Food and Agriculture Organization of the United Nations

GLOBAL SYMPOSIUM ON SOIL EROSION

15-17 MAY 2019 - ROME, ITALY

OUTCOME DOCUMENT

GLOBAL SOIL PARTNERSHIP

itps INTERGOVERNMENTAL TECHNICAL PANEL ON SOILS

Joint FAO/IAEA Programme Nuclear Techniques in Food and Agriculture

UNCCD SPI Science - Policy Interface

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An event co-organized by:

FAO | Food and Agriculture Organization of the United Nations
GSP | Global Soil Partnership
ITPS | Intergovernmental Technical Panel on Soils
UNCCD-SPI | Science-Policy Interface of the United Nations Convention to Combat Desertification
Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture

Food and Agriculture Organization of the United Nations
Rome, 2019

Required citation:

FAO, 2019. *Outcome document of the Global Symposium on Soil Erosion*. Rome.

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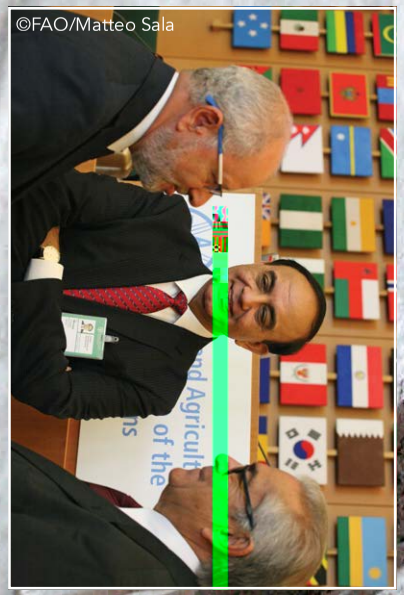
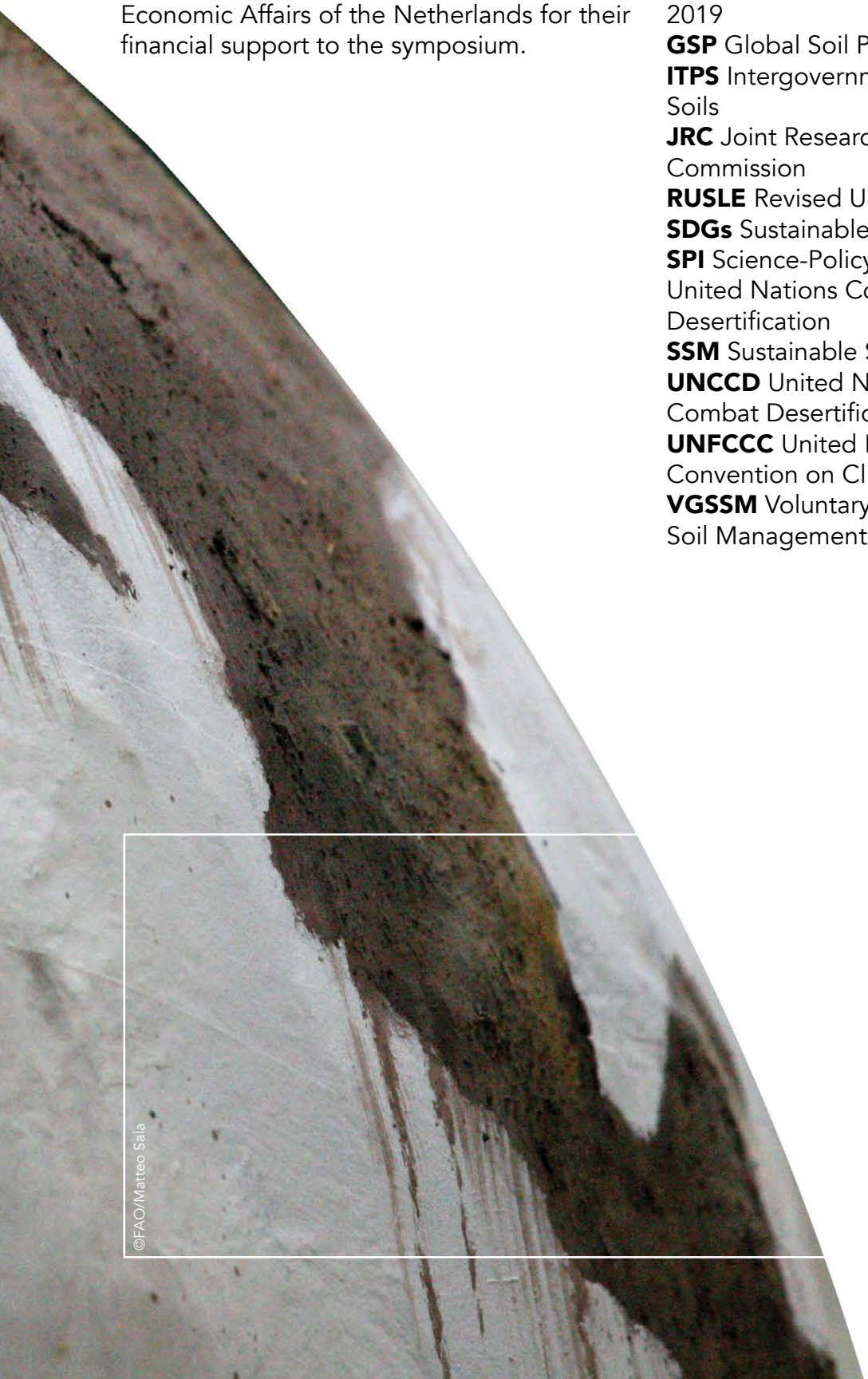


ACKNOWLEDGEMENTS

The Organizing Committee and the Scientific Committee express their sincere gratitude to member countries, institutions, and individuals for their important contributions to the success of the symposium. Sincere gratitude goes to the European Commission, the Ministry of Finance of the Russian Federation, the Swiss Confederation and the Ministry of Economic Affairs of the Netherlands for their financial support to the symposium.



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ABBREVIATIONS

EC European Commission
ELD Initiative Economics of Land Degradation Initiative
FAO Food and Agriculture Organization of the United Nations
GDP Gross Domestic Product
GIS Geographical Information System
GSER19 Global Symposium on Soil Erosion 2019
GSP Global Soil Partnership
ITPS Intergovernmental Technical Panel on Soils
JRC Joint Research Centre of the European Commission
RUSLE Revised Universal Soil Loss Equation
SDGs Sustainable Development Goals
SPI Science-Policy Interface of the United Nations Convention to Combat Desertification
SSM Sustainable Soil Management
UNCCD United Nations Convention to Combat Desertification
UNFCCC United Nations Framework Convention on Climate Change
VGSSM Voluntary Guidelines for Sustainable Soil Management

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SCIENTIFIC AND ORGANIZING COMMITTEES

This outcome document, "Stop soil erosion, save our future", was prepared and reviewed by members of the Scientific and Co-organizing Committees (see below) but does not necessarily represent the views of those bodies or their member states. This document is also based on and complemented by a book of proceedings, which presents extended abstracts of the various sessions.

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SUMMARY

The Global Symposium on Soil Erosion (GSER19) was jointly organized by the:

- Food and Agriculture Organization of the United Nations (FAO);
- Global Soil Partnership (GSP) and its Intergovernmental Technical Panel on Soils (ITPS);
- Science-Policy Interface of the United Nations Convention to Combat Desertification (SPI-UNCCD);
- Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture.

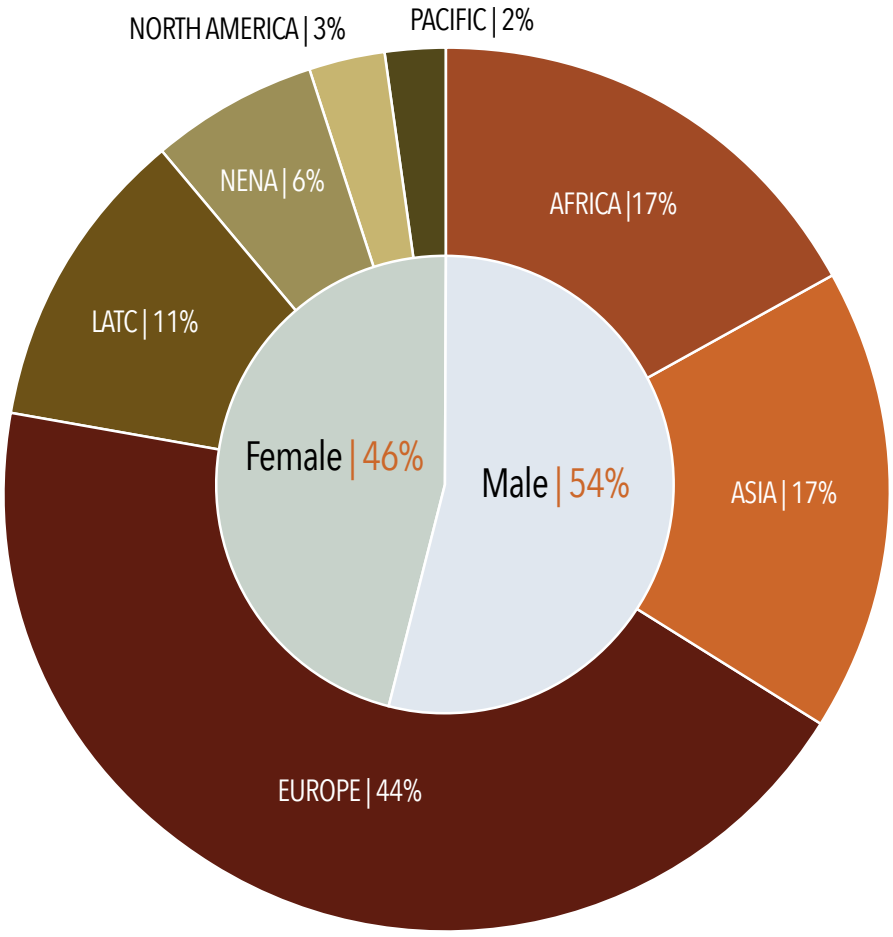
The symposium was held at the FAO headquarters in Rome, Italy, 15-17 May 2019 and attended by more than 500 participants (46 percent women, 54 percent men) from 104 countries, including representatives of FAO member states, organizing institutions, the academia, the private sector and civil society, farmers, as well as scientists and land users working on soil erosion and related fields.

The overall aim of the symposium was to gather available updated information and scientific knowledge on soil erosion with regards to: the causes; risks posed to food production and the environment; assessment, modelling and mapping; techniques to reduce and stop soil erosion, participatory research with farmers and regenerating soil health; policies implemented to limit soil erosion and its costs.

The three-day symposium was structured around three main themes focusing on: 1) Soil erosion assessment tools and data; creation, consolidation and harmonization; 2) Policies and practices in action to address soil erosion; 3) The economics of soil erosion prevention, management and remediation.

Participants engaged actively by presenting the results of the studies demonstrating: that soil erosion is a global threat; the main patterns of soil erosion in different countries and under various land uses; the challenges of monitoring and obtaining data (especially for wind and tillage erosion); the challenges to halt soil erosion, and not only control or manage it; the challenges of implementing sound policies to address soil erosion; the interconnection between soil erosion and the other soil threats (e.g. loss of fertility and soil organic carbon, soil pollution); and ultimately the needs of dialogue and site-specific solutions to be implemented at local scale. The recommendations presented in this document aim to support the development of policies and actions to encourage the implementation of soil management and land use planning strategies that enhance the prevention, minimization and remediation of soil erosion, through the promotion of sustainable soil management (SSM).

GSER19 | STATISTICS OF ATTENDANCE



BACKGROUND OF THE GLOBAL SYMPOSIUM ON SOIL EROSION

Soil erosion is one of the ten major soil threats identified in the 2015 Status of the World's Soil Resources report (FAO and ITPS, 2015) and subsequently addressed in the FAO's Voluntary Guidelines for Sustainable Soil Management (VGSSM) (FAO, 2017). Soil erosion is defined as the net long-term balance of all processes that detach soil and move it from its original location through three major pathways: water, wind and tillage (FAO, 2019). Erosion hampers the provision of many vital ecosystem services normally provided by healthy soils (Adhikari and Hartemink, 2016).

Soil erosion, though, is a natural process that is part of soil and landscape formation and evolution, it is significantly accelerated by human activities such as removal of vegetative cover, down-slope tillage, overgrazing, etc. (Borrelli *et al.*, 2017). Climate change, land levelling, continuous mechanical tillage of agricultural land, some land use changes, deforestation, amongst others, are leading drivers of accelerated soil erosion with consequences of extreme events such as landslides, increased emissions of greenhouse gases and soil organic carbon losses (Borselli *et al.*, 2006; Lal, 2019).

Soil erosion negatively impacts agricultural food production, water quality, and the environment in general. On farmlands, soil erosion reduces soil water infiltration capacity, moisture availability, drainage capacity, plant rooting depth, and loss of soil nutrients. The displaced soil particles from eroded sites cause sedimentation and pollution of surface water storage, blockage of waterways, and destruction of infrastructures (Lal, 2017). Therefore, our ability to feed and live in an ecologically stable environment now and in the future will depend on our ability to reduce and further reverse the rates at which our soils are currently eroding (Poesen, 2018).

Control and prevention of soil erosion is key to combating climate change and contribution towards Sustainable Development Goal (SDG) 13, UNFCCC COP23, and the Koronivia Decision. Adopting erosion-prevention and remediation measures is also directly linked to the achievement of many of the other SDGs such as SDG 2 on "Zero hunger", SDG 3 on "Good health and well-being", SDG 4 on "Life below water", SDG 6 on "Clean water and sanitation", SDG 13 on "Climate Action", and SDG 15 on "Life on land". In addition, implementation of erosion-control practices in the industry and production sectors can contribute to the attainment of SDG 9 on "Industry, innovation and infrastructure" and SDG 12 on "Responsible production and consumption". Already, soil erosion constitutes to the sub-indicator of the SDG 2.4 (target 2.4.1) (United Nations, 2015).

The overall aim of the symposium was to review the current state of scientific knowledge on soil erosion and its effects on food production, the environment, and the economy. The symposium also aimed to build scientific evidence to support actions and decisions to stop soil erosion for increased food safety, food security and nutrition, ecosystem services and the overall life on earth, in line with the SDGs.

Specifically, the objectives of the symposium were to:

1. Identify options to consolidate, generate and harmonize soil erosion data and assessment tools for promoting their use in decision making at all levels;
2. Review and discuss existing national and international policies, agreements and frameworks addressing soil erosion prevention, management and remediation in order to assess their effectiveness and propose ways to enhance them;
3. Critically reflect on the economics of soil erosion paying attention to which SSM practices are cost effective and which others not and why, investigating options for measures that do not give a short/medium term financial benefit; and
4. Advocate for an agenda for action to prevent, mitigate, monitor soil erosion, and regenerate soil health.

SYMPOSIUM THEMES, KEY QUESTIONS AND DISCUSSION SUMMARY

The symposium's three main themes were designed to focus discussions on:

1. Soil erosion assessment tools and data; creation, consolidation and harmonization
2. Policies and practices in action to address soil erosion
3. The economics of soil erosion prevention, management and remediation

The aim of the interactive discussions was to develop conclusions and recommendations, based on the scientific evidence presented, on the way forward to prevent and minimize soil erosion. The identification of weaknesses in knowledge and regulations has led to the definition of a line of work for the future. In the lead-up to the symposium, key questions were developed as well as expected outcomes to the symposium, for each theme, to stimulate discussion and help in identifying priority actions. Presentations in parallel sessions set the scene for debating the thematic questions, and interactive discussions. Small workshops were held on the morning of the last day to develop answers, and to propose a timeline to achieve the expected outcomes of the symposium. Due to the nature of the questions and the complexity of soil erosion, concrete and simple answers were not always possible to find based on discussions only. As a result, discussions were focused on the ultimate actions implied in each question, also in what needs to be considered to develop appropriate answers.

The GSER'19 themes and subthemes are listed in the next section, with brief summaries of their importance, followed by another summary of the main discussion points on each theme, as agreed through consensus by participants during the interactive discussion sessions. Even if treated separately in this document, it should be emphasized that the three themes are interrelated.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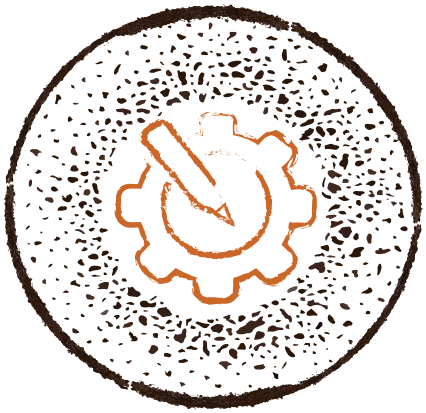


THEME 1: SOIL EROSION ASSESSMENT TOOLS AND DATA; CREATION, CONSOLIDATION AND HARMONIZATION

There has been much research carried out in recent decades to better understand the mechanisms and spatial distribution of soil loss by water erosion and, to some extent, by wind and tillage. Although some significant progress has been made with regard to large-scale assessments of some water erosion processes (Borrelli *et al.*, 2017; Van Oost *et al.*, 2007), the lack of comprehensive information about global soil erosion dynamics forces both decision-makers and the scientific community to resort to pioneering studies carried out during the late 1980s and early 1990s such as the United Nations Environment Programme's (UNEP) project on Global Assessment of Soil Degradation (GLASOD) (Oldeman, 1994).

Key questions

1. What are the current deficiencies in the current methods/models for assessing and mapping soil erosion? What is the role of the web and mobile technologies?
2. What soil erosion assessment outcomes and decision-making tools for soil erosion control are available and how can these be improved, taking into consideration the issue of inconsistencies in methods and uncertainties in results?
3. Why do we need a global assessment of soil erosion and can such assessment be the baseline for a global monitoring system?
4. How can information products (e.g. maps and reports) be concretely used in controlling soil erosion and in prioritizing areas of intervention?

Discussion summary

Most of the speakers of the technical sessions of the GSER19 targeted water erosion during their talks. This reflects current research which is mostly oriented on water erosion processes rather than wind and/or tillage. This does not mean that the other types of erosion are less important, especially when we know that tillage erosion rates often exceed water erosion rates in croplands. Tillage erosion is a major cause of moderate to high rates of soil erosion and should be the focus of future soil conservation efforts. Wind erosion is also a serious threat to natural environments, especially in arid zones that cover 47 per cent of the earth. A specific problem highlighted during the discussions are dust storms that are caused by wind erosion. Other types of erosion identified as major concerns that need extensive research are gully (ephemeral and large) erosion, soil loss due to root-crop harvesting, and subsurface erosion. In addition, streambank erosion or coastal erosion which locally are also a serious problem in the advent of climate changes require specific research. Finally, in agricultural land, research is still needed to define more precise ranges of soil erosion. Erosion in agricultural land deserves special attention as it causes the greatest loss of soil fertility, due to the drag of soil colloids.

Further, discussions stressed that modelling should not replace field observation and measurements. Although modelling is commonly preferred at large scales, there are concerns about availability for validation data. There were also insights into the new devices and technologies used for precision agriculture such as drones could allow cost-effective data validation. Such opportunities permit a great quantity of measurements in both large and small scales (e.g. gully erosion). Participatory approaches are also needed to get field data and raising farmers' awareness of the problem of soil erosion. More than

providing data, using bottom-up approaches in erosion data validation contributes to farmer's awareness raising, and acceptation of sustainable soil management (SSM) practices on field. Moreover, in any study, uncertainty levels should always be known in order to define the accuracy of models and/or maps.
A last challenge concerns the establishment of integrated models, which remain very complex and so far, most available models consider single processes. For example, most presentations addressing water erosion estimates were based on the use of RUSLE (Revised Universal Soil Loss Equation). RUSLE is underpinned by over 40 years of extensive use, ground-truthing, and research, and provides a useful basis for modelling soil erosion, particularly in cropping systems. However, RUSLE is only valid for obtaining sheet and rill erosion estimates. Gully erosion and high slope areas are not represented in the model. There were multiple opinions given by the participants regarding the need for gully erosion estimates – ephemeral gully estimates as well as that for traditional large gullies. This was highlighted as a major gap in water erosion research. At larger scales, integrated modelling for soil conservation management and planning purposes must consider the integration of wind, water and tillage erosion modelling. On cultivated lands, tillage erosion operates and interacts with wind and/or water erosion.
Discussions led to the conclusion that both global and local data were needed for different outcomes. All soil erosion models used to affect soil management are designed to operate at the local scale (hillslope, fields). However, it is also necessary to assess the extent of soil erosion at larger scales for policy and programming purposes. This necessity requires the aggregation of model outputs at provincial, national, regional and global scales. FAO can contribute to global data creation and make authoritative assessments that are regularly updated. Getting accurate, harmonized and global data can create incentives to the governments to develop sound policies applicable to farmers. Also, as soil erosion is a transboundary issue, collaboration of neighbouring countries is needed. In this regard, there is a need to develop standards to harmonize the data produced in order to compare erosion levels between different boarder areas. Currently, there are many models using different approaches making it difficult to make comparison between studies.
A global assessment of soil erosion will target policy makers at the global and national scales, farmers, local governments and non-governmental organizations at the local level. A particular attention should be taken in order to properly communicate the results to farmers and land users, as well as policy decision-makers. However, communication should be tailored according to the needs of the targeted audience. For farmers, the message needs to be pragmatic (avoiding formulas), but assessments cannot be based only on empirical methodologies. Also, links must be made between soil erosion, economic returns, crop productivity and soil quality. To reach policy- and decision-makers at the global and national level, assessments should first match their concrete needs, which are very demanding on data and information. In both cases, the complexity of the questions asks for providing holistic information. Thus, current research should focus on getting data where there is none, thus targeting research gaps (e.g. data on wind erosion, tillage erosion, mining activities or land levelling). This would enhance the accuracy and allow validation of maps. Then, links should be made between the impacts of soil erosion and food security. This could be made by linking soil erosion with the carbon cycle, soil fertility, crop production and water quality. Also, erosion risk maps should link to the associated costs at the global and national scale. Improved understanding of the costs of erosion would help foster land development plans and highlight the benefits of erosion prevention actions at the local level. Finally, the importance of adopting soil erosion as an SDG 15.3 indicator[1] was raised.

[1] Target 15.3 : By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

THEME 2: POLICIES AND PRACTICES IN ACTION TO ADDRESS SOIL EROSION

Worldwide, soil erosion is recognized as one of the biggest soil threats (FAO and ITPS, 2015), addressed in the VGSSM (FAO, 2017) and constitutes a sub-indicator to the SDG 2.4 (target 2.4.1). Presenters in Theme 2 on Policies and Practices reported a variety of examples of national soil erosion policies, laws or plans, based on incentives such as subsidies, or using regulation with enforcement based on fines. Examples of both bottom-up participatory approaches and top down approaches were presented. In some cases, soil erosion control was also targeted by other policies, not specific on soil erosion, and it was noted that policies can sometimes have little link between them, or worse, be contradictory. Erosion prevention policy implementation ultimately relies on the final land-user, i.e. in most cases the farmer or the land-owner. Implementation of sustainable soil management practices at farm scale remains a challenge due to lack of awareness and information on the best practices, and the benefits of their use. Participants unanimously, recognised a clear need of strong action to raise awareness of the economic, production, and environmental costs of soil erosion in the general public, stating that "People are a mirror of the land they live on".

Key questions

1. Which erosion control measures or practices have proven to be effective?
2. Which policies are currently being implemented and used to enhance erosion prevention, remediation, or mitigation practices by land managers?
3. What are the current policy gaps, challenges and opportunities for the effective implementation of erosion prevention, remediation, or mitigation?
4. Where a lack of legislation is identified, which policies could be introduced to effectively implement soil erosion prevention, remediation, or mitigation measures?
5. What are the most useful means of converting erosion prevention, remediation, or mitigation policy into practical action?

Discussion summary

Overall, soil erosion in agricultural lands is mainly due to unsustainable soil management (e.g. overgrazing, monocropping, deforestation, nutrient mining, etc.) and land use practices that disturb the soil and leave it exposed to agents of erosion. Most solutions to combat soil erosion are already well-known; they are multiple and site-specific. In many cases, soil erosion has been existing and dealt with for a long period, such as shown by the adoption of anti-erosion practices by the Mayan civilization, more than 2 000 years B.C. Discussions enhanced the need to take into account the traditional and indigenous knowledge, as well as scientific information to prevent and/or remediate soil erosion.
General solutions have been already presented in the VGSSM (FAO, 2017), but the solutions need to be implemented and adapted to meet site-specific needs at the local scale, there is not only one solution and not all conservation techniques are viable or efficient in every case. For example, terraces or agroforestry in some areas may not provide the desirable return to farmers. In addition, with climate change, an increase in the frequency of extreme events is expected.

There is a need to design practices for more frequent and intense storm events than may have been previously experienced in some geographical zones. A major challenge is to get policies implemented in regions and countries that currently lack appropriate measures to prevent, remediate or mitigate effects of soil erosion.

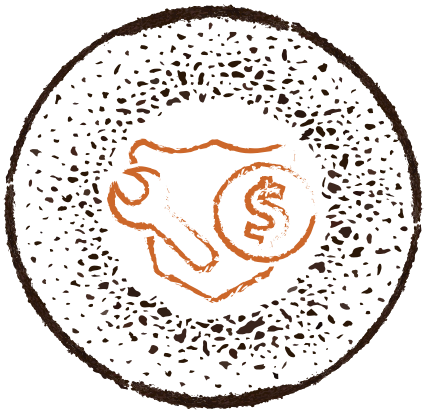
In spite of many well-established methods to prevent, remediate or mitigate soil erosion, implementation may be limited due to lack of; (1) incentives, (2) short-term returns to farmers, and/or (3) awareness of the risks caused by soil erosion. In some instances, there is less motivation to prevent soil erosion as it does not always immediately translate into a loss of productivity (especially were agriculture is based on high-inputs), only when passing a tipping point will the effects become obvious and concerning. For example, in Europe, soil erosion has no significant impact on yields as any effects of erosion is masked by high inputs of fertilisers and use of irrigation.

Integrated approaches to managing all forms of soil erosion are necessary to halt soil loss and restore eroded soils. For example, in water-scarce areas, implementing sustainable soil management practices such as cover crops, to avoid bare-ground fallow can create competitive use of water with crops that are often faced with water limitation for growth. Filling gullies to restore eroded soil can be an option for young gullies/gully head and rills, but the materials used should never be polluted (e.g. trash or waste). Other soil threats should also be addressed, such as soil compaction which can lead to soil erosion. Thus, approaches to control erosion need to be defined in a holistic manner.

Policies should be defined both at farm and catchment scales to deal with the on-site and off-site effects of soil erosion. It is critical that scientists and policy makers understand the everyday realities of farmers, appreciate their concerns and consider the local knowledge. Furthermore, expressing policies in simple local language could help to fulfil the gap between scientists, politicians, and the land users who will ultimately need to implement the required measures. Most research results are presented in papers written in English and are generally available only to those who can subscribe to journals or to readers with the academic knowledge to understand the information. Moreover, most policies worldwide are not defined by English speakers and are implemented by land users whose language is not English and who do not have direct access to scientific or policy documents.

Land tenure is a critical point for successful policy implementation. Farmers with insecure land tenure are not willing to invest in SSM unless it is subsidised and/or compensated for. Indeed, the benefits for investing in sustainable soil management are usually visible after many years of implementation.

To be implemented correctly, SSM practices should be simple and cost-effective to ensure a maximum impact to farmers. The shifting in practices will be adopted only if farmers are willing to do so, therefore they need to be well-informed and aware of the benefits of SSM practices. Hence, the use of participatory approaches in policy development are an important lever to foster the change in attitude and to scale up the implementation of SSM. Raising awareness among farmers should be the first step, and the second to help farmers find the best adapted solutions for their specific situation and needs. It was a consensus among the participants that - one solution does not fit all.



THEME 3: THE ECONOMICS OF SOIL EROSION PREVENTION, MANAGEMENT AND REMEDIATION

Soil is a natural capital that provides a range of ecosystem services (Adhikari and Hartemink, 2016). Soil erosion directly affects the provision of agricultural and environmental benefits. Development of mitigation strategies to decrease soil erosion could reduce social costs and increase the overall ability of the soil to provide ecosystem services. Many presentations demonstrated the multi-faceted benefits of sustainable soil management.

According to the Ecosystem Services Partnership, "an important reason is that money spent on nature conservation, landscape restoration, and sustainable land management is still seen as a cost and not as an investment with a high return in benefits: ecological, social and economic". The characterization and quantification of the costs of soil erosion and the costs and benefits of soil erosion prevention practices are therefore important to inform policy makers and to foster investments in erosion-control and reversing projects. Some leading projects are already working on assessing the economic cost of land degradation (ELD initiative), or ecosystem services (Ecosystem Assessment and Rating system), and many economic investigations have been performed to assess the cost-benefits of soil erosion at national level, but at global level, such studies are still challenging. Policy and investment actions are tightly connected, some points, especially concerning the use of incentives were discussed in Themes 2 and 3. Such quantification is also crucial at farm scale, given that prevention, management and remediation necessarily are actions taken by land managers. The quantification of the economics of soil erosion and soil erosion control at farm scale should be expressed in terms that are meaningful to farmers – production and profit.

Key questions

1. What are the associated costs of soil erosion for agriculture, based on the cost of one ton of soil loss?
2. What are the direct costs associated with loss of soil (either qualitative of quantitative) for the supply of agricultural services and the indirect costs to the environment and human infrastructures?
3. Are the costs of implementing soil erosion control practices offset by current and future benefits of more, or more profitable, production?
4. What technologies, innovations or approaches exist to decrease the costs of implementing soil erosion control practices compared to that of conventional soil management?

Discussion summary

Most presentations concluded that reducing erosion could be cost-effective and that modelling is needed. Numerous challenges are faced when speaking about economic modelling of soil erosion costs and benefits of erosion control. First of all, in many models, the large-scale impacts and the associated costs of soil erosion are not considered. Secondly, economic costs and benefits are difficult to simulate with precision due to complexity and number of variables. In addition, socio-economic and physical data are often considered separately although they should be considered together in order to obtain more integrated models. Thirdly, many empirical relationships are used in economic models. The challenge is to find the most appropriate model in a given region. Climate change is also adding uncertainties

to economic models and although climate change is a factor that will keep affecting soil erosion its effects are difficult to estimate. In addition, most studies were performed at national or local scale, and there is lack of harmonization in the indicators to allow proper comparison between the investigations. The issue of harmonization was also discussed in Theme 1. Finally, if in most cases on-site consequences are recognised, they are also very challenging to assess economically. The lost crop production is not well documented, making it very difficult to assess a cost to soil erosion.

Knowledge on the costs of soil erosion and benefits of soil erosion control could inform and support governments in the definition of adapted incentives to convince and motivate farmers to adopt SSM practices. There are still ongoing debates on the right incentives to be used (also addressed in Theme 2): subsidies or penalty ("carrot or stick")? Participants concluded that the most effective systems would have a combination of incentives and penalties. The latter would not be appropriate in most developing countries and may be difficult to implement in general.

Some discussions also highlighted the need for payments to farmers for ecosystem services in order to compensate them for producing externalities for society. The difficulties in quantifying environmental benefits in monetary terms should not be an excuse for not providing incentives to the farmers. However, the relevance and application of such payments are still highly debated amongst the scientific and farming community.

In any case, soil restoration may take a long time and the time-frame to get benefits back is highly dependent on practices, location and climate conditions. The socio-economical changes during this period also determine the final cost-benefit balance of the practices. There is a need to help farmers with the right incentives from the beginning. They also need to be compensated for measures taken in the short term that will provide for long term benefits.

Many certifications and eco-labels exist that recognise farmers to adopt a certain number of SSM practices, with the aim of providing a marketing, and potentially a pricing advantage. Certification or eco-label approaches need to be scientifically robust, comprehensive, and assessed by an independent third party.

At the international level some voluntary and industry standards support erosion control (e.g. the VGSSM), but no binding and authoritative instruments exist to make correct implementation. In addition, countries have many other priorities and may tend to neglect land and soils. Policy makers need to be convinced of the benefits from ensuring SSM. Speaking only about negative aspects and losses is not enough.

In general, the highest productivity loss on agricultural lands occurs where erosion rates are highest, and the highest economic loss occurs when agriculture contributes to a high percentage of the GDP. Thus, differences across countries do not only depend on erosion rates but also on the relative importance of agriculture in the country's GDP. In the end, countries that have less soil loss will develop a competitive advantage as production increases. This should be an additional incentive to foster the adoption of SSM by governments.

Many patterns show that land demand increases in response to soil erosion and the loss of productivity. At the global level, agricultural production does not increase on a given area. However, the increase of demand often leads to land conversion to agriculture especially from forested or rangeland areas. These conversions are considered inappropriate as they represent a major driver of soil erosion. If the right SSM practices are not implemented to stop soil erosion on the long term, economic losses may continue because land remains degraded, thus land conversion to extend agricultural areas continues. There is an urgent need to halt soil erosion and get soil health and agricultural productivity back.

RECOMMENDATIONS

THEME 1: SOIL EROSION ASSESSMENT TOOLS AND DATA; CREATION, CONSOLIDATION AND HARMONIZATION

Expected outcome

The specific outcome for theme 1 was to propose a country driven process to produce a Global Soil Erosion Map (GSERmap) which would be able to include the three major soil erosion drivers (water, wind and tillage) following a multi-phased approach, with:

- **Phase 1:** Global scale products that are globally consistent, thus allowing for comparison between geographic regions and for identifying hotspots
- **Phase 2:** National scale products that will follow a semi-standardized and uniform methodology allowing the incorporation of available national data
- **Phase 3:** National scale products based on field or on-screen visual interpretation of soil erosion signs achieved through monitoring programs

Recommendation 1

Create an expert and multi-stakeholder working group to develop the methodology and guidelines for the preparation of the Global Soil Erosion map

Proposed calendar of action is the following:

- 2019 – Phase 1 (Top-down): The global soil erosion sensitivity maps (water, wind and tillage) will be prepared using global datasets to be used for identifying hot spots. These maps will explore the spatial pattern of potential soil erosion sensitivity globally, identifying possible hot spots and allowing comparisons among different geographical areas.
- 2020 – Phase 2 (Country-driven): National scale maps describing soil erosion risk to the best of the country knowledge, available methods and input data. This can be done by combining the harmonized global soil erosion sensitivity maps with high detail national information on land use, land management practices, tillage operations (tillage intensity) and land use pressure indices derived by remote sensing data.
- 2021 onwards - Phase 3 (Action on the ground): While the first and second level products would provide information useful for global and national-scale analyses for eventually designing conservation practices, the third level product approach will generate new information on the occurrence of various soil erosion processes or adding information at the frontiers of tools and methods.

Recommendation 2

Organize capacity development and training for countries to develop national soil erosion assessment, as well as the necessary data management and monitoring facilities

This applies to all FAO member countries in need of such capacity. Priority should be given to countries lacking national information on soil erosion and using global datasets with focus on areas where data is missing. Developing monitoring systems for water, wind and tillage erosion would enable countries to obtain proper data and reduce the uncertainties and inaccuracy in existing global data.

THEME 2: POLICY AND PRACTICES TO ADRESS SOIL EROSION

Expected outcome

- Build a database on the best erosion control practices implemented according to regional contexts;
- Establishment of an action plan to support the formulation, implementation, and monitoring of soil erosion control policies;
- Provide SoiLEX[2] with a collection of analysed effective policies to control soil erosion;
- Analyse major gaps on the development and implementation of soil erosion control policies at global, regional and national levels.

Recommendation 3

to establish a working group to develop a database of good practices for addressing soil erosion control

The obtained information will complement the ongoing work made by the GSP Secretariat and its partners on the elaboration of a database detailing the best SSM practices according to the ten soil threats addressed in the VGSSM. The database will need to ensure the best available practices and participation from farmers. It should include testimonies and case-studies. It should be based on existing tools such as the WOCAT database (WOCAT, 2019), which should be completed and adjusted to match farmers and land-users' demands.

Recommendation 4

to implement an action plan on the assessment of effective policies and practices to control soil erosion and to analyse major gaps on the development and implementation of soil erosion control policies at global, regional and national levels

A region-specific strategy will be developed, promoted and implemented starting in 2019. The agenda will be developed based on country's participation. The agenda of action will cover different steps such as:

- the development and launch of a global questionnaire to assess legal instruments and management practices in countries. The global questionnaire will be provided to all national GSP focal points who should forward it to all national relevant bodies. Data gathered will contribute to feed the SoiLEX database and will enable identification of the needs and best actions to implement, based on national contexts. Identifying the main national weaknesses and strengths in soil erosion prevention and mitigation is the first step in establishing a work plan, focusing efforts on weaknesses and promoting knowledge transfer between regions;
- the compilation of results and analysis of the regional situation. More than focusing only on successful policies, insights should be made on major policies that contribute to soil erosion acceleration, in order to get the complete overview and representation of the global and regional context;
- the development of policy briefs or any other relevant document to raise awareness of the legal instruments and practices needed for each identified context or region;
- the implementation of awareness-raising activities through multi-stakeholders training, workshops and educational material in collaboration with Regional Soils Partnerships;
- the development of participatory programmes such as the Soil Doctors[3] to assist local action.

[2] SoiLEX is an online database based on the already existing FAOLEX (http://www.fao.org/faolex/en/) expected to be launched by mid-209. SoiLEX will gather all existing legal instruments directly linked to soils available on FAOLEX. Information will be gathered according to relevant topics, including the ten soil threats presented in the VGSSM.

[3] The Soil Doctors is GSP initiative consisting in a farmer-to-farmer training system that aims to build the capacity of smallholder farmers on the practice of SSM and support governmental agencies and organizations working on agricultural extension at the field level (promoting broader impact and a reduction of costs), more information available on http://www.fao.org/global-soil-partnership/pillars-action/2-awareness-raising/soil-doctor/en/.

THEME 3: THE ECONOMICS OF SOIL EROSION PREVENTION, MANAGEMENT AND REMEDIATION

Expected outcome

The expected specific outcome for theme 3 is to propose a cost-benefit analysis of erosion and erosion prevention, remediation, and mitigation practices, following a tiered approach, with:

- **Tier 1:** Guidance for evaluating costs of erosion and economic assessment of soil erosion management practices as a flowchart;
- **Tier 2:** Erosion-specific template providing an on-line (and off-line) tool and guidance for calculating the cost-benefit of erosion management activities in their specific situation

Recommendation 5

Implement a global study on the economics of soil erosion and soil erosion control as a first contribution to the ongoing initiative on the economics of Sustainable Soil Management

At the Sixth Plenary Assembly of the Global Soil Partnership, countries requested for the launch of a global study on the economics costs and benefits of SSM. Leading a global study on the economics of soil erosion should be the first step to define a clear methodology to carry out an economic assessment of the costs of erosion and benefits of control measures, further extendable to SSM. The work should involve all country's inputs, be led by countries and for countries with the support of the Global Soil Partnership. The methodology should be based on the recommendations made during the GSER19, i.e. (1) implement a global review and assessment of the ongoing works on the topic (e.g. the Economics of Land Degradation (ELD) initiative, ongoing works with the Joint Research Centre of the European Commission (JRC)), (2) identify the gaps and best indicators to elaborate the Tier 1 approach. Concerning the Tier 2 approach, proposals and case-studies should also be country-driven. The economic assessment should eventually be understandable and accessible to all stakeholders.

Recommendation 6

Facilitate and support multi stakeholder dialogue by creating a multi stakeholder platform to inform and advise on the best approaches and strategies to implement soil erosion control activities at all scales and their benefits, contributing to fill gaps between science, policy and land-users.

The multi-stakeholder platform will complement the ongoing work of the GSP secretariat, with the objective of informing and sharing knowledge on the best strategies to adopt to communicate studies results, adapted to different targets (farmers, policy-makers). The multi stakeholder platform would also facilitate the access to information in national networks (farmer's organizations, governmental bodies, etc.).

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CONCLUSIONS AND WAY FORWARD

The GSER'19 brought together experts engaged in activities with FAO, the GSP and its ITPS, the UNCCD-SPI and the Joint FAO/IAEA Programme on Nuclear Techniques in Food and Agriculture, together with independent scientists, policy makers and land managers. Their common goals were soil erosion assessment and modelling, prevention and control, as part of an overall sustainable soil management strategy and the global agenda for sustainable development and food security. Scientists from around the globe were active in presenting the results of studies describing the risks posed to food security, biodiversity and the environment, addressing the challenges of getting data (especially for wind and tillage erosion) reversing soil erosion rather than solely halting it; and discussing and developing key messages as reflected in this document. UN members and especially their policy advisors and decision-makers are encouraged to use this outcome document and to implement the recommendations at national and local levels.

Experts at the symposium concluded that there is convincing scientific evidence that soil erosion is a global threat to food production systems, available land for future demand, rural livelihoods, human health and biodiversity; and that coordinated effective action needs to be fostered and accelerated to address this issue.

The symposium provided scientific evidence that soil erosion is accelerated by anthropogenic actions such as deforestation and improper agricultural management but also by mining activities, or land levelling amongst the main causes. Research gaps, and the lack of data, especially towards the assessment of wind and tillage erosion, demonstrated the need to provide a relevant and scientifically sound global assessment of soil erosion. One of the main conclusions from the symposium is that soil erosion is a global and well-known issue that needs to be addressed at various scales. Soil erosion is a complex issue, as it has both on-site and off-site consequences. It makes it challenging to assess, especially economically. Soil erosion consequences are often not recognised in the case of high-input agriculture where erosion does not necessarily lead to measurable productivity loss in the short term. However, in the longer-term erosion consequences are devastating for the society and the associated costs may be tremendous, with consequences including crop production decline and, in extreme cases, land abandonment and human social disruption.

In the current context of population increase and climate change, natural areas become scarcer and stopping soil erosion and retrieve land productivity are necessary to avoid further inappropriate land conversions. Urgent action is needed from governments to support farmers and land-users in the transition, and crucial action is needed at global level to raise awareness of the importance of healthy and productive soils, to ensure a sustainable future and the achievement of many of the SDGs targeting hunger, water quality, and life on land, amongst others.

Soil erosion is a general acknowledged as not a new issue. It occurs globally, from grasslands, to coastal areas, to agricultural lands and natural forests. For this reason, addressing soil erosion requires joint efforts from all stakeholders. The prevention and reversal of soil erosion to maintain soil health should be a top priority worldwide, as the consequences for food security and loss of the remaining available natural lands are enormous. Since the beginning of agriculture, local knowledge and indigenous practices have contributed to maintaining healthy soils, but most soils have been eroded above their formation rate due to intensive agriculture and unsustainable soil management. We must consider local knowledge and indigenous practices, as well as the information from scientific studies. Improved land tenure should be a top priority as land security facilitates the willingness of farmers to undertake longer-term planning and thus foresee the benefits of implementing SSM practices.

The VGSSM were developed in an inclusive

process and approved by FAO member countries. The VGSSM provide the general ideas but need to be adapted and implemented at national scale in order to efficiently impact soil erosion. The general ideas provided by the VGSSM are:

- Land use changes such as deforestation or improper grassland-to-cropland conversion that cause removal of surface cover and loss of soil carbon should be avoided or carefully planned and appropriately implemented if unavoidable;
- A cover of growing plants or other organic and non-organic residues that protects the soil surface from erosion should be maintained through implementation of appropriate measures such as mulching, minimum tillage, no-till by direct seeding with attention to reduced herbicide use, cover crops, agro-ecological approaches, controlled vehicle traffic, continuous plant cover and crop rotation, strip cropping, agroforestry, shelter belts, and appropriate stocking rates and grazing intensities;
- Erosion by water on sloping and relatively steep lands should be minimized by measures that reduce runoff rates and velocity such as strip cropping, contour planting, crop rotation, intercropping, agroforestry, cross slope barriers (e.g. grass strips, contour bunds and stone lines), terrace construction and maintenance, and grassed waterways or vegetated buffer strips;
- Where appropriate, riparian buffers, buffer strips, wetlands, water harvesting and cover crops should be used/installed to minimize export of soil particles and associated nutrients and contaminants from the soil system and protect the downstream areas from damaging impacts; and erosion by wind, including dust storms, should be minimized and mitigated through vegetative (trees and shrubs) or artificial (stone walls) wind breaks to reduce wind velocity.

One of the key activities of the GSP after the symposium will be the compilation of the GSERmap, using a country-based participative approach with harmonized specifications. In conjunction with this activity, it was recommended to establish a working group of soil erosion experts under the auspices of the GSP. The purpose is to facilitate collaboration among key scientific stakeholders, advisory panels and implementation bodies to develop feasible and regionally contextualized guidelines for measuring, mapping and monitoring water, wind and tillage soil erosion. Technical support will be given to countries to increase capacity in the data acquisition, data processing and soil erosion modelling.

The development of a policy calendar for action to start after the symposium will be useful for translating scientific evidence into accessible language to support decision-making by member countries. Success stories, current threats to implementation, and real-life examples of practices with greatest chances of success would be the most effective. To achieve large scale implementation of soil erosion control and SSM, the scientific community, policy and decision makers, land-users and farmers, and extension services should engage in a participatory, interactive and iterative communication process. Extension services are crucial for bringing recommended management practices to users such as through the Soil Doctors Programme[4]. Raising awareness of the benefits for landowners and the wider society to stop soil erosion is essential to ensure a sustainable future.

This outcome document "Stop soil erosion, save our future" will be submitted through appropriate channels, at the 14th Conference of the Parties (COP 14) of the UNCCD and the GSP Plenary Assembly.

[4] http://www.fao.org/global-soil-partnership/pillars-action/2-awareness-raising/soil-doctor/en/

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GLOBAL SYMPOSIUM ON SOIL EROSION

#StopSoilErosion

http://www.fao.org/about/meetings/soil-erosion-symposium

The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

THANKS TO THE FINANCIAL SUPPORT OF

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