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Preparation of the UNCCD 2nd Scientific Conference

Overview of working papers prepared for the UNCCD 2nd Scientific Conference

Note by the secretariat

Summary

This document addresses some of the most important issues to be discussed at the UNCCD 2nd Scientific Conference "Economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas". It gives an overview of the two white papers prepared for the Conference: White Paper I, "Economic and social impacts of desertification, land degradation and drought" and White Paper II, "Costs and benefits of policies and practices addressing desertification, land degradation and drought".

The topics considered in this document will be the subject of keynote lectures, plenary sessions, parallel and special sessions and workshops during the Conference. Valuable input from conference participants is expected to further bridge the gap between theory and the practical application of strategies and policies by strengthening existing methodologies and looking ahead to provide formal tool boxes of specific methodologies to identify the continuing causes and impacts of desertification and land degradation. This might be achieved by contributing to the implementation of both new and existing policies and programmes, and, finally, meeting the needs of people and communities affected by desertification, land degradation and drought.

Contents

I. Background

1. The United Nations Convention to Combat Desertification (UNCCD) provides a universal legislative reference framework for desertification, land degradation and drought (DLDD), particularly in the drylands where some of the most vulnerable ecosystems and lower income groups in the world exist. The 195 country Parties to the Convention work together to improve the living conditions for people in drylands, to maintain and restore land productivity and to mitigate the effects of drought.

2. There is widespread consensus that the economic issues of DLDD are not adequately addressed by the current political agenda, and lack of reliable data on the economic importance of sustainable dryland development is a major driver for the limited development investment in drylands. The lack of reliable economic data for sound and well-informed decision-making at all levels has been linked to the relatively limited scientific basis for economic valuation of dryland ecosystems. Meanwhile, emerging and ongoing environmental and socioeconomic problems call for improving current land management practices that need to be grounded in sound scientific input.

3. The need to successfully mainstream land degradation issues into relevant national policies and frameworks is recognized and encouraged by international mechanisms such as the UNCCD and the Millennium Development Goals. The UNCCD 10-year strategic plan and framework to enhance the implementation of the Convention (The Strategy) (see ICCD/COP(8)/16/Add.1) is advocated as a guide for decision makers to help with developing or adopting national methodologies, while national action programmes could serve as a framework to enhance mainstreaming at the national level.

4. By its decision 16/COP.9, the Conference of the Parties (COP) decided that the specific thematic topic for the UNCCD 2nd Scientific Conference would be "Economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas". Information on the organization and preparation process of the Conference is contained in document ICCD/CST(S-3)/2.

5. The present document gives an overview of (i) the two white papers prepared for the UNCCD 2nd Scientific Conference by the Global Risk Forum (GRD) Davos, (ii) the two working groups (established by the Scientific Advisory Committee) and (iii) the review group. The members of the two working groups are listed in document ICCD/CST(S-3)/2; the members of the review group are given in annex I, below.

6. White paper I is entitled "Economic and social impacts of desertification, land degradation and drought"; White Paper II is entitled "Costs and benefits of policies and practices addressing desertification, land degradation and drought". Both papers aim: (i) to identify and assess the different types of costs relating to DLDD and elaborate methodologies on how to develop effective policies and strategies, including support with shaping action at the local level; (ii) to synthesize existing scientific knowledge to provide a basis for policy-oriented recommendations, and (iii) to ensure the flow of new knowledge to and from the UNCCD 2nd Scientific Conference. The content of the two White Papers is outlined in table 1 and table 2, below.

Table 1.
Structure of White Paper I "Economic and social impacts of desertification, land degradation and drought"

	Economic and social impact assessment	*Macro and microlevel impact assessment*	*Direct and indirect cost assessment*
Identification	Identifying economic and social impacts of DLDD	Identifying micro and macro level impacts of DLDD	Identifying direct and indirect costs of DLDD
Methodologies	Measuring economic and social impacts of DLDD - examples of specific results and data	Measuring micro and macro level impacts of DLDD - examples of specific results and data	Measuring direct and indirect costs of DLDD - examples of specific results and data
Implementation	Tool box of specified, problem-oriented methodologies with guidelines for decision makers	Strategy for decision makers to take national methodologies to regional and global levels	Effective policies that include direct and indirect costs

Table 2
Structure of White Paper 2 "Costs and benefits of policies and practices addressing desertification, land degradation and drought"

	Socioeconomics of sustainable land management policies and practices	*Valuating and measuring resilience*	*Valuating ecosystem services*
Identification	Strengths and weaknesses of current approaches/ methodologies to validate sustainable land management (SLM)	Defining resilience in drylands	Methodologies for evaluating ecosystem services
Methodologies	Costs and benefits of SLM policies and practices, incl. hidden costs and externalities	Measuring resilience in drylands (social, ecological, economic, political)	Application of methodologies: Values of different dryland ecosystem services
Implementation	Conditions for SLM success: Governance, rights, institutions, transaction costs, etc.	Policy impacts on resilience	Effective policies to incentivise ecosystem services – social benefits

7. The topics addressed in the present document will be the subject of keynote lectures, plenary sessions, parallel sessions, special sessions and workshops during the Conference. Valuable input from conference participants is expected to further bridge the gap between theory and the practical application of strategies and policies by strengthening existing methodologies and looking ahead to provide formal tool boxes of specific methodologies to identify the continuing causes and impacts of desertification and land degradation. This might be achieved by contributing to the implementation of new and existing policies and programmes and, finally, meeting the needs of DLDD-affected people and communities. Additional input and knowledge gathered at the Conference, together with this summary document, will constitute the latest scientific findings on these topics. The report of the Conference, containing these findings, will be published as one of the main outcomes of this Scientific Conference.

II. Economic and social impacts assessment of desertification, land degradation and drought

8. Land degradation in the drylands, whether driven by human actions or biophysical factors, results in loss of or damage to natural capital and social welfare. Likewise, poorly managed drought risk, which is typical in highly vulnerable dryland communities, leads to further desertification and loss of livelihood opportunities. This reduces the value of soil, water, plant and animal resources to society, including the contribution of ecosystem function and processes to primary production and related industries.

9. The economic and social impacts of DLDD are substantial and multifaceted and may be recognized by decreasing agricultural gross domestic product (GDP) in agricultural productivity, or an increase in poverty, starvation, malnutrition, high infant mortality, and social conflicts or migration, among others.

10. There is global evidence that DLDD is leading to heavy economic losses and a study commissioned by the Global Mechanism (GM) estimated the costs of land degradation to result in 3-5 per cent of global agricultural GDP (Berry and others 2003). According to a regional study supported by the GM and the United Nations Economic Commission for Latin America and the Caribbean the losses vary widely between countries and inside countries, reaching values of at least 6.6 per cent in Paraguay and 24 per cent in Guatemala (Morales, and others 2012). Analyses looking at individual triggers identified costs, for example, of salinity to global agriculture, at about USD 12 billion per year (Pitman and Läuchli 2004), with processes such as wind erosion, affecting 548 million hectares worldwide in 1991 (Nkonya and others 2011).

11. Several studies show that the social impacts of DLDD are enormous. Nearly 870 million people, or one in eight, were suffering from chronic undernourishment in 2010–2012, according to the new United Nations hunger report by the Food and Agriculture Organization (FAO 2012), and 1.1 billion people do not have access to safe drinking water. This situation is due partly to the reduction in land productivity as a result of the expansion of desertification, the severity of land degradation and high frequency of drought.

12. After the FAO improved its undernourishment estimates, from 1990, the figures suggest that progress in reducing hunger has been more pronounced than previously believed. Most of the progress, however, was achieved before 2007–2008. Regionally, the rate of progress in the reduction of undernourishment has been higher in Asia and the Pacific and in Latin America and the Caribbean. Undernourishment in Sub-Saharan Africa has improved, but less rapidly, while Western Asia has seen an increase in the prevalence of undernourishment over this period (FAO 2012). The highest Global Hunger Index (GHI) scores are found in Burundi, Eritrea, Haiti, Ethiopia, Chad, and East Timor (Timor-Leste) (IFPRI et al. 2012).

13. The international community is aware of the economic and social importance of land degradation. In 1996, the UNCCD entered into force with the aim of combating desertification and mitigating the effects of drought. The UNCCD, along with the other two Rio Conventions, the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), is one of the major legally binding international agreements that links environment and development and which is well positioned to address the problems outlined above. The themes of the three Conventions – desertification/land degradation/drought (UNCCD), climate change (UNFCCC) and biodiversity loss (CBD) – have become an integral part of the international political agenda for sustainable development and environment. In the meantime, Rio+10 further required that causes of desertification and land degradation should be addressed by strengthening the implementation of the UNCCD (United Nations 2002) while Rio+20 specifically

highlighted desertification, land degradation and drought as area of future action (United Nations 2012).

14. Continuing land degradation directly contributes to the ongoing loss of biodiversity and interacts with climate change in a complex manner (MEA 2005; Thomas 2008). Meanwhile, it is recognized that limiting factors have prevented optimal implementation of the UNCCD. Chief among these factors are insufficient financing and resourcing, a weak scientific basis and knowledge exchange, insufficient advocacy and awareness, an inadequate legal basis at the national level, failure to harness synergies between the three Rio Conventions, general institutional weaknesses in implementing national action programmes and difficulties in reaching consensus among country Parties in the relevant international processes (e.g. Mouat et al. 2006; Bauer and Stringer 2009; UNEMG 2011).

15. Some of these limiting factors are being counteracted and are currently addressed by the Advisory Group on Scientific Advice for the UNCCD. For example, the importance of an integrated approach and stronger collaboration was generally recognized by each of the three Conventions in order to strengthen activities in a synergistic manner, reduce potential conflicts, avoid duplication of efforts and use available resources more efficiently and effectively (UNFCCC 2004a).

16. In addressing these necessities, numerous actions were initiated such as the Joint Liaison group, the Zero Net Land Degradation initiative to secure the continuing availability of productive land for present and future generations, a joint work plan between UNCCD and CBD, and opportunities for further synergies through the newly established Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). Despite these initiatives, the Earth's environmental challenges continue to expand and become ever more difficult to address.

III. Macro and micro level impact assessment of desertification, land degradation and drought

17. Many examples illustrate the impacts of DLDD on the national, regional or local economies and on human well-being. China, for example, is severely impacted by desertification, as 2.62 million km^2 are susceptible to land degradation as defined in the UNCCD, accounting for about 27 per cent of the country's landmass. Over 400 million residents are affected, causing an annual direct economic loss exceeding 64 billion Yuan Renminbi (CNY) (Wang et al. 2012). Further studies show that the direct costs of soil nutrient loss, which includes losses of nitrogen, phosphorus, potassium, and organic matter (due largely to soil erosion by wind) amount to over 380 billion Yuan per year (using 2005 price levels; Zhang 2006), while costs due to agriculture loss (that is, linked to crop farming and animal husbandry) amount to about 267 billion Yuan per year (Liu, 2006) in China. The authors point out that large differences exist in the direct costs estimated in different studies, and conclude that the variables included in such calculations therefore need careful consideration. An example from Uzbekistan shows that due to land degradation and related factors average yields have declined in many areas by 20–30 per cent, contributing to worsening rural poverty and vulnerability (Nkonya and others 2011).

18. Examples from Africa show that in Northern Kenya about 3.75 million people needed food assistance due to drought in 2011 (WFP 2012). The total loss per hectare of wheat in Ethiopia ranged between USD 46 and USD 544 per hectare in 2003 (Berry 2003). In Eastern Africa, the overall food security situation has started to improve with the beginning of the harvest season 2012 in several countries, following declining food prices and improved livestock productivity due to heavier rains. However, about 13.4 million people are still in need of humanitarian assistance (FAO 2012). Because of deforestation,

Niger and Peru have experienced losses of forest ecosystem goods and services of 0.26 and 0.10 per cent of GDP respectively (Nkonya and others 2011).

19. In a comprehensive study on the impacts of DLDD in Ghana, Diao and Sarpong (2007) have estimated the effects of soil loss on the economy and on poverty using a computable general equilibrium model. The model predicts that land degradation reduces agricultural income in Ghana by a total of USD 4.2 billion over the period 2006–2015, which is approximately 5 per cent of total agricultural GDP in these 10 years (Diao and Sarpong 2007).

20. Generally, studies on the impact of land degradation on macro, and especially on micro, scales illustrate the complex interaction and integration of biophysical (such as ecosystems, soil productivity, climate) and human factors (such as economic production, poverty, migration, institutions), in a "downward spiral" linking rural poverty and environment (Scherr 2000). Temporal and spatial effects also become especially evident looking at the impacts of DLDD at the micro level.

21. Consequently, methodologies for analysing the causes and effects of DLDD need the collection and analysis of comprehensive data. National accounting measures such as GDP calculations do not suffice, as they fail to account for example the costs of natural resource inputs in the production process.

22. To appraise the value of ecosystems, ecosystem accounting techniques have been developed to measure the specific costs and benefits related to ecosystem services and the natural capital of the ecosystems. Much of the work around ecosystem accounting techniques has focused on ensuring that natural resources will be fully integrated in the national accounting systems. Almost all countries in the world apply the System of National Accounts (SNA) developed by the United Nations to measure all economic activities, for example, the gross national product (GNP) and the net worth of a nation in the form of aggregate stock of assets and liabilities. The SNA is based on aggregate indicators of income, investments, and consumption and provides comprehensive information for economic analysis, decision-making and policy design, implementation, and monitoring.

23. It is also critical for environmental accounting to recognize that the SNA is based on quantity and price measurements (Boyd and Banzhaf 2007). However, for the environmental sector challenges arise both for quantification and monetization. To ensure a more complete reporting on the state of the environment, the SNA framework has been expanded with a standard on environmental accounting (United Nations Statistics Division 2012).

24. Environmental inputs are typically conceived to be "free" of charge. This is one of the main reasons why many of the economic studies analyse DLDD only incompletely. Various impact assessment methodologies at differing geographical scales were developed (for example, agricultural productivity and food, combined effect of ecologic and economic factors at regional level or selection of adequate monitoring or focusing on indicators development (e.g. Mantel and others 1997; Stocking and Murnaghan, 2001; Salvati and Zitti, 2009; Vogt et al. 2011; Sommer and others 2011). Thus political discussions are affected by the scientific uncertainty relating to methodological incompleteness as probably being the main reason why international negotiations delay recommending formal tools for impact assessment of DLDD, as part of scientific support to the UNCCD.

25. Several authors postulate inputs from the scientific community to analyse and address the complex DLDD issue. Vogt and others (2011) claim a robust scientific framework that links the drivers, processes and symptoms of desertification. Such a framework will allow for the identification of key variables to be monitored and will provide a basis for an improved forecasting and assessment of vulnerability, thereby providing highly important information for policy- and decision-making (Vogt and others

2011). Akhtar-Schuster and others (2011) claim a more active role for research in mitigating DLDD. They identify institutional infrastructures through which scientific findings may more effectively enter policy, suggesting that scientific bodies are required to devise strategies, coordinate and stimulate the global scientific research community to support mainstreaming and the up-scaling of efforts to combat land degradation.

26. As with the analysis of DLDD, mitigation efforts are often incomplete and specific, problem-oriented methodologies and guidelines for decision makers are rare (for example, Bowyer and others 2009). On a national level, at this stage, only a few country Parties have satisfactory legislation to combat desertification/land degradation and mitigate the effects of drought, and therefore substantial reform is much needed (Du Qun and Hannam 2011). The list of bottlenecks includes the preferred traditional sectoral approach to DLDD, including easier manipulation of individual resources (that is, soil, forest) and a lack of ability to implement synergetic actions at the decentralized level.

27. Activities on an international level should be reflected at regional, national to local levels, where synergies are most promising, and need to be promoted. This requires stronger collaboration between the national focal points (NFPs) that serve each of the Rio Conventions and play a key role in bridging differences of involved parties especially at the policy level (Akhtar-Schuster and others 2011; Mouat and others 2006). However, many joint international activities fail to have a synergistic impact on the national, regional and local levels (United Nations Environment Management Group 2011) as mainstreaming has faced a number of institutional, financial, legal, knowledge and policy barriers. According to IFPRI (2011 b) global awareness, action to prevent or mitigate land degradation and drought at national or international levels has been limited, primarily because there are limited assessments regarding the cost of land degradation.

28. Recently, a number of promising global initiatives addressing the shortage of economic data to promote and guide restoration of degraded land, zero land degradation, and minimizing the impacts from droughts has been initiated. Among the recent initiatives should be mentioned, the Economics of Land Degradation (ELD) initiative which was launched in 2011 by the German Ministry for Economic Cooperation and Development, the European Union, the secretariat of the UNCCD, and the Korean Forest Service (ELD 2012). ELD shall develop a holistic framework for the consideration of the economic values of land in political decision-making processes; compile case studies of benefits derived from sustainable land and soil management on a global and local scale; and estimate the economic costs resulting from the degradation of land and related ecosystem services and compare them to costs of protecting the land. In preparing the initiative, an initial study was carried out in 2011 that focused primarily on ecosystem services taking into account impacts of desertification beyond the dryland ecosystems. The study shows that comprehensive valuation of the cost of desertification is a highly complex task and substantial work is still required before acceptable assessment models are available. These models would have agreed boundaries regarding issues such as which indirect costs are to be integrated and the timeframe for the valuations. (Nkonya and others, 2011).

IV. Direct and indirect cost assessment of desertification, land degradation and drought

29. Comprehensive cost analyses of DLDD are rare because of the complexity and uncertain boundaries of the system in terms of time and space. Hence, in many cases, cost analyses are only partial, often ignoring indirect costs, neglecting offsite costs, or disregarding the difference between costs of action versus those of inaction. Consequently, the potential economic benefits of reducing DLDD are often grossly underestimated. As in

case of assessment methods, this uncertainty is one of the main reasons why promoting formal tools and methodologies by the UNCCD or at national level has failed.

30. From an economic perspective, the best technique for valuation of assets and services is, in principle, observed market prices. However, for many environmental goods and services market prices do not apply directly, as discussed for instance during the UNCCD 1st Scientific Conference (Winslow and others 2009). First of all, many dryland environmental assets and services are never put in an open market and when they do market prices do not necessarily reflect externalities unless this value is reflected in taxes, subsidies, and other regulatory mechanisms. Secondly, regulating, maintenance, and cultural services generated by ecosystems in general are not transacted through markets and consequently do not have explicit market values although they might be highly valued by people (Eigenraam and others 2011).

31. Incorporating indirect costs of DLDD allows a more comprehensive approach. Indirect costs estimate impacts across all sectors of the economy, such as for example, price transmission mechanisms and costs relating to poverty or migration. As a complement to direct cost analyses, indirect approaches encompass harms more comprehensively and thereby improve both the illustration of essential costs and understanding of the processes and complex interplay between biophysical and human factors relating to DLDD. Requier-Desjardins and Bied-Charreton (2006), for example, value migration as the differentiated direct and indirect costs and benefits incurred at both the places of origin and arrival.

32. Another approach to analysing the impact of DLDD is offered by assessing the costs of action versus those of inaction. In this approach, information about all costs (from society's point of view) relating to prevention or mitigation of land degradation (action) and continued degradation (inaction) are considered.

33. In several case studies, the authors applied the action versus inaction approach. Morales and others (2012), for example, calculated the annual cost of inaction in terms of total productive factor and gross value product as a proportion of agricultural GDP. The values they came up with ranged between 7.6 and 40.5per cent per annum. Nkonya and others (2011) exemplify the approach with a study from India. There, about 2 per cent of the crop area is affected by salinity, which reduces crop rice yields by as much as 22 per cent. Based on crop simulation models, the cost of desalinization was estimated at only 60 per cent of the costs of inaction (Nkonya and others 2011). The authors propose a framework to implement the approach and emphasize the need to take into account direct and indirect costs and benefits of terrestrial ecosystem services in the process. They further put forward a partnership concept for implementing the recommendations in order to deliver a global, integrated and peer-reviewed economic and policy assessment of land degradation (Nkonya and others 2011).

34. It is only by conceptualizing the social processes linked to DLDD and the underlying contextual situation that the impacts (or costs) and necessary investments into recovery can be properly quantified. For Yesuf and others (2005) it is decisive to achieve a full cost-benefit analysis of feasible options to reduce land degradation and improve productivity. Estimating the costs of land degradation, no matter how well done, will only take us a little way towards deciding what to do about it. Decision and policy makers need to know what actions can be taken, that are socially profitable and beneficial. In defining what the roles of governments and other stakeholders should be, it is also important to consider the difference between private and social costs and returns. This requires the investigation of off-site effects where those are likely to be important, as well as the on-site costs and benefits of land management options. As part of the effort to address these and other gaps, this study was undertaken to prepare a framework for global assessment of the economics of desertification, land degradation and drought (IFPRI 2011).

V. Socioeconomics of sustainable land management policies and practices

35. Land degradation continues to pose a threat to future food production potential in many developing economies. Various approaches, mainly based on command-and-control policies, have been tried with limited success in the past to encourage adoption of, for example, erosion-control practices by farm households (Shiferaw and Holden 2000).

36. Studies have shown that people are more likely to comply with regulations enacted by local councils than with regulations imposed by higher authorities. For example, communities in India and Peru made significant progress when they used bottom-up approaches to manage natural resources (Nkonya and others 2011). Bollig and Schulte (1999) argue that African pastoralists have developed sustainable modes of pasture management based on a detailed knowledge of the dryland ecosystems. The knowledge system relates to a cultural landscape and not to abstract ecological considerations. This pastoral knowledge may have allowed the pastoralists to adapt their strategies reducing the scope of livestock and wildlife mortality caused by desertification in the region. However, they may not be sufficient to counter serious impacts on the local economy and food insecurity (Pamo, 1998). Farmers in Niger started actively protecting or planting trees once they were given a mandate to own the trees (Nkonya and others 2011), which suggests that property rights are an important consideration.

37. Many examples demonstrate that land users must receive direct benefits from preventing or mitigating land degradation. Shiferaw and Holden (2000) propose the use of interlinked contracts which create positive incentives for land conservation, and analyse the social efficiency of such policies for erosion control in the Ethiopian highlands using a non-separable farm household model. Incentive contracts linked with conservation seem to offer promising approaches for sustainable resource use in poor rural economies (Shiferaw and Holden 2000).

38. Wang and others (2012), after examining state investment in mitigation and current rehabilitation strategies in China, recommend (i) broadening the previous sectoral perspective to a multi-stakeholder approach; (ii) setting priority zones; (iii) steering state investment from government investment in tree plantations to acquisition of planted/greened areas; and (iv) introducing preferential policies in favour of sandy land restoration, including extending land tenures to 70 years and compensating for ecological services.

39. Generally, a governance environment allowing for sustainable land management is distinguished by several conditions. Nkonya and others (2011) suggest that the international development community should focus on decentralizing natural resource management, invest in agricultural research and development, and build local capacity for participatory programmes. In addition, clarified property rights and related legal protection and enforcement of rights, including for communal lands, as well as access to rural services properly managed by central governments is part of the necessary institutional agenda for sustainable land use and management.

VI. Valuing and measuring resilience

40. While the decade following the Rio Summit in 1992 was the decade of ‘sustainability’, the decade of Rio+20 seems to be the decade of ‘resilience’. Over the last couple of years, a large number of documents on resilient societies, resilient policies, resilient organizations, resilient communities, and so forth, have been published, and the

term ‘resilience’ is now used across professions. However, it is typically defined differently both within and between these professions – or used without any definition.

41. In order to be a useful complement to promoting the sustainable dryland and drought risk management framework, it is important that resilience brings additionality. The Resilience Alliance, which is an international network of scientists working on socio-ecological systems, is working towards a definition for resilience of socio-ecological systems that encompass three interrelated components: the ability to absorb perturbations and still retain key functions; the ability of self-organization; and the capacity to learn, to change and to adapt. Whether or not this definition renders the concept more operational is still being questioned by a number of researchers (Béné and others 2012).

42. While ‘resilience’ originates from the Latin *resilire* ‘to spring back’ this notion is seen by many as contradictory to the sustainable development concept. To be useful, ‘resilience’ should therefore be defined in terms of improving and bouncing forward and using changes and stressors as opportunities for improvement (Shaw 2012). We suggest the following definition for resilience in relation to sustainable dryland and drought risk management: The capacity of individuals, communities and systems to survive, adapt, and grow in the face of change, even change resulting from catastrophic incidents.

43. While there is still debate about the measurement and even relevance of measuring resilience, there seems to be a growing consensus on a number of characteristics of resilience: diversity, flexibility, acceptance of uncertainty and change, community involvement, preparedness, social and economic equity, social values and structures, non-equilibrium dynamics, learning, cross-scalar perspective. Indicators can be established for most of these characteristics, as suggested by Cutter and others (2012), thus allowing for qualitative assessments of resilience.

44. Reynolds and others (2007) argue that during the early stages of land degradation and desertification, losses are compensated by the social resilience of the local human populations (Bollig and Schulte 1999; Pamo 1998) or by economic inputs from government (Vogel and Smith 2002). However, when certain thresholds are crossed, social resilience or government subsidies may not be enough to compensate for the loss of productivity. This leads to a number of socioeconomic changes that range from changes in prices and trade due to lower agricultural production to population migration (Reynolds and others, 2007; Requier-Desjardins and Bied-Charreton, 2006).

45. The case of nomadic livestock systems in Northern Cameroon is one of the examples of social resilience to desertification. These systems were relatively well adapted to the fluctuating Sub-Sahelian environment of the region until 1979, when the Maga Dam was built to store water for a rice irrigation project. This dam prevented the normal flooding of dry season grazing land for livestock and wildlife and has induced large-scale desertification. Pamo (1998) found that wildlife and pastoralists in the region have adjusted to the new conditions by diversifying their herds, an ecological as well as an economic-based strategy, and by practising increased mobility.

VII. Valuing ecosystem services

46. Ecosystem services are broadly defined as the benefit people obtain from the ecosystems (MEA 2005). Ecosystems and carrying potentials of the ecosystems have been neglected for a long time, and ecosystem-related benefits are often considered per se, or gratis. With an increasing degree of natural resources being over exploited, the importance of ecosystem services is becoming more widely recognized. It is essential that knowledge of the importance of factors which, when combined, provide us with the environmental conditions we depend on.

47. The Millennium Ecosystem Assessment (MEA) identified the following ecosystem services: provisioning services (such as food and timber), regulating services (for example, climate regulation through carbon storage and sequestration, water purification and regulation), cultural services (such as aesthetic and recreational services) and supporting services (such as soil formation). This report also estimated that 60 per cent of the Earth's ecosystem services have been degraded largely because of human causes (MEA 2005).

48. Since the MEA, there has been an increasing demand for integrating an ecosystem approach into environmental accounting. In order to develop a standard for ecosystem service accounting, an experimental framework is currently being developed and tested in the context of the system for environmental economic accounts (SEEA) Central Framework (UNSD and others, 2011). It is expected that a revised version of SEEA integrating ecosystem services will be endorsed in 2013 (Haines-Young and Potschin 2011).

49. One of the critical challenges in creating ecosystem accounts that can capture the changing capacity of ecosystems to provide goods and services to people lies in the classification of ecosystem goods and services and how to define a normal functioning ecosystem, including environmental structures, processes and functions. According to the Australian Bureau of Statistics (2011), for instance, environmental information relating to ecosystem functions remains "patchy" with inconsistent definitions, independence from any framework, and lack of representativity in time, space and subject matter.

50. Examples for ecosystem valuation studies in the context of DLDD are offered by MEA (2005) and the economics of ecosystems and biodiversity (TEEB) (TEEB 2010). Accordingly, a 3,100 ha coastal peat bog in Sri Lanka provided an estimated USD 5 million in benefits from flood control services (MEA 2005), whereas the protection that coral reefs provide to islands in Southeast Asia is estimated to be worth USD 55-USD 1,100 per hectare per year (TEEB 2010). The Masoala forest in Madagascar provides soil erosion protection services, which contribute to reduced sedimentation of local rice paddies and fish nurseries (TEEB 2010).

51. Comprehensive analyses of the costs of DLDD look at the impacts of DLDD on a whole range of ecosystem services and the welfare implications for people. However, as mentioned earlier, most work on the costs of DLDD focuses on declines in the provisioning services of affected ecosystems, that is, the direct costs of declining productivity of crop or livestock production.

52. The full impact of DLDD on ecosystems, however, goes beyond provisioning services to affect important regulating services, cultural services and supporting services. As these types of services are rarely traded in markets, the benefits associated with such services are generally undervalued in decision-making (MEA 2005). In addition, there are often global benefits but costs are borne locally.

53. Noel and Soussan (2009) outline ecosystem services valuation techniques, classifying them as (i) revealed preference approaches such as market prices, effects on production, travel cost techniques, or hedonic prizing; (ii) cost-based approaches, such as replacement costs, mitigative/ avertive expenditure, damage cost avoided; and (iii) stated preference approaches, such as contingent valuation, conjoint analyses or choice experiments.

54. The valuation techniques listed above all seek to place monetary values on ecosystem services. However, economic valuation can only be applied to a portion of those services (TEEB 2010). In addition, it is essential to assess trade-offs; values should be spatially and temporally explicit and at scales meaningful for policy formation or interventions; any valuation study should be fully aware of the cost side of the equation, as focus on benefits only ignores important societal costs, like missed opportunities relating to alternative uses, and analysis of risks and uncertainties (TEEB 2010).

55. A thorough assessment needs to capture all changes in ecosystem services and use of the total economic value (TEV) framework helps to formalize this. The TEV framework identifies the different types of values that are affected by DLDD, be they use, option or existence values. (Nkonya and others, 2011).

VIII. Conclusion

56. This document is brought before the Committee on Science and Technology for its consideration prior to the UNCCD 2nd Scientific Conference in order to facilitate the substantive work and input during the Conference itself.

Annex I

List of members of the Review Group of the UNCCD 2nd Scientific Conference

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Annex II

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