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SOIL FOR FOOD SECURITY AND CLIMATE CHANGE ADAPTATION AND MITIGATION

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I. The Challenge

1. FAO's report on the State of Food Insecurity in the World shows that 1.02 billion people are hungry and undernourished worldwide in 2009. Most of these undernourished people and the rural poor often live in marginal areas seriously affected by loss of soil productivity, degradation of soil, water and biological resources and the associated loss of vital ecosystem services upon which their livelihood depends.
2. A significant percentage of the land used for agriculture, including grazing land, is moderately or severely affected by soil degradation resulting in significant cost of inputs, lost productivity and services. Climate change is expected to exacerbate effects of soil degradation through increases in drought and heat stress, extreme weather events, and an increase in pests and diseases. Pressures on land resources are continuously increasing due to population growth and changing consumer habits particularly in emerging economies. Unless properly managed, continued land degradation by small and large, subsistence and commercial farmers practising unsustainable agriculture systems (including crop, livestock and forestry systems), driven by short-term needs, will cause further decline in soil productivity and loss of the array of provisioning, socio-cultural, regulating and supporting services provided by ecosystems.
3. Soils underpin the food systems that support human lives and livelihoods – providing the support base and nutrients for plant and animal life and the means for the capture and retention of rainwater and the maintenance of the hydrological cycle that is vital for life on earth. Soils also perform many vital functions in terms of nutrient cycling, soil carbon sequestration, climate regulation, rainfall infiltration and their services in sustaining the provision of food and water are a basis for environmental, economic and social stability.
4. Sound technical solutions, knowledge sharing, policies, investments and raising awareness are needed to support the efforts of land users in sustaining and restoring the soil resources upon which our livelihood depends. This will contribute to attaining the multiple benefits of an efficient and productive agriculture, the safeguard and sustainable use of natural resources for current and future generations, and reduced risks of climate change and variability to livelihoods.
5. Aware of the importance of soils for food security and nutrition, FAO is playing a major role in advancing knowledge on soil resources and the dissemination of technologies and approaches for sustainable soil management in a range of ecosystems and socio-economic contexts. However, soil science and expertise both in FAO and partner organizations and in many countries' agriculture and environment sectors, has been gradually eroded and there has been reduced investment in this vital area over the last decades. There is a need to give renewed attention to soils in FAO in order to address today's critical food security and climate change agendas.
6. This paper proposes the ways and means to maintain and restore FAO's role as a centre of excellence on soils for food security and to continue to provide support to member countries in addressing sustainable management of the land resource as well as land degradation, for accelerating agricultural growth and adapting to and mitigating climate change and other global challenges.

II. Soils for Food Security, Ecosystem Services and Climate Change Adaptation and Mitigation: An Integrated Perspective

7. Soil is the essential component of land and production systems and performs important provisioning and regulatory ecosystem functions by maintaining the exchange of energy and

matter between the biosphere, atmosphere, hydrosphere and lithosphere. Soil is a major habitat and carbon sink, and as such, provides the substrates and a foothold for crops and makes nutrients and water available to plants. Within this context, healthy soils are the basis for enhanced food and nutrition security and provide various ecosystem services, including maintenance of biodiversity and resilience to climate variability and climate change within the broader framework of sustainable development.

8. Soil is essentially a non-renewable resource: it can be readily degraded but is extremely slow to restore. The primary role of soil as a provider of vital ecosystem services deserves much greater recognition among policy makers, technical specialists concerned with food, agriculture and environmental management and the range of land users. The services that healthy soils provide need to be evaluated and remunerated in terms not only for their productive services but also for other positive externalities that they provide. The possibility for land users to obtain Payment for Environmental Services (PES) can be used to encourage the adoption of more sustainable land use systems and soil management practices and to enhance the economic viability of a given management system.

9. One major role of soils in this respect is as provider of "green water" stored in the soil and "blue water" delivered to downstream users. Upstream land users in watersheds can better manage their soil resources and thereby generate green water credits to supplement their income from the sale of food and other products. Various schemes are now operating in most regions, led by Latin America, where land users upstream are remunerated for their contribution to the provision of reliable water quantity and quality downstream.

10. The role of soils in carbon sequestration in suitable production and livelihood systems is another possible service that can be remunerated. Until recently, most efforts to use agriculture to reduce greenhouse gas (GHG) emissions have involved above-ground carbon sequestration, since the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (UNFCCC), established under the Kyoto Protocol, considers only afforestation and reforestation as acceptable sequestration activities. More recently, REDD+¹ mechanisms have been developed for deforestation and reversing degradation in forestlands, as well as the multiple benefits of the ecosystems, including the above- and below-ground carbon pools. Soil is the largest carbon reservoir of the terrestrial carbon cycle and holds the greatest mitigation potential, provided it is linked to the intensification of carbon capture through biomass production. There is also growing interest and commitment in harnessing soil potential in carbon sequestration and generating additional remuneration for smallholders through carbon finance. It is anticipated, subject to success in the negotiations, that a mechanism could be put in place by the next Conference of the Parties to the UNFCCC. Such support mechanisms should also extend to restoring carbon pools and reducing emissions through suitable agronomic practices, though measurement and accountability present challenges.

11. Efforts to enhance soil carbon sequestration can provide win-win options with positive effects in terms of food security and poverty alleviation. Many of the world's poor are producers on poor quality lands whose soil organic carbon has been depleted through years of extractive production systems. Evidence shows that increasing soil carbon pools, through improved organic matter management, reducing repetitive soil disturbance or avoiding mechanical tillage and burning of crop residues and grasslands, improves the soil biophysical and chemical properties and hence contributes to increased and stabilised crop yields and grass/rangeland productivity. Moreover, such practices enhance rainwater capture and retention, maintain the water cycle, increase resilience to drought and reduce risk of flooding. Thus, while contributing to mitigating climate change through sequestering carbon and to enhancing food security, these management practices also enhance the capacity of farmers and herders to adapt to climate change. Financial incentives for restoration of soil organic carbon, while contributing to the agriculture carbon

¹ REDD+ (reducing emissions from deforestation and forest degradation in developing countries - plus conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries).

balance, can serve as a key strategy for improving agricultural productivity and sustainable land management and reducing vulnerability among smallholders.

12. Many forms of agriculture-based soil carbon sequestration are low-cost means of mitigating climate change that can be readily implemented through a range of proven Sustainable Land Management (SLM) technologies, such as agroforestry, integrated crop-livestock systems that make more efficient use of organic resources, conservation agriculture systems that combine no – or minimum – tillage with permanent cover and crop rotations, as well as organic agriculture systems. Such strategies also generate important food security benefits over the long run, although they frequently require investment and compensation mechanisms to support farmers during a transition period. Targeted investment programmes, and setting up equitable payment mechanisms will be required to promote adoption of recommended management practices to restore soil quality, particularly among poor farmers who live in marginal areas.

13. Important political progress in this regard was made within the Declaration of the World Summit on Food Security (Rome, 16-18 November 2009), which explicitly recognized the link between mitigation, adaptation and food security. FAO Members, through the Declaration, stated that they *"aimed to enhance and develop financing mechanisms and other appropriate measures to support adaptation to, and mitigation of, climate change that are accessible to smallholder farmers, and are based on equitable, transparent and effective institutional arrangements"*.

14. It will be equally important that the ongoing negotiations under the UNFCCC also recognize these important linkages and help to shape financing and technology mechanisms that allow agriculture and soil carbon sequestration to contribute to national mitigation and adaptation efforts, including within the contexts of Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programmes of Action (NAPAs). FAO has strongly advocated for an appropriate inclusion of agriculture and soil carbon sequestration within the eventual outcome of the UNFCCC negotiations. It has also highlighted that many agricultural practices, particularly those that involve soil carbon sequestration, can benefit climate adaptation, food security and rural development. Such synergies, make agriculture an attractive option for early action on climate change, especially in the agriculture-based economies of the developing world if any eventual trade-offs are also well-managed.

15. FAO, now joined by a group of its partners (Consultative Group on International Agricultural Research (CGIAR), International Fund for Agricultural Development (IFAD), World Bank), will continue to provide Parties with technical information, assessments and possible options on how agriculture, particularly soil carbon sequestration, could contribute to tackling climate change, while safeguarding the sector's role vis-à-vis food security and poverty reduction. Such information, assessments and options seek to support decision-making by Parties on the governance of an issue that directly affects and is affected by agriculture. FAO has also called for support of pilots at country level to build confidence and readiness for action, especially the win-win action offered by soil carbon sequestration. The next meeting of the UNFCCC Conference of the Parties, scheduled to be held in Mexico at the end of 2010, and a meeting of the Subsidiary Body for Scientific and Technological Advice, scheduled to be held in Bonn in June 2010, will be key gatherings within the UNFCCC negotiating process.

III. FAO Work on Soils and Current Capacity

16. In 1960, FAO and the International Soil Science Society (ISSS) collaborated in the Soil Map of the World project resulting in the FAO-UNESCO Soil Map of the World (1970) and the World Soil Charter (1981). In 1977, the *Framework for Land Evaluation* was published and, in 1978, the first results of *FAO's Agro-ecological Zones* study were published and later expanded globally in cooperation with the International Institute for Applied Systems Analysis (IIASA). This work was the basis for estimating the World Carrying Capacity under different input scenarios and modelling for FAO perspective studies such as the *State of the World Food and Agriculture* (SOFA). During the 1980s, much of this earlier work was consolidated and expanded.

A major contribution was the harmonization of soil classification and terminology under the ISSS initiative of the World Reference Base for Soil Resources and the constant updates of the soil map of the world under the ISSS working group on the world Soil and Terrain Database (SOTER). This culminated in 2008 with the publication of the Digital Harmonized World Soil Database.

17. Over the years, FAO produced numerous states of the art, benchmark norm-setting knowledge systems, publications and guidelines and built national soil laboratories and capacities. It remains the custodian of thousands of soil maps and a major source of soil and information systems worldwide through its land and water digital media series, data bases and website. FAO established various regional soil networks in Western Africa, Eastern Africa, Southeast Asia, Latin America and elsewhere to share knowledge and expertise to address soil degradation and sustain soil fertility and productivity. These responded to needs in both modern specialized agricultural systems, which rely on high inputs to achieve and sustain high yields (that often result in pollution and loss of biodiversity), and traditional agricultural systems that are becoming unsustainable because of their increasing demands on limited and degraded land resources. A renewed emphasis on sustainable land management was given by the 1992 Rio Conference which promoted participatory and integrated approaches in land use planning (Guidelines published by FAO in 1994) as part of the sustainable development process (rather than a production-focused approach) and FAO acted as the Task Manager of Land Chapter among others.

18. FAO has been playing a lead role in assessing land degradation globally, nationally and locally with a focus on drylands through the Land Degradation Assessment in Drylands Project (LADA). It has become a key partner in this respect for the UN Convention on Combating Desertification (UNCCD) and the Global Environment Facility (GEF). FAO plays an important role in compiling, analysing and mapping geo-digitized data drawing on its soil, water, climatic, agriculture, forest and related information systems and statistics. Drought monitoring and the use of satellite soil moisture estimates is providing better drought indices and improving predictability of crop yields at seasonal time scale.

19. FAO has been a major partner in documenting systematically a harmonized inventory of sustainable soil and water conservation techniques and sustainable land management (SLM) interventions with the World Overview of Conservation Approaches and Technologies (WOCAT). The WOCAT databases contain a full range of case studies documented from all over the world. Online databases are in development allowing interactive updating by FAO partners and members of the WOCAT network. This important resource is being updated, with many best practices from sub-Saharan Africa through TerrAfrica and the LADA. FAO is now involved in assessing SLM Technologies, in terms of their environmental and socioeconomic impacts, in promoting uptake of SLM measures through farmer-led learning approaches, and in advising countries and other stakeholders in setting up appropriate incentive arrangements.

20. In cooperation with the United Nations Convention on Biological Diversity (UNCBD), FAO pioneered the development of "Soil biodiversity initiative" as an integral part of the programme of work on Agricultural Biodiversity and has been undertaking work on a number of related activities in several countries. For example, its work on sustainable crop production intensification recognizes the need to capitalize on biological processes so that efficiency gains in crop production can be captured. Conservation agriculture, eco-agriculture and organic agriculture systems are good examples of agricultural practices in which biological processes in soil are enhanced through management, thereby increasing efficiency in terms of required fertilisers and energy. Moreover, such practices that harness soil biological functions also contribute to mitigating and adapting to climate change, through sequestering carbon, making effective use of rainwater and enhancing soil moisture for drought mitigation. There have been several major initiatives at the global level in support of regional and national efforts in mainstreaming sustainable production intensification. One example is the stakeholder soil health consultation that led to the hosting of a global communication platform for the Conservation Agriculture Community of Practice (CA-CoP).

21. As highlighted in the documentation for the Copenhagen process (COP-15, UNFCCC), soil is a key component in the various climate change activities of FAO, from global impact assessments, building adaptive resilience, to identifying mitigation potentials and adaptation-mitigation synergies that enhance food security and sustainable development. In December 2009, FAO initiated a consultation process inviting experts and representatives from key institutions to review the state of knowledge on GHG emissions and the mitigation potentials in the agriculture, forestry and fisheries sectors. The consultation highlighted that the largest source of mitigation potential in agriculture is soil carbon sequestration through improved cropland and grazing land management as well as the restoration of degraded soils. FAO also prepared a soil carbon gap map that identifies bright spots for soil carbon sequestration. The consultation underscored that there is a need to collect the data, build the knowledge and capacity and develop the policy and methodologies to facilitate the transformation of the agriculture sectors as a solution to climate change and into more sustainable, productive, resilient and climate friendly sector².

22. FAO needs a strong capacity in soils to respond to all the demands outlined above and the emerging issues related to climate change.

IV. A Soil Partnership for Food Security and Climate Change Adaptation and Mitigation

23. FAO's High-Level External Committee (HLEC) on the Millennium Development Goals advised the Director-General (13-14 October 2009), that FAO, as a global knowledge organization, take the leadership in establishing a Global Soil Partnership that includes a comprehensive view of the problem and the opportunities the Soil Partnership will create to improving food security and livelihood, as well as, to address the challenges of climate change. The HLEC suggested that the Partnership should pilot, coordinate and catalyze efforts at the global level – starting from the knowledge, information and soil-related activities of local, country and regional networks to ensure the appropriate coverage of the problems and building capacities of member countries to address Millennium Development Goals particularly MDG1 and 7. In this respect, FAO regional networks are a solid base to support a Global Soil Partnership in collaboration with the International Soil Reference and Information Centre (ISRIC), the International Institute for Applied Systems Analysis (IIASA), the European Soil Bureau, the International Union of Soil Sciences (IUSS), CA-CoP and others. These networks could be complemented with the networks of the CGIAR centres and regional research networks, drawing on partnerships that have been built throughout the years between substantive soil institutes in various countries (China, India, Russia, United States of America, EU countries and others) and FAO. Such a Global Soil Partnership would promote and support a number of Soil-Based Networks and Programmes as well as crop and animal-based networks in developing coordinated actions at national, regional and global levels to address soil-related problems in specific soil types and ecosystems, as well as the interrelations among soil management, food and livelihood security and climate change.

24. Through enhanced and applied knowledge of soil resources and in order to respond to needs of FAO Member countries in meeting their commitments to the MDGs, environmental conventions (UNCCD, CBD and UNFCCC) and in support of the UN Commission on Sustainable Development (CSD) and its Rio+20 process, the Global Soil Partnership would:

- Assess land degradation globally, nationally and locally, including LADA.
- Document a harmonized inventory of sustainable soil and water conservation techniques and SLM interventions with WOCAT.
- Promote and mainstream promising sustainable production systems and the associated ecosystem services for development, including intensification, livelihoods, food security and economic growth.

² <http://www.fao.org/climatechange/59239/en/>

- Increase recognition, and improve provision of those ecosystem services specifically derived from soil health and sustainable production systems, in particular those of the Carbon, Nitrogen and water cycles and soil biological activity (soil biodiversity) associated with improved practices.
- Coordinate assessment of soil health and productivity, carbon stocks, and cost-benefit analysis of improved soil management practices.
- Validate and promote wide adoption of improved technologies and management practices for increasing soil productivity and food security, enhancing efficient use of inputs, preventing soil degradation and restoring degraded soils.
- Create learning and training opportunities for farmers, extension agents and researchers in sustainable soil management and innovative farming methods. In this regard re-orienting extension and research systems to address the needs of rural women would be vital.
- Develop Soil Health and Management guidelines and norms and support policies and strategies that harness the win-win opportunities of sustainable soil management (productivity, carbon sequestration, soil biodiversity, water balance, food security).
- Engage with external partners and donors to leverage resources through emerging financial mechanisms for soils as a central element of climate change adaptation and mitigation.

V. FAO Process towards the Earth Summit in 2012 (Rio+20)

25. In the current era of multiple crises, from food price, through climate change to economic failure, policy makers around the world are exploring opportunities to make a shift to a green economy. The international community is seeking new ways of developing the concept of sustainable development up to and beyond the Earth Summit in 2012, mainly with regards to practical ways for the coherent implementation of the three pillars of sustainability, moving away from trade-offs to synergies between the economic, social and environmental dimensions of development.

26. The UN General Assembly at its 64th Session agreed to convene a UN Conference on Sustainable Development in Brazil in 2012. The objectives are: to secure renewed political commitment to sustainable development; to assess progress and gaps in implementation of the major summits; and to address new and emerging challenges including food, fuel, climate, finance and employment. The two main themes of the Conference are: a green economy in the context of sustainable development and poverty eradication; and the institutional framework for sustainable development. The preparation of the Conference will include three Preparatory Committee meetings and the first meeting will be held on 17-19 May 2010, following the 8th Session of the Commission on Sustainable Development (CSD). The Natural Resources Management and Environment Department acts as FAO Focal Point for the CSD and the Joint Crisis Initiative 4 on the Green Economy.

VI. Committee Guidance

27. The Committee is invited to take note of the critical importance of the above suggestions and is invited to provide guidance on future work on the following points:

1. Request FAO to significantly strengthen its soil and land-related capacities in FAO work programme by highlighting the opportunities emerging from carbon financing in the climate change agenda and the potentials of agriculture to provide win-win options in addressing the challenge of food security and climate change adaptation and mitigation.
2. Encourage FAO in taking the leadership in establishing a Global Soil Partnership similar to the Global Water Partnership to strengthen soil, land and production systems-related networks and capacities at national, regional and global levels. This is also in line with the reform of the governance of the Committee on World Food Security (CFS)

and the establishment of the High-Level International Expert Panel on Food Security and Nutrition (HLPE).

3. Encourage and recommend allocation of resources for FAO to provide technical information and assessments, in particular on agro-ecological zoning and land use statistics, in order to promote possible options and advocacy work together with partners (IFAD, CGIAR and World Bank), to support decision-making within the ongoing UNFCCC negotiations and ground level pilot action. This is with a view to ensuring that future climate change strategies as well as their financing and technology mechanisms are inclusive of agricultural productivity, particularly soil carbon sequestration, and accessible to smallholder farmers. This could contribute significantly to climate change mitigation and adaptation, while also benefiting food security and poverty reduction.
4. Coordinate FAO's contributions to Rio+20: The Natural Resources Management and Environment Department could be requested to lead the FAO contributions to the UN Conference on Sustainable Development in 2012. The overall objective of such a targeted activity would be the identification of scenarios of sustainable growth pathways for the agriculture and food sector, focusing on strengthening resilience in the face of shocks. This would place member countries in a better position to both sustaining progress towards food security and mobilizing some of the investments to be made within the framework of the green economy or global green new deal for sustainable ecosystem resource management.