United Nations ICCD/COP(14)/CST/3

Convention to Combat Desertification

Distr.: General
3 July 2019

Original: English

Conference of the Parties
Committee on Science and Technology
Fourteenth session
New Delhi, India, 3–6 September 2019
Item 2 (b) of the provisional agenda
Items resulting from the work programme of the Science-Policy Interface for the biennium 2018–2019
Guidance to support the adoption and implementation of land-based interventions for drought management and mitigation, under objective 2

Policy-oriented recommendations resulting from guidance for the adoption and implementation of land-based interventions for drought management and mitigation, under objective 2 of the Science-Policy Interface work programme for the biennium 2018–2019

Synthesis report by the Executive Secretary*

Summary

By decisions 21/COP.13 and 29/COP.13 paragraph 3, the Conference of the Parties requested the Science-Policy Interface (SPI), as objective 2 of its work programme for the biennium 2018-2019, to provide technical guidance to Parties to support the adoption and implementation of land-based interventions for drought management and mitigation.

Land management offers opportunities for mitigating the effects of drought and, more generally, refocusing actions on "proactive drought management". It also increases the resilience of people and ecosystems to drought. Following an extensive scientific review, the SPI conducted an assessment of 14 categories of sustainable land management measures in four land use types (agriculture, grazing, forests and woodlands, and mixed land use), which builds on existing United Nations Convention to Combat Desertification initiatives in the context of land degradation neutrality. The outcomes of this assessment provide a scientifically sound basis to understand how land management can contribute to drought mitigation and risk management, leading to a proposal for a new concept of drought-smart land management (D-SLM) and practical guidance for scaling up D-SLM.

This document presents activities undertaken by the SPI on this objective as well as a summary of the key findings emerging from the technical report entitled "Land-Drought Nexus: Enhancing the role of Land-based Interventions in Drought Mitigation and Risk Management". This document also includes conclusions and proposals for consideration by the Committee on Science and Technology at its fourteenth session.

* The present report was submitted after the deadline so as to include the most recent information.

Contents

List of abbreviations

COP	Conference of the Parties
CRIC	Committee for the Review of the Implementation of the Convention
CSO	civil society organization
CST	Committee on Science and Technology
DLDD	desertification/land degradation and drought
D-SLM	drought-smart land management
EbA	ecosystem-based adaptation
Eco-DRR	ecosystem-based disaster risk reduction
GEF	Global Environment Facility
GM	Global Mechanism
GWP	Global Water Partnership
IFAD	International Fund for Agricultural Development
IFS	Integrated Financing Strategies
IDMP	International Drought Management Programme
IRA	Institute of Resource Assessment
IRAD	Institute for Agriculture Research and Development
LAC	Latin America and the Caribbean
LDN	land degradation neutrality
NAP	national action programmes
NBS	nature-based solutions
SLM	sustainable land management
UNCCD	United Nations Convention to Combat Desertification

I. Background

1. In its decision 21/COP.13, the Conference of the Parties (COP) of the United Nations Convention to Combat Desertification (UNCCD) adopted the Science-Policy Interface (SPI) work programme for the biennium 2018–2019 (decision 21/COP.13, annex). Under objective 2 of this work programme, the SPI is requested to "provide guidance to support the adoption and implementation of land-based interventions for drought management and mitigation" based on a review of existing synthesis reports and, if necessary, referring to primary literature. This was reinforced by 29/COP.13, where the SPI was requested in paragraph 3 to provide the technical guidance outlined in decision 21/COP.13 within the context of UNCCD policy advocacy on drought.

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

3. Under the leadership of the Bureau of the CST, the UNCCD secretariat and the SPI drafted a concept note, terms of reference and proposal evaluation criteria for the scientific work towards objective 2. Following a public competitive tender to 16 institutions specializing in this subject matter from every region in the world, the UNIQUE forestry and land use GmbH (UNIQUE) was commissioned for the task of drawing up a report under the guidance of the SPI.

4. During the eighth meeting of the SPI (10–12 October 2018), the SPI working group on objective 2, working with representatives of UNIQUE, completed the scoping of the technical report, taking into consideration feedback on the concept note received from other members and observers of the SPI as well as their recommendations about relevant scientific literature and case studies which could be of relevance in the development of the document. The main critical issues identified during the scoping meeting included: (a) the target audience and focus of the report; (b) the breadth and detail of the report; (c) the land-drought nexus and impacts of the human activities related to land and water management and drought mitigation; (d) major enablers for adoption and implementation of land-based interventions; and (e) the analysis of existing or ongoing relevant science and science-policy initiatives to ensure added value and avoid duplication of work. At the end of that meeting, a draft annotated outline of the content was agreed upon. Thereafter, the SPI, in close co-operation with the UNCCD secretariat, supervised, reviewed and contributed to the work of the commissioned experts through regular virtual meetings and electronic communication.

5. In keeping with decision 19/COP.12 as well as internal SPI procedures, a draft of the technical report was scientifically reviewed by the larger SPI before undergoing an international, independent review which included domain experts selected by the co-chairs of the SPI from each region. The co-lead authors of the technical report ensured that all peer review comments received appropriate consideration. A summary of the technical report provided by the CST Chair was also reviewed by the Bureau of the COP.

6. The final draft of the technical report, entitled "Land-Drought Nexus: Enhancing the role of Land-based Interventions in Drought Mitigation and Risk Management" and an associated Science-Policy Brief will be available at CST 14/COP 14. The main scientific findings emerging from the technical report are summarized in this document, followed by conclusions and a set of actionable proposals for consideration by the CST at its fourteenth session (CST 14).

II. Summary of the main scientific findings

A. Introduction, definitions and scope

7. Drought is one of the major drivers of global food and water insecurity, affecting agricultural production and access to food and water. Drought can, in extreme cases, force people to abandon their land, resorting to migration as their last livelihood strategy,[1] making the prospect of ending hunger and malnutrition by 2030 more difficult.

8. The objective of the technical report produced by the SPI in collaboration with UNIQUE is to provide a comprehensive review of existing synthesis reports and primary literature in order to: (a) highlight the potential of land-based interventions to mitigate the effects of drought by increasing the resilience of ecosystems and the socioeconomic well-being of populations; and (b) provide guidance to support the adoption and implementation of land-based interventions for drought management and mitigation in the context of land degradation neutrality (LDN).

9. Sustainable land management (SLM), nature-based solutions (NBS), ecosystem-based adaptation (EbA), and ecosystem-based disaster risk reduction (Eco-DRR) have been well recognized by scientists and policy-makers working on addressing land degradation, climate change mitigation and adaptation, biodiversity conservation and water-related disaster reduction, as proactive, effective approaches for improving long-term ecosystem and human resilience. While all of these approaches have unique features, all provide examples of land-based interventions which are relevant in the context of drought.

10. Land-based interventions are defined in this report as actions tied to the sustainable use and management of land, including the restoration and rehabilitation of landscapes or biomes. There are a wide range of potential interventions which confer resilience to drought, including certain types of infrastructure for water harvesting or erosion control, climate-smart agriculture practices such as conservation farming, technologies to improve water use efficiency, afforestation and reforestation. These interventions share core characteristics from the concepts of SLM, NBS, EbA and Eco-DRR and offer opportunities for mitigating the effects of drought and, more generally, refocusing actions on "proactive drought management", thereby increasing the resilience of ecosystems and people to drought.

11. Building on a systematic review of land-based interventions and drought within the approaches of SLM, NBS, EbA, and Eco-DRR, this report introduces a new concept of drought-smart land management (D-SLM) to further characterize those practices for drought mitigation (i.e. against drought impacts and vulnerability). Such D-SLM interventions improve the capacity of soil to accept, retain, release and transmit water, and increase plant water use efficiency. They can do so broadly by increasing the water supply where it is needed by living organisms (e.g., crop root systems) or by reducing water demand (e.g., drought resistant crop varieties). D-SLM interventions contribute to avoiding, reducing and reversing land degradation under the LDN framework.

12. It is well recognized that there is no universally accepted drought definition, and drought definitions have been developed by different stakeholders beyond the meteorological aspects alone, extended by its degree of impacts mostly on the agriculture, hydrological, socioeconomic, and ecological sectors. Decision-makers must be aware that definitions of drought, water scarcity and aridity may have implications on the effectiveness of associated policies, particularly when considering the land-drought nexus, as different definitions account (or do not account) for land in different ways.

13. An understanding of those definitions and how they are being used in national policies will influence whether or not those policies adequately address both land management and drought and whether drought management strategies and action plans include land use, land management and restoration/rehabilitation actions able to mitigate drought. An improved understanding of the relationship between land-based interventions and drought mitigation is

[1] FAO 2018. FAO Migration Framework-Migration as a choice and opportunity for rural development: <http://www.fao.org/3/ca3984en/ca3984en.pdf>.

urgently needed in order to improve the targeting and monitoring of interventions and policies. **In all cases, the human response is a critical component that must be a part of any effective proactive drought and land management planning approach.**

14. It is recognized that, in the context of drought, the terms mitigation, management and response have nuanced and often conflicting definitions. The use of mitigation in this report refers to actions and programmes intended to moderate or even prevent impacts from drought. Typically, management and response often describe actions taken to alleviate impacts during or after an occurred event. In this report, proactive management is used as an all-inclusive term representing all three when considered in the context of planning and preparation for extreme conditions before difficulties associated with drought occur.

15. The concept of drought risk management used in this report is defined as a continuous process of analyses, adjustment and adaptation of policies and actions to reduce drought risk, including reducing the vulnerability and enhancing the resilience of the affected populations. Drought risk management focuses on delivering a drought-resilient society by reducing drought risks and promoting environmental, societal and economic opportunities now and in the longer term. It recognizes that risks can never be removed entirely, and that reducing risk may be at the expense of other societal goals.[2]

16. Drought risk mitigation used in this report is defined as any structural/physical measures (e.g. appropriate crops, dams, engineering projects) or non-structural measures (e.g. policies, awareness, knowledge development, public commitment, and operating practices) undertaken to limit the adverse impacts of drought.

B. Strong linkages between land use, water use and drought

17. There are strong links between the drought-land nexus and human decisions on land use and land use change which impact water availability and determine ecosystem and human resilience to drought. Water reaches land via precipitation and, in some climates and systems, irrigation. It leaves land via runoff (water not absorbed by soil that then runs downslope), transpiration (water emitted by plants as they cool), soil evaporation (water loss directly from the land surface, especially bare and sealed surfaces) and, in some cases, via artificial drainage (removal of excess water through underground pipes or tiles). Between inflows and outflows, some water remains in the soil for periods of time; the amount and duration of soil water storage depends on soil properties such as organic matter content, pore space and size and on processes such as infiltration rate, that is, the speed at which water filters into the soil.

18. Whereas healthy soils can store water that functions as a buffer in times of drought, human-induced land degradation reduces soil water holding capacity and amplifies water scarcity and increases the vulnerability to droughts. Hence, restoration or rehabilitation of degraded land and enhancing soil health can create better resiliency to drought. Soil loss, especially of the upper layers that contain most organic matter, leads to a reduction in the capacity to retain soil moisture. Land degradation can also contribute to a reduced infiltration of water. Global modelling studies have found that more effective management of water in soil has significant potential to both improve crop production and reduce the overall amount of water runoff resulting from agricultural systems. Impervious surfaces such as pavements seal the soil surface, eliminating rainwater infiltration and natural groundwater recharge.

C. Gaps and needs for integrating land use and land management practices into drought risk management as a proactive approach

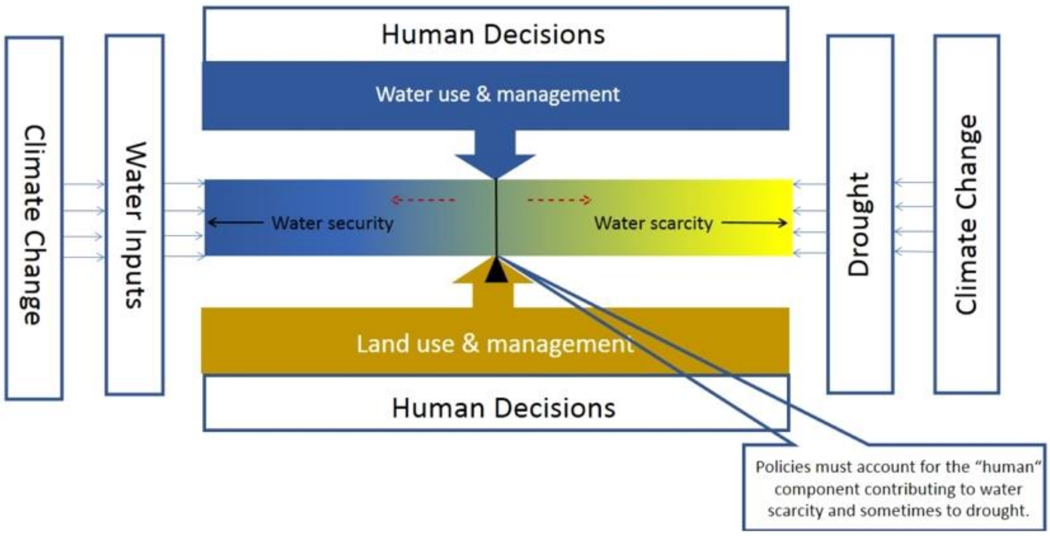
19. Policy approaches and actions seeking to provide ex-post relief to drought-affected populations and economic activities are less effective than proactive actions utilizing drought risk management measures to mitigate the effects of drought. Strategies based around drought relief and ex-post interventions are costly and incentivize the continuation of drought-sensitive economic activities, thus increasing the future costs of drought relief rather than

[2] UNCCD, 2018. Reporting manual for the 2017–2018 UNCCD reporting process: <https://prais.unccd.int/sites/default/files/helper_documents/2-Manual_EN_1.pdf>.

building resilience against droughts. Proactive drought risk management is a more efficient way to reduce drought impacts on communities, economies and the environment.

20. Many examples have illustrated that human-induced land degradation has made droughts last longer, while well managed land provides a buffer for drought. Reductions in soil moisture, including those brought on through unsustainable land management and/or rainfall deficits, can aggravate the severity and/or duration of droughts, meaning that these activities must be pro-actively taken into account in drought policy responses. This determines the success of the policy responses. The figure below represents this concept and process, and the potential for policies to move the black marker indicating the current situation towards either water security (blue) or water scarcity (yellow).

Figure
Human decisions impacting drought and land



Note: The black marker (triangle) denotes a hypothetical current situation, and its movement left or right would be influenced by policies that would contribute to water security (towards the left) or water scarcity (towards the right).

21. Investing in land-based interventions that seek to simultaneously address land degradation, drought and water scarcity has high economic, social and environmental returns, but a lack of impact data and vulnerability assessments are often barriers to proactive drought management, particularly drought risk mitigation.

D. Effectiveness and benefits of drought-smart land management practices

22. The effectiveness and multiple benefits of drought-smart land management practices for drought risk mitigation through improving ecosystem and social resilience at local and national levels varies depending on a variety of factors. The table (see page 9 and 10) provides a synthesis of D-SLM measures organized into 14 groups made up of different types of strategies and interventions. These are considered with respect to four land use types (crop, grazing, forests and woodlands, and mixed) and an assessment of the impact of the D-SLM practices on soil, water, biophysical/ecosystem attributes and socioeconomic factors that determine ecosystem and human resilience to drought. A detailed description of 17 D-SLM practices related to these measures is provided in the Annex. Also taken into consideration were the strength of scientific evidence of the effectiveness of these practices and their capacity to deliver multiple benefits. The main findings of the assessment were as follows:

(a) There is **robust evidence and high agreement** that adoption of D-SLM practices alleviates the negative impacts of droughts on the productivity of croplands, grazing lands, forests and woodlands, and mixed land uses, including under climate change;[3]

(b) There is **high confidence** that most D-SLM practices contribute to higher crop yields, especially after a long-term application, under water shortages and marginal soils;

(c) There is **medium confidence** that D-SLM practices for improving pasture management have positive impacts on forage production and livestock productivity under droughts;

(d) Many, but not all, D-SLM practices contribute to soil carbon sequestration (**robust evidence, high agreement**);

(e) Application of D-SLM practices in degraded lands can positively affect biodiversity (**medium confidence**);

(f) D-SLM practices have higher socioeconomic returns than conventional practices under droughts and in marginal soils. Many, but not all, D-SLM practices allow for improved drought resilience without curtailing farmers' opportunities to maximize their benefits during normal or wet years (**robust evidence, medium agreement**);

(g) D-SLM practices enhance all dimensions of food security (**medium evidence, high agreement);** and

(h) Further drought vulnerability and risk assessments in different contexts covering both natural (climatic, soil and water) and socioeconomic aspects are needed for more ecologically effective implementation of the D-SLM practices in integrated and collaborative drought risk mitigation across ecosystems, administrative boundaries and rural-urban landscapes.

[3] The presented assessment makes use of the Intergovernmental Panel on Climate Change uncertainty language style, as presented at: <http://www.ipcc-wg2.awi.de/guidancepaper/ar5_uncertainty-guidance-note.pdf >.

Table
Drought-smart land management measures: impacts, costs and benefits, synergies, trade-offs and constraints

Land use	D-SLM category	LDN category	Upfront costs	Net economic returns	Food Security and Poverty Reduction	Trade-offs and constraints
Croplands	Controlling Soil Erosion	Avoid, Reduce	High	Neutral and negative in the short term,[a] positive in the long-term	Limited evidence	Labor availability could be a constraint
	Minimizing soil disturbance	Avoid, Reduce	Medium	Often, but not always, positive already in the short-term	Positive	Competition between uses of plant residues for mulching or for livestock feeding
	Integrated soil fertility management	Avoid, Reduce, Reverse	Low	Usually already positive in the short-term	Very positive	Competition between uses of livestock manure as soil amendment and energy source.
	Improved water management	Avoid, Reduce, Reverse	Ranges from low to high	Usually already positive in the short-term, especially in arid environments or where water is priced.	Positive	Lack of water markets and pricing can limit incentives for their adoption
	Improved vegetation management	Avoid, Reduce, Reverse	Low to medium	Usually already positive in the short-term	Positive	May require technical capacities for their adoption by farmers

Land use	D-SLM category	LDN category	Upfront costs	Net economic returns	Food Security and Poverty Reduction	Trade-offs and constraints
Grazing land	Grazing pressure management	Avoid, Reduce	Medium	Usually already positive in the short-term	Positive	In some areas competes with expanding crop production
	Water management	Avoid, Reduce, Reverse	Medium to high	Limited evidence	Limited evidence	Limited evidence
	Vegetation management	Avoid, Reduce, Reverse	Low to Medium	Usually already positive in the short-term	Positive	Limited evidence
Forest/woodlands	Sustainable forest management, Afforestation, reforestation, and of reducing deforestation	Avoid, Reduce, Reverse	High	Neutral and negative in the short term, positive in the long-term	Positive	Limited evidence
Mixed land uses	Adopting agro-forestry and agro-pastoralism	Avoid, Reduce, Reverse	Medium to high	Neutral and negative in the short term, positive in the long-term	Positive	Takes relatively long time for implementation
	Water management	Avoid, Reduce, Reverse	Medium to high	Usually already positive in the short-term	Limited evidence	Lack of water markets and pricing can limit incentives for their adoption
	Integrated watershed management	Avoid, Reduce, Reverse	Very high	Positive in the long-term	Limited evidence	Takes relatively long time for implementation
	Urban green infrastructure	Avoid, Reduce, Reverse	Medium to high	Positive	Limited evidence	Requires considerable technical capacities for planning and implementation

Source: SPI Technical Report: The Land-Drought Nexus: Enhancing the Role of Land-based Interventions in Drought Mitigation and risk management.

[a] Short-term – one or two growing seasons.
Note: Drought-smart land management (D-SLM).

E. Enabling policies and tools of guidance for drought-smart land management

23. This report proposes a set of five enablers for D-SLM adoption and implementation. They include: a landscape approach, capacity-building and development, good land and water governance, geospatial analysis, and finance:

(a) A 'landscape' is a socio-ecological system. It includes: topography, natural resources, biodiversity and culture, as expressed in various land uses. Droughts extend beyond administrative boundaries, therefore, an integrated landscape approach aids in problem-solving across sectors and boundaries. Moreover, a landscape approach is fundamental to LDN. Hence, for successful drought risk management, it is important to adopt landscape scale management of land and water resources and to understand how landscape management impacts people's livelihoods;

(b) Developing capacity on the land-drought nexus and communicating the multiple benefits of D-SLM across sectors, communities of practice and disciplines is crucial. Enhancing the uptake and sustainability of D-SLM initiatives across sectors hinges on capacity in and communication on the multiple benefits of D-SLM across sectors, communities of practice and disciplines;

(c) Good, effective and participatory land and water governance is as important to drought mitigation as the application of the best technologies because it creates the enabling environment for the adoption and scaling up of D-SLM and its associated technologies. Such an environment requires, *inter alia*, effective institutions combined with the empowerment of women (one of the majority groups among rural land and water users) and legal security (land tenure, water rights);

(d) Remote sensing and geospatial information are powerful tools that can be employed to monitor and assess the status of land surface health or stress, detect environmental changes and assess the impacts of those changes. Integration of multi-temporal and multi-sensor data at various scales allows for the detection of crop-specific drought stress and can thereby support D-SLM by helping determine the effectiveness of strategies; and

(e) Fostering and increasing awareness around D-SLM is linked to sufficient financing. Successful implementation of D-SLM and such initiatives depends on the effective mobilization of resources from all sources, including national budgets, partnerships with external donors and innovative sources of finance (e.g. interlinking with carbon financing through voluntary credits, public-private partnerships), ideally concurrent with local and national programming. D-SLM does not necessarily require additional financial resources but usually involves redirecting and making more effective use of existing financing.

F. Urgent actions needed

24. Land use coupled with water use is projected to continue increasing at the global level as a function of population growth, economic development and changing consumption patterns, among other factors. Industrial and domestic demand for water will likely grow much faster than agricultural demand, although agriculture will remain the largest overall user. Land and water use for food will face a double challenge as human demand for food and competition for it from the other sectors are both set to increase.[4] Climate change exacerbates the situation by accelerating the occurrence and intensity of climate-related disasters such as droughts and floods.

25. The technical report produced by the SPI for objective 2 recommends that scientists, policy-makers and practitioners take the following immediate actions:

[4] <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2018-nature-based-solutions/>.

(a) Recognize the integrative potential for D-SLM practices to bring together LDN, drought risk management and related policy actions;

(b) Integrate land use, land use change and land degradation as factors in drought and drought risk management practices and policies;

(c) Facilitate coordination and meaningful interaction between the land use planning/management community within the context of LDN and the drought risk management community, notably by creating a common understanding of definitions, suitable indicators, and the cross-sectoral nature of drought risk management and land management – potentially through the adoption of the D-SLM concept. Lack of consensus on these practices currently reduces the effectiveness of both LDN and drought risk management actions; and

(d) Promote interventions that focus on a set of five enablers necessary for optimized adoption, implementation and scaling-up of the D-SLM at landscape level:

(i) Make use of geospatial analyses that integrate Earth observation information and risk assessments, including satellite and in-situ data, through geographic information systems, which allows for the monitoring and mapping of land surfaces, including water bodies;

(ii) Implement integrated land use planning and integrated landscape management in the context of LDN to optimize D-SLM as long-term proactive measures for drought mitigation and risk management;

(iii) Strengthen national and local capacity on the multiple benefits of D-SLM across multiple sectors, communities of practice and disciplines;

(iv) Ensure effective local institutions in combination with place-based policies and legal security (lend tenure, water rights) to ensure the relevant and inclusive design, implementation, monitoring and evaluation of land-based interventions to mitigate drought effects; and

(v) Mobilize finance for the support and promotion of D-SLM, ideally concurrent with local and national programming.

III. Conclusions and recommendations

26. This SPI technical report for objective 2 provides well-established scientific evidence for understanding the strong linkages between land use and drought and that the management of both land and drought is fundamentally connected through water use. The report reveals the significant capacity of human decisions in land and water management to alter, either positively or negatively, the resilience of communities and ecosystems. It also documents the biophysical mechanisms and processes which, when managed appropriately, provide opportunities to adapt to drought through an improvement in the ability of soils to accept, retain, release and transmit water, and increase plant water use efficiency.

27. It identifies that a lack of data on the impacts of the implementation of D-SLM practices on drought mitigation and the potential economic returns that may result from enacting D-SLM is a barrier to integrating drought risk management practices into land use and land management practices and policies.

28. The results emerging from the synthesis and assessment show the scientific evidence to date on the potential of 14 groups of D-SLM measures in four land use types to simultaneously positively affect drought risk mitigation, land degradation prevention, restoration/rehabilitation, biodiversity conservation, soil carbon sequestration (*robust evidence, high agreement*), and allow for improved drought resilience without curtailing farmers' opportunities to maximize their benefits during normal or wet years (*robust evidence, medium agreement*). The results also show the potential for these D-SLM practices to improve productivity, leading to higher socioeconomic returns than

conventional practices under drought conditions, including in marginal soils, thereby enhancing all dimensions of food security (*medium evidence, high agreement*).

29. The report re-emphasizes how, when compared to ex-post interventions, greater ecological and economic cost-benefit efficiency can be realized through proactive D-SLM interventions by building resilience and disincentivizing the continuation of drought-sensitive economic activities and decreasing the future costs of drought relief.

30. The report proposes guidance through enhancing five enablers to support adoption, implementation and scaling up of D-SLM. It brings to the forefront the need for vulnerability and risk assessments in different contexts covering both natural (climatic, soil and water) and socio-economic aspects. Both aspects are necessary for more ecologically effective implementation of D-SLM practices in order to more effectively pursue integrated and collaborative drought risk mitigation across ecosystems, administrative boundaries and rural-urban landscapes.

31. It reveals that well-optimized, local and context-based D-SLMs defined as biological or geographical in scope, through the implementation of integrated land use planning and integrated landscape management in the context of LDN, can improve the resilience and reduce the vulnerability of ecosystems, land-users and society at large to drought, offer opportunities for mitigating the risk of drought and, more generally, contribute to "proactive drought risk management".

32. To enable an enhanced role of the land based-interventions in drought risk management and drought mitigation, the SPI suggests that the CST consider the following recommendations:

(a) Recommendation 1: Invite Parties to consider strengthening the interlinkages between national land and national drought policies, consider changing the policies to fully reflect the influence of land use and management and land degradation on water availability and water scarcity, and consider the positive role D-SLM practices could have in building the resilience of communities and ecosystems to drought, when pursued in the context of LDN;

(b) Recommendation 2: Invite Parties to take measures to ensure their departments dedicated to drought management integrate land use, land use change and land degradation as factors in drought and drought risk management practices and policies, while also ensuring that their land and water use departments integrate D-SLM practices into their relevant policies and initiatives;

(c) Recommendation 3: Invite the Parties, international organizations and cooperating partners to enhance cross-sectoral collaboration and coordination in their policies and programmes to promote the interventions necessary to optimized adoption, implementation and scaling-up of D-SLM to landscape level, focusing on a set of five enablers, including:

(i) Implementing integrated land use planning and landscape management;

(ii) Strengthening national and local capacity on the multiple benefits of D-SLM across sectors, communities of practice and disciplines, taking into consideration gender integration;

(iii) Ensuring effective local institutions in combination with place-based policies and legal security on land tenure and water rights to ensure relevant and inclusive design, implementation, monitoring and evaluation of land-based interventions to mitigate the effects of drought;

(iv) Developing user-friendly tools which improve the access of policy-makers, planners and practitioners at all levels to geospatial analysis that integrates Earth observations, including satellite and in-situ data of land, water and meteorology, through the use of geographic information systems, which would allow the integrated monitoring and mapping of land cover, including water bodies, land degradation and drought risk;

(v) Mobilizing both conventional and innovative finance, including from public and private investors, in the form of ecosystem service payments, carbon emission offsetting, insurance coverage and investments in sustainable land-based value chains to support and promote D-SLM, ideally concurrent with local and national programming; and

(d) Recommendation 4: Request that the UNCCD secretariat and the SPI, in collaboration with the World Meteorological Organization, the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme and other relevant land, water and meteorological organizations, in the context of the Integrated Drought Management Programme, facilitate coordination and interaction between LDN and drought risk management communities, notably by creating a common understanding of definitions and the cross-sectoral nature of drought risk management and land management.

Annex

Description of drought-smart land management practices

	Name	Impact on Water	Other Biophysical Impacts	Socio-economic impacts	References
1	Bund: "A structural measure with an embankment of soil or stones, constructed along the contour and stabilized with vegetative measures (grass and fodder trees)" (Sanz et al., 2017).	Increases water retention and infiltration	Reduces soil erosion, prevents soil fertility loss, facilitates biomass accumulation and nutrient enhancement, improves yields	Increases agricultural incomes through improved yields but entails high upfront costs, reduces production risk under a variable climate	(Dutilly-Diane et al., 2003; Kato et al., 2011; Sanz et al., 2017; Wei et al., 2016)
2	Terrace: "A structural measure constructed by carefully removing a superficial soil layer from one part of a field, concentrating it on the lower end of that field in order to reduce slope gradient and length. Another terrace is created directly downslope to form a cascade of terraces" (Harari et al., 2017). In contrast to bunds, terraces are long-term measures requiring higher investments (Gebremedhin & Swinton, 2003)	Improves soil moisture holding capacity and water infiltration and reduces runoff	Controls erosion, accumulates biomass, recharges soil water, enhances nutrients and usually increases crop yields	Improves incomes and increases food production, contributing to food security and poverty reduction	(Adgo et al., 2013; Harari et al., 2017; Liniger & Critchley, 2007; Pender & Gebremedhin, 2007; Sanz et al., 2017)
3	Mulching: "Covering the ground with a layer of plant materials" (Bayala et al., 2012)	Improves soil water retention and transmission, reduces drought stress	Protects soil against wind and water erosion, provides nutrients which have a positive effect on yields	Increases agricultural incomes, trade-offs as a source of fodder and labour requirements for mulch spreading	(Affholder et al., 2010; Bayala et al., 2012; Harari et al., 2017; Sanz et al., 2017)
4	Cover crops: "Crops that replace bare fallow during winter period and are ploughed under as	Improves soil water retention and transmission, reduces drought stress for subsequent crops	Sequesters carbon, reduces soil erosion and compaction, and nitrogen leaching, increases biodiversity and	Increases agricultural incomes	(Altieri, 1999; Blombäck et al., 2003; Campiglia et al., 2010; Chabi-Olaye et al., 2007; Kaye

	Name	*Impact on Water*	*Other Biophysical Impacts*	*Socio-economic impacts*	*References*
	green manure before sowing of the next main crop" (Poeplau & Don, 2015)		weed control, improves yields		& Quemada, 2017; Lal, 2004; Poeplau & Don, 2015)
5	Vegetative strips: "Any vegetated area set-aside from the main cropping regime within or around a field" (Marshall & Moonen, 2002)	Reduces soil erosion and enhances soil water retention, improves water quality, often also serves as bio-drainage	Benefits biodiversity and air quality, sequesters carbon, reduces the transportation of contaminants and suspended sediments by water flow	Usually has positive effects on yields, leading to higher agricultural incomes	(Borin et al., 2010; Dorioz et al., 2006; Harari et al., 2017; Liniger & Critchley, 2007; Marshall & Moonen, 2002; Sanz et al., 2017)
6	No-till, reduced tillage: "Growing crops (or pastures) without disturbing/minimum disturbance of the soil through tillage" (Sanz et al., 2017)	Efficient use of soil water: increases infiltration, reduces water loss, increases water availability for plants	Increases crop production and yield stability, has heterogeneous impacts on soil biota	Reduces energy costs, sometimes increases labour inputs, increases herbicide applications.	(Erenstein & Laxmi, 2008; Ernst & Emmerling, 2009; Guto et al., 2012; Pittelkow et al., 2015; Sanz et al., 2017)
7	Laser land levelling: Use of high-precision laser equipment for the levelling of fields	Reduces water runoff, improves water use efficiency	Produces higher yields than under conventional levelling, improves field traffic ability	Increases agricultural profitability	(Abdullaev et al., 2007; Aryal et al., 2015; Kaur et al., 2012)
8	Biochar soil amendment: "Biochar is a carbonaceous material obtained from thermal decomposition of residual biomass at relatively low temperature and under oxygen limited conditions (pyrolysis)" (Alburquerque et al., 2013)	Improves soil water transmission	Sequesters carbon sequestration, manages contaminants, increases soil fertility	Economic viability of biochar application may be low	(Alburquerque et al., 2013; Clare et al., 2014; Cornelissen et al., 2013; Lehmann et al., 2006; Smith, 2016)
9	Compost soil amendment: "Application of organic matter from weeds and bio-waste decomposed by Microorganism" (Sanz et al., 2017)	Improves soil water holding capacity	Improves soil tilth. Its decomposition slowly releases available nutrients for plant uptake. Composting could help reduce environmental degradation from the open dumping of organic waste.	Increases yields, especially with longer-term application	(Bekchanov & Mirzabaev, 2018; Doan et al., 2015; Evanylo et al., 2008; Sanz et al., 2017)

	Name	*Impact on Water*	*Other Biophysical Impacts*	*Socio-economic impacts*	*References*
10	Water harvesting technologies: "Are a range of technologies for collecting and storing water for productive uses" (Nyakudya et al., 2014) such as Zai pits (Burkina Faso), Tassa (Niger), half-moons, Ndiva (Tanzania), sub-surface water harvesting, kyariz systems (Turkmenistan), rock catchment, pond sand filter (PSF) (see section 2.1)	Improves soil water availability and retention, increases groundwater recharge	Reduces soil erosion, increases biomass production, enhances soil nutrient cycling	Increases incomes and food security	(Akhtar et al., 2016; Fox & Rockström, 2003; Oweis et al., 2012; Vohland & Barry, 2009)
11	Improved irrigation technologies: Irrigation technologies such as drip irrigation, spate irrigation, sub-soil drip irrigation, irrigation at night, etc. which reduce water application in crop production	Increases water use efficiency in crop production	Reduces secondary salinization and waterlogging, fungal diseases due to excessive root zone moisture and nutrient losses through leaching	Increases the profitability of agricultural production, especially during drought periods and in settings with water pricing. In areas without water shortages, yields may be lower than under conventional irrigation technologies (e.g. furrow and flooding irrigation).	(Dağdelen et al., 2009; Geerts & Raes, 2009; Harari et al., 2017; Sanz et al., 2017; Vickers, 2018)
12	Integrated watershed management: An approach that combines the management of land, water and vegetation at the watershed level to limit drought impacts	Conserves water conservation, improves groundwater levels	Reduces soil erosion	Increases yields and cropping intensity, improves food security	(Joshi et al., 2005; Wang et al., 2016; Wani et al., 2012; Wani et al., 2003)
13	Rotational Grazing: Involves sequential use of multiple pastures to optimize re-growth of pasture plants	Helps to cope with rainfall variability, improves infiltration rates and runoff in rangelands	Limits rangeland degradation and soil compacting by livestock trampling, increases soil C and C to N ratios	Helps sustain livestock herds during drought years and under high rainfall variability	(Bailey & Brown, 2011; Briske et al., 2008; Teague et al., 2010)

	Name	*Impact on Water*	*Other Biophysical Impacts*	*Socio-economic impacts*	*References*
14	Afforestation: Establishment of trees on an area where there were no trees previously	Improves water conservation and regulation, decreases water availability for other vegetation in some arid areas	Reduces soil erosion, sequesters carbon, improves biodiversity	Increases incomes from marginal areas	(Djanibekov & Khamzina, 2016; Harari et al., 2017; Niu & Duiker, 2006; Sanz et al., 2017)
15	Reforestation: Replanting of trees on an area which was previously deforested	Improves water conservation and regulation, decreases water availability for other vegetation in some arid areas	Reduces soil erosion, sequesters carbon, improves biodiversity	Increases incomes from marginal areas	(Chazdon et al., 2016; Harari et al., 2017; Sanz et al., 2017)
16	Agroforestry: Agriculture incorporating cultivation of trees	Improves water availability and water regulation	Sequesters carbon, reduces soil erosion, increases soil fertility and bio-drainage	Improves incomes and food security	(Nair, 1993; Nair et al., 2009)
17	Agropastoralism: Integration of crop production and livestock production activities	Improves resilience against rainfall variability and droughts	Reduces soil degradation in rangelands	Improves incomes and food security	(Harari et al., 2017; Liniger & Critchley, 2007; Sanz et al., 2017)