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Sustainable land management for addressing desertification/land degradation and drought, climate change mitigation and adaptation

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Synthesis report by the Science-Policy Interface

Summary

Sustainable land management (SLM) represents a holistic approach to achieving long-term productive ecosystems by integrating biophysical, sociocultural and economic needs and values. SLM is one of the main mechanisms to achieve land degradation neutrality.

To foster and facilitate the adoption of SLM practices that address desertification/land degradation and drought while mitigating climate change and enhancing climate change adaptation, the Science-Policy Interface assessed the synergistic potential of SLM practices while also critically evaluating the possible trade-offs between the different objectives. The assessment provides a scientifically sound basis to understand the potential of SLM to contribute to multiple objectives and provides practical guidance for creating an enabling environment for the selection and large-scale implementation of effective, locally adapted SLM practices.

This document presents a summary of the main scientific findings resulting from the assessment of the synergistic potential of SLM as well as conclusions and proposals for consideration by the Committee on Science and Technology at its thirteenth session.

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I. Background

1. In its decision 21/COP.12 the Conference of the Parties (COP) to the United Nations Convention to Combat Desertification (UNCCD) decided to adopt the Science-Policy Interface (SPI) work programme for the biennium 2016–2017, which requested the SPI to undertake work to highlight the science-based synergistic potential of sustainable land management (SLM) practices to address desertification/land degradation and drought (DLDD), climate change mitigation and adaptation (objective 2).

2. In line with its mandate, as defined in decision 23/COP.11 and 19/COP.12, the SPI, under the leadership of the Committee on Science and Technology (CST) Bureau, was requested to provide the CST with clear and well-defined thematic guidance on scientific knowledge requirements and identify the most optimal way forward (e.g. commissioning an individual or group of experts, etc.) to address these knowledge requirements. For objective 2, the SPI decided that the commissioning of experts would be the most optimal way forward.

3. Under the leadership of the CST Bureau, the UNCCD secretariat and the SPI drafted terms of reference and proposal evaluation criteria for the scientific work relating to objective 2. Following a public tender and a selection on a competitive basis, the Basque Centre for Climate Change (BC3) was commissioned to prepare a report in association with the Mediterranean Center for Environmental Studies (CEAM) in December 2016.

4. A scoping meeting was held on 19–20 December 2016 in Bonn, Germany, at which the co-leaders of objective 2 of the SPI work programme, one SPI Co-Chair, and representatives from BC3 and the UNCCD secretariat discussed the scope and structure of the report and methods to be applied. Discussions at this meeting also considered the outcomes of the scoping questionnaire that had been distributed amongst SPI members working on SPI objective 2 to capture their expectations for the report and to invite these SPI members to provide information on case studies and literature resources, which could be of relevance for the development of the document. The main critical issues identified during the scoping meeting included: (i) the target audience and added value of the report; (ii) the breadth and detail of the report; (iii) synergies between addressing DLDD, climate change mitigation and climate change adaptation; (iv) the creation of an enabling environment for SLM; and (v) an analysis of existing or ongoing relevant scientific and science-policy initiatives to ensure added value and avoid duplication of work. At the end of that meeting, participants agreed on a draft table of contents. Thereafter, the SPI, in close cooperation with the UNCCD secretariat, supervised and reviewed the work of the commissioned experts throughout the consultancy period through conference calls and frequent email exchanges.

5. In line with decision 19/COP.12, any scientific output prepared under the supervision of the SPI (such as that being prepared under objective 2) should undergo an international, independent review process, and any output published under the name of the UNCCD should be reviewed by the COP Bureau prior to publication. In this regard, the report was prepared under the thorough and continuous supervision of the four designated SPI co-leaders of objective 2 of the SPI work programme from December 2016 to May 2017 and included an iterative internal and external scientific review. Notably, the draft went through a parallel review process by all SPI members and six external expert reviewers, selected by the SPI co-chairs, from the different United Nations regions. Moreover, the preliminary results of the report were presented and discussed at the Global Symposium on Soil Organic Carbon held in Rome on 21–23 March 2017. Subsequent to the internal and external review, the consolidated draft was once again discussed at the SPI meeting held on 27–28 April 2017. The final version of the report was submitted by the

UNCCD secretariat on 5 May 2017 to the COP Bureau for its review by 26 May 2017. The report forms the basis for developing a Science-Policy Brief, which is to be done by the SPI in a final step.

6. This document presents a summary of the main scientific findings emerging from the final report entitled "Contribution of sustainable land management to successful land-based climate change adaptation and mitigation" by the BC3 and CEAM as well as conclusions and proposals for consideration by the CST at its thirteenth session.

II. Summary of main scientific findings

A. History, definition and scope of sustainable land management

7. In document ICCD/CRIC(11)/INF.3, SLM was defined as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions''. This definition, originating from the United Nations Earth Summit in 1992, presents SLM as a holistic approach to achieving long-term productive ecosystems by integrating biophysical, sociocultural and economic needs and values.

8. The conceptual framework for land degradation neutrality (LDN), as developed by the SPI (ICCD/COP(13)/CST/2), considers SLM one of the main mechanisms to achieve LDN.

9. The concept of SLM is applicable to any ecosystem and land-use type where it contributes to addressing DLDD and climate change mitigation and adaptation, and to achieving LDN. This means it can be promoted by countries according to their individual socioecological circumstances and national planning and development objectives.

B. Sustainable land management as a land-based solution for desertification/land degradation and drought, and climate change adaptation and mitigation: synergies and trade-offs

10. Land provides vital environmental functions and ecosystem services, including provisioning, regulating, supporting and cultural services. These ecosystem services support the production of food, feed, fuel and fibre for society, regulate the risks of natural hazards, and provide cultural and spiritual services for human well-being. DLDD and climate change can negatively affect the provision of ecosystem services with severe implications for sustaining livelihoods and safeguarding human well-being.

11. There is increasing scientific evidence of the potential advantages of SLM technologies as land-based solutions to address DLDD, climate change adaptation and climate change mitigation simultaneously, while often achieving other co-benefits, such as protecting biodiversity and securing the quantity and quality of soil and water as well as economic opportunities. However, comprehensive multiobjective assessments, including assessments of co-benefits, trade-offs, barriers to implementation, and enabling conditions, are needed. The SPI assessment report helps fulfil this need.

12. There is no one-size-fits-all measure to achieve SLM. For each specific local scale, SLM strategies have to consider the complex interplay of: (i) socioecological systems and their vulnerability, resilience and adaptive capacities to human activities; and (ii) climate change impacts, as well as the interaction between these two drivers of changes. To achieve

SLM, land should be perceived as a multifunctional socioecological system whose natural capital, soil and biodiversity, while interacting with water and the atmosphere, generate the flow of ecosystem services that support human well-being by securing the lives and livelihoods of individuals and communities. Decision-making on SLM needs to consider all possible synergies and trade-offs across spatial and temporal scales.

13. Few generalizations can be made from the findings of local SLM impact studies because their effectiveness is inherently dependent upon the local socioeconomic, environmental and cultural context. Therefore, reliable quantitative assessments of the global impacts of SLM are difficult to make and were not the objective of the assessment report. Nevertheless, there is widespread scientific evidence of the advantages individual SLM practices can have in simultaneously addressing DLDD, climate change adaptation and climate change mitigation based on empirical, site-specific research. The assessment report provides many local examples, which it uses to conclude that, with regard to their simultaneous contribution to addressing DLDD, climate change mitigation and climate change adaptation, it is most efficient to have combinations of SLM practices that aim at:

(a) **Increasing and stabilizing crop productivity** through combinations of vegetation, crop diversification, soil fertility and sustainable water management practices. The contributions of these practices to climate change mitigation are likely to be less widely applied in drylands, where climate change adaptation and the reduction of DLDD through SLM practices are often the priority;

(b) **Ensuring sustainable grazing land management** by managing the timing and severity of grazing to ensure that the carrying capacity is not exceeded. Where suitable, measures may also be applied to increase and stabilize productivity in grazing lands through pasture management, diversification and selection of the most appropriate species, and the prioritization of indigenous species, taking account of their resilience to climate change;

(c) **Maintaining or increasing forest cover** through sustainable forest management, afforestation and reforestation. These practices have a significant potential for climate change mitigation and biodiversity conservation while preventing land degradation and increasing the resilience of forest-dependent communities. By enhancing forest carbon stocks and forest cover with the most appropriated mix of species and prioritizing the use of indigenous species, these practices enable adaptation to hydro-climatic and geological events such as heatwaves, droughts, floods, landslides, and sand and dust storms;

(d) **Establishing combinations of crops and multipurpose tree systems** through agroforestry practices. These mixed systems contribute to increases in soil quality, nutrient cycling and carbon sequestration and control soil erosion, while providing food and income to communities and enhancing resilience to climate change.

14. **Increasing soil organic carbon (SOC)** stocks is key to most SLM practices and creates synergies in addressing DLDD, climate change adaptation and climate change mitigation. Maintaining or increasing SOC stocks contributes to reducing greenhouse gas (GHG) emissions and removing carbon dioxide (CO_2) from the atmosphere, improves soil health and fertility through improved water and nutrient retention and availability to plants, and therefore contributes to food production potential and resilience to drought. The potential and magnitude of each of these benefits depends on the current soil carbon stocks and local environmental, socioeconomic and cultural conditions.

15. SLM practices have strong potential to enhance SOC sequestration, although estimates of this potential should consider the full GHG balance, including possible interactions between the carbon and nitrogen cycles that could affect the net climate change mitigation potential of applied practices. Even when the mitigation potential of SLM is not fully achieved, its impact on SOC should be considered since increasing SOC has crucial

positive benefits for achieving LDN, climate change adaptation, food security and the protection of biodiversity.

16. The large-scale adoption of SLM practices in all managed ecosystems (irrigated and rainfed croplands, grazing lands, forests and woodlands) could theoretically sequester about 1–2 Gt of carbon per year globally over 30–50 years, although estimates vary in magnitude depending on which land-use categories, management practices and GHG fluxes are included. At any site, the rate of SOC sequestration depends on current SOC stocks and declines over time as the saturation level is approached; the main carbon sequestration potential is in degraded soils. In soils with high SOC content, preventing SOC loss is a priority. Overall, SLM provides an opportunity to recover between 21 to 51 Gt of the lost carbon in the world's agricultural and degraded soils. The achievable local or regional SOC sequestration may be higher or lower than the theoretical SOC sequestration potential based on local environmental, socioeconomic, cultural and institutional contexts.

17. Databases such as the World Overview of Conservation Approaches and Technologies (WOCAT), TerrAfrica, the World Bank sourcebook, and the Voluntary Guidelines for Sustainable Soil Management (VGSSM) provide comprehensive recommendations and examples of SLM practices. The combined implementation of practices that address soil and water conservation, the diversification of cropping systems, the integration of crop and livestock systems, and the promotion of agroforestry are most effective and should be prioritized.

C. Barriers to the adoption and implementation of sustainable land management

18. The adoption of SLM practices is still slow despite advances in the scientific understanding of the principles and benefits of SLM. Often, the implementation of SLM is limited to a minority of innovative land-users and practitioners in traditional systems. Although SLM is increasingly promoted at the policy and international development cooperation level, land degradation is still increasing and a major global threat.

19. Identified barriers for the implementation of SLM are related to technological, ecological, institutional, economic and sociocultural issues such as:

(a) Limited finance and access to capital for the implementation and maintenance of SLM;

(b) Lack of access to appropriate technologies, practices or equipment;

(c) Lack of access to knowledge and information on SLM options and their proper implementation;

(d) National policies, regulations, and weak governance structures that inhibit decision-making at different scales; insecure land tenure; and absent or poorly functioning research and extension services;

(e) Environmental constraints for the implementation of certain SLM practices;

(f) Insufficient availability of land, human, biomass, energy, water and/or plant resources;

(g) Stakeholder perception of DLDD and climate change impacts and of the potential benefits and costs of SLM.

D. Opportunities and enabling conditions for scaling up sustainable land management

20. The success of creating synergies through SLM for addressing DLDD, climate change adaptation and climate change mitigation depends on sustaining and scaling up the implementation of SLM practices. This is an important social and institutional challenge.

21. The multiple long-term benefits brought about by SLM in addressing DLDD, climate change mitigation and climate change adaptation, contributing to multiple Sustainable Development Goals (SDGs) and protecting biodiversity, provide a global incentive for policymakers to develop and support decisions aimed at implementing SLM.

22. To trigger the wide-scale adoption of SLM practices, tangible short- and long-term benefits for land users, such as yield increases, resistance to drought and/or monetary incentives, must be evident and achievable. Land users are most likely to adopt SLM practices if they are convinced it maintains or enhances production and food security and if there are economic benefits or other direct incentives.

23. Examples of policy instruments that facilitate and incentivize the implementation of SLM practices and remove the barriers to the adoption of such practices include:

(a) Linking of existing agricultural subsidy schemes to the implementation of SLM practices or the development of new payment schemes for ecosystem services to compensate land owners and managers for the implementation or maintenance costs of SLM practices that help to protect ecosystem services for society as a whole;

(b) Support for the identification and establishment of sustainable business models and investment opportunities for SLM practices that contribute to addressing DLDD, climate change mitigation and climate change adaptation;

(c) Long-term financial and regularity commitment of governments for the implementation and maintenance of SLM practices;

(d) Policies that ensure the effective and accessible communication and availability of information arising from research on SLM practices and their implementation by facilitating qualified extension services and the exchange of open source data and by strengthening knowledge exchange networks;

(e) Increased opportunities for local training, education, capacity-building and support for the selection and implementation of SLM practices.

24. Meaningful stakeholder engagement throughout the planning, implementation and monitoring phases is necessary to co-create and pursue effective solutions. The consideration of local needs and traditional knowledge in the selection or design of new SLM practices considerably increases their level of acceptability among the envisaged land users and decision-makers. Participatory monitoring programmes can further help increase awareness and knowledge exchange. Hybrid knowledge developed through participatory processes that combine scientific evidence and local and traditional knowledge should inform policies.

25. Supporting decision-making on SLM practices requires a framework that facilitates knowledge exchange and discussion among land users, policymakers, different decision-making levels, scientists, civil society organizations (CSOs) and other stakeholders, giving full consideration to subnational social, economic and cultural realities, values and development trends.

26. A framework for identifying the impacts of existing and/or alternative transformational land management options on the natural environment and on social,

economic and cultural development requires reliable information from transdisciplinary cross-sectoral assessments at local and regional scales, with special attention given to the social and institutional system. These assessments should include co-benefits and trade-offs based on a complete value chain and socioeconomic analysis as well as on local knowledge of barriers to implementation and to establishing the enabling conditions for SLM strategies. Harnessing possible synergies among multiple objectives and goals could lead to a pragmatic and integrated framework for making the best technical choices and promoting the necessary enabling environments tailored to specific scales and circumstances.

III. Conclusions and proposals

27. There is strong scientific evidence that SLM can contribute significantly to addressing DLDD, climate change mitigation and climate change adaptation and to achieving multiple SDGs. SLM contributes directly to SDG 15 (life on land), which focuses on the achievement of LDN, by introducing land management practices that prevent the loss of healthy land through land degradation and maintain or improve the productivity of land. By enhancing food security and other livelihood benefits and increasing the resilience of the land and the populations depending on it, SLM also directly contributes to SDG 2 (zero hunger), SDG 3 (good health and well-being) and SDG 1 (end to poverty). SLM contributes to SDG 6 (clean water and sanitation) through its contribution to sustainable water management, and it has strong potential to contribute to climate change adaptation and mitigation actions as defined by SDG 13 (climate action). The SPI assessment report provides generic scientific guidance for countries for developing SLM strategies that optimize the synergies and trade-offs available through SLM and for determining the most effective means for the selection and large-scale implementation of region-specific SLM practices.

28. The report identifies barriers for large-scale implementation and provides recommendations on how to overcome these barriers by creating an enabling environment for SLM and carrying out transdisciplinary assessments at local and regional scales. The recommendations aim to enhance the capacities of Parties to meet their LDN target and achieve climate change mitigation and adaptation and other co-benefits.

29. There are no one-size-fits-all approaches to achieving SLM. Both the design and impacts of SLM practices depend on local environmental, socioeconomic and cultural conditions. The design and approach to foster SLM implementation need to consider the complex interplay of local and regional socioecological systems and their vulnerability, their resilience and adaptive capacities to human activities and climate change impacts, and the interaction between these drivers of changes.

30. In creating synergies between DLDD, climate change adaptation and climate change mitigation, it is most efficient to choose those measures that aim at: (i) increasing and stabilizing crop productivity; (ii) ensuring sustainable grazing land management; (iii) maintaining or increasing forest cover; (iv) establishing combinations of crops and multipurpose tree systems. SOC sequestration is a key element of most SLM practices and provides crucial synergies for pursuing DLDD, climate change mitigation and climate change adaptation objectives.

31. Often, there are barriers to the large-scale implementation of SLM practices. To overcome these barriers and trigger the wide-scale acceptance and successful implementation of SLM practices and the monitoring of their impacts requires the creation of an enabling environment at national and subnational levels, including:

(a) Mainstreaming best practices for SLM into national integrated land-use planning strategies;

(b) Strengthening national policy, legal and institutional frameworks for decision-making on SLM as one of the main means to achieve LDN;

(c) Developing and supporting economic incentives for the implementation of SLM through sustainable business models, subsidies and/or payments for ecosystem services schemes;

(d) Improving land tenure security to incentivize land users to invest in SLM;

(e) Organizing capacity-building at all relevant levels of decision-making to enhance awareness of the benefits of SLM practices and demonstrate methods for selecting and implementing SLM practices;

(f) Institutionalizing meaningful stakeholder engagement throughout the planning, implementation and monitoring phases of SLM strategies.

32. A high level of scientific confidence is necessary in order to make recommendations for SLM practices. Therefore, transdisciplinary research should focus on reducing uncertainties by analysing and promoting long-term experiments, scaling up results through meta-analyses and modelling studies, quantifying synergies and trade-offs for the natural environment and human well-being, and identifying barriers to implementation and opportunities for creating an enabling environment.

33. The SPI suggests that the CST consider the following proposals and recommends that the COP:

(a) ***Proposal 1:*** **Endorse the scientific assessment of synergies and trade-offs brought about by SLM in addressing DLDD, climate change mitigation and climate change adaptation, indicating that the assessment reflects the present level of common understanding and encourages further development and practical verification;**

(b) ***Proposal 2:*** **Invite Parties to consider the use of locally adapted SLM practices as effective means to achieve land-based national objectives related to (i) addressing DLDD, climate change mitigation and climate change adaptation; and (ii) achieving LDN, taking into consideration possible synergistic national actions related to the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity;**

(c) ***Proposal 3:*** **Call upon Parties to develop and promote policy instruments that help to overcome technological, institutional, economic and sociocultural barriers to the large-scale implementation of local SLM practices by creating an enabling environment at national and subnational levels based on: (i) mainstreaming SLM practices into national integrated land-use planning strategies; (ii) supporting the implementation of SLM as one of the means to achieve LDN; (iii) developing and supporting economic incentives for the implementation of SLM; (iv) improving land tenure security to incentivize land users to invest in SLM; (v) supporting capacity-building on SLM practices at all relevant levels of decision-making; and (vi) institutionalizing meaningful stakeholder engagement throughout the planning, implementation and monitoring phases of SLM strategies;**

(d) ***Proposal 4:*** **Invite Parties to institutionalize meaningful stakeholder engagement throughout the planning, implementation and monitoring phases of SLM strategies to facilitate the use of scientific and local knowledge, optimize knowledge exchange and discussion between land users, policymakers, scientists, CSOs and other**

stakeholders, and increase chances that effective local SLM solutions are embraced at the required scale and implemented locally;

(e) ***Proposal 5:*** **Invite Parties to initiate and support the development of transdisciplinary research programmes aimed at: (i) performing multi-objective assessments, including synergies and trade-offs for the natural environment and human well-being; (ii) identifying barriers and enabling conditions for the implementation of SLM practices; and (iii) building on participatory research methods;**

(f) ***Proposal 6:*** **Request the SPI to continue working on the assessment to provide science-based evidence on the contribution SLM has on enhancing the livelihoods and socioeconomic conditions of people affected by DLDD as part of its work programme for 2018-2019.**