GSPPA-IV/16/Report

Fourth Meeting of the Global Soil Partnership Plenary Assembly

Rome, Italy, 23-25 May 2016

Food and Agriculture Organization
of the United Nations

GSPPA-IV/16/Report

REPORT OF THE FOURTH MEETING OF THE PLENARY ASSEMBLY OF THE GLOBAL SOIL PARTNERSHIP

Rome, 23 – 25 May 2016

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2016

Contents

Opening of the Session

The fourth meeting of the Plenary Assembly (PA) of the Global Soil Partnership (GSP) was held in Rome at FAO headquarters on 23-25 May 2016 (the list of participants is attached in Annex I).

The Assembly was chaired by Mr. Mahmoud Hasan Al-Ferihat (Jordan) with Mr. Victor Chude (Nigeria) acting as Vice-chair and Mr Thomas Reinsch (United States) as Rapporteur.

Mr. Ren Wang, Assistant Director-General for Agriculture and Consumer Protection, welcomed participants on behalf of the FAO Director-General, Jose Graziano da Silva. He highlighted that, after a successful International Year of Soils in 2015, FAO is still fully committed to implement actions towards sustainable soil management (SSM) under the GSP. Following the endorsement of the World Soil Charter by the FAO Conference and the launch of the Status of the World's Soil Resources report in 2015, the GSP was able to support more effective cooperation and action in the fight against soil degradation and for the cause of SSM. Within the context of active implementation of concrete actions needed at country level, he expressed gratitude to all current GSP resource providers, notably the European Union, Switzerland, Kingdom of Thailand, Russian Federation, Germany, and the Eurasian Food Security Centre from Russia.

The Assembly appreciated the keynote address by Ms. Ismahane Eluafi, Director General International Center for Biosaline Agriculture (ICBA), highlighting the need to cope with marginality and salinization for sustainable food security, and indicating that saline soils occurred on a large scale and that large quantities of soil were continuously being lost due to salinity. She further indicated that innovative solutions were needed to support biosaline agriculture and illustrated some of these solutions as part of sustainable soil management.

The provisional agenda and timetable were adopted, as presented in document GSPPA:IV/2016/1.

Item 2: Work of the Intergovernmental Technical Panel of Soils (ITPS) (document GSPPA:IV/2016/2)

2.1 Report by the chairperson on main activities and outcomes

In addition to the overview contained in the document, the Assembly welcomed the oral presentation by the ITPS Chairperson, Dr. Luca Montanarella, outlining substantive achievements by the Panel and portraying issues that prevented ITPS full functionality.

The PA expressed appreciation for the broad range of activities undertaken by the ITPS in the last twelve-month period, including its heavy involvement in the preparation of the "zero" and first draft of the Voluntary Guidelines for Sustainable Soil Management (VGSSM).

The Assembly noted the decision of the ITPS to establish four specific working groups (WGs) tasked to address the main priorities for action identified in the Status of World's Soil Resources (SWSR) report, namely:

- Sustainable soil management and assessment of soil degradation and restoration;
- The global management of soil organic matter;
- Sustainable nutrient management aiming to stabilize or reduce global nitrogen (N) and phosphorous (P) fertilizer use, while simultaneously increasing fertilizer use in regions of nutrient deficiency; and
- Improve soil data and information systems.

The PA enquired about the Terms of Reference of these working groups, while the ITPS clarified that it was an internal arrangement of work. In this regard, the PA drew attention to the need for a clear plan for preparing the new version of the SWSR by 2020 and addressing how governments' participation would be ensured.

The PA also stressed that ITPS Chairpersons relating to the GSP Pillars should be fully involved in the development and execution of the Global and Regional Implementation Plans under these Pillars. In particular, the ITPS should ensure scientific integration between global and regional levels.

2.2 Interface with other pertinent bodies and initiatives

The Assembly was pleased to note that the ITPS, with assistance from the GSP Secretariat, had established structured collaboration arrangements with the Science-Policy Interface (SPI) of the United Nations Convention to Combat Desertification (UNCCD), the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), including *via* a full day of meetings with representatives of these organizations during the fifth ITPS working session (March 2016). A number of joint activities and outputs had been agreed on, or were in the pipeline, to put cooperation with these bodies on a concrete path. The PA recommended implementation of these agreed actions to the fullest extent possible.

The PA enquired about the planned Global Soil Organic Carbon Symposium and after clarification by the Secretariat, expressed interest in this event and outcome.

While awaiting an official response from IPBES, the ITPS expressed its willingness to contribute in the review process of the first Land Degradation and Restoration draft report.

In connection with the indicators for the SDG 15, the ITPS confirmed its commitment to contribute with the sub-indicator 15.3 on soil organic carbon including the preparation of a global soil organic carbon map by 2017.

2.3 ITPS work programme 2016 – 2017

While the PA expressed some concern about overloading the Panel in a busy period, the PA accepted the work plan, while requesting to include two complementary tasks: an assessment at global level of the impact of Plant Protection Products on soil functions and soil ecosystems; and an assessment at global level of the potential of soil protection for increased resilience in a context of climate change (water retention, soil organic matter, soil biodiversity, carbon storage, soil fertility, etc.).

The ITPS Chair called attention to the need to advance firmly on the execution of the Global and Regional Implementation Plans as many of the Panel activities depended on such progress, particularly under Pillar 4. Comprehensive and reliable soil data and information were indeed essential for preparing new global assessments, including the new version of the SWSR by 2020.

The PA recommended that the Secretariat:

- pursue all the necessary actions in order to extend the term of ITPS members from two to three years, addressing also the issue of replacement of members due to unforeseen circumstances. The issue of gender balance was highlighted again regarding future ITPS appointments;

- take account of full participation by ITPS members when organizing meetings and thinking about logistical arrangements; advancing the execution of the Global and Regional Implementation Plans was also deemed key to progress by ITPS in carrying out its work plan; and to consider rotation of regional venues for ITPS working sessions within the limits of available resources;

- encourage partners to support the proposed work plan for 2016-2017 by providing financial resources.

Item 3: Voluntary Guidelines for Sustainable Soil Management (document GSPPA:IV/2016/3)

The Plenary Assembly took due note that the draft VGSSM under consideration were the result of intensive discussion and inclusive formulation processes, including the following steps:

- initiation during the 24th session of the FAO Committee on Agriculture (COAG) in 2014;
- discussion of a concept note for the VGSSM during the 3rd PA session in June 2015;
- endorsement of the preparation of VGSSM by the FAO Council in December 2015; and
- the development of the text in various stages during the last months, including consultations with stakeholders, and more formal instances such as the ITPS meeting of March 2016 and an Open-ended Working Group in April 2016.

In this light, the Assembly appreciated the extensive work done to develop the VGSSM and reiterated that they were of voluntary nature and therefore not legally binding, while aiming to be an important source of reference for general and technical policy recommendations on sustainable soil management, for use by a wide range of committed stakeholders.

The PA requested that minor revisions be made to the text prior to endorsement. Based on all the comments and suggestions made or transmitted, a revised version of the VGSSM was discussed. The PA underlined that after their final endorsement by the 155th session of the FAO Council, special attention should be given to implementation. Development of technical manuals for specific issues (e.g. acid soils, acidification, etc.) could be considered by the Secretariat and interested stakeholders.

Accordingly, the Plenary Assembly adopted the revised text of the VGSSM as included in Annex II, and looked forward to its positive consideration at the 25th session of COAG and its final endorsement by the 155th session of the FAO Council.

Item 4: Implementation process under the GSP Pillars (document GSPPA:IV/2016/4)

4.1 Progress in the implementation of endorsed Plans of Action

The PA acknowledged the extensive work done so far in formulating detailed GIPs under the GSP Pillars, thereby transforming the agreed Plans of Action into concrete blueprints to guide collective and individual actions by all interested partners. The Assembly stressed the need for integration between the GIPS and RIPs to ensure coherence of action at global and regional levels.

The Assembly called on all partners to join forces in the execution of these plans, including those partners prepared to invest resources in this process, including in-kind contributions.

4.2 Pillar 4 Implementation Plan

In view of its special importance, the PA welcomed the progress made for having an Implementation Plan under Pillar 4 ready after a very inclusive process.

However, Members expressed concern regarding the availability of resources for executing the plan in a satisfactory manner. It was mentioned that many countries and some regional initiatives had soil information systems already available, so they should be included in the process.

The Pacific Soil Partnership advised that it was working towards establishing a Pacific Soil Portal and mobilizing financial resources for this activity, as a contribution to the global soil information system. Members from Latin America stressed the need for further support to maintain and enhance the Latin American Soil Information System (SISLAC).

The PA stressed that governance of implementation and decision making processes under this GIP needed to be clear in terms of the roles of the Plenary Assembly, the International Network of Soil Information Institutions (INSII) and the Pillar 4 working group. The Secretariat clarified that the Plenary Assembly was the overall GSP decision making body where progress under the Pillar 4 GIP would be reported and overall strategic decisions would be made. The INSII was the specific decision making body for the GIP, so that important operational decisions would be made there. The Pillar 4 WG was in charge of day to day decision-making for advancing the execution of activities contemplated in the GIP.

Accordingly, the PA invited partners to join the process of establishing the Global Soil Information System and become active members of the INSII by sharing expertise, data, information and other inputs.

The Assembly requested the Secretariat to move resolutely into supporting the execution phase of the GIP, focusing on developing as rapidly as possible the specifications, intellectual property rights policy and the code of ethics that are to govern the system and formalize membership and framework.

Bearing in mind the need to deliver key outputs by 2017, the PA stressed that it was imperative for resource partners to contribute financially, including by seconding experts to the Secretariat, to the execution of the GIP under Pillar 4. The Netherlands flagged their in-kind contribution by making ISRIC available to play a role during implementation.

The Plenary Assembly reiterated that harmonization was essential to the GSP implementation and particularly to Pillar 4. Hence, the opportunity to collaborate with the Global Open Data for Agriculture and Nutrition (GODAN), as appropriate.

Item 5: Report on Regional Soil Partnerships (document GSPPA:IV/2016/5)

5.1 Development of Regional Implementation Plans (RIPs)

The Assembly reiterated the importance of an active network of Regional Soil Partnerships (RSPs) for the implementation of the GSP mandate. It appreciated the oral reports made by representatives of RSPs on the current status in respective geographical areas, i.e. Africa; Asia; Near East and North Africa; Central America, Mexico and the Caribbean; Europe; the associated Eurasian Sub-Regional Soil Partnership; South America; North America; and the Pacific.

The Assembly was pleased to note that to date, all regions and in some cases sub-regions, had RSPs in operation, while a few of these still required a firmer consolidation phase. It appreciated the

consistent efforts made by the Secretariat, including the use of all available funds, to support the establishment of viable RSPs and the development of Regional Implementation Plans (RIPs).

When well formulated RIPs are in place, including identification of the main priorities and concrete activities to promote sustainable soil management and reverse soil degradation, the PA emphasized the urgency of initiating and pursuing consistent execution of these RIPs. This required adequate resources (in-kind and financial) to be provided, while some regions clearly needed more external support than others.

Accordingly, the Plenary Assembly renewed its call to all partners to participate actively in, and support the RSPs, in particular empowering the RSPs to finalize and execute Regional Implementation Plans. In addition, the Assembly called for increased collaboration between regions to explore to what extent training and experience could be shared towards achieving common regional goals. The PA highlighted the need for facilitating cooperation between RSPs and invited the Secretariat to assist cooperation among them, using tools such as South-South Cooperation.

Under this item, the Secretariat presented the upgraded website of the Global Soil Partnership and requested partners to provide feedback in order to improve it.

Item 6: Report on the financial status of GSP, including the Healthy Soils Facility (document GSPPA:IV/2016/6)

The Assembly took note of the progress made in mobilizing extra-budgetary resources since the GSP inception, including through the Healthy Soils Facility, and expressed its gratitude to those donors who had made financial contributions to date. It observed, however, that against the planned indicative target given in the programme document of the Healthy Soils Facility of USD 60 million, only approximately 10% - i.e. USD 6.3 million - had been obtained so far.

In this light, the Plenary Assembly renewed its call to all partners, and especially resource partners, to support the GSP implementation and execution of the Global and Regional Implementation Plans by contributing funds, including through the Healthy Soils Facility, and providing in kind contributions to specific activities in substantially higher volumes.

The Plenary Assembly highlighted the need for a resource mobilization strategy in this regard.

The Plenary assembly appreciated the in-kind contribution from partners to the Global Soil Partnership, including by participating in plenary assemblies, working groups, workshops and all GSP related activities.

The Plenary Assembly underlined the usefulness of formulating, to the extent possible, an annual financial report which would include information on the activities performed to date and an annual project of budget based on the activities to be implemented. It also invited the Secretariat to consider developing synergies with other funds and initiatives.

The PA stressed the need to ensure, on a regular basis, interpretation and translation in all six FAO languages at its yearly sessions and requested that the issue be considered by the FAO Council.

Item 7: Report on the Implementation of the International Year of Soils (document GSPPA:IV/2016/7)

The Assembly was impressed by the range of events and activities which took place or were carried out in connection with IYS celebrations throughout the year and at all levels, from global down to local, as described in the document and highlighted in a video presentation shown during the meeting.

The PA was also pleased to note that those activities involved a very wide range of stakeholders and interested parties, i.e. not limited to government entities and civil society organizations or the media but also the general public, including substantial numbers of students in schools and other teaching institutions.

The Assembly commended the Secretariat for the encouragement and advice provided for the organization of IYS activities, and acknowledged the financial resources made available by some donors. It noted that, as per established practice in connection with International Years for which FAO was entrusted leadership, a full report would be submitted to the next session of the FAO Conference in 2017. The PA suggested that the links with the International Year of Family Farming and the International Year of Pulses be covered in that report.

The Assembly noted that information on the IYS would be kept, either under the GSP website or the FAO soil portal.

The Assembly renewed its call to all stakeholders to pursue the awareness raising momentum acquired thanks to the IYS, so as to translate it into further concrete actions against soil degradation and for promoting sustainable soil management. It observed that World Soil Day and the Glinka World Soil Prize would be the main awareness raising platforms to maintain the IYS momentum. It further noted that some partners under the leadership of the International Union of Soil Sciences had proclaimed the International Decade of Soils for the period 2015 to 2024.

Item 8: Establishment of the Glinka World Soil Prize (document GSPPA:IV/2016/8)

In recalling that it did not prove feasible to proceed with the formal establishment of a World Soil Prize during the IYS itself, as originally envisaged, the Assembly considered the proposed modalities for such an activity to be placed under the aegis of the GSP, as outlined in a concept note in the document.

The Assembly agreed with the establishment of the Glinka World Soil Prize as per the features and award process described in the concept note, while recognizing that its effective implementation would be subject to the availability of financial support from interested partners. The Assembly acknowledged the commitment of the Russian Federation to finance the Prize for the first three years.

Item 9: Implementation of the World Soil Day and its celebration in 2016 (document GSPPA:IV/2016/9)

The Assembly took note of the successful celebration of World Soil Day (WSD) in 2015 with activities carried out in more than 100 countries. It stressed the particular significance of WSD 2015, as it was

also the opportunity to close the International Year of Soils with events organized by the Secretariat in Rome, New York, Bangkok, Santiago and Accra.

The Assembly took note of the plans made for WSD celebrations in various locations in December 2016 and recalled that the selected theme was: "Soils and pulses: symbiosis for life". It encouraged partners to plan for, and support further concrete WSD activities at both national and regional levels. Partners were requested to forward to the Secretariat information on planned activities in order for these to be listed on the GSP website.

The Assembly agreed with the intent of the Secretariat to keep the momentum gained with the IYS legacy by pursuing a committed awareness raising activity supported by a dedicated team and not limited to the WSD only. Hence, year-long contacts would be maintained with the public, delivering appealing educational material that could be used across a variety of audiences in several languages.

Finally, the Assembly agreed with the theme proposed for the WSD celebration in 2017: "Caring for the planet starts from the ground". It also invited resource partners to contribute financially to the implementation of the sustained communication plan proposed by the Secretariat.

Item 10: Development of synergies with other initiatives, the case of 4/1000 initiative (document GSPPA:IV/2016/10)

The Assembly was advised of the scope of the 4/1000 initiative through an oral presentation made by the Permanent Representation of France to FAO and the INRA representative.

In noting the many similitudes in intent with the GSP, the Assembly urged that due attention be paid to ensuring synergy with GSP activities and avoiding duplication to the maximum extent possible.

Item 11: Election of the Chairperson and Vice-Chairperson, and appointment of the Rapporteur for the next period

In line with agreed arrangements, Mr. Victor Okechukwu Chude from Nigeria and Mr. David L. Lindbo from United Sates were subsequently nominated as Chairperson and Vice- Chairperson respectively, both to serve from the end of the present meeting until the next session. In addition, Mr. Neil McKenzie from Australia was subsequently nominated to act as Rapporteur for the next session in 2017.

Item 12: Date and venue of the next Plenary session

The PA endorsed the proposed dates of 20 to 22 June 2017 for the next plenary session to be held at FAO headquarters in Rome.

Item 13: Any other matters

The PA took note of the new Global Soil Biodiversity Atlas developed by the Joint Research Commission which was freely available in hard and electronic copy.

Ms. Lee Heng (Head of the Section, Soil and Water Management & Crop Nutrition Section in the joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture) made a presentation on:

"Opportunities of nuclear techniques for healthy soils and better farming" which would ensure synergies with the Global Soil Partnership community.

ANNEX I | List of Participants

FAO members

Country	Participants
Argentina	Fritz Federico
	Medina Carla Pascale
	Montani Cazabat Nazareno
Armenia	Ghazaryan Sargis
Austria	Walkner Gunter
Australia	Navarrete Rosemary
	Mc Kenzie Neil
Bangladesh	Hasan Md Nazmul
Benin	Igue Attanda Mouinou
Bolivia	Gazaui Maria Eugenia
	Oller Catoira Roxana
	Sanchez-Gomez Luis
Brazil	Da Rocha Maria Laura
	Lima Ferreira Roberta Maria
	Oliviera de Almeida Machado Pedro Luiz
	Sa Ricarte Antonio Otavio
Bulgaria	Rousseva Svetla
Burundi	Dodiko Prosper
Chile	Guerra Alejandra
	Ruiz Cardenas German Amador
	Vigneaux Margarita
China	Ding Lin
	Tang Liyue
Costa Rica	Ceciliano Piedra, Luis Fernando
	Innecken Zúñiga Pablo José
Cote d' Ivoire	Kanga Kouame
Cuba	Muñiz Ugarte Olegario Pablo
Cyprus	Poulides George
	Ellinas Spyridon
Czech Republic	Kozak Josef

Country	Participants
	Polakova Sarka
Democratic People's Republic of Korea	Kim Jong Hyok
	Rim Song Chol
Dominican Republic	Arvelo Mario
	Vicioso Julia
	Infante Quinones Diana
	Laureano Maria Cristina
Ecuador	Carranza José Antonio
Egypt	El Ghonamey Yousef
	Shalaby A. Ahmed
European Union	Masson Josiane
	Olazabal Claudia
	Montanarella Luca
France	Tomasi Serge
	Chotte Jean-Luc
	De Laurens Patrick
	Halley Des Fontaines Ségolène
	Lardy Lydie
	Mialet-Serra Isabelle
	Pra Marlène
	Rulliere Sandra
	Slak Marie-Françoise
	Soussana Jean-François
Germany	Bollmann Joachim
	Marx Kirstin
	Engelberg Walter
Ghana	Quaye Kumah Nii
Guatemala	Hochstetter Stephanie
	Wohlers de Meie Sylvia M.L.
	Olivero Garcia Nelson
Haiti	Charles Emmanuel
	Durand Marie Laurence
	Jinius Joseph Henrilus

Country	Participants
	Senatus Jean Turgot
	Theodore Yves
Hungary	Kálmán Zoltán
Iceland	Hoskuldsson Benedikt
	Jonasson Jon Erlingur
Iran	Dehghan Shoar Majid
	Ghorashizadeh Shanin
Iraq	Al-Samaraee Muhsin Younis
	Harfoush Manar
	Alsamarai Maath
	Al Rifaie Amjed
Italy	Altobelli Filiberto
	Benedetti Anna
	Cardini Giulio
	Sacco Pierfrancesco
Japan	Matsumoto Maho
Jordan	Alferihat Mahmoud
Kenya	Mwaniki John Munene
Kuwait	Jhail Yousef
	Al-Sabah Manar
	Al Bazzaz Slahuddin
Liberia	Kromah A. Haruna-Rashid
	Sheriff Mohammed
	Tripodo Paola
Libya	Haroun Salem
Madagascar	Ratohiarijaona Suzelin
Malawi	Kambauwa Gertrude
Malaysia	Nordin Mohamad Nazrain
	Binti Salim Azulita
Mexico	Jimenez Sauma Benito
	Nieves Frausto Jorge Luis
Morocco	Moussadek Rachid
Mozambique	Nobela Laurinda

Country	Participants
Namibia	Shiningayamwe Ella
Nepal	Dawadi Durga Prasad
Netherlands	Brand Hans
	Verbug Gerda
	Van den Bosch Rik
Niger	Addam Kiari Saidou
Nigeria	Olaniran yaya Olaitan
	Chude Victor
Panama	Jacome Angelica
Paraguay	Soto Sapriza Mirko
Peru	Chirinos Llerena Carla Stella
Portugal	Pedigao Antonio
Russian Federation	Antyukhin Kirill
	Konstantinopolskiy Ivan
San Marino	Ciambotta Marco
	Emiliani Marina
	Rotondaro Daniela
Saudi Arabia	Alshankiti Abdullah
	Elouafi Ismahane
	El Habti Sara
	Nahi Mostafa
Senegal	Diop Baye Moctar
	Diouf Mamadou Saliou
	Gueye Fatoumata Diene
	Niang Mohamed Bassirou
Slovakia	Candarkova Kristina
	Janova Vlasta
	Okenkova Marieta
	Weberova Zora
South Africa	Mampholo Ramakgwale Klaas
	Rampedi Moshibudi
Spain	Rambla Gil Amparo
	Rodrigue Villar Silvia

Country	Participants
Swaziland	Dlamini Patrick Bhekisisa
Sweden	Karltun Erik
Switzerland	Ulrich Andrea
	Havlicek Elena
Tajikistan	Ahmadov Hukmatullo Mahmudovich
Thailand	Nimchuar Sompong
	Wiangwang Narumon
Turkey	Dedeoglu Hilmi Ergin
	Hizli Serap
	Madenoglu Sevine
	Mermut Ahmet Ruhi
	Tel Selda
	Erdogan Hakki Emrah
United Republic of Tanzania	Mndeme Ayoub
United States of America	D'Arcangelo Maria Adelaide
	Norris John
	Reinsch Thomas
Uzbekistan	Khasankhanova Gulchekhra
Venezuela	Eljuri Abraham Elias Rafael
	Pestana de Barros Porfirio
	Reyes Verde Luis Geronimo
Yemen	Shoja'Aadin Haytham
	Al-Na'Ami Abdullah
	Al-Ashwal Mahmoud
	Hatem Tariq
Zambia	Musuhwa Kayoya
Zimbabwe	Chivandre Placida Shuvai
	Gwenzi Shepard Shepard
	Magwenzi Godfrey

Other partners

Name	Organization	Country
Aprile Hugh	Catholic Relief Services	USA
Bertsch Floria	ACCS	Costa Rica
Gonzalo Signorelli de Farias	Brazilian Soil Science Society	Brazil
Capolongo Laura	World Farmers' Organization	Italy
Ciancio Aurelio	CNR	Italy
Dazzi Carmelo	University of Palermo	Italy
Gamboni Mauro	CNR	Italy
Grandi Cristina	IFOAM	Italy
Grundy Mike	CSIRO	Australia
Guerrieri Luca	EuroGeoSurveys	Italy
Horn Rainer	IUSS	Germany
Lilly Allan	James Hutton Institute	UK
Luise Anna	ISPRA	Italy
Rice Charles	Soil Science Society of America	USA
Schmidt Axel	Catholic Relief Services	Peru
Sow Mamadou Amadou	Institut National de Pédologie	Senegal
Terribile Fabio	University of Palermo	Italy
Trifonova Totka	Agricultural Academy	Bulgaria
Verma Dharmesh	Agri Net Solutions	India
Watts Chris	Rothamsted Research	UK
Zucca Claudio	ICARDA	Jordan

International Organizations

Name	Organization	Country
Lomena Gelis Monica	GM of UNCCD	Germany

Name	Organization	Country
Dane Daniel	FAOR	Egypt
Heng Lee Kheng	IAEA	Austria
Brahene Sebastian	FAOR	Ghana
Bunning Sally	FAO	Italy
Mansur Eduardo	FAO	Italy
Vargas Ronald	FAO	Italy
Baritz Rainer	FAO	Italy
Caon Lucrezia	FAO	Italy
Verbeke Isabelle	FAO	Italy
Ziadat Feras	FAO	Italy
Darkashalli Hashem	FAO	Italy

ANNEX II | Revised text of the VGSSM

1. Introduction

These Voluntary Guidelines for Sustainable Soil Management (VGSSM) were developed through an inclusive process within the framework of the Global Soil Partnership (GSP). They aim to be a reference providing general technical and policy recommendations on sustainable soil management (SSM) for a wide range of committed stakeholders. The guidelines were adopted by the 4th GSP Plenary Assembly (Rome, 25 May 2016), approved by the __th session of the FAO Committee on Agriculture (Rome, ___) and finally endorsed by the __th session of the FAO Council (Rome, __).

1.1 Background and rationale

Soils are an essential and non-renewable natural resource hosting goods and services vital to ecosystems and human life. Soils are fundamental for producing crops, feed, fibre, fuel, and they filter and clean tens of thousands of cubic kilometers of water each year. As a major storehouse for carbon, soils also help regulate emissions of carbon dioxide and other greenhouse gases, which is fundamental for regulating climate. SSM is an integral part of sustainable land management, as well as a basis for addressing poverty eradication, agricultural and rural development, promoting food security and improving nutrition.

Soil is the world's largest terrestrial pool of carbon[1,2] and approximately 95% of global food is produced in soil[3]. SSM is a valuable tool for climate change adaptation and a pathway for safeguarding key ecosystem services and biodiversity. Due to the incalculable value soils provide to society through ecosystem services, SSM ensures a high return on investment by supporting and increasing these services. Widespread adoption of SSM practices generates multiple socio-economic benefits, especially for smallholder farmers and large scale agricultural producers worldwide whose livelihoods directly depend on their soil resources.

However, evidence recently provided in the Status of the World's Soil Resources (SWSR) report and other studies shows that about 33% of global soils are moderately or highly degraded[4,5], *i.e.* due to unsustainable management practices. On a global scale an annual loss of 75 billion tons of soil from arable land is estimated to cost about USD 400 billion each year in lost agricultural production[6]. **This loss** also significantly reduces the soil's ability to store and cycle carbon, nutrients, and water. Annual cereal production losses due to erosion have been estimated at 7.6 million tonnes.

Growing concerns about the state of global soils resulted, amongst others, in the establishment of the Global Soil Partnership, the proclamation of the International Year of Soils (2015) by the UN General Assembly and the adoption of the revised World Soil Charter by the FAO Conference. In a broader context, the 2030 Agenda for Sustainable Development adopted a number of related targets in 2015, *i.a.* those aimed at restoring degraded soil, striving to achieve a land degradation-neutral world and implementing resilient agricultural practices that progressively improve soil quality and minimize soil contamination. SSM strongly contributes to collective efforts towards climate change adaptation and mitigation, combating desertification and promoting biodiversity, and therefore has specific relevance to the United Nations Framework Convention on Climate Change (UNFCCC), United Nations

[1] *Carbon sequestration in dryland soils*. FAO, 2004.
[2] *Land use, land use change, and forestry. Summary for policy-makers*. IPCC, 2000 (pp. 3-4).
[3] *Healthy soils are the basis for healthy food production*, FAO, 2015.
[4] *Status of the World's Soil Resources (SWSR). Main Report*. FAO and ITPS, Rome, 2015 (p. xix).
[5] *The state of the world's land and water resources for food and agriculture (SOLAW). Managing systems at risk*. FAO, Rome and Earthscan, London, 2011 (p. 113).
[6] *The value of land: Prosperous lands and positive rewards through sustainable land management*. The Economics of Land Degradation (ELD) Initiative, 2015 (p. 80).

Convention to Combat Desertification (UNCCD) and United Nations Convention on Biological Diversity (UNCBD).

The revised World Soil Charter calls for the incorporation of SSM principles and practices into policy guidance. In response, the GSP decided to develop the present Voluntary Guidelines in line with its overall goal of promoting SSM.

1.2 Objectives

The objectives of the VGSSM are: to present generally accepted, practically proven and scientifically based principles to promote SSM and to provide guidance to all stakeholders on how to translate these principles into practice, be it for farming, pastoralism, forestry or more general natural resources management.

1.3 Nature and scope

The VGSSM are of voluntary nature and are not legally binding. They elaborate the principles outlined in the revised World Soil Charter, taking into account the evidence provided in the SWSR. The guidelines address technical aspects of SSM including core characteristics of sustainably managed soils, key challenges and potential solutions to address them. The VGSSM focus mostly on agriculture which is broadly defined as the production of food, fibre, feed, timber and fuel, although many of the principles described have a significant influence on ecosystem services provided by managed and unmanaged soil systems.

The guidelines are not expected to provide detailed recommendations, but are designed to inform strategic and context-specific decision-making at all relevant levels. They are intended to contribute to global, regional and national efforts towards the eradication of hunger and poverty due to the importance of soils in sustainable development.

1.4 Target audience

By providing an easily accessible and readily understandable reference to a wide range of stakeholders, the potential target audience of the VGSSM includes: government officials, policy makers, farmers, pastoralists, forest and land managers, extension services and agricultural advisors, development partners, civil society, private sector and, academia, etc.

1.5 Definition of sustainable soil management

In these guidelines, SSM is defined according to Principle 3 in the revised World Soil Charter as follows:

> *"Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity. The balance between the supporting and provisioning services for plant production and the regulating services the soil provides for water quality and availability and for atmospheric greenhouse gas composition is a particular concern".*

The types of ecosystem services and the soil functions referred to in the definition can be elaborated as follows:

- Supporting services include primary production, nutrient cycling and soil formation;
- Provisioning services comprise the supply of food, fibre, fuel, timber and water; raw earth material; surface stability; habitat and genetic resources;
- Regulating services imply the regulation of aspects such as water supply and quality, carbon sequestration, climate regulation, control of floods and erosion; and

- Cultural services denote the aesthetic and cultural benefits derived from soil use.

SSM is associated with the following characteristics:

1. Minimal rates of soil erosion by water and wind;
2. The soil structure is not degraded (e.g. soil compaction) and provides a stable physical context for movement of air, water, and heat, as well as root growth;
3. Sufficient surface cover (e.g. from growing plants, plant residues, etc.) is present to protect the soil;
4. The store of soil organic matter is stable or increasing and ideally close to the optimal level for the local environment;
5. Availability and flows of nutrients are appropriate to maintain or improve soil fertility and productivity, and to reduce their losses to the environment;
6. Soil salinization, sodification and alkalinization are minimal;
7. Water (e.g. from precipitation and supplementary water sources such as irrigation) is efficiently infiltrated and stored to meet the requirements of plants and ensure the drainage of any excess;
8. Contaminants are below toxic levels, i.e. those which would cause harm to plants, animals, humans and the environment;
9. Soil biodiversity provides a full range of biological functions;
10. The soil management systems for producing food, feed, fuel, timber, and fibre rely on optimized and safe use of inputs; and
11. Soil sealing is minimized through responsible land use planning.

2. Challenges for achieving sustainable soil management

Soils have diverse chemical, physical and biological properties. As a consequence, they differ in their responses to management practices, their inherent ability to deliver ecosystem services, as well as their resilience to disturbance and vulnerability to degradation. The Status of the World's Soil Resources report identified ten key threats that hamper the achievement of SSM. These threats are: soil erosion by water and wind, soil organic carbon loss, soil nutrient imbalance, soil salinization, soil contamination, acidification, loss of soil biodiversity, soil sealing, soil compaction and waterlogging. These different threats vary in terms of intensity and trend depending on geographical contexts, though they all need to be addressed in order to achieve sustainable soil management.

SSM shall contribute to addressing global challenges, and meeting international commitments, including:

- the 2030 Agenda for Sustainable Development, where SSM could directly or indirectly contribute to achieving several of the agreed goals and targets;
- the Zero Hunger Challenge (to end hunger and malnutrition and assure food security for a growing population);
- climate change adaptation and mitigation, especially in the light of the Paris Agreement adopted at the UNFCCC COP21, which embodies a strong commitment to address climate change and give agriculture a prominent role in that process;
- the commitment to combat desertification and mitigate effects of drought, especially the strive to achieve a land degradation neutral world, taking note of the potential benefits for all as per the last UNCCD COP12;

- the Aichi targets which underline an important agenda to preserve biodiversity and the provision of ecosystem services;
- securing land tenure under the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT).

This context points to major opportunities to promote SSM. Taking the above into account, an enabling environment for promoting SSM is fostered by the following core actions:

- Establishing or strengthening inclusive SSM-supportive agricultural/environmental policies

Where appropriate, inclusive policies to promote SSM should be linked to agricultural and environmental policies, so that their implementation provides multiple benefits. If existing, these policies can be reviewed, as appropriate, to mainstream SSM.

- Increasing responsible investment and positive incentives aimed at promoting sustainable soil management

Where appropriate, responsible investment in SSM according to the Principles for Responsible Investments in Agriculture and Food Systems (CFS-RAI) should be increased. Provision of positive incentives to those stakeholders who implement SSM principles while recognizing the value of ecosystem services could be envisaged.

- Promoting secure land tenure rights according to the VGGT

SSM is affected by secure land tenure rights being in place or not. Access and tenure rights are an important factor for SSM to be properly implemented by land users and to enable long-term planning.

- Fostering and strengthening targeted soil research

It is imperative that investment in soil research is increased to enable national research programs and their partners to work with land users to identify and address the constraints they face in increasing the ecosystem services provided by soils (i.e. soil productivity).

- Preventing or minimizing soil degradation and restoring/rehabilitating degraded soils (including historically degraded soils)

Soil degradation shall be minimized using SSM, especially through soil conservation approaches that proved to be successful. Soil rehabilitation and/or soil restoration should also be a priority, returning degraded soils to productivity, especially in historically sound agriculture or other production systems currently under threat.

- Promoting effective education programmes

Where appropriate, education on soils (formal or informal) should be strengthened. That could start with the reflection of their importance in the school's curricula and extending to more professional levels. Capacity development on SSM should be enhanced so that more professionals are brought up-to-date on "state of the art" methods and tools.

- Ensuring adequate inclusion of SSM in extension services

Agricultural extension services should promote SSM principles and practices.

- Establishing/strengthening soil information systems

Considering the living nature of soils, the assessment of their status should be a pre-condition to planning any SSM intervention. Soil data and information (including local knowledge) are essential for understanding soil conditions and trends in soil functions, as well as for targeting interventions to increase productivity. Where appropriate, national soil information systems should be established or strengthened in order to have solid monitoring capacities of soil condition in place.

These systems would also contribute to the Global Soil Information System being promoted by the Global Soil Partnership.

- Fostering international cooperation/collaboration on soils

International cooperation on soils should foster the exchange of knowledge, technology and information. Various arrangements including “North-South”, “South-South” and “Triangular” cooperation could be used for that purpose.

- Promoting communication on SSM practices

Pursuing the efforts of the International Year of Soils 2015, SSM practices should be promoted and disseminated in view of their provisioning of important ecosystem services.

3. Guidelines for sustainable soil management

The following constitutes technical guidelines to address soil threats that hamper SSM. They should not be viewed as a full list of good practices, but rather a technical reference to be applied on a context specific basis. Specific technical manuals may be developed later to provide complementary tools.

3.1 Minimize soil erosion

The SWSR report identified soil erosion by water and wind as the most significant threat to global soils and the ecosystem services they provide. Soil erosion causes the loss of surface soil layers containing organic and mineral nutrient pools, partial or complete loss of soil horizons and possible exposure of growth-limiting subsoil, as well as off-site impacts such as damage to private and public infrastructure, reduced water quality and sedimentation. Soil erosion is accelerated by human activities through, amongst others, reduced plant or residue cover, tillage and other field operations, and reduced soil stability leading to soil creep and landslides.

- 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.

3.2 Enhance soil organic matter content

Soil organic matter (SOM) plays a central role in maintaining soil functions and preventing soil degradation. Soils constitute the largest organic carbon pool on the Earth and play a critical role in regulating climate and mitigating climate change through trade-offs between greenhouse gas emission and carbon sequestration. For this reason, SOM is strategic for climate change adaptation and mitigation, and global stores of SOM should be stabilized or increased. A loss of soil organic carbon (SOC) due to inappropriate land use or the use of poor soil management or cropping practices can cause a decline in soil quality and soil structure, and increase soil erosion, potentially leading to emissions of carbon into the atmosphere. On the other hand, appropriate land use and soil management can lead to increased SOC and improved soil quality that can partially mitigate the rise of atmospheric CO_2.

- Increase biomass production by increasing water availability for plants using methods (e.g., irrigation with drippers or microsprinklers; irrigation scheduling; monitoring of soil moisture or loss of water via evapotranspiration) that maximize water-use efficiency and minimize soil erosion and nutrient leaching, using cover crops, balancing fertilizer applications and effective use of organic amendments, improving vegetative stands, promoting agroforestry and alley cropping, and implementing reforestation and afforestation;
- Protect organic carbon-rich soils in peatlands, forests, pasturelands, etc.;
- Increase organic matter content through practices such as: managing crop residues, using forage by grazing rather than harvesting, practicing organic farming, applying integrated soil fertility management and integrated pest management, applying animal manure or other carbon-rich wastes, using compost, and applying mulches or providing the soil with a permanent cover;
- Fire should preferably be avoided, except where fire is integral to land management, in which case the timing and intensity of burning should aim to limit losses of soil functions. Where fire is a naturally occurring event, steps to minimize erosion and encourage re-vegetation after fire should be considered, where practical.
- Make optimum use of all sources of organic inputs, such as animal manure and properly processed human wastes;
- Management practices such as cover crops, improved fallow plant species, reduced- or no-tillage practices, or live fences should be adopted to ensure the soil has a sufficient organic cover;
- Decrease decomposition rates of soil organic matter by practicing minimum or no-tillage without increasing the use of herbicides; and
- Implementing crop rotations, planting legumes (including pulses) or improving the crop mix.

3.3 Foster soil nutrient balance and cycles

The concepts of sufficiency and utilization efficiency apply especially to nutrient dynamics in the soil-water-nutrients-plant root continuum. Plant nutrition should be based on crop needs, local soil characteristics and conditions, and weather patterns. Plant nutrition can be enhanced through nutrient recycling or additions including mineral (chemical) fertilizers, organic fertilizers and other soil amendments including primary sources (e.g. rock phosphate) and secondary sources (e.g. phosphorus from sewage sludge). It is crucial to select an appropriate plant nutrient management system and approach alongside assessing the suitability of the land for a given land use.

The benefits of sufficient and balanced nutrient supply for plant needs are well-established and include: production of food, feed, fibre, timber, and fuel at levels at, or close to, the optimum potential in the specific geographical context; reduced need for pest control measures, external application of organic and inorganic amendments, and mineral fertilizers; less pollution resulting from inappropriate

use of agro-chemicals; and enhanced soil carbon sequestration through biomass production and restitution to the soil.

The lack of basic nutrients leads to the underdevelopment of plants and decrease in yields and crop nutritional value. The consequences of excess nutrients in soils are a) the loss of excess nutrients (especially nitrogen and phosphorus) from agricultural fields, causing eutrophication and deterioration of water quality and terrestrial and aquatic ecosystems; b) increased release of the greenhouse gas nitrous oxide from soils to the atmosphere; c) leaching of mobile forms of nitrogen to water used for human consumption, with potential human health impacts; and d) crop failure.

- Natural soil fertility and natural nutrient cycles should be improved and maintained through the preservation or enhancement of soil organic matter. Improved soil fertility can be attained through soil conservation practices such as the use of crop rotations with legumes, green- and animal manures, and cover crops in combination with reduced- or no-tillage with attention to reduced herbicide use, as well as agroforestry. Nutrient cycles are best managed in integrated systems such as crop-livestock systems or crop-livestock-forest systems;
- Nutrient use efficiency should be optimized by adopting measures such as applying balanced and context adapted soil organic and inorganic amendments (e.g. compost and liming agents, respectively) and/or innovative products (e.g. slow and controlled release fertilizers), as well as the recycling and reuse of nutrients;
- Fertilizer application methods, types, rates and timing should be appropriate to limit losses and promote balanced crop nutrient uptake. This should be based on soil and plant analyses and be a long-term endeavor rather than short term action;
- The addition of soil micronutrients should be considered when planning soil fertilization;
- Practical sources of plant nutrients should be used, including the precise and judicious use of organic and mineral amendments, inorganic fertilizers, and agricultural bio-products. These amendments and bio-products include liquid, semi-solid or solid manures, crop residues, composts, green manures, household refuse, clean ash generated during bioenergy production, soil amendments and inoculants. In order to increase their efficiency, such measures should be combined with the mitigation of other limiting factors (such as water deficiency). Safe use (including tolerable levels of contaminants and pollutants, and worker health) of these amendments should be ensured;
- Soil and plant-tissue testing and field assessments should be adopted and used. This provides valuable guidance in diagnosing and correcting limiting factors in crop production related to plant nutrients, salinity, sodicity, and extreme pH conditions. Such guidance is key for making informed decisions and monitor progress;
- Where appropriate, livestock movement and grazing should be managed to optimize manure and urine deposition;
- Application of liming agents in acid soils is a prerequisite for optimal nutrient use efficiency in such soils, while application of organic amendments such as compost, as well as appropriate soil-crop management should be considered for alkaline and other soils; and
- Naturally occurring mineral fertilizer resources like rock phosphate or potash should be allocated efficiently and strategically to ensure the continued availability of adequate amounts of mineral inputs for future generations.

3.4 Prevent, minimize and mitigate soil salinization and alkalinization

Salinization is the accumulation of water-soluble salts of sodium, magnesium and calcium in the soil. It is the consequence of high evapotranspiration rates, inland sea water intrusion, and human-induced

(e.g. improper irrigation) processes. Salinization reduces crop yields and, above certain thresholds, completely eliminates crop production.

- Surface cover should be optimized to reduce evaporation losses;
- Efficiency of irrigation water use should be increased through improved conveyance, distribution, and field application methods. Application methods should be used that operate with low pressure and apply the water directly to the soil. Automization of water supply and application of water on top of crops should be avoided to reduce evaporation losses;
- Irrigation management should ensure sufficient water for plant growth and efficient drainage to avoid problems of salinization;
- Irrigation water quality should be tested and monitored; when feasible, water desalinization should be performed;
- Surface and sub-surface drainage systems should be installed and maintained to control rising groundwater tables and control soil salinity. The design of these systems needs to be based on a thorough understanding of the water balance in these areas; and
- If soils are already degraded and prevention is no longer an option, reclamation of saline soils can be achieved using a variety of techniques such as direct leaching of salts, planting salt tolerant varieties, domestication of native wild halophytes for use in agro-pastoral systems, chemical amelioration and the use of organic amendments.

3.5 Prevent and minimize soil contamination

Soil may filter, fix and neutralize, but also release pollutants when conditions change (e.g. heavy metal release with lowering pH). Therefore, prevention of soil contamination remains the best way to maintain healthy soils and food safety in accordance to the Sustainable Development Goals.

Contaminants can enter soils from a variety of sources including agricultural inputs, land application of by-products, atmospheric deposition, flood and irrigation water, accidental spills, inappropriate urban waste and wastewater management, and other means. Accumulation and contamination occur if the rate of addition of a given contaminant exceeds its rate of removal from the soil system. Negative consequences may include plant toxicities and subsequent productivity declines, contamination of water and off-site areas through sediment transport, and increased human and animal health risks through accumulation in the food-chain.

- Governments are encouraged to establish and implement regulations to limit the accumulation of contaminants below established levels to safeguard human health and well-being, and facilitate remediation of contaminated soils that exceed these levels;
- Management of local soil contamination requires establishing background levels, followed by testing, monitoring and assessing contaminant levels to identify sites that are likely to be contaminated. Risk assessment, including total cost assessment, and remediation should be applied to reduce risks to humans and ecological systems;
- Identification of soils that are the most susceptible to the harmful effects of diffuse pollutants is needed. Appropriate attention should be given to reduce contaminant loads in these soils;
- Information on contaminated soil sites should be available to the public;
- Contaminated soils should not be used for food and feed production;
- Recycled nutrients originating from treated waste water or other waste materials that are used as soil amendments should be properly processed and tested to ensure they contain safe levels of contaminants and plant available nutrients. For instance, organic

xenobiotics can pose a serious, incalculable and irreversible threat to soil fertility and human health; and

- Outflows of flood water from paddy rice cultivation after applying fertilizers and pesticides should be minimized to avoid off-site effects.

3.6 Prevent and minimize soil acidification

Human-induced acidification of agricultural and forest soils is primarily associated with removal of base cations and loss of soil buffering capacity or increases in nitrogen and sulfur inputs (e.g. legume pastures fertilizer inputs, atmospheric deposition). Soils with low pH-buffering capacity and/or high aluminium content are most prevalent when they have a low content of weatherable minerals (e.g. ancient, strongly weathered soils, and soils developed from quartz-rich parent materials).

- Monitoring soil acidity and minimizing surface and sub-surface soil acidity by using proper amendments (such as lime, gypsum and clean ash);
- Balanced fertilizer and organic amendment applications; and
- Appropriate use of acidifying fertilizer types.

3.7 Preserve and enhance soil biodiversity

Soils provide one of the largest reservoirs of biodiversity on earth, and soil organisms play key roles in the delivery of many ecosystems services. Little is known about the degree of biodiversity required to maintain core soil functions, but new tools for biochemical techniques and DNA analysis suggest significant progress in this area is possible.

- Monitoring programs for soil biodiversity, including biological indicators (e.g. community ecotoxicology) and *in-situ* early warning signals, should be undertaken;
- Soil organic matter levels supporting soil biodiversity should be maintained or enhanced through the provision of sufficient vegetative cover (e.g. cover crops, multiple crops), optimal nutrient additions, addition of diverse organic amendments, minimizing soil disturbance, avoiding salinization, and maintaining or restoring vegetation such as hedgerows and shelterbelts;
- The authorization and use of pesticides in agricultural systems should be based on the recommendations included in the International Code of Conduct on Pesticide Management and relevant national regulations. Integrated or organic pest management should be encouraged;
- The use of nitrogen fixing leguminous species, microbial inoculants, mycorrhizas (spores, hyphae, and root fragments), earthworms and other beneficial micro-, meso- and macro- soil organisms (e.g. beetle banks) should be encouraged where appropriate, with attention to limiting the risk of invasive processes by promoting the use of local biodiversity and avoiding the risk of disturbance in soil services;
- Restoring plant biodiversity in ecosystems, thereby favouring soil biodiversity;
- In-field crop rotation, inter-cropping, and preservation of field margins, hedges and biodiversity refuges should be encouraged; and
- Any land use change in areas with high biodiversity should be subject to land use planning and in line with the UNCBD, UNCCD and other relevant international instruments and with national law.

3.8 Minimize soil sealing

Land conversion and subsequent soil sealing for settlements and infrastructure affect all soils, but are of particular concern on productive, arable soils because of their importance for food production and food security and nutrition, and circular economy targets. In many places, urban sprawl affects the

most productive soils adjacent to the cities and settlements. Soil sealing and land conversion causes a largely irreversible loss of some or all soil functions and the ecosystem services they provide.

- Considering the total value of soils and to ensure the preservation of productive, arable soils, existing policies, relevant laws and land use planning procedures for the development of settlements and infrastructure should be reviewed as appropriate;
- Where policy and legislation aim to minimize land conversion, measures should be implemented to encourage densification and re-use of existing urban or industrial areas such as abandoned areas and brownfields, and restoring degraded neighbourhoods after appropriate reclamation measures have been implemented. Ecological restoration of quarries and mining sites should be encouraged; and
- Soils with significant ecosystem services including high soil carbon stocks, high biological diversity or high agricultural suitability should be protected from land conversion for settlements and infrastructure by special legislation.

3.9 Prevent and mitigate soil compaction

Soil compaction is related to the degradation of soil structure due to imposed stresses by machinery and livestock trampling. Soil compaction (reduced or disrupted pore continuity) reduces soil aeration by destroying soil aggregates and collapsing macropore density, and reduces water drainage and infiltration, generating higher runoff. Compaction limits root growth and seed germination by high mechanical impedance, affecting soil biodiversity and causing surface soil crusting.

- Deterioration of soil structure due to inappropriate or excessive tillage should be prevented;
- Vehicular traffic should be minimized to the absolutely essential, particularly on bare soils, by reducing the number and frequency of operations, creating controlled traffic systems, and by performing agriculture/forestry operations only when the soil moisture content is suitable down to deeper depth;
- Machines and vehicles used in the field should be adjusted to soil strength and should be equipped with tyre pressure control systems or other means to reduce surface pressure (e.g. contact area), and use of heavy machinery should be avoided. During forestry operations, machine traffic should be restricted (e.g. controlled traffic) and brush mats used to help protect exposed soils from physical damage; on agricultural soils, controlled traffic and drive rows should be established, where possible;
- Cropping systems should be selected that include crops, pasture plants and, where appropriate, agroforestry plants with strong tap roots (dense and fibrous root systems) able to penetrate and break up compacted soils;
- An adequate amount of soil organic matter should be maintained to improve and stabilize soil structure;
- Macrofauna and microbial (especially fungal) activity should be promoted to improve soil porosity for soil aeration, water infiltration, heat transfer and root growth; and
- In grazing systems, a sufficient cover of growing plants should be maintained to protect the soil from trampling and erosion; livestock management should take into account grazing intensity and timing, animal types and stocking rates.

3.10 Improve soil water management

A sustainably managed soil has rapid water infiltration, optimal soil water storage of plant available water and efficient drainage when saturated. However, when these conditions are not met, waterlogging and water scarcity problems arise. On the one hand waterlogging, which is related to the saturation of soil with water, creates rooting problems for many plants, thereby reducing yields, and can cause contaminants such as arsenic and methylmercury to become mobile in the soil. On the other

hand, water scarcity occurring in areas where water is lost by evaporation, surface runoff and percolation, can cause crop failure.

- In humid areas where precipitation exceeds evapotranspiration, additional drainage systems are needed to provide aeration for root functions like nutrient uptake. This is a concern especially in fine-textured soils which have high water retention capacity.
- Surface and sub-surface drainage systems should be installed and maintained to control rising groundwater tables in order to mitigate potential waterlogging;
- The efficiency of irrigation water use by plants should be increased through improved conveyance, distribution, and field application methods (e.g. scheduled drip or microsprinkler irrigation) that reduce evaporation and percolation losses of irrigation water, as well as through better soil water reserve estimation, better species or variety choices, and better computing of water loading periods and amounts;
- In dryland cropping systems, measures should be implemented to optimize water-use efficiency such as the management of soil cover (e.g. previous crops, forage and fallow) and water harvesting to increase soil water availability at sowing; reduction of runoff and evaporative losses from the soil surface; and ensuring that there is adequate water available at each stage of crop development. These measures often involve trade-offs and risks that should be recognized and managed;
- Optimal soil water extraction by the crop through the selection of appropriate cultivars and careful timing of agronomic operation should be promoted; and
- Regularly monitor irrigation water quality for nutrients and potential harmful substances.

4. Dissemination, use and evaluation of the VGSSM

Without prejudice to the voluntary nature of the present guidelines, all stakeholders are encouraged to promote, support and use the guidelines according to their respective individual or collective needs, mandates, abilities, and relevant national contexts. The successful use of the guidelines needs a collective action of multiple stakeholders in an inclusive, participatory, gender sensitive, cost-effective and sustainable manner. In doing so, evidence-based scientific knowledge as well as local knowledge should be used as appropriate.

Acknowledging that States have the primary responsibility for achieving food security and nutrition of their population, they are encouraged to:

- Take the lead in promoting the use and evaluation of the VGSSM;
- Set up relevant platforms and frameworks, as appropriate, for collective action at local, national and regional levels, or use the existing facilities to promote these voluntary guidelines;
- Promote effective extension services that rely on proper research and education institutions and mainstream SSM in their activities; and
- Evaluate their use and the impact of improved soil management on food security, ecosystem services related to soil functions and on the efforts towards achieving the Sustainable Development Goals.

In this endeavour, States may seek technical support from FAO or other international and regional bodies, as appropriate. The Regional and Sub-Regional Soil Partnerships are instrumental in disseminating and promoting the use of the VGSSM.

Development partners, relevant specialized agencies and programmes of the United Nations, international financial institutions and regional organizations are encouraged to:

- Support the dissemination and implementation of these voluntary guidelines; and

- Facilitate, as appropriate, technical cooperation, financial assistance, capacity development, knowledge sharing and transfer of technology aimed at promoting SSM.

For other stakeholders, the following is suggested:

- Private sector enterprises involved in soil management are invited to promote the use of the guidelines with a focus on managing risks to maximize positive and minimize negative impacts on SSM, relevant to their context and circumstances;
- Civil society organizations with relevance to soil management are invited to integrate the guidelines in their policies and programmes, advocate for the appropriate use of the guidelines and assist with building capacity of their members with the aim of contributing to SSM; and
- Research organizations, universities, academia, extension organizations and/or programmes are invited to promote integration of the guidelines in their own policies, and facilitate knowledge exchange and skills development to contribute to SSM.

The GSP, hosted by FAO, presents a global forum where different stakeholders learn from each other's experiences and assess progress toward the implementation of these guidelines and their relevance, effectiveness and impact. The GSP Secretariat and the Intergovernmental Technical Panel on Soils (ITPS) as its advisory body will report to the GSP Plenary Assembly on the progress in the implementation of the guidelines, as well as evaluate their impact and their contribution to the improvement of soil management.

Dissemination and promotion of the guidelines at the regional level should be supported by all stakeholders, particularly through the Regional Soil Partnerships.

In promoting the use of the VGSSM, possible synergies and collaboration with other relevant initiatives related to sustainable soil management could be explored.