Economic and Social Impacts of Desertification, Land Degradation and Drought: Key Findings, Policy Implications and Recommendations of White Paper 1

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WHITE PAPER I

Economic and Social Impacts of Desertification, Land Degradation and Drought

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United Nations Convention to Combat Desertification

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Key Findings, Policy Implications, and Recommendations

Economic and Social Costs and Benefits of DLDD

(Grainger *et al*., 2013, Chapter 2 of WP I)

- Understanding and evaluating the economic and social costs and benefits associated with Desertification, Land Degradation and Drought (DLDD) is essential to developing cost-effective policies and strategies for addressing DLDD.
- However, little research has been published in peer-reviewed literature on the economics of desertification, or of land degradation in general. This severely constrains the scientific knowledge which WG 1 can synthesize and evaluate. One reason for the gap is that formal economic modelling of land degradation only began in the 1980s. Another is that the volume of economic research in this field has not expanded greatly since the early 1990s.

Direct Economic Costs

- …are "on-site" costs incurred through reductions in income of land users as a result of the lower productivity of land resulting from DLDD.
- However, estimates vary widely and are very inaccurate. For example, four estimates of direct costs as a proportion of Gross Domestic Product (GDP) in single countries in the 1980s were: 0.4% of GDP in the USA; 2% of GDP in India; 9% of GDP in Burkina Faso; and 0.9-12.5% in Mali.
- Large differences are also found between the direct costs estimated in different studies for the same country, e.g. India and China.

Table 1. Estimates of national direct costs of land degradation in the 1980s as a proportion of Gross Domestic Product (GDP).

Country	Magnitude	Per cent GDP	Per cent Agricultural GDP*	Reference
Burkina Faso	-	9	20	Lallement (1989)
Ethiopia	-	-	2	Bojö and Castells (1995), based on Hurni (1988)
India	Rs 75 billion	2	4	Reddy (2003)
Mali	-	0.9-12.5	2-30	Bishop and Allen (1990)
USA	$27 billion	0.4	20	Pimentel *et al.* (1995)

* NB. Estimates made for this review.

(Source: Grainger *et al*, 2013; Chapter 2 of WP I)

Table 2. Estimates of the direct costs of soil erosion on agricultural production in Ethiopia as a proportion of Agricultural Gross Domestic Product (AGDP)

Study	Projection Period (Years)	Discount Rate (%)	Direct Cost (% AGDP)
Ethiopian Highlands Reclamation Study (FAO, 1986)	25	9	2.2
Soil Conservation Research Project (Hurni, 1988; Bojö and Castells 1995)	0	-	2.0
National Conservation Strategy Secretariat (Sutcliffe, 1993)	25	Na	6.8
World Bank Reassessment (Bojö and Castells, 1995)	100	10	3.0

Source: Yesuf *et al*. (2007).

Table 3. Three estimates of the extent and annual direct cost of land degradation in India.

	NRSA (1988-89)	ARPU (1990)	Sehgal and Abrol (1994)
Area affected by soil erosion (million ha)	31.5	58.0	166.1
Area affected by salinization, alkalinization & waterlogging (million ha)	3.2	-	21.7
Total area affected by land degradation (million ha)	34.7	58.0	187.8
Cost of soil erosion in lost nutrients (Rps billion)	18.0	33.3	98.3
Cost of soil erosion in lost production (Rps billion)	67.6	124.0	361.0
Cost of salinization, alkalinization and waterlogging in lost production (Rps billion)	7.6	-	87.6
Total direct cost of land degradation (Rps billion)	75.2	-	448.6

Sources: Reddy (2003) (NRSA and APRU); Sehgal and Abrol (1994).

Table 4. Total costs of desertification in China
(Source: Case Study 1 by Cheng *et al*. 2013).

	Total costs (billion RMB)	Base year	Nominal GDP[b] (billion RMB)	GDP deflator[b] (1978=100%)	% of GDP
Zhang *et al.*	54.1	1995	6079.37	502.3%	0.89%
Lu & Wu	64.2	1999	8967.71	700.9%	0.72%
Liu	128.1	1999	8967.71	700.9%	1.43%
Average	89.28[a]	1999	8967.71	700.9%	1.00%

a. Steps for calculating average desertification costs are as follows. First, adjust the total costs of desertification in Zhang *et al.* (1996) to 1999 price level using GDP deflators. Then, calculate the arithmetic mean of the constant- price costs of desertification in the three studies.
b. GDP data and GDP deflator data are both from *China Statistical Yearbook 2012*.

Direct Economic Costs

- Estimate variation and inaccuracy can be linked to the lack of reliable biophysical measurements of the extent and rate of change of desertification; the use of different economic estimation methods; the embryonic nature of economic research in this field; and isolation from estimates of the benefits of actions that cause degradation and are central to decision-making and its appraisal.
- The accuracy of estimates will not improve until there is far better biophysical monitoring of the extent and rate of change of desertification.

Indirect Economic Costs

- … are incurred through off-site impacts that can be some distance from the land use that is the source of degradation, and so are generally suffered by people other than those who cause degradation.
- For example, the erosion of soil by water and wind leads to the siltation of rivers, reservoirs and irrigation canals which reduces their effectiveness and exacerbates flooding. Excessive or inappropriate use of water results in salinity and alkalinity.
- The impacts of dust and sand storms in many parts of Africa and Asia.

Indirect Economic Costs

- Estimates of indirect costs are less common than those for direct costs, and most indirect costs are still not estimated because of lack of data.
- The annual indirect costs of soil erosion in the USA have been estimated as $17 billion, compared with direct costs of $27 billion, raising total costs of soil erosion to 0.7% of GDP. But this could be an underestimate, since valuation of ecosystem services is still embryonic. In China, sand and dust storms linked to soil erosion have resulted in indirect costs due to airline delays and impacts on human health.
- The range and inaccuracy of estimates of indirect costs is explained in a similar way to those for direct costs, with the additional complications that market prices are lacking for many of these impacts and impact profiles and subsequent costs vary from country to country.

Estimation of Indirect Economic Costs

- Various methods are used to estimate the values of indirect costs. They include:

  (i) Contingent valuation, measured by people's willingness to pay for or accept a phenomenon.

  (ii) Choice experiment, determined by choosing one option from a range of options.

  (iii) Avoided cost, estimated by avoiding the cost due to damage.

  (iv) Replacement cost, which is the cost of replacing a service by the least costly alternative (Adhikari and Nadella, 2011; Nkonya *et al*., 2011; Requier-Desjardins *et al*., 2011).

  As examples of the last two methods, the impact of soil erosion on the siltation of hydroelectric reservoirs has been estimated by avoiding the cost of dredging reservoirs (Hansen and Hellerstrein, 2007), and by the cost of replacing hydro-electricity by electricity generated in another way, e.g. from fossil fuels (Clark, 1996).

Economy-Wide Costs

- Both direct costs and indirect costs can, through a complex chain of influences, lead to a multitude of other costs throughout an economy.
- For example, soil which is eroded by wind and reduces reservoir capacity can lead to electricity outages throughout a country, which, in turn, can result in production losses in many industries and other commercial enterprises, which eventually affects the size of government spending and the income of employees who are put on short-time work (Nkonya *et al*., 2011). Even a reduction in agricultural production and income caused by land degradation can have "knock-on" effects throughout an economy by affecting the circulation of income and international trade flows.
- Estimates of these two categories of economy-wide costs are infrequent because of the difficulties involved. But the estimation of economy-wide costs is important.

Social Impacts

- Social impacts, such as an *increase in poverty*, are important, but their estimation is hindered by lack of social and biophysical data and by synergies between these impacts and the underlying social causes of desertification.
- It is important to evaluate the societal distribution of impacts in terms of the *institutions, environmental justice, risk, vulnerability* and *migration*.
- Other social impacts include *food security and health*, as well as contribution to *conflicts and political instability* (e.g., there is evidence to show that severe drought in China between 1638 and 1641 may have influenced the peasant rebellions that hastened the demise of the Ming Dynasty in 1644 (Cook *et al*., 2010).

Economic and Social Impacts

- While sustainable land management is an important measure for tackling desertification, research into entitlements, environmental justice and vulnerability suggests that tackling desertification is not just about adopting physical remedies, as social remedies are equally important.
- This means that economic impacts and social impacts need to be tackled in an integrated manner, rather than separately, if policies for addressing desertification are to be effective.
- However, improving estimates of the magnitudes of economic and social impacts will require better measurements of the extent and rate of change of desertification, and the integration of desertification into national statistics and planning methods.

Institutional Settings and Government Policies

- It is crucial to understand the institutional settings in which land users make decisions that may lead to, or avoid, desertification. Deciding to use land in a way that leads to desertification is not necessarily abnormal or irrational, and governments may unintentionally exacerbate this, e.g. when they subsidize fertilizer use; support food prices to benefit farmers and determine the level of subsidy; or introduce large capital-intensive agricultural schemes that can have positive local impacts but negative national or even regional and global impacts.

Institutional Settings and Government Policies

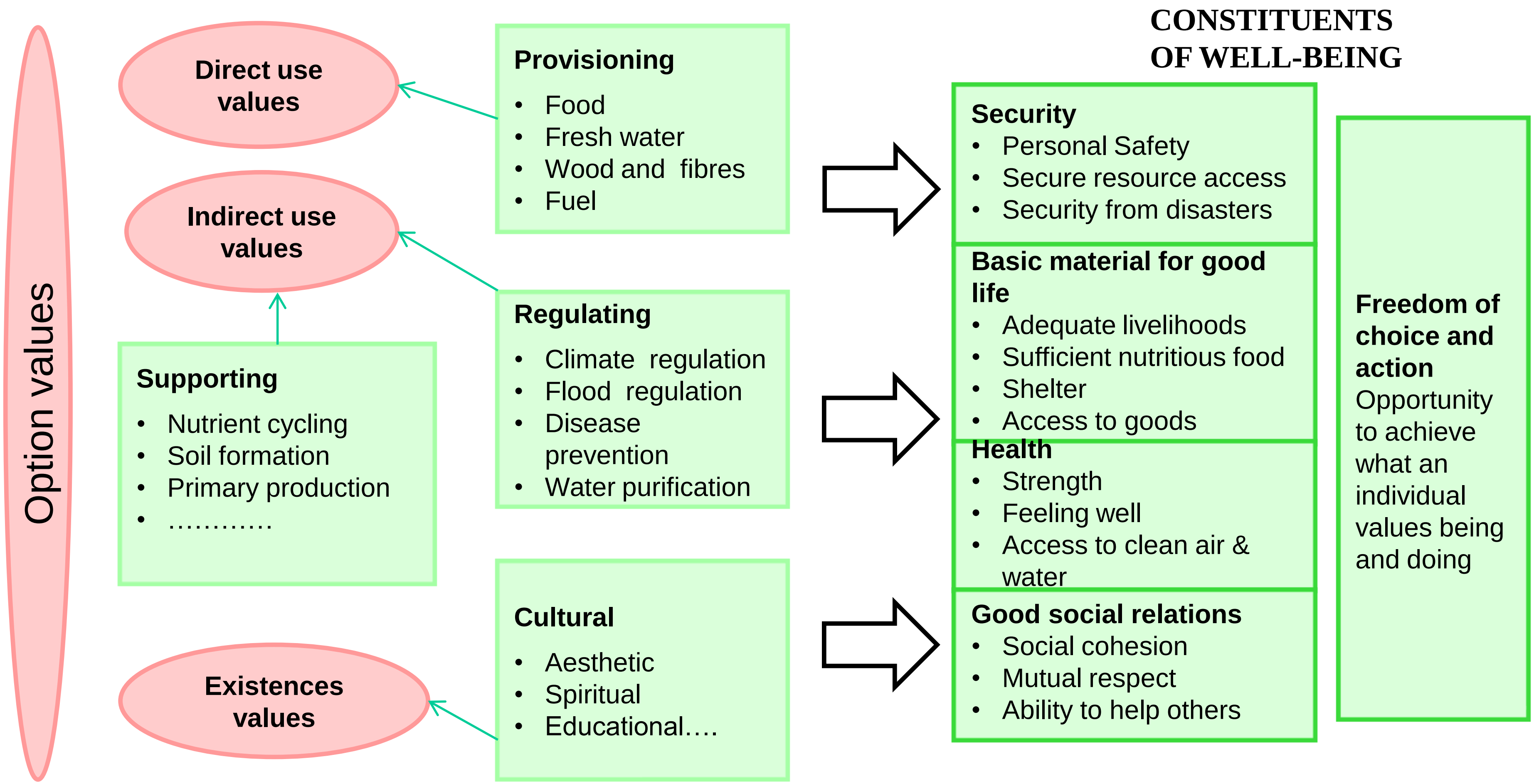
- So the rate of desertification could be reduced if:
  - government policies were evaluated beforehand to check for unintended consequences;
  - societal institutions were audited to check for constraints that lead to land user degrading land instead of managing it sustainably; and
  - an integrated approach was taken to national land-use planning and government policies.

Analytical Frameworks, Methodologies and Tools for Evaluating the Costs of DLDD
(Olsen, 2013, Chapter 3 of WP I)

- Analytical frameworks, methodologies and tools are available for the identification and measurement of the costs of DLDD, including a methodology for prioritizing across geographic areas based on an assessment of the costs of investing in effective prevention and mitigation of land degradation compared to the costs of the loss in ecosystem services (i.e. the cost of action versus inaction). But these frameworks, methodologies and tools can still be further improved.
- A thorough assessment needs to identify important changes to ecosystem services and ecosystem service delivery, and knowledge gaps still exist.

Total Economic Value (TEV) Framework

- Application of the Total Economic Value (TEV) framework may assist in the identification of different types of economic values associated with the range of ecosystem services that are affected by DLDD, including values associated with direct use (fuelwood, animal fodder) or indirect use (soil fertility) option values based on maintaining resources for future use or existence values (linked to the utility people derive from knowing certain species, habitats, landscapes continue to exist).
- Figure 1 illustrates the relations between ecosystem services, human well-being and economic valuation.



Source: Adapted from Millennium Ecosystem Assessment 2005

Figure 1. Ecosystem services, human well-being and economic valuation.

Measurement of Social Costs

- The application of the TEV framework, economic valuation of changes to ecosystem services and the integration of these values into social cost benefit analysis provide decision makers with a sounder basis for making land use decisions relative to simply looking at the direct costs of DLDD.
- Cost-benefit analysis should include the identification of how the costs associated with DLDD and the benefits of sustainable land management are distributed across stakeholders, focusing on those groups with a greater reliance on ecosystems and poor and vulnerable households.

Distribution Analysis

- The measurement of the social costs of DLDD is not a simple process, as it requires information about the physical, social and economic effects and their distribution across society and over time.
- Distributional analysis can inform decisions around land use to ensure policies and land management practices selected are both equitable and efficient from the perspective of society. If there are trade-offs to be made, as often is the case, decision makers will have information available to help them to prioritize objectives in a transparent manner.

Effective Policies and Strategies for Addressing DLDD
(Hannam and Low, 2013, Chapter 4 of WP I)

- Effective policies and strategies that guide the implementation of the UNCCD at the national, regional and global levels include policies and strategies for land, forest, water and other natural resources management, developed as part of an overall national policy framework to improve land management and promote sustainable development.
- These policies must be based on the best available knowledge and science relevant to the local, national and regional conditions and circumstances. Thus, it is important that there is greater investment in scientific research on DLDD in order to better develop and formulate effective policies. In addition, attention needs to be paid to the science policy interface and the structures and processes through which scientific knowledge reaches policy makers.

The Need for Improvement in the NAP Process

- The UNCCD National Action Programme (NAP) process should facilitate affected Parties to present their strategies for DLDD prevention and mitigation and outline future action.
- At the global level more resources are required to enable affected Parties, especially developing countries, to implement their obligations under the UNCCD.
- Regional cooperation is an important component for successful implementation and coordination mechanisms must respond to existing and emerging needs, capacities and the specific issues of each region.
- At the national and local levels, decision makers should also have responsibility to ensure participation and provide full ownership to local and primary affected communities, while mobilizing access to resources from relevant institutions and organizations.

The Need for a Legal System for Effective Land Management

- The approach to implement national policies and strategies to combat DLDD should include a legal system that provides for the effective management of land, taking an ecosystem-based approach.
- At the international level the UNCCD has many gaps and limitations for the protection and sustainable use of land and it lacks key elements to provide the effective ways to protect and manage the ecological aspects of land (e.g., ecologically based guidelines to Parties for the preparation or revision of national legislation). The proposal for an international instrument for global land and soil degradation is regarded as essential as part of the national, regional and international framework for addressing DLDD.

Harnessing synergy between UNCCD, UNFCCC and CBD

(Kellner and Dreber, 2013, Chapter 5 of WP I)

- Due to the interlinkages between DLDD, loss in biodiversity and climate change, harnessing synergy between UNCCD, UNFCCC and CBD is vital when working on terrestrial ecosystems. The development of synergistic approaches together with the creation of an enabling policy and institutional environment is important for the strengthening of these Conventions.
- Options for building synergies among the Rio Conventions in specific cross-cutting areas includes capacity-building, technology transfer, research and monitoring (e.g., terrestrial features), information exchange and outreach, reporting and financial resources. However, there are still shortcomings in the collaboration between the conventions, which impede synergistic effects.

Harnessing synergy between UNCCD, UNFCCC and CBD

- Developing and practising synergies among the Rio Conventions in a fully operationalized manner requires:
  - (i) improving interactions at regional, national and local levels;
  - (ii) reducing potential conflicts between independent activities;
  - (iii) reducing duplication of efforts through improved knowledge transfer; and
  - (iv) sharing financial resources in a more efficient and balanced way.
- Promoting synergies at regional, national and local levels requires also stronger collaboration among the National Focal Points (NFPs) that serve each of the Convention and play a key role in bridging the differences between involved parties especially at the policy level. However, this still requires improvements in efficiency and effectiveness.

Financial Resources

- Adequate financial resources are required to develop and implement effective policies for addressing DLDD, and thus more financial resources should be provided by the financial mechanisms of the UNCCD (GM and the GEF) to assist developing country Parties.
- However, compared to the funding provided for climate change and biodiversity, which accounts 32% and 28.47% of the GEF-5 resources (1 July 2010-30 June 2014) respectively, the funding provided for SLM focal area accounts for about 9.53%.

The limits of ZNLD

- Within WG 1, there were some discussions on the limits of Zero Net Land Degradation (ZNLD) among some members. The Chair is of the view that if only ZNLD is to be achieved, then at best it will only maintain "a land degradation neutral world", and it will be impossible "*to secure the continuing availability of productive land for present and future generations*". He proposes a more positive and proactive concept of Net Restoration of Degraded Land (NRDL) (i.e. the rate of land restoration is greater than the rate of land degradation), which provides a more progressive outlook and a more practical measure to combat land degradation and desertification. Indeed, in China, targets have been set to restore a total of 100×10^4 km^2 degraded land by 2050 (Wang *et al*., 2012), and thus NRDL rather than ZNLD will be a better indicator to measure China's achievements in combating land degradation and desertification.

Case Study 1: Methodologies for Valuating Desertification Costs in China

(by CHENG Leilei, CUI Xianghui, GONG Liyan and LU Qi)

- Based on literature review, the case study assesses the total costs of desertification in China, including agricultural loss, transportation loss, and the costs of siltation of rivers, reservoirs and irrigation canals resulting from desertification in China. In addition, annual housing facility loss by sand-blown disaster and adverse health effects by dust/sand storms were estimated.
- Four valuation methods, i.e. the Dose-Response Approach (DRA), Change in Productivity Approach (CPA), Replacement Cost Approach (RCA), and Illness Cost Approach (ICA), are commonly used to estimate the costs of desertification in China.

Case Study 2: Economic assessment of DLDD in Spain

(by Luuk Fleskens, Doan Nainggolan and Lindsay Stringer)

- The EU FP6 DESIRE project developed a Desertification Mitigation Cost Effectiveness (DESMICE) model to undertake spatially-explicit cost-benefit analysis of land degradation mitigation strategies.
- DESMICE was applied to the Rambla de Torrealvilla catchment, Murcia, Spain, where rainfed cereals, almond and olive orchards, irrigated vegetables, grapes, livestock, shrubs and forests dominate, and where soil erosion and water scarcity present key challenges (Nainggolan *et al*., 2012).
- DESMICE ran 5 different scenarios (baseline, technology, policy, global scenario (a): food production and global scenario (b) minimize land degradation)to establish how the investment costs of mitigation strategies change based on environmental conditions.
- DESMICE has also been tested in many of the other DESIRE project study sites (Fleskens *et al*., 2012). Such scenario studies provide a useful way to assess the costs and benefits associated with alternative land management options.

Policy Recommendations

1. Governments would benefit from integrating the economic, social and environmental costs of DLDD in national environmental accounts with the benefits from land use that generate these costs. This could support integrated land-use planning and monitoring of the sustainability of national development.
2. It is not possible to make accurate estimates of the economic, social and environmental costs of DLDD without reliable spatial information on the extent and degree of desertification and its rate of change. Better national and global monitoring of desertification is essential to improve the accuracy of estimates of these costs..

Policy Recommendations

3. Economic impacts and social impacts need to be tackled collectively in an integrated manner, rather than separately, if policies for addressing DLDD are to be effective.
4. Governments should check their policies for unintended consequences; societal institutions need to be audited to check for constraints that lead to poor people degrading land instead of managing it sustainably; and an integrated approach should be adopted to national land-use planning and government policies.

Policy Recommendations

5. The CST, supported by the UNCCD Secretariat, could sponsor a workshop organized by the Economics of Land Degradation initiative that would enable a group of leading economists to catalyse the development of a new family of economic models of DLDD with policy applications. This will benefit governments and could have a snowball effect on economics research in this neglected area.

Policy Recommendations

6. A legal system that provides for the effective management of land, taking an ecosystem-based approach, may be established to guide the implementation of national policies and strategies for addressing DLDD. The proposal for an international instrument for global land and soil degradation is regarded as essential as part of the national, regional and international framework for effectively protecting and managing the ecological aspects of land and for addressing DLDD.

Policy Recommendations

7. The Parties may wish to request both the GM and the GEF to raise their levels of technical and financial support for eligible developing country Parties for the implementation of the UNCCD and for addressing DLDD, including the estimation of social and economic impacts of DLDD where appropriate.

Thank you for your kind attention!