CONVENTION ON BIOLOGICAL DIVERSITY

CBD/SBSTTA/24/CRP.10
17 March 2022

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Twenty-fourth meeting (resumed)
Geneva, Switzerland, 14-29 March 2022
Agenda item 7

REVIEW OF THE INTERNATIONAL INITIATIVE FOR THE CONSERVATION AND SUSTAINABLE USE OF SOIL BIODIVERSITY AND UPDATED PLAN OF ACTION

Draft recommendation submitted by the Chair

Annex

DRAFT PLAN OF ACTION 2020-2030 FOR THE INTERNATIONAL INITIATIVE FOR THE CONSERVATION AND SUSTAINABLE USE OF SOIL BIODIVERSITY

I. INTRODUCTION

1. Since the launch of the International Initiative for the Conservation and Sustainable Use of Soil Biodiversity, a significant amount of new scientific, technical and other types of knowledge relevant to soils and their biodiversity has been released.

2. The plan of action 2020-2030 for the International Initiative for the Conservation and Sustainable Use of Soil Biodiversity is based on the review of the Initiative, the *Status of the World's Soil Resources* report[1] and on the preliminary findings of the report on the *State of Knowledge on Soil Biodiversity - Status, Challenges and Potentialities*,[2] prepared by the Food and Agriculture Organization of the United Nations (FAO) and the Intergovernmental Technical Panel on Soils.

3. Improved management of soil and its biodiversity offers solutions for all sectors that rely on soils, including forestry, farming, as well as natural areas, while it can simultaneously increase carbon storage, improve water and nutrient cycling, resilience to climate change, including through nature-based solutions,[3] and mitigate pollution. Soil biodiversity depends on the type of climate, mineral soil and type of vegetation and, in turn, this biodiversity has an effect on soil. In order to maintain or restore the biodiversity of soils, it is necessary to maintain or restore their biophysical, biochemical and biological properties. Soil biodiversity and its biotic interactions are an important lever to improve soil quality and function, highlighting the importance of research, monitoring and management that is geared directly at soil biodiversity, as an integrative part and key element of soil quality. Soil biodiversity is also crucial to improve not only soil health,[4] but also plant, animal and human health.

4. However, soil is one of the world's most vulnerable resources in the face of pollution, climate change, desertification, land degradation, drought, land-use change, unsustainable agriculture practices,

[1] Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils (2015). *Status of the World's Soil Resources* – Main Report, Rome.

[2] CBD/SBSTTA/24/INF/8.

[3] At its he fifth session, the United Nations Environment Assembly, in its resolution on "Nature-based solutions for supporting sustainable development", formally adopted the definition of nature-based solutions as being "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."

[4] Soil health defined as: "The capacity of soil to function as a living system. Healthy soils maintain a diverse community of soil organisms that help to control plant disease, insect and weed pests, form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive repercussions for soil water and nutrient holding capacity, and ultimately improve crop production". FAO. 2011. *Save and Grow: A Policymaker's Guide to the Sustainable Intensification of Smallholder Crop Production*. ISBN 978-92-5-106871-7112. http://www.fao.org/3/i2215e/i2215e00.htm

biodiversity loss, increased demand for water and food production, urbanization and industrial development. Therefore, in order to safeguard soils and ecosystems, it is necessary to prevent soil loss and soil biodiversity loss from anthropogenic drivers related to climate change, such as the increase in temperature, droughts or extreme rainfall, and to land-use change.

5. The present plan of action presents global actions to support the integration of soil biodiversity considerations into the context of the post-2020 global biodiversity framework, as well as within and across productive sectors.

6. The elements of this plan of action recognize the need to mainstream soil biodiversity across sectors and the need for integrated approaches to better address the complex interactions that come into play as the conservation and sustainable use of soil biodiversity usually involve economic, environmental, cultural and social factors. The importance of implementation at the field level with due consideration of gender roles, local context and specificities is another element reflected in the plan, while awareness-raising, sharing of knowledge, capacity-building and research remain key to ensuring a better understanding of the role of soil biodiversity for sustainability.

7. The present plan of action has been prepared jointly by FAO, the Secretariat of the Global Soil Partnership (GSP) and the Secretariat of the Convention on Biological Diversity, in consultation with other partners and relevant experts, pursuant to decision 14/30.

II. PURPOSE AND OBJECTIVES

8. The *Status of the World's Soil Resources* report identified 10 threats critical to soil functions. The loss of soil biodiversity was identified as one of these threats, and a respective call for action was strongly recommended. The Voluntary Guidelines for Sustainable Soil Management[5] provide a framework for reverting it through a number of policies, research and field actions.

9. The *purpose* of this plan of action is to provide ways to encourage conservation, restoration and sustainable use of soil biodiversity and to support Parties, other Governments, subnational and local governments, indigenous peoples and local communities, women and youth, relevant organizations and initiatives, in accelerating and upscaling efforts towards the conservation, restoration and sustainable use of soil biodiversity, and towards the assessment and monitoring of soil organisms to promote their conservation, sustainable use and/or restoration, and to respond to challenges that threaten soil biodiversity.

10. The *overall objective* of this plan of action is to mainstream soil biodiversity science, knowledge, and understanding into public policies, at all levels, and to foster coordinated action to safeguard and promote the conservation, restoration and sustainable use of soil biodiversity and its ecosystem functions and services, which are essential for sustaining life on Earth, while acknowledging that economic, environmental, cultural and social factors contribute to sustainable soil management, and to promote investment in soil biodiversity research, monitoring and assessment at all levels. Achieving this objective will ensure that soil biodiversity recovers and continues to provide a full range of functions. It will also formally promote sustainable soil management practices that can enhance soil biodiversity while maintaining the productivity of managed ecosystems.

11. The *specific objectives* of this plan of action are to help Parties, other Governments, indigenous peoples and local communities, women and youth, and other stakeholders, in accordance with national priorities and circumstances, consistent with the Convention and other applicable international obligations, as well as relevant organizations and initiatives, with the following:

(a) Implementing coherent and comprehensive policies for the conservation, restoration and sustainable use of soil biodiversity at the local, subnational, national, regional and global levels, considering the different economic, environmental, cultural and social factors of agricultural producers and their soil

[5] FAO 2017. *Voluntary Guidelines for Sustainable Soil Management*. Food and Agriculture Organization of the United Nations, Rome. http://www.fao.org/documents/card/en/c/5544358d-f11f-4e9f-90ef-a37c3bf52db7/.

management practices, and mainstreaming their integration into relevant sectoral and cross-sectoral plans, programmes and strategies;

(b) Encouraging the use of sustainable soil management practices and existing tools, sustainable traditional practices, guidance and frameworks to maintain and restore soil biodiversity and to encourage the transfer of knowledge and enable women, particularly rural women, indigenous peoples and local communities and all stakeholders to harness the benefits of soil biodiversity for their livelihoods, taking into account national circumstances;

(c) Promoting education, awareness-raising and developing capacities in the public and private sectors on the multiple benefits and application of soil biodiversity, sharing knowledge and improving the tools for decision-making, fostering engagement through collaboration, intergenerational transmission of traditional knowledge of indigenous peoples and local communities and partnerships, and providing practical and feasible actions to avoid, reduce or reverse soil biodiversity loss;

(d) Developing voluntary standard protocols to assess the status and trends of soil biodiversity, as well as monitor activities, in accordance with national legislation, to address gaps in knowledge and foster relevant research, and to enable compilation of large data sets to support research and monitoring activities;

(e) Recognizing and supporting the role of indigenous peoples and local communities, women, smallholders and small-scale food producers, particularly family farmers, and the land and resource rights of indigenous peoples and local communities in accordance with national legislation and international instruments through agroecological and other sustainable intensification approaches.

(e) *alt* Recognizing and supporting the role, and land and resource rights of indigenous peoples and local communities, in accordance with national legislation and international instruments, as well as the role of women, smallholders and small-scale food producers, particularly family farmers, in maintaining biodiversity through sustainable agricultural practices, such as agroecology and ecological intensification.

12. The plan of action seeks to contribute to the achievement of the Sustainable Development Goals, in particular Goals 2, 3, 6, 13, 14 and 15, the post-2020 global biodiversity framework, the 2050 Vision for Biodiversity, the FAO Strategy on Mainstreaming Biodiversity across Agricultural Sectors,[6] the UNCCD 2018-2030 Strategic Framework[7] and the objectives, commitments and initiatives under other conventions and multilateral environmental agreements, including, the three Rio conventions, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal,[8] the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade[9] and the Stockholm Convention on Persistent Organic Pollutants,[10] and the Minamata Convention on Mercury.

III. SCOPE AND PRINCIPLES

13. The *scope* of this updated plan of action focusses on soils across agricultural, other productive landscapes and other relevant ecosystems. It is wide and far-reaching and context-dependent to ensure that it responds to specific situations and farmer typologies and that it prioritizes actions on the basis of country goals and the needs of direct beneficiaries.

14. The Initiative continues to be implemented as a cross-cutting initiative by Parties to the Convention, the Secretariat, FAO and its Global Soil Partnership in partnership with the work of the Intergovernmental

[6] FAO. 2020. *FAO Strategy on Mainstreaming Biodiversity across Agricultural Sectors*. Rome. https://doi.org/10.4060/ca7722en.

[7] United Nations Convention to Combat Desertification, Conference of the Parties, thirteenth session, decision 7/COP.13 (see ICCD/COP(13)/21/Add.1).

[8] United Nations, *Treaty Series*, vol. 1673, No. 28911.

[9] Ibid., vol. 2244, No. 39973.

[10] Ibid., vol. 2256, No. 40214.

Technical Panel on Soils, the Global Soil Biodiversity Initiative, the Science-Policy Interface of the United Nations Convention to Combat Desertification, education, academic and research bodies, donor agencies and the private sector, as well as relevant organizations, farmers, land owners and land managers, indigenous peoples and local communities, women, youth, subnational governments and civil society.

15. When linked to the post-2020 global biodiversity framework, the United Nations Decade on Ecosystem Restoration,[11] the United Nations Decade of Family Farming 2019-2028, the 2030 Agenda for Sustainable Development and its Sustainable Development Goals, [12] the Paris Agreement [13] and land degradation neutrality targets, the scope of this plan of action can achieve multiple co-benefits of soil biodiversity processes for improved and more sustainable land-use practices.

16. The plan of action adheres to the *principles* of the ecosystem approach,[14] which is aimed at providing better biological, physical, economic and human interactions associated with sustainable and productive ecosystems.

17. The plan of action focuses on the improvement of livelihoods, on the implementation of integrated and holistic solutions adapted to national and subnational contexts and in developing synergies for better soil biodiversity research, monitoring and assessment while ensuring multi-stakeholder participation.

18. The plan of action recognizes the role of farmers, smallholders, small-scale food producers, family farmers, peasants, landowners, land managers, foresters, ranchers, indigenous peoples, local communities, women, youth, education, academia and research bodies, civil society, subnational governments, the private sector, and other relevant stakeholders in the conservation, restoration and sustainable use of soil biodiversity and for the implementation of the plan.

19. FAO is invited to facilitate the implementation of the plan of action, and it is intended to align activities on soil biodiversity more closely with other FAO-related activities as well as with regional and country offices in order to create synergies and provide broader support. The full implementation of the plan of action at the national and subnational levels will depend on the availability of resources.

IV. GLOBAL ACTIONS

20. To support the implementation of coherent and comprehensive policies for the conservation, restoration and sustainable use of soil biodiversity at all levels, the following global actions have been identified and can be considered, as appropriate and on a voluntary basis, by Parties and other Governments, in collaboration with relevant organizations:

(a) Develop protocols, follow harmonized methods and use tools to collect and digitize soil biodiversity data and to improve mapping capabilities of Parties, acknowledging the differences in soil types across regions;

(b) Include soil biodiversity as an important component of soil description surveys using a large range of tools, including state-of-the-art methods and technology, and the development of bioindicators;

(c) Establish or strengthen, as appropriate, a monitoring network to assess and keep track of the abundance and diversity of multiple soil taxa or units and of the changes in soil biodiversity and its functioning, in accordance with national legislation;

(d) Prepare a global assessment of soil biodiversity based on the compilation of national information captured from field assessments in all regions that addresses the gaps in soil knowledge at the

[11] See General Assembly resolution 73/284 of 1 March 2019.

[12] General Assembly resolution 70/1.

[13] United Nations, *Treaty Series*, Registration No. I-54113.

[14] Decision V/6.

global level and the need to invest in technologies to map soil biodiversity, especially in developing countries;

(e) Develop or identify and implement feasible indicators of soil biodiversity that are related to key ecosystem functions and services and under the framework of the one-health concept;[15]

(f) Strengthen education and capacity-building to monitor soil microbiodiversity and contribute to human, plant and soil health;

(g) Promote ecosystem-based approaches to conserve, restore and sustainably manage soil biodiversity in response to numerous challenges, such as loss of soil organic carbon and the need for sustainable management of soil in the context of climate change, the control, prevention and suppression of soil-borne diseases, enhancement of soil nutrients, food security and food safety, reducing water scarcity and disaster risk;

(h) Engage with the United Nations Decade on Ecosystem Restoration, to pursue restoration of degraded soils and their multifunctionality, including the utilization of restored areas and degraded agricultural areas for food production and avoiding expansion to natural areas where feasible;

(i) Encourage non-State actors, research bodies, subnational governments, cities and other local authorities, to become involved in the implementation of the plan of action;

(j) Encourage awareness-raising on the importance of soil biodiversity and its functions and services through subnational, national, regional and global platforms, such as FAO and GSP, which provide existing channels to be leveraged;

(k) Promote conservation, restoration and sustainable use activities and management practices.

(l) Identify the cumulative impacts of multiple sectors on the quality of soil biodiversity;

(m) Prevent and address negative impacts of farming practices, such as unsustainable use of fertilizers and pesticides to soil biodiversity, based on risk assessment approaches.

V. KEY ELEMENTS AND ACTIVITIES

21. The plan of action comprises four main elements that could be undertaken, as appropriate and on a voluntary basis, by Parties and other Governments, in collaboration with relevant organizations:

(a) Policy coherence and mainstreaming;

(b) Encouraging the use of sustainable soil management practices;

(c) Awareness-raising, sharing of knowledge and capacity-building and development;

(d) Research, monitoring and assessment.

Element 1: Policy coherence and mainstreaming

Rationale

Soil loss and soil biodiversity loss is a cross-cutting issue, and policies should be designed to integrate considerations not only into the context of sustainable agriculture and sustainable forest management, but also within other sectors, especially infrastructure, mining, energy, transport and spatial planning. Appropriate and coherent national and subnational policies are needed to provide an effective and enabling environment to support activities by farmers, land managers and foresters, indigenous peoples and local communities, women and youth and all relevant stakeholders. Inclusive policies that take soil biodiversity into consideration and promote its conservation, restoration and sustainable use can provide multiple benefits by linking agriculture, food production, forestry, marine, water, air, human health, culture, spiritual and environmental policies.

[15] https://www.who.int/features/qa/one-health/en/

Activities

1.1 Promote the importance of mainstreaming soil biodiversity, including the conservation, restoration, sustainable use and management of soil biodiversity into policies aimed at the sustainability of agriculture, and other relevant sectors and support the development and implementation of coherent and comprehensive policies for the conservation, sustainable use and restoration of soil biodiversity at the local, subnational, national, regional and global levels;

1.2 Foster activities to safeguard and promote the importance as well as the practical application of soil biodiversity, and integrate them into broader policy agendas for food security, ecosystem and landscape restoration, climate change adaptation and mitigation, urban planning and sustainable development, including the post-2020 global biodiversity framework, UNCCD 2018-2030 Strategic Framework and the Sustainable Development Goals;

1.3 Promote the implementation of sustainable soil management[16] as one of the vehicles to promote integrated and holistic solutions which recognize the key role of above-ground/below-ground biodiversity interactions and of indigenous peoples and local communities and their traditional knowledge and practices, considers local contexts and integrated land-use planning, in a participatory manner;

1.4 Promote integrated ecosystem approaches for the conservation, restoration and sustainable use of soil biodiversity considering, as appropriate traditional agricultural practices;

1.5 Promote policies that provide economic incentives for practices that protect or increase soil biodiversity, avoiding policy measures that would distort trade and create inefficiency; and eliminate, phase out or reform incentives, including subsidies harmful to soil biodiversity;

1.6 Develop policies and actions based on the recognition that soil biodiversity is central for sustaining all ecosystems and a key asset in restoring soil multi-functionality in degraded and degrading ecosystems;

1.7 Strengthen synergies between scientific evidence, conservation, restoration and sustainable practices, farmer-researcher community practices, agricultural advisory services and traditional knowledge of indigenous peoples and local communities to better support policies and actions;

1.8 Address linkages between soil biodiversity and human health, nutritious and healthy diets, pollutants exposure, including pesticides, veterinary drugs, and overflow of fertilizers;

1.9 Promote ways and means to overcome obstacles to the adoption of sustainable soil management associated with land tenure, the rights of users of land and water, in particular women, the rights of indigenous peoples and local communities in accordance with national legislation and international instruments, recognizing their important contributions through their knowledge and practices, gender equality, access to financial services, agricultural advisory services and educational programmes;

1.10 Consider the use and implementation of existing tools and guidance at the national, subnational, regional and global levels, such as the FAO agroecology knowledge hub, the FAO Voluntary Guidelines for Sustainable Soil Management,[5] the FAO's Revised World Soil Charter,[17] the Code of Conduct on Pesticide Management[18] and the International Code of Conduct for the Sustainable Use and Management of Fertilizers;[19] the Committee on World Food Security's Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forest in the Context of National Food Security;[20]

---

[16] See FAO 2017. *Voluntary Guidelines for Sustainable Soil Management*. Food and Agriculture Organization of the United Nations. Rome. http://www.fao.org/3/a-bl813e.pdf

[17] http://www.fao.org/documents/card/en/c/e60df30b-0269-4247-a15f-db564161fee0/

[18] http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/en/

[19] http://www.fao.org/3/ca5253en/ca5253en.pdf

[20] http://www.fao.org/3/i2801e/i2801e.pdf

1.11 Encourage Parties to include soil biodiversity in national reports and national biodiversity strategies and action plans;

1.12 Promote coordinated spatial planning and other approaches to reduce the loss of soil and biodiversity and implement adequate monitoring of soil sealing

1.13 Identify sources of financial resources for the implementation of the action plan

Element 2: Encouraging the use of sustainable soil management practices

Rationale

Management practices and land-use decisions undertaken by farmers, ranchers, landowners, land managers, foresters, indigenous peoples, local communities, women and youth and all relevant stakeholders influence ecological processes, including soil-water-plant-atmosphere interactions with biodiversity. There is increasing recognition that the sustainability of agriculture and other managed systems depends on the optimal use of the available natural resources, biogeochemical cycles, biodiversity, including soil biodiversity, its functions and its contribution to ecosystem services. Improvement in sustainability requires the optimal use and management of soil fertility and soil physical properties and soil restoration, which rely, in part, on soil biological processes and soil biodiversity. Direct and indirect drivers of soil biodiversity loss need to be addressed at multiple scales, and special attention is needed at the farm~~, arable lands~~ and forestry level and across entire ecosystems.

Activities

2.1 Promote the improvement of soil health and the enhancement of soil organism abundance and diversity, by improving their food, water and habitat conditions through sustainable agricultural practices,[21] such as agroecology and ecological intensification and the restoration of degraded soils to increase ecosystem connectivity and restore production areas;

2.2 Develop, enhance and implement science-based risk assessment procedures, as appropriate, on a regular basis, considering field-realistic exposures and longer-term effects, for veterinary drugs (e.g. antibiotics[22]), pesticides and pesticide-coated seeds, pollutants (including emerging substances, such as microplastics and new organic compounds), biocides and other contaminants to inform risk management decisions, to limit or minimize pollution and to promote the science-based application and minimization of veterinary drugs, fertilizers and pesticides (e.g. nematicides, fungicides, insecticides and herbicides) to enhance the conservation, restoration and sustainable use of soil biodiversity, human health and well-being;

2.3 Facilitate, for all relevant stakeholders, access to policies, tools and enabling conditions, such as access to technologies, innovation and funding, as well as to traditional practices that promote the conservation, restoration and sustainable use of soil biodiversity at the field level, taking into account the full and effective participation of indigenous peoples, local communities, women, youth, education, academia and research bodies, subnational governments and stakeholders in the implementation of this Initiative;

2.4 Encourage sustainable agricultural practices, such as agroecology, integrated production systems (crop, livestock, aquaculture, forest and agroforestry), no-tillage systems, crop rotation in the field, fallow periods, inter-cropping, perennial crops, multicropping, cover crops, mixed crops, addition of organic matter and preservation and development of perennial vegetation in field margins and biodiversity refuges, and of landscape features, such as hedgerows, contour bunds and terraces;

---

[21] These practices may include: agroforestry; the maintenance of adequate soil organic matter content and soil microbial biomass; provision of sufficient vegetative cover; multicropping; longer crop rotation; minimization of soil disturbance and tillage; no-tillage systems; use of organic fertilizers; use of biological nitrogen fixation; appropriate management of agricultural waste; integrated pest management; optimization and minimization of agricultural chemicals, in accordance with science-based risk assessment; and presence of native habitats within agricultural landscapes.

[22] For example, antibiotics used on livestock that can seep into the soil.

2.5 Facilitate site-specific remediation of contaminated soils;[23] preferring those alternatives that show minor risks to biodiversity, while exploring the implementation of bioremediation strategies that use native microorganisms;

2.6 Prevent the introduction and spreading, and minimize the impact of invasive alien species that present a direct and indirect risk to soil biodiversity, and monitor the dispersion and eradicate, control or manage those already established;

2.7 Protect, restore and conserve soils that provide significant ecosystem services, particularly those with high amounts of biological diversity or agricultural suitability, including through the use of sustainable soil management practices;

2.8 Promote sustainable soil and associated water and land management practices that maintain, restore and promote the resilience of carbon rich soils (such as peatlands, black soils, mangroves, coastal wetlands, seagrasses and permafrost);

2.9 Promote sustainable soil and associated water and land management practices that support the achievement of land degradation neutrality;

2.10 Promote ecosystem-based approaches to avoid land-use changes that cause soil erosion, the removal of surface cover and loss of soil moisture and carbon, and implement mitigation measures to alleviate degradation;

2.11 Promote conservation, restoration and sustainable management of soil biodiversity, and implement where appropriate, ecosystem-based approaches for adaptation, mitigation and disaster risk reduction;

Element 3: Awareness-raising, sharing of knowledge and capacity-building

Rationale

Increased awareness and understanding are critical for the development and promotion of improved practices for the conservation, restoration and sustainable use of soil biodiversity and ecosystem management. This requires collaboration that ensures the full and effective participation of and feedback from a broad range of stakeholders, including farmers, landowners, land managers, smallholders and small-scale food producers, indigenous peoples and local communities, women and youth, decision makers, education, academia and research bodies and relevant institutions and organizations to ensure effective actions and collaborative mechanisms. Strengthening capacities to promote integrated and multidisciplinary approaches are needed to ensure the conservation, restoration, sustainable use and enhancement of soil biodiversity. This will further improve information flows and cooperation among actors to identify best practices and foster the sharing of knowledge and information.

Activities

3.1 Increase understanding of the role of soil biodiversity and soil health in agroecosystems, forests, silvopastoral and other managed ecosystems, and in the effect on land management practices and ecosystem health;

3.2 Increase understanding of the consequences of soil biodiversity decline in specific agroecosystems, other managed ecosystems and natural environments and engage targeted key stakeholder groups, including farmers, ranchers, foresters, civil society, education, academia and research bodies, the mass media, and consumer organizations on the importance of soil biodiversity for health, well-being and livelihoods;

3.3 Strengthen the understanding of the impacts of sustainable land-use and soil-management practices, as an integral part of agricultural and their importance for sustainable livelihoods;

[23] The importance of special soils creating environments for specific soil biota (for example, natural extremely acidic or alkaline soils; natural hypersaline soils; natural soils containing high quantities of rare elements) should be recognized. Although they are not necessarily productive or high biodiverse soils, they host important communities as gene reserves and merit protection as they may contain unknown, adapted organisms that can be useful in the future.

3.4 Promote awareness-raising and sharing of knowledge through tools and digital technology and promote capacity-building and mutual learning, including at the local and field levels by developing collaborative activities, such as peer-to-peer learning, for the promotion of best practices for soil biodiversity assessment, management and monitoring for all land management activities;

3.5 Enhance education, and knowledge on soil biodiversity, soil health and the ecosystem functions and services they provide, through the update of educational curricula for professionals, including economy, agronomy, veterinary, taxonomy, microbiology, zoology and biotechnology, and through the creation and dissemination of training and information materials on soil biodiversity;

3.6 Support citizen science campaigns and awareness-raising activities to engage relevant stakeholders in the conservation, restoration and sustainable use of soil biodiversity, including celebrations on 5 December of World Soil Day, which was designated by the General Assembly of the United Nations in 2013;[24]

3.7 Build and strengthen the capacities of farmers, landowners, land managers, foresters, ranchers, the private sector, education, academia and research bodies, indigenous peoples and local communities, women and youth, and vulnerable communities, as appropriate, in designing and implementing sustainable soil management practices and the sustainable application of soil biodiversity and consider traditional knowledge and practices;

3.8 Compile, protect, maintain and promote traditional knowledge, innovations and sustainable practices of indigenous peoples and local communities, with their free, prior and informed consent, related to soil biodiversity maintenance, soil fertility and sustainable soil management and promote work mechanisms between traditional agricultural knowledge and scientific knowledge that contribute to implementing sustainable agricultural practices in accordance with local agroecological and socioeconomic contexts and needs;

3.9 Develop partnerships and alliances that support multi-disciplinary approaches, foster synergies and ensure multi-stakeholder participation with respect to sustainable soil management;

3.10 Foster scientific and technical cooperation to promote access to the latest technologies and molecular tools for soil biodiversity assessment and monitoring in developing countries.

Element 4: Research, monitoring and assessment

Rationale

Assessing and monitoring the status and trends of soil biodiversity, of measures for the conservation, restoration and sustainable use of soil biodiversity and of the outcomes of such measures, is fundamental to inform adaptive management and to guarantee the functioning of all terrestrial ecosystems, including the long-term productivity of agricultural soils. Soil biodiversity data that can be globally aggregated is needed to guide the decision-making process, with particular focus on those regions and areas currently lacking data. Education, academia and research bodies and relevant international organizations and networks should be encouraged to undertake further research, taking into consideration soil biodiversity functions regional pedodiversity, and relevant traditional knowledge, to address gaps in knowledge, and to expand research and to support coordinated global, regional, national, subnational and local monitoring efforts.

Activities

4.1 Increase national capacities on soil biodiversity taxonomy and address taxonomic assessment needs in different regions, and design targeted strategies to fill the existing gaps;

4.2 Promote further research to identify ways to integrate the application of soil biodiversity into farming systems as part of efforts to improve yield quantity and facilitate the harmonization of protocols for research, data collection, management and analysis, storage and curation of samples;

[24] See General Assembly resolution 68/232 of 20 December 2013 on World Soil Day and International Year of Soils.

4.3 Promote further research to identify risks to soil biodiversity under climate change and potential adaption measures and mitigation tools, including the potential loss of key species and their habitats, as well as the role of soil biota in wider ecosystem resilience and restoration that contributes, as appropriate, to the formulation of policy plans;

4.4 Promote the implementation of and further research and analysis of integrated pest management practices as they interact directly with functions and services provided by soil biodiversity, taking into account the negative impact of pesticides on soil organisms to support the development of more feasible and sustainable alternatives;

4.5 Promote research in order to qualify and quantify soil biodiversity in agriculture and in other managed ecosystems and cultural landscapes, and to develop consistent and comparable protocols to monitor soil quality;

4.6 Promote research, information management and dissemination, data collection and processing, community-based monitoring, transfer of knowledge and technologies, including modern geospatial technologies, genomic technologies and networking;

4.7 Promote the fair and equitable sharing of the benefits arising out of the utilization of soil genetic resources, considering the potential to develop new products and medicines, in line with the third objective of the Convention;

4.8 Mobilize targeted participatory research and development, ensuring gender equality, women's empowerment, youth, gender-responsive approaches and the full and effective participation of indigenous peoples and local communities in all stages of research and development;

4.9 Develop and apply tools to assess the status of soil biodiversity in all regions and to address gaps in knowledge in all levels, by using a range of available tools, from traditional macroorganism and soil fauna observation and analysis, national and subnational statistics, soil surveys, to cutting-edge approaches and new technologies, as appropriate;

4.10 Generate data sets on soil biodiversity, pedodiversity[25] and on soil degradation at the national, subnational and regional levels through a standard monitoring process that allows the creation of regional, national, subnational and local visual maps, georeferenced information systems and databases to indicate the status and trends of soil biodiversity and crop-specific vulnerability to support informed decision-making and comparisons;

4.11 Promote dissemination, co-creation of knowledge and exchange of information and data, in line with Articles 8(j) and 8(h) of the Convention on Biological Diversity and, through transdisciplinary approaches, ensure that all decision makers and stakeholders have access to reliable and up-to-date information;

4.12 Encourage the development of harmonized definitions, standard baselines, indicators and national and subnational-level monitoring activities of soil biodiversity with the inclusion of a vast range of soil organisms, from microorganisms to fauna, as well as monitoring the effectiveness of soil management interventions in the field;

4.13 Compile, systematize and share lessons resulting from experiences or case studies on the implementation of sustainable soil management practices in the context of agricultural practices with positive impacts on soil biodiversity;

[25] The term 'pedodiversity' and many tools for studying pedodiversity were adapted from biology. Pedodiversity, for example, can be measured just as biodiversity is measured - by means of special indices showing the abundance of species and the taxonomic distances between them. A set of mathematical methods, both parametric and non-parametrical, can be applied to quantify soil spatial heterogeneity

4.14 Promote research and capacity-building on soil management practices, including agroecological and other biodiversity-friendly management practices, that ensure conservation, restoration and sustainable use of soil biodiversity.

4.15 Promote development of commercial application, in a sustainable manner, of products based on soil biodiversity in order to promote human health directly or indirectly.

VI. SUPPORTING VOLUNTARY GUIDANCE, TOOLS, ORGANIZATIONS AND INITIATIVES RELATING TO THE CONSERVATION AND SUSTAINABLE USE OF SOIL BIODIVERSITY

22. Relevant voluntary guidance and tools developed under the Convention, and those developed by partner and relevant organizations and initiatives, such as the Voluntary Guidelines for Sustainable Soil Management and the World Soil Charter, issued by FAO, will be made available in the clearing-house mechanism.

_____