronconi (the Imola Assessor for Urban Development Planning), Sergio Santi (President of the Fondazione Cassa di Risparmio di Imola), Carmelo Dazzi (President of the European Society for Soil Conservation) and Gilmo Vianello (President of the Organizing Committee).

The Conference was supported by the European Commission and international scientific societies (International Union of Soil Sciences, IUSS; International Soil Conservation Organization, ISCO; World Association of Soil and Water Conservation, WASWAC; European Confederation of Soil Science Societies, ECSSS; European Commission Joint Research Centre, EC-JRC) as well as national scientific societies and research institutes (Società Italiana della Scienza del Suolo, SISS; Società Italiana di Pedologia, SIPE; Consiglio per la Ricerca e la Sperimentazione in Agricoltura, CRA) and some private agencies working in environmental areas (Prati Armati, Ambios s.r.l., BioAlgae, Agroverd, Ecosearch). A special contribution was given by Geolab onlus (Imola) who largely facilitated the organization of the Conference.

The main themes and subjects, that were presented and discussed by the four invited lectures, the 30 oral presentations, the high number of posters presented in the thematic sessions and during the scientific excursion, are summarized below. More information and a comprehensive programme of the Conference can be found at:

http://aswep-essc.unibo.it/index.php

The Scientific Programme

The Conference consisted of four main sessions, each of which had a topic concerning the biogeochemical cycles in soil sciences, summarized in Concepts, Factors, Processes and Techniques and was introduced by renowned experts. The scientific contributions were held by experienced scientists, along with young Ph.D. candidates and researchers, which actively enriched the well-balanced programme of the Conference.

The Factors session was introduced by Professor Markus Egli from the University of Zurich, who gave a talk about how to determine soil production and erosion rates in mountain areas (Plate 1). In this session, particular interest was mainly devoted to the problem of both geogenic and anthropogenic soil pollution by different sources, such as heavy metals and emerging pollutants. Moreover, it was highlighted how the functionality of soil can be affected by extreme environmental conditions.

Plate 1. *Marku Egli is presented with a certificate for his keynote presentation by Carmelo Dazzi.*

The **Concept** section was presented by Professor Paolo Nannipieri from the University of Florence, who discussed the importance of biological systems for understanding and investigating soil functionality, and overviewed advances in research techniques (Plate 2). Several approaches applied to the study of nutrient fluxes in soil-water interfaces were discussed in this session, highlighting the importance of modelling, as well as bench-scale and field experimentations for better comprehension of geochemical fluxes of nutrients.

Professor Eleonora Bonifacio from the University of Torino introduced the third session, **Processes** (Plate 3). She overviewed the pedogenetic processes linked to organic matter stabilization. One important topic discussed in this session regarded the processes through which contaminants in soil can be mobilized/stabilized by organic matter and plants, includ-

Plate 2. *Paolo Nannipieri is presented with a certificate for his keynote presentation by Giuseppe Corti.*

Plate 3. *Eleonora Bonifacio is presented with a certificate for her keynote presentation by Gilmo Vianello.*

ing some interesting examples of phytoremediation techniques. Another relevant discussion regarded the processes of gas emission in wetlands and saturated soils and their effects on soil functionality.

Finally, for the session **Techniques,** Professor Christoph Külls from the University of Freiburg proposed a new method for the application of isotope techniques to monitor water and carbon dioxide fluxes in soil unsaturated zones (Plate 4). During this session most presentations discussed the use of different models to assess the effects of vegetation on soil stability.

Plate 4. *Christoph Külls is presented with a certificate for his keynote presentation by Adam Kertész.*

The Conference had a large poster session and the organizers judged the best poster of each scientific area. The winners were:

'Effects of the GAEC cross compliance standard 'management of set-aside' on soil biodiversity in Italy' by S. Mocali, S. Landi, A. Fabiani, G. d'Errico, R. Piccolo, P. Bazzoffi for the **Factors** session.

'Humic acid properties in the oligotrophic bog of west Siberia' by M.V. Zykova, E.E. Veretennikova for the **Concept** session.

'Rhizosphere effect on a soil derived from limestone in a thousand year old holm oak (*Quercus ilex* L.) forest' by A. Agnelli, L. Massaccesi, M. De Feudis, V. Cardelli, S. Cocco, G. Corti for the **Processes** session.

'Understanding the carbon isotopic signature in complex environmental matrices' by C. Natali, G. Bianchini for the **Techniques** session.

For an overview of the abstracts, either of presentations or poster sessions, please access the above mentioned link to the Conference web site.

The ESSC provided two grants to support the participation of young researchers to the Conference. During the Conference, Obiageli Obua (working at the University of Wolverhampton, UK) and María Pilar Serrano Muela (working at the Superior Council of Scientific Research (CSIC), Zaragoza, Spain) were awarded the ESSC grant by the ESSC Grant Commission (Plate 5).

Plate 5. *María Pilar Serrano Muela (ESSC Young Scientist Prize Winner) with Carmelo Dazzi and Edoardo Costantini.*

The post-Conference excursion visited the San Vitale pinewoods, in the lowlands of the Adriatic coast, north of Ravenna. The area is rich in human-nature interactions and is characterized by variable morphology and habitats, even though it has a limited extent. Thus, it is a suitable location for the understanding of biogeochemical processes in a particularly diverse environment, and it has attracted the prolonged interest of many researchers. The group from the University of Bologna showed forest soil profiles, one of which is included in the newest class of soils in the Soil Taxonomy classification system (USDA): the subaqueous soils. Moreover, during the field trip Professor David Weindorf (USA) had the opportunity to perform XRF in-field analysis on one of the soil profiles with a modern portable instrument (DELTA Mining and Geochemistry Handheld XRF Analyzer, Olympus) (Plate 6).

The Social Programme

The excursion to the natural park 'Vena del Gesso,' on the second day of the Conference, transported participants through stunning landscapes and unusual environments. With the help of local guides, the group went through natural aspects and historical events of the area. The Park is sprinkled of natural caves and tunnels dug in the Gessoso-Solfifera Formation (Upper Miocene), which have been used from the very beginning of human history for different

Plate 6. *David Weindorf performing in-field XRF analysis on one of the soil profiles during the field trip.*

purposes. After the visit to the Grotta del Re Tiberio, the social dinner was held in Riolo Terme and the Roaring Emily Jazz Band enlivened the evening.

On the third day, the participants to the Conference experienced the evocative voices of the Stelutis Choir. Ballads, work songs and lullabies from the Emilian peasantry tradition were performed in a touching cappella style.

At the end of the Conference Professor Carmelo Dazzi read the ASWEP-ESSC International Conference resolution, which has been approved unanimously by the participants. The agreed text is reported below.

E-mails:
serena.carbone2@unibo.it
chiara.ferronato2@unibo.it
marco.natale4@unibo.it

Final resolution ASWEP – ESSC
RESOLUTION OF THE ASWEP – ESSC INTERNATIONAL CONFERENCE
Biogeochemical Processes at Air-Soil-Water Interfaces and Environmental Protection
IMOLA (ITALY), 23 – 26 JUNE 2014

The ASWEP–ESSC International Conference on **'Biogeochemical Processes at Air-Soil-Water Interfaces and Environmental Protection'** involving about 100 participants from 25 countries, representing national and international societies of soil science, research agencies, universities, government bodies, higher education, science, public non-governmental organizations and business,

hearing

the results of the invited lectures, the 30 oral presentations and several posters presented from the thematic sessions,

identified

that the level of degradation of natural resources, and particularly soils, related to human pressure, is becoming increasingly evident in many areas of the world;

considering

the importance of the multi-functionality of soils and of the impact of processes at Air-Soil-Water Interfaces on environmental equilibria and on human health and welfare all over the world;

the REFIT Communication from the European Commission on the withdrawal of the 'Thematic Strategy for Soil Protection'

request

that decision-makers, land managers and administrators:

ensure application of sound environmental management technologies for soil, air and water protection so as to ensure a healthy environment for present and future generations;

recognize the importance of high quality soils for agriculture and the environment and to protect this valuable resource from degradation and consumption;

apply soil information and scientific knowledge more effectively in order to protect and safeguard the ecological and life support capacity of soils;

maintain the Soil Framework Directive;

stress

the importance of natural resources in maintaining and safeguarding environmental equilibria for human health and well-being.

and recommend all Governments and Institutions

to develop environmental policies aimed at promoting the maintenance and improvement of soil functions, such as biomass production, storing, filtering, and transforming nutrients and water, hosting the biodiversity pool, acting as a platform, acting as a carbon pool and mitigating climate change, and geological and cultural heritage.

to pay particular attention to maintain and re-establish the specific functions of soils to produce goods and services of quality and quantity when damaged;

to pay particular attention to maintain and to re-establish the correct equilibria in the air-soil-water interface processes that influence all living systems and the quality of life.

Winner of the ESSC Young Scientist Prize to attend the Imola Conference

Dr María Pilar Serrano Muela won a prize of €500 to attend the Imola Conference. Below, Maria presents a short biography.

I finished my degree in Geography in 2003 at the University of Zaragoza, Spain. I began at the Pyrenean Institute of Ecology (CSIC) in May 2005, with the financial support of the RESEL Project, a consortium between the 'Consejo Superior de Investigaciones Cientificas' (CSIC) and the Spanish Ministry of Environment. In 2006 I received a grant (I3P-CSIC Programme) to carry out my Doctoral Thesis, which I finished in 2012 and was entitled: 'Influence of vegetation cover and soil properties in the hydrological response: runoff generation in a forested catchment in the mid-mountain.' In this period I have participated in several research projects, I have attended several congresses and meetings and published scientific articles. During this period I spent one month at the 'Centro di Ricerca per l'Agrobiologia e la Pedologia,' CRA-ABP, in Florence (Italy).

During these 10 years of experience I have been responsible for the maintenance and control of equipment installed in the experimental basins of the Pyrenean Institute of Ecology, considered among the most important in Europe in environmental hydrology and geomorphology to study erosion and hydrological processes of different land use and land covers. I am interested in hydrology, runoff and sediment yield, forest environments, experimental catchments, soil conservation and global change.

E-mail: **piliserranomuela@gmail.com**

Gerold Richter Award 2015

The ESSC Gerold Richter Award for Outstanding Contributions to Soil Conservation and Protection within Europe

This is awarded to a person (exceptionally a corporate body) who has, over the period of his or her career, made significant and internationally recognized contributions to the investigation and/or promotion of soil conservation in Europe. The contributions may be in research, practise, policy-making or any other activity deemed appropriate.

The recipient should be a member of the ESSC, but this is not mandatory.

Nominations are invited for the ESSC Awards to be presented before the 7th International Congress in Moscow 18 – 22 May 2015

Previous recipients:

Silsoe	1996	G. Chisci (Italy)
Valencia	2000	R.P.C. Morgan (UK)
Budapest	2004	A. Kertész (Hungary) and A.C. Imeson (UK)
Palermo	2007	N. Yasouglou (Greece)
Thessalonika	2011	J. Rubio (Spain)
Moscow	2015	_____

Any member of the Society may propose a person (exceptionally a corporate body for the Gerold Richter Award). Individuals may propose themselves. Nominations should state the name and address of the person being proposed followed by a 500 – 1000 word statement describing the contribution on which the nomination is based.

Nomination for the award should be sent to the ESSC President and to the ESSC Secretary.

Prof. Carmelo Dazzi
ESSC President
Dipartimento di Scienze Agrarie e Forestali
Università di Palermo
Viale delle Scienze, Ed. 4 – 90128 Palermo
Italy
e-mail: **carmelo.dazzi@unipa.it**

Edoardo A.C. Costantini
ESSC Secretary
CRA-ABP Agrobiology and Pedology Research Centre
Piazza M. D'Azeglio 30 – 50121 Firenze
Italy
e-mail: **edoardo.costantini@entecra.it**

The ESSC Young Person's Award for the Understanding and Promotion of Soil Conservation in Europe

This is awarded to a member of the Society, aged 40 years or under, who over the previous four years has made an important contribution to soil conservation in Europe through research, practise, policy-making or any other activity deemed appropriate.

Previous recipients		
Silsoe	1996	Dr Jürgen Schmidt
Valencia	2000	Dr Stefan Doerr
Budapest	2004	no recipient
Palermo	2007	no recipient
Thessalonika	2011	no recipient
Moscow	2015	_____

Nominations

Any member of the Society may propose a person. Individuals may propose themselves. Nominations should state the name and address of the person being proposed followed by a 500 – 1000 word statement describing the contribution on which the nomination is based.

Nomination for the award should be sent to the ESSC President and to the ESSC Secretary.

Prof. Carmelo Dazzi
ESSC President
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SOIL EROSION SONGS

The soil, floods and erosion have inspired singer-songwriters to compose songs with titles such as "Dust pneumonia blues," "Don't treat it like dirt" and "A love song for soil." A not too exhaustive search on YouTube has found some 20 soil erosion songs. A link to the songs can be found on the site:

http://www.kwaad.net/Soil_Erosion_Pictures.html

I would appreciate readers sending me information on other soil songs.

Enjoy the music!

Frans Kwaad
E-mail: **frans.kwaad@tiscali.nl**

Editor's note:

At the ESSC Council meeting in Lleida (Spain) in September 2006, the interactions between the ESSC and younger soil scientists were discussed (see Newsletter 2006/3, p. 5-8). It was decided that the ESSC should be more proactive in its support of younger scientists. As part of that initiative, we welcome articles from both Ph.D. researchers and supervisors. We would like to hear from recent Ph.D. graduates; what advice and experience do you have which you would like to share with your colleagues in earlier stages of their research? We would also like to hear from current Ph.D. researchers; what are the factors which both encourage and limit progress? What are the particular challenges facing part-time Ph.D. researchers? We also invite contributions from experienced Ph.D. supervisors. What experience would you like to share with less experienced colleagues? If you are a less experienced Ph.D. supervisor, what supervisory issues do you find challenging? In short, please tell us "what I know now, which I wish I knew then!"

Editor's note:

The citation details of Ph.D. theses by ESSC members since and including 2004 have been added as an additional page to the ESSC web site. To date, 51 Ph.D. theses are quoted. On the ESSC web site, please look under 'Publications.' Please forward the citation details of any additional Ph.D. thesis completed since the year 2000 by an ESSC member to any of the Editorial team. We will then add the thesis citation details to the web site.

ESSC membership list and contact details

Web Based Bulletin Board

The ESSC wishes to rapidly disseminate information to its members. Please forward information to the ESSC web site to be placed on our ESSC Bulletin Board. These could include searches for potential collaborators for research proposals, calls for research proposals, job opportunities, research studentship opportunities, impending conferences and other items of important information for rapid dissemination. Of course, we will also continue the regular circulation of information via our Newsletter. The **NEW** ESSC web site is:

http://www.soilconservation.eu/index.html

ESSC membership list and contact details

The full ESSC membership list is held on the ESSC web site. Under 'members' you can obtain a full listing. Also under 'members' you can click on any member country and find a listing of members in the selected country.

We are trying to keep the membership list on the web site up-to-date. Please check your details and let us know if there are any necessary correction(s). If your details change,

also please let us know. Some members have requested that we do not add their e-mail addresses to the web site, to avoid uninvited 'spam' e-mails. Of course, we respect this request. Therefore, while we retain a list of the e-mail addresses of ESSC members, this list will not be available on the web site.

Editorial matters in Bratislava are handled by Ing Karol Végh. In terms of membership lists, contact details and the ESSC web site, please send updated information to Karol at:

E-mail: **k.vegh@vupop.sk** or **kajove@gmail.com**

Please also use and refer to the **'Directory of European Organizations and Persons Working on Soil Protection'** as a reference source for European colleagues, both members and non-members of the ESSC. This publication contains the e-mail addresses of most ESSC members and will be subject to periodic updates. The reference citation is:

Rubio, J.L., Imeson, A.C., Bielek, P., Fullen, M.A., Pascual, J.A., Andreu, V., Recatala, L. and Ano, C. (2006). Directory of European Organizations and Persons Working on Soil Protection. Soil Science and Conservation Research Institute, Bratislava, 190 pp. (plus CD-Rom).

This publication is available as a pdf document on the 'Publications Archive' on the ESSC web site.

FORTHCOMING DATES FOR YOUR DIARY...

International Conference on Geomorphometry for Natural Hazards Geomodelling

The Institute of Geoecology and Geoinformation, Adam Mickiewicz University in Poznań and the International Society for Geomorphometry announce the fourth bi-annual conference and workshops in Poznań (Poland), 22 – 26 June 2015.

Scope: The interdisciplinary nature of geomorphometry makes it a key science for natural hazards: from land observations which can serve as ground truth to mathematical models and the development of new computer software. Monitoring of the Earth's surface provides a growing amount of high-resolution DEMs and LiDAR data which require new geomorphometric tools capable of handling, analysing and visualizing large quantities of data in real-time. Contributions that address these issues are especially welcome, including methods for continuous monitoring at times and locations where hazards occur, and fast computational methods for near real-time analysis of elevation data.

Themes include: Acquisition of high resolution elevation data, New algorithms and software for automated interpretation of digital elevation data, Modelling extreme processes on the Earth's surface, Multi-scale automated mapping of Earth surface changes, Working with continental-scale high resolution data, Simulating changes of the Earth's surface relief and 3D and 4D dynamics of the Earth's surface in selected areas.

Key Dates

- Extended abstracts due: **1 November 2014.**
- Notification of acceptance (revisions): **1 February 2015.**
- Workshop proposals due: **1 February 2015.**
- Final camera-ready digital manuscripts due: **1 May 2015.**
- Early registration deadline: **1 May 2015.**
- Conference dates: **22 – 26 June 2015.**

Venue

Gollegium Geographicum, Adam Mickiewicz University in Poznań, Poland.

Schedule

- 22 – 24 June: oral and poster sessions.
- 25 June: four workshops in the computer laboratories
- 26 June: full-day field trip.

Field Trip

The full-day trip will study post-glacial lowlands, including eskers, channel lakes, thrust moraines, undulated plains and river terraces. A special point of interest is the unique site of mid-Holocene meteorite craters.

Contact

- Conference Website: **www.geomorphometry.org/2015**
- Conference Office e-mail: **conference2015@geomorphometry.org**
- Tel.: **0048 61 8296196 (J. Jasiewicz).**

International Interdisciplinary Conference on
Land Use and Water Quality
Agricultural Production and the Environment
Vienna, Austria, 21–24 September 2015

LuWQ2015. 2nd International Interdisciplinary Conference on LAND USE and WATER QUALITY: Agricultural Production and the Environment Vienna (Austria), 21 – 24 September 2015

Scope and Objectives

This is the second LuWQ Conference. The previous meeting was held in The Hague (The Netherlands) in 2013. The aims of the Conferences are to discuss the entire policy cycle for water quality improvement. This cycle includes problem recognition, formulation of technical options, the process of policy development, interaction with policy-makers, stakeholders and pressure groups, policy implementation, monitoring and research. This Conference also aims to intensify contacts, on the one hand, between scientists with a background in natural sciences and scientists with a background in social and economic sciences and, on the other hand, between scientists, water managers and policy-makers. The objectives are:

- To provide a forum for exchange of scientific knowledge, research on system knowledge, modelling and uncertainty.
- To discuss the entire policy cycle for water quality improvement.
- To intensify contacts: (a) between soil/water related scientists, agro-related scientists, social scientists, ecological scientists and economists, and (b) between scientists, water managers and policy-makers.

Target groups are scientists, managers and policy-makers involved in the policy cycle for water quality improvement. It includes activities characterized by the following keywords: agronomy, agro-economics, agro-sociology, water management, water policy, hydrology, aquatic ecosystems, terrestrial ecosystems, unsaturated zone, groundwater, surface waters, drinking water, monitoring, modelling, water quality, nutrients, pesticides and other organic agrochemicals, and heavy metals.

The Conference is organized by the Universität für Bodenkultur Wien (BOKU), University of Natural Resources and Life Sciences, Vienna, and is convened by BOKU; RIVM National Institute for Public Health and the Environment, The Netherlands; Department of Bioscience, University of Århus, Silkeborg, Denmark; Umweltbundesamt, Environment Agency Austria; Umweltbundesamt (UBA), Federal Environment Agency, Germany; and Charles University, Prague, Czech Republic.

Abstract submission: abstracts are due by 1 February 2015.

For further information, please contact the Organizing Committee:
Willibald Loiskandl: **willibald.loiskandl@boku.ac.at**
Alexandra Strauss-Sieberth: **alexandra.strauss-sieberth@boku.ac.at**
Karel Kovar: **karel.kovar@pbl.nl**
More information is available on the Conference web site:
http://web.natur.cuni.cz/luwq2015/

Photographs of Vienna
by Dico Fraters, The Netherlands.

Articles, reports, letters, views or comments on any aspect of soil erosion and conservation in Europe are always welcome.

We invite proposals for special thematic issues of the Newsletter. We also welcome any comments on the ESSC Newsletter and suggestions on how it can be improved and developed.

Do not forget to send in your details of the following information:

(i) Reviews of recent conferences.
(ii) Recent grant awards.
(iii) The citation details and abstracts of completed Ph.D. and M.Sc. theses.
(iv) Newly enrolled Ph.D. research students, title of their research topic and names of research supervisors.
(v) Recent staff institutional movements/promotions.
(vi) A reference list of your 'new' international refereed scientific journal papers, which have been published recently (since and including the year 2000).
(vii) At the ESSC Council at Průhonice (Czech Republic) in June 2009, it was agreed that the Newsletter will present a series of national reports on soil erosion and soil conservation activities in individual European countries. If you would like to volunteer a contribution, please contact any member of the Editorial team.

Send these details to either:
Professor Mike Fullen: **m.fullen@wlv.ac.uk**
or
Dr Colin Booth: **colin.booth@uwe.ac.uk**

and they will include this information in the next issue.

PLEASE NOTE:
We publish two Newsletter issues per year. The deadlines are:
1 March and 1 September.

The following four verses are a selection of translated ancient songs (ballads) of the Hani minority people of Yuanyang, Yunnan Province, south-west China. The Hani are world-famous as the builders and guardians of the rice terraces of Yuanyang (Plate 1). Until recently, the Hani had no written language. These ballads were collated by Hongzhen Zhang, based on meetings with the Mopi (elders of the Hani). The verses were abstracted from:

Hongzhen Zhang (2010). Interpretations of the Hani Seasonal Production Ballads. Yunnan Press Group Company and Yunnan Art Press Company, Kunming, 248 pp. (ISBN 978-7-5489-0034-4).

Plate 1. *The rice terraces of Yuanyang (photo taken by Mike Fullen (Wolverhampton, UK) on 23 October 2009).*

II. On the Arrival of the Three Months of Spring

Verse 142

In winter, the sunlight is tender,
And the sunlight varies in different seasons.
Different seasons show different weather,
And it is hard to find a depression
where the dew cannot be evaporated by the sunlight.

Three days passed,
The seedling grows well just like the sorghum.
It is a round of time of 13 days,
If ten roots are impossible, at least a root grows firm;
In a round of time of 13 days,
If ten leaves are impossible, at least one leaf takes shape.

After three nights, the seedlings in the fields look green,
The seedling takes root in the soil,
And the leaves can be seen.

Verse 146

Don't worry about cutting the earthworm accidentally,
Don't be afraid of cutting the mole cricket.
What's the trouble of cutting the earthworm,
And what's the trouble with cutting the head of the mole cricket?

When Bingu bird sings, it is time to rake the field for the second time.
In continuous act of raking fields,
Chufa should be eradicated with rakes.

After three days, the buckwheat in the mountain buds with green leaves;
After three nights, the seedling grows as tall as the field ridge.
In dozens of days, it will take root,
In dozens of days, leaves will grow.
The seedling should be transplanted among different fields.

Verse 158

People go farming with bamboo hat and coir raincoat.
At the time for men to rake the field
And the women to plant seedlings.
Men and women go farming with their friends.

Do plant the seedlings straight,
And plant each seedling in equal distance.
The remaining seedlings are put by the field in the sun.
When the women take a rest,
The rakes are put on the ridge;
When the men take a break,
Spring rain drops in the right condition.
The raindrops are of the same size,
As if they have been screened out with a sifter.

❧

Verse 160

In the right condition raindrops beat down the withered leaves,
Trinkling the edge of the leaves like grease.
The raindrops fall on the muddy road.
Without raindrops in winter, the stream may dry up,
And is revives in March with the coming of raindrops.

The grass of Eyuecao buds gradually on the edge of the village,
Woods and grass look green by the pool.
And Wushanoao grass returns to life again.
Horses nicker in the stall,
And the fat and husky oxes grow well.

Guricao grass by the fields bud with tender leaves,
Offering succulence for the pigs,
The boar grows fatter and stronger day by day.

❧

Verse 162

In the hill there grows tender Luobucao grass,
Which meets the piglets taste.
By the river there grows tender Bapicao grass,
Which is beneficial to sows.

The root is the same,
But the new leaves replace the old ones;
New tree-tops grow,
And the old trees take on a new look;
Spring raindrops are of the same size,
As if they have been screened out through sifters.

Thanks to Professor Li Yong Mei (Yunnan Agricultural University, P.R. China) and Professor Wang Weiguang (The University of Wolverhampton, UK) for their editorial help with the Hani ballads.

"To be a successful farmer one must first know the nature of the soil"

(Xenophon of Athens, 400 BC)

"Go upon the lande that is plowed and if it synge or crye or make any noyse under they fete then it is too wet to sowe. If it make no noyse and will beare thy horses, thanne sowe in the name of God"

(16th Century Husbandry Guide)

Modern English
"Go upon the land that is ploughed and if it sing or cry or make any noise under your feet then it is too wet to sow. If it makes no noise and will bear your horses, then sow in the name of God"

Source: Cranfield University (2007). A Guide to Better Soil Structure. National Soil Resources Institute, Cranfield (UK), 19 pp.

E-version available from:

http://www.landis.org.uk/downloads/downloads/structure_brochure.pdf

"Soil erosion is as old as agriculture. It began when the first heavy rain struck the first furrow turned by a crude implement of tillage in the hands or prehistoric man. It has been going on ever since, wherever man's culture of the earth has bared the soil to rain and wind"

(Hugh H. Bennett and W.C. Lowdermilk, 1930s)

"...soil is alive and is composed of living and nonliving components, having many interactions. It is a part of the larger unit, the terrestrial ecosystem, that soil must be studied and conserved....we must remember that the biota have been involved in [the soil systems] creation, as well as adapting to life within it"

(D.C. Coleman and D.A. Crossley Jr., 1996)

"It is not a coincidence the best farm soils in North America are in the same approximate locale as our most replete and consumptive metropolises"

(Justin Isherwood)

"The voyage of discovery lies in not finding new landscapes, but in having new eyes"

(Marcel Proust, 1871 – 1922)

"Climate is what you expect; weather is what you get"

(Mark Twain, 1887)

IF

If you can keep your head when
All about you are losing theirs
And blaming it on you;
If you can trust yourself when
All men doubt you, but make
Allowance for their doubting too;
If you can wait and not be tired
By waiting,
Or being lied about,
Don't deal in lies,
Or being hated,
Don't give way to hating,
And yet don't look too good,
Nor talk too wise:
If you can dream...
And not make dreams your master
If you can think...
And not make thoughts your aim;
If you can meet with
Triumph and Disaster
And treat those two imposters
Just the same;
If you can bear to hear the truth
You've spoken twisted by knaves
To make a trap for fools,
Or watch the things you gave
Your life to, broken, and stoop and
Build 'em up with worn-out tools:

If you can make one heap of all
Your winnings and risk it in
One turn of pitch-and-toss,
And lose, and start again at your
Beginnings and never breathe
A word about your loss;
If you can force your heart
And nerve and sinew to serve
Your turn long after they are gone,
And so hold on when there is
Nothing in you except the Will
Which says to them: "Hold on!"

If you can talk with crowds
And keep your virtue or walk
With Kings...
Nor lose the common touch
If neither foes nor loving
Friends can hurt you,
If all men count with you,
But none too much;
If you can fill the
Unforgiving minute with sixty
Seconds' worth of distance run,
Yours is the Earth
And everything that's in it.
And... what is more...
You'll be a Man, my son!

Rudyard Kipling (1865 – 1936)

AIMS OF THE SOCIETY

The ESSC is an interdisciplinary, non-political association, which is dedicated to investigating and realizing 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.

Informing the public about major questions of soil conservation in Europe.

Collaborating with institutions and persons involved in practical conservation work in Europe.

The ESSC aims at co-ordinating 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.

Durch Information der Öffenlichkeit über wichtige Fragen des Bodenschutzes in Europa.

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 problemes 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

La ESSC es una asociación interdisciplinar, no-politica, dedicada a la investigación y a la realización de acciones orientadas a la conservación del suelo en Europa. La ESSC persigue sus objectivos en los sectores cientificos, educacionales y aplicados, en al ámbito europeo:

Promocionando la investigación sobre degradación, erosión y conservación de suelos.

Informanto al público sobre los principales aspectos de conservación de suelos.

Colaborando con instituciones y personas implicadas en la práctica de la conservación de suelos.

La ESSC aspira a coordinar los esfuerzos, en los temas arriba mencionados, de todas las partes implicadas: centros de investigación, profesores y estudiantes de geo-ciencias, agricultura, selvicultura y ecología, agricultores, servicios de extensión agraria, industrias e instituciones gubernamentales.

Visit the ESSC Website: http://www.essc.sk

MEMBERSHIP FEES

I wish to (please mark appropriate box):

- Join the ESSC
- Renew my membership of the ESSC
- Know whether I have outstanding membership contributions to pay

Membership rates:

Standard Rates:

- One year € 25.00
- Three years € 70.00

Institutional Membership € 15 per member per year.

Institutional membership involves the payment of a flat rate of € 15 (per member per year) for institutes/societies with at least 10 members. This fee is irrespective of the country.

Members of the specific institute or society would be full members of the ESSC and receive the ESSC Newsletter.

Students:

50 % reduction on above rates for three years
Your supervisor must provide written confirmation of student status

I wish to pay my membership contribution by (please mark appropriate box):

- Credit card (MasterCard, Visa)
- PayPal (from your personal PayPal account or with your credit card as a PayPal guest; send an e-mail to Wim.Cornelis@UGent.be and you will receive a money request)
- Bank Transfer (Branch address: Fortis Bank, Zonnestraat 2, B-9000 Ghent, Belgium; International transaction codes: IBAN – BE29 0014 5139 8064 and BIC – GEBABEBB ; Account name: European Society for Soil Conservation; Account number: 001-4513980-64)

CARD NO. ..... EXPIRY .....

Amount: € ..... Date: ..... Signature: .....

NAME: .....

ADDRESS: .....

.....

E-MAIL: .....

MEMBERSHIP NUMBER (if known): M0 .....

Please send this form to: ESSC Treasurer, Professor Dr Wim Cornelis
Department of Soil Management, Ghent University,
Coupure links 653, B-9000 Ghent, BELGIUM
Wim.Cornelis@UGent.be