THE ECONOMICS OF LAND DEGRADATION

ELD CAMPUS
Module:

Land degradation versus sustainable land management

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Abbreviations

CIAT	International Center for Tropical Agriculture
ELD	Economics of Land Degradation
FAO	Food and Agriculture Organization
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLASOD	Global Assessment of Human-induced Soil Degradation
ICT	Information Communication Technology
IPBES	Intergovernmental scientific and political platform for biodiversity and ecosystem services
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Center
LDN	Land degradation neutrality
SDG	Sustainable Development Goal
SLM	Sustainable Land Management
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WOCAT	World Overview of Conservation Approaches and Technologies

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01 Definition, dimension and causes of land degradation

All human life ultimately depends on land including the soil and water found there. From land, food is grown, protective shelters are raised on it, and through and across it the fresh water we drink is purified and delivered. Land provides humans with the means to live, and from the first steps tread upon it, has been a patient provider of vital resources. But, at the start of the 21st century, our lands are no longer able to keep up with the pressures placed on its limited resources. Increasing misuse and demands for its goods are resulting in rapidly intensifying desertification and land degradation globally – an issue of growing importance for all people and at all scales (ELD Initiative 2015, 9). During the past decade, several studies and respective reports alerted the world's society regarding the phenomena of land degradation, i.e. the loss of soil productivity.

What is meant by land and land degradation?

Land: The Earth's surface and natural resources found there (ELD Initiative 2013, 5)

Land degradation: Defined by the United Nations as a reduction or loss of the biologic or economic productivity and complexity of rain-fed cropland, irrigated cropland or range, pasture, forest, and woodland. It corresponds to the reduction in the economic value of ecosystem services and goods derived from land as a result of anthropogenic activities or natural biophysical evolution (ELD Initiative 2013, 5).

And how is soil degradation defined?

Soil: Is a component of land and is defined as the top layer of the Earth's crust, formed by mineral particles, organic matter, water, air and living organisms over time. It is the interface between earth, air and water and hosts most of the biosphere (European Commission, 2006).

Soil degradation: Soil degradation is described by physical, chemical, and biological degradation processes acting upon the soil and impacting soil resources and environmental quality, as well as human well-being and livelihoods (FAO E-learning Centre 2019, glossary).

What is desertification?

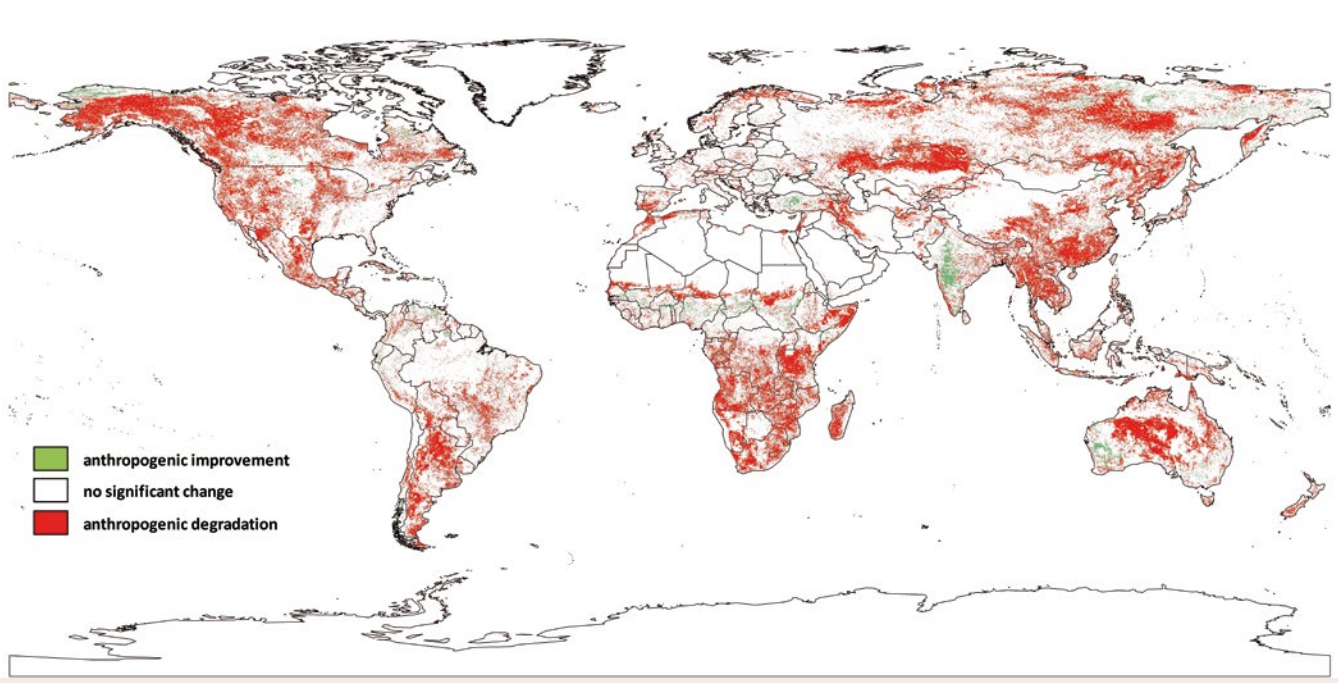
Desertification: Land degradation in drylands resulting from various factors, including climatic variations and human activities (WOCAT glossary).

Land degradation is a complex phenomenon that manifests in many ways. There have been numerous efforts using a variety of approaches to characterise land degradation over the last few decades. Estimates of the extent of land degradation vary, but approximately one third of the world's arable land is thought to have been affected by degradation and desertification to date (ELD Initiative 2015, p.8).

A recent review of various datasets and the approaches to their development (e.g., expert opinion, satellite derived net primary production, biophysical models, and abandoned cropland) has been conducted by Gibbs and Salmon. They show that estimations of the area of globally degraded land range from less than 1 billion ha to over 6 billion ha, according to the used database and methodology. For instance, the 1994 GLASOD study estimates that nearly 2 billion ha (22.5%) of agricultural land, pasture, forest and woodland have been degraded since mid-twentieth century (ELD Initiative 2015; Gibbs and Salmon, 2014). According to Nkonya et al. 2016, the total area affected by declining soil productivity over the last 30 years globally is around 30% (see figure 1). The UNCCD indicates that 52% of the land used for agriculture is moderately or severely affected by soil degradation (UNCCD, 2009).

FIGURE 1

Loss of soil productivity – worldwide
Source: Nkonya et al. 2016



Over 10 million hectares of arable land worldwide are degrading every year- an area roughly 1/3 the size of Germany (Pimentel et al. 1995). The UNCCD even indicates 12 million ha/year.

Land degradation in numbers

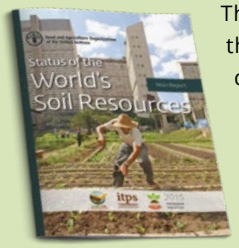
- About 44% of all cultivated systems worldwide are located within drylands.
- 65% of dryland areas are rangelands, which are better suited to sustainable grazing than crop production. However, as early as between 1900 and 1950, approximately 15% of dryland rangelands were converted to cultivated systems.
- 2 billion hectares of agricultural land, pasture, forest and woodland have been degrading since 1950 (Gibbs and Salmon 2014).
- 10 to 20% of land globally is already degraded – about 6 to 12 million square kilometres.
- 52% of agricultural land worldwide is moderately or severely affected by soil degradation.
- 75% of the Earth's land areas are substantially degraded, undermining the well-being of 3.2 billion people (IPBES 2018).

Source: ELD Initiative 2015 (2) and as cited

The effects of land degradation and desertification are distributed unevenly throughout human populations and often impact the most vulnerable – the rural poor. This population regularly depends on land for their sustenance and livelihoods, and the ramifications of degradation affect them most deeply because of this intimate relationship. An ELD Initiative study by Barbier and Hochard on the spatial and economic distribution of the rural poor in the context of land degradation found that over a third of this marginalised population – up to 1.4 billion people – live in less favoured agricultural land and areas. However, having access to an understanding of the full economic benefits and receiving equitable distribution of rewards gained by all of society through their land stewardship, and especially when implementing sustainable land management, is key in resolving many of the issues this population faces. SLM in this context is seen as a solution to halt and reverse the above-mentioned degradation trends (ELD Initiative 2015, Value of Lands, p.9; Barbier and Hochard 2014).

Several important research organisations, think tanks and scientific panels have published reports on the topic during the past years, in order to draw the attention of political decision-makers and the public on this important phenomena, the consequences, as well as urgent action needed to halt and revert the tendencies. **You can click on the respective report cover to access them directly.**

The Status of the World's Soil Resources Report (FAO 2015)



The Status of the World's Soil Resources report is one of the main achievements of the Global Soil Partnership in the context of the 2015 International Year of Soil. Produced by the Intergovernmental Technical Panel on Soils, the report aims to incentivise collective efforts to achieve global sustainable management of soils. Soils are fundamental to life on Earth, yet they are under threat of continuous degradation. Further loss of productive soils will amplify food-price volatility, and potentially cause widespread poverty among millions of people. The main threats are soil erosion, loss of soil organic matter, and nutrient depletion.

The four main recommendations of the report include sustainable soil management, stabilised stores of soil organic matter, reduced use of nitrogen and phosphorus fertilisers, and improved observation systems to monitor the progress in these three priority areas.

Source:
https://ec.europa.eu/jrc/en/news/world-s-soil-resources-human-pressure-reaching-critical-limits

The Value of Land (ELD Initiative 2015)

The Value of Land report introduces the ELD Initiative's 6+1 approach, highlighting the importance of valuing ecosystem services, the potential of sustainable land management to mitigate land degradation as well as pathways for stakeholders' engagement and perspectives. Based on this broader understanding of movements toward corrective actions on a variety of land issues, this report forms the core of the ELD Initiative's knowledge outputs as it pertains to the economics of land degradation and sustainable land management.

This report is structured to provide an overview of the economics of land degradation and the benefits of sustainable land management. It describes the setup of the ELD Initiative and its collaborations, networks, and partners, and the role of ELD in international efforts on climate change and the upcoming Sustainable Development Goals (SDGs), before zooming the lens from the global scale through the regional to the local level.

Source:
http://www.eld-initiative.org/index.php?id=111
http://www.eld-initiative.org/fileadmin/pdf/ELD-main-report_en_10_web_72dpi.pdf

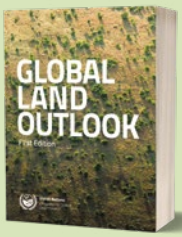
Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development (Nkonya et al. 2016)

This volume deals with land degradation, which is occurring in almost all terrestrial biomes and agro-ecologies, in both low- and high-income countries and is extending to about 30% of the total global land area. About 3 billion people reside in these degraded lands. However, the impact of land degradation is especially severe on livelihoods of the poor who heavily depend on natural resources. The annual global cost of land degradation due to land use and cover change and lower cropland and rangeland productivity is estimated to be about 300 billion USD.

The results in this volume indicate that reversing land degradation trends makes both economic sense, and has multiple social and environmental benefits. On average, 1 USD investment into restoration of degraded land returns 5 USD. The findings of the country case studies call for increased investments into the rehabilitation and restoration of degraded lands, including through policy measures such as strengthening community participation for sustainable land management.

Source: https://www.springer.com/us/book/9783319191676

Global Land Outlook, first edition (UNCCD 2017)



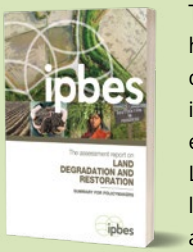
Land is an essential building block of civilization, yet its contribution to our quality of life is perceived and valued in starkly different and often incompatible ways. Conflicts about land use are intensifying in many countries. The world has reached a point where we must reconcile these differences and rethink the way in which we use and manage the land.

Our ability to manage trade-offs at a landscape scale will ultimately decide the future of land resources: soil, water, and biodiversity. Indeed, integrated land and water management is recognised as an accelerator for achieving most of the SDGs.

The evidence presented in this first edition of the Global Land Outlook demonstrates that informed and responsible decision-making along with simple changes in our everyday lives, can, if widely adopted, help to reverse the current worrying trends in the state of our land resources.

Source:
https://www.unccd.int/sites/default/files/documents/2017-09/GLO_Full_Report_low_res.pdf (p.10)

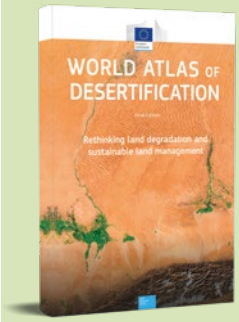
Assessment Report on Land Degradation and Restoration (IPBES 2018)



The Land Degradation and Restoration assessment report is the world's first comprehensive evidence-based assessment report on land degradation. It recognizes that combatting land degradation, which is a pervasive, systemic phenomenon occurring in all parts of the world, is an urgent priority in order to protect the biodiversity and ecosystem services that are vital to all life on Earth and to ensure human well-being. Land degradation negatively impacts 3.2 billion people, and represents an economic loss in the order of 10% of annual global gross product. The Report concludes that avoiding land degradation and restoring degraded lands makes sound economic sense, resulting in, inter-alia, increased food and water security, increased employment, improved gender equality, and avoidance of conflict and migration. Avoiding land degradation and restoring degraded lands are also essential for meeting the Sustainable Development Goals.

Source:
https://www.ipbes.net/system/tdf/2018_ldr_full_report_book_v4_pages.pdf?file=1&type=node&id=29395 (p.6)

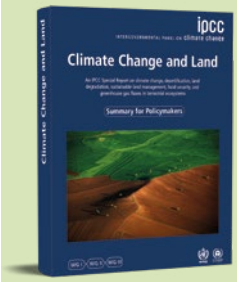
World Atlas of Desertification (JRC 2018)



Climate change is expected to expand the world's fragile drylands through an increased frequency, duration and severity of droughts. This may lead to an accelerated rate of desertification which, in turn, is likely to increase poverty. The Joint Research Center (JRC) studies different aspects of these coupled human-environmental phenomena by monitoring and assessing regional and global desertification, land degradation and drought (DLDD). It develops integrated methodologies and indicators for assessing DLDD, which are used to compile the World Atlas of Desertification.

This atlas, which is being coordinated by the JRC and the United Nations Environment Programme (UNEP), will be a means of bringing scientific advancements into the policy arena for better decision making and mitigation.

Source: https://ec.europa.eu/jrc/en/scientific-tool/world-atlas-desertification



Special Report on climate change and land (IPCC 2019)

At its 43rd Session (Kenya, 2016), the IPCC Panel decided to prepare a special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

The Special Report was published in August 2019.

Source: https://www.ipcc.ch/report/srccl/

Causes of land degradation

Burgeoning populations with shifting demographics and distributions are increasing the demands on land to produce food, energy, water, resources, and livelihoods. Environmental shifts induced through stressors (e.g. climate change) and dissolution of ecosystem stability are further decreasing the ability of land to respond resiliently to natural or anthropogenic pressures. 60% of the Earth's land surface is managed, and approximately 60% of that is agricultural land use. Estimates of the extent of land degradation vary as was shown above, but they all indicate that land degradation is widespread, on the rise, and occurring in all land cover types and agroecologies, and especially so in drylands. Many degrading practices can be linked to the 'tragedy of the commons' in which the demands of individual interest take precedence over shared, sustainable use of land resources, leading to its overexploitation (adapted from ELD 2015, p.9).

According to IPBES 2018, the underlying drivers of land degradation are:

- The high-consumption lifestyles in most developed economies, combined with rising consumption in developing and emerging economies;
- High and rising per capita consumption, amplified by continued population growth in many parts of the world;
- Unsustainable levels of agricultural expansion, natural resource and mineral extraction, and urbanisation;
- The growing demand for food, fodder, fuel, and raw materials, which is increasing pressures on land and the competition for natural resources.

At the same time, degradation is reducing the amount of productive land available.

Von Braun (2013) distinguishes four categories of drivers for land degradation: proximate, underlying, natural and anthropogenic. Proximate drivers have a direct effect on the degradation of terrestrial ecosystems. For instance, a topography marked by steep slopes is subject to a risk of soil erosion by water. Proximate drivers are then divided according to the cause of land degradation, either due to a biophysical process (natural) and or due to unsustainable land management practices (anthropogenic). The second category, underlying drivers, indirectly induce proximate drivers of land degradation. For example, in a context of poverty there are no funds available to invest into the implementation of sustainable land management practices. In a given context, land degradation is the result of a combination of these proximate and underlying drivers. Thus, to address land degradation context-specific SLM packages must be designed. These should include the technological, policy and institutional dimensions of the problem (von Braun 2013 and ELD 2013). Table 1 shows the diversity of drivers of land degradation, divided into four categories.

TABLE 1

Drivers related to land degradation

Source: ELD Initiative 2013, adapted from von Braun et al. 2013

Driver	Proximate	Underlying	Natural	Anthropogenic
Topography	✔		✔	
Land Cover	✔		✔	✔
Climate	✔		✔	
Soil Erodibility	✔		✔	
Pest and Diseases	✔		✔	
Unsustainable Land Management	✔			✔
Infrastructure Development	✔			✔
Population Density		✔		
Market Access		✔		
Land Tenure		✔		
Poverty		✔		
Agricultural Extension Service Access		✔		
Decentralization		✔		
International Policies		✔		
Non-farm Employment		✔		

Overall, we can distinguish between natural processes and human-induced processes. Natural processes, such as soil erosion by wind and water, hurricanes, landslides or floods, can be the starting point of land degradation.

Human-induced processes can help mitigate natural processes, or reversely they can accelerate land degradation initiated by natural processes (FAO E-learning Centre 2019).

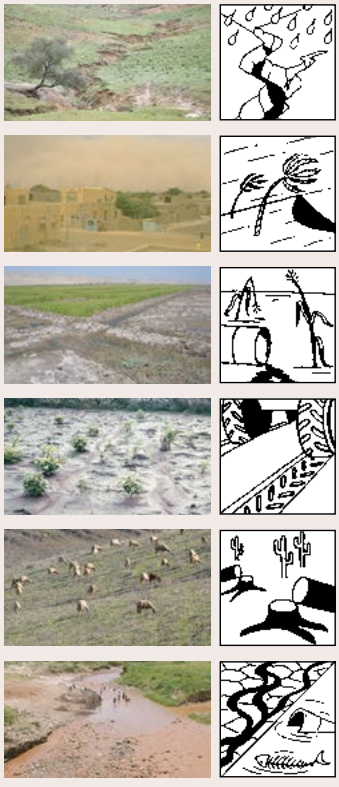
Categories of land degradation

The World Overview of Conservation Approaches and Technologies (WOCAT) defines six categories of land degradation (see figure 2) according to the process which leads to land degradation (Harari et al. 2017):

- **Soil erosion by water,** e.g. gully erosion, coastal erosion, mass movements/landslides;
- **Soil erosion by wind,** e.g. loss of topsoil, off-site degradation effects;
- **Chemical soil deterioration,** e.g. fertility decline and reduced soil organic matter content, salinisation;
- **Physical soil deterioration,** e.g. compaction, soil sealing;
- **Biological deterioration,** e.g. reduction of vegetation cover, increase of pests; and
- **Water degradation,** e.g. change in quantity of surface water, and change in aquifer level.

FIGURE 2

Categories of land degradation
Source: Harari et al. 2017



Effects of land degradation

Land degradation jeopardises the provision of ecosystem services by soils, which are as follows:

- **Provision of food, fibre and fuel**
  Soil is a fundamental and irreplaceable natural resource. It provides raw materials, such as food and fibre, two essential resources for humans. It also stores, filters and transforms many substances, including water, nitrogen and carbon in a regulatory role.

- **Habitat for organisms**
  Soils host a large spectrum of living organisms ranging from microorganisms to larger ones like earthworms. Besides this below-ground life, the vegetation that grows on soils is essential for many organisms living above-ground.

- **Foundation for human infrastructure**
  Soils protect the physical and cultural environment for humans and human activities. They also keep track of historical periods that have marked human history.
  (FAO E-learning Centre 2019)

Figure 3 shows which of these ecosystem services provided by soils are affected by land degradation.

In a given context, land degradation leads to problems of:

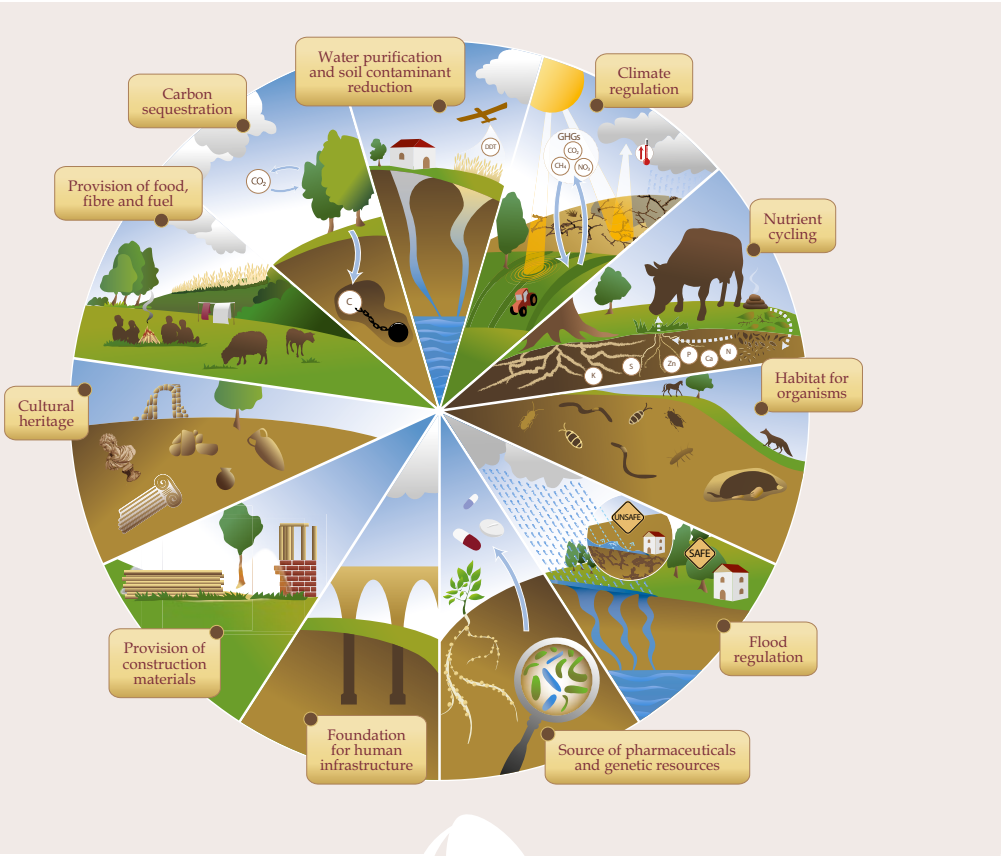
- food security;
- resilience to climate shocks;

and it causes further negative environmental effects in the region and can eventually lead to

- migration;
- hunger;
- poverty; and even
- conflict.

FIGURE 3

Environmental services linked to land
Source: FAO 2015. Soil functions.



Acceleration of climate change

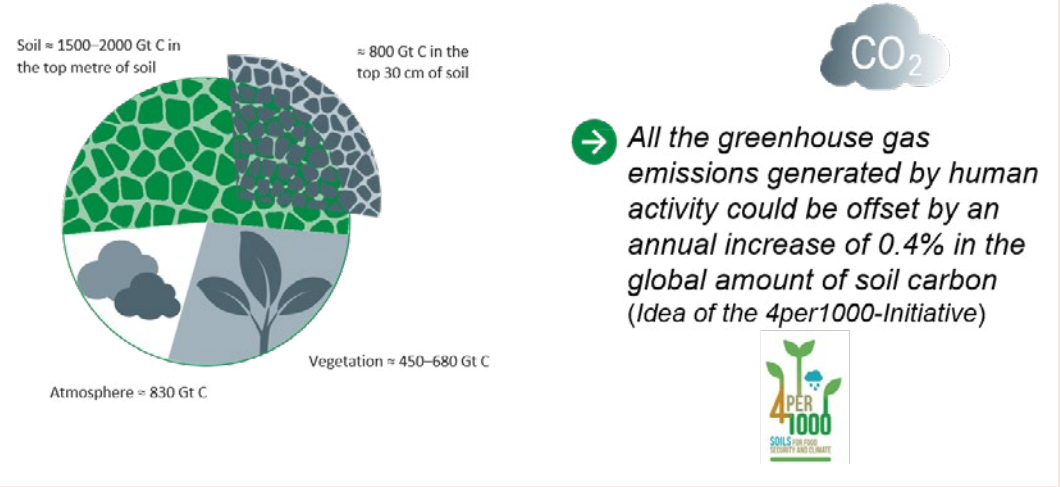
Land degradation is a major contributor to climate change, while climate change can exacerbate the impacts of land degradation and reduce the viability of some options for avoiding, reducing and reversing land degradation (IPBES 2018). After the oceans, soils act as biggest carbon sink in the biosphere with a capacity of 1550 billion tonnes worldwide. To compare, the atmosphere represents a carbon pool of 760 billion tonnes and all living organisms and plants store up to 560 billion tonnes of carbon (FAO E-learning Centre 2019).

The goal of achieving land degradation neutrality by 2030 (see section on LDN below) is therefore seen as critical in reaching other international commitments to climate change adaptation and mitigation, conservation of biodiversity and forests, alleviating rural poverty and hunger, ensuring long-term food security, and building resilience to drought and water stress. Aiming to sustainably use these critical natural resources also includes the need to protect the key ecosystem services that land and land-based ecosystems provide, including the production of food, feed, fibre, and fuel, carbon sequestration, nutrient cycling, water regulation, etc. (ELD Initiative 2015).

FIGURE 4

Carbon sinks

Source (adapted from):
https://knowledge.unccd.int/sites/default/files/2018-09/2015_PolicyBrief_SPI_ENG_0_0.pdf



Sustainable land management practices

What is meant by sustainable land management (practices)?

Sustainable land management (SLM) is referred to as the adoption of land use systems that enhance the ecological support functions of land with appropriate management practices, and thus enable land users to derive economic and social benefits from the land while maintaining those of future generations. This is usually done by integrating socio-economic principles with environmental concerns so as to: maintain or enhance production, reduce the level of production risk, protect the natural resource potential, prevent soil and water degradation, be economically viable, and be socially acceptable.

SLM practices or measures are those that serve to maintain ecological resilience and the stability of ecosystem services indefinitely, while providing sustenance and diverse livelihoods for humans. It does not refer to a single method or practice, but is rather a portfolio of possible technologies, practices, and approaches to land management that are implementable at the local scale. It further involves all relevant and affected stakeholders and their needs in a participatory manner, and is supported by the broader cultural, economic, environmental, legal, political, technical, and social framework and environment. It needs to be adaptive and work with iterative feedback, as the context for sustainable land management is constantly shifting with changing environments, populations, and demands.

Sources: ELD Initiative 2013, p.5 and ELD Initiative 2015, p.11ff

The following list as well as figure 5 give an orientation on typical SLM measures. A lot of these measures are also applied in conservation agriculture and climate-smart agriculture schemes.

- **Agronomic measures:** Mixed cropping, intercropping, relay cropping, cover cropping; conservation agriculture, production and application of compost/manure, mulching, trash lines, green manure, crop rotations; zero tillage (no-till), minimum tillage, contour tillage;
- **Vegetative measures:** Agroforestry, windbreaks, afforestation, hedges, live fences; grass strips along the contour, vegetation strips along riverbanks; fire breaks; tree nurseries; upper catchment reforestation; protection of natural tree vegetation/farmer-managed natural regeneration;
- **Structural measures:** Terraces; earth bunds, stone bunds; retention/infiltration ditches, planting holes, micro-catchments; water-spreading weirs; dams; pans to store water; stone and earth walls with planted vegetation; barriers; palisades, gabions;
- **Management measures:** Area closure/resting, protection, afforestation; Change from grazing to cutting (for stall feeding), farm enterprise selection (degree of mechanization, inputs, commercialization), irrigation; from mono-cropping to rotational cropping; from continuous cropping to managed fallow; from open access to controlled access (grazing land, forests); from herding to fencing, adjusting stocking rates, rotational grazing; fodder and seed banks; pasture management; control of invasive species; crop residue management; soil analysis for optimising plant fertilisation; integrating livestock for organic fertilisation; improving pastures according to the Vallerani method[1].

Source: WOCAT website

[1] *A mechanized technology of water harvesting to restore arid and desertified soil that uses special ploughs designed and patented by Dr. Venanzio Vallerani, more information is available on http://www.vallerani.com/wp/*

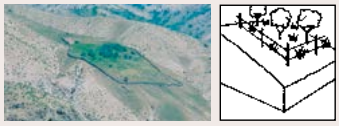
FIGURE 5

SLM measures
Source: Harari et al. 2017

agronomic measures
- are associatet with annual crops
- are repeated routinely each season or in a rotational sequence
- are of short duration and not permanent

vegetative measures
- involve the use of perennial grasses, shrubs or trees
- are of long duration

structural measures
- often lead to a change in slope profile
- are of long duration or permanent



management measures
- involve a fundamental change in land use
- involve no agronomic and structural measures

Benefits and long-term impacts of SLM measures

SLM measures have proven positive socio-economic, ecological, economic and institutional benefits, Kramer and Lanouette 2017 for instance state:

Socio-economic dimension

- SLM activities lead to higher crop yields, enable diversification and production of high-value market produce and increased household income;
- Increased income is often reinvested into health, education or general wellbeing;
- Reduced pressure on land resources is stemming migration from (less) degraded rural agricultural regions.

From a natural resource perspective

- SLM measures have far reaching benefits in terms of improving soil health and fostering biodiversity;
- SLM measures increase the water holding capacity and organic matter content of the soil and thereby improve the resilience of production towards climate change and extreme weather events;
- SLM measures play an important role in stabilising soil carbon, via direct carbon storage into soils from plant photosynthesis and via the prevention of accelerated top-soil erosion (and thus carbon loss);
- The effects of a healthier natural resource base can also strengthen household adaptation and resilience to climate change;
- SLM measures can increase groundwater availability and thereby result in greater access to water for household needs.

From an institutional framework perspective

- Beneficiaries of past SLM interventions who gained knowledge, experience and skills constitute an important resource for scaling out appropriate SLM options. Farmer-to-farmer exchanges, for example, often occur even without formal project activities;
- In regions like the Sahel, a strong degree of organisation was found to be necessary and often resulted in the creation (or reinforcement) of sustaining social capital (e.g. via local governance systems) which has the potential to play important roles during subsequent interventions.

Due to their various positive impacts, SLM should therefore be promoted as part of climate, environmental, agricultural, food security and biodiversity policies.

03 Barriers for SLM adoption and gender concerns

Even though beneficial, there are limiting factors for SLM, for example:

- Many SLM practices are investment or labour-intensive (terracing, stone lines, water-spreading weirs, etc.);
- Economic returns are not always achieved immediately, but may take several years or be long-term if forestry is involved
- Agricultural service providers and extension often focus on short-term gains and neglect sustainable soil and resources management, thereby causing a lack of know-how on appropriate SLM measures at farmer level;
- Weak tenure security and limited access to finances, inputs and machinery hamper application of SLM measures; and
- social and cultural barriers to innovations can exist.

Table 2 provides a more detailed overview of the existing barriers, which have been aligned with the drivers influencing land users decision-making as well as potential instruments to overcome the barriers and allow for SLM adoption.

Furthermore, gender aspects need to be addressed, especially in rural areas where more and more women are running households and managing the use of natural resources. Globally, less than 15 percent of all landholders are women (Kaaria and Osorio 2018). However, many lack or are denied rights to the land, despite the fact that women who have ownership of land can earn more money, which they often spend on caring for family members in higher proportions than men do, leading to improved food security and reduced poverty. Certain laws may favour the passing of land titles through men or even openly deny them to women.

This discourages women from investing time into sustainable practices for land that they do not have rights to and may even be evicted from. These types of laws can be revisited with economic evidence, which shows that there are increased rates of return when women have land rights, and changed to reflect the more rewarding nature of revised legal frameworks.

Integrating gender aspects in the planning, design, implementation, and evaluation of projects and investments in sustainable land management is thus very important and the ultimate goal should be to reduce gender inequalities and ensure that men and women can equally benefit from any intervention. Policies, institutional arrangements, and investments that create an environment conducive to gender-responsive sustainable land management are crucial.

TABLE 2

Barriers to the adoption of Sustainable Land Management practices and instruments to overcome them

Sources: left column- adapted from TMG accompanying research for GIZ Global Soil programme (internal paper); right column- adapted from de Graaff 2008

Barriers to the adoption of Sustainable Land Management and instruments to overcome them		
Barriers to the adoption of SLM measures from farmers' point of view	**Drivers influencing land users' decision making**	**Selected examples of instruments to overcome barriers in order to upscale SLM**
Farmers don't perceive land degradation as a problem Farmers don't see need for / are not interested / don't believe in SLM	Increased awareness	Mass communication (radio, theatre, etc.)
Farmers don't know how to implement SLM	Improved access to knowledge	Formal education, extension service, knowledge-sharing through Information Communication Technology (ICT)
Long-term SLM benefits do not correspond to farmers' immediate needs	Increased (short-term) profitability (cost-benefit/return on investment) of SLM measures	Subsidies, Payment for ecosystem services, input and output price, trade policies, improvements in market infrastructure and access, carbon credits, marketing labels
	Reduced economic risk	Insurance, subsidies, soil testing, carbon credits, conversion / retention premiums for organic farming, conversion bans with compensation payments
Insecure land use rights keep farmers from investing in land that might not be theirs later on	Land tenure security	Cadastre systems, formal/informal land titles
Fragmented, small plots make it hard for individual farmers to achieve benefit/impact from SLM	Population pressure	Policy and financial incentives for sustainable intensification of production per unit land area
Farmers perceive SLM as too labour-intensive	Reduced labour intensiveness	Access to machinery, Food for work / cash for work schemes, collective action (family, neighbours, community)
Farmers consider SLM measures as socially/ culturally inappropriate	Increased socio-cultural acceptance by target beneficiaries	Participatory planning of SLM, Farmer-to-farmer trainings, study-tours for farmers to learn from fellow farmers, local user agreements, ICT, mass communication (radio, forum theatre, etc.)
Farmers don't have access to required inputs and machinery for SLM	Improved access to SLM inputs and machinery	Provision of supplies through extension service, farmer organisations, private sector, credit, collective action (family, neighbours, community), access to technical support (own or paid machinery)
Farmers don't have access to the required financial resources	Improved access to financial resources	Credit schemes, special grant schemes for higher-risk activities (e. g. organic farming schemes)
Farmers don't face sanctions for non-sustainable land management and/or don't receive rewards for SLM	Social consensus on (and social control of) soil protection measures (incl. punitive measures)	Regulatory framework (binding laws), institutionalized guidelines and standards for soil protection/-rehabilitation, informal agreements on local level, use of customary procedures or peer pressure
Farmers are incentivized towards non sustainable land management	Reduced adverse incentives	Intersectoral policy planning (government, donors)

Instruments to incentivise SLM and necessary action on different levels

As the above discussion on barriers showed, an enabling environment in order to fully and successfully implement sustainable land management practices must be created. Within this process, the ecological and socio-economic context needs to be considered, including a thorough understanding of the financial and economic costs and benefits of land management, complemented with an understanding of the drivers of land degradation. This analysis can inform the development of policies and incentives to identify and support positive, rewarding scenarios. Economic incentives and mechanisms reward land users for potential losses incurred in switching to sustainable management. When enabling conditions are absent, sound economic arguments can be used to build support for the removal or easing of other cultural, environmental, legal, political, social, and technical barriers, to create economically viable opportunities for sustainable land management.

To achieve the adoption of SLM, it is highly important to know the drivers influencing land users' decision making in order to co-generate the most effective instrument(s) to overcome barriers. Only by creating an enabling environment for SLM, it is possible to successfully up-scale SLM practices. Upscaling is understood as the process leading to the achievement of a broad outreach and impact in terms of relevance, quantity, quality and sustainability beyond project boundaries.

Unfortunately, a lot of disincentives (adverse incentives) that prevent or divert investment from SLM persist, so that a change of framework conditions is needed, with the introduction of positive incentives to invest into SLM. These incentives aim to catalyse a large-scale and enduring adoption of soil protection measures and sustainable agricultural practices and should ideally be effective beyond the immediate intervention area of government or donor-funded projects. Only a context-specific combination of different instruments at different levels might create an enabling environment, for example formal (policy), informal (social), technical (know-how transfer) and/or private sector instruments (access to inputs, etc.).

In order to create an enabling framework for SLM, the following instruments can be applied by policy makers and action can be taken (compare with table 2).

Local level (municipalities, communities)

- Ensure access to land, with particular emphasis on young entrepreneurs and women, optimally securing tenure/legal rights in the long-term (otherwise using informal agreements)
- Facilitate the definition and implementation of locally accepted regulations for the use of land and natural resources
- Put sustainable land management high on the local agendas including integration of activities into decentralised budgets in order to be able to (co-)finance activities towards erosion control, land restoration, etc.
- Increase awareness on environmental issues (in schools, during local events, etc.)
- Encourage farmer-to-farmer visits and local prizes and awards for SLM
- Provide effective and accessible extension services and knowledge transfer at the local level
- Enhance community collaboration to reduce labour intensity, encourage community work
- Conduct participatory land use planning and harmonise inter-sectoral planning at local level

National or subnational level

- Ensure tenure security/legal rights
- Create a favouring regulatory framework, including standards and guidelines and the possibility to conclude informal user agreements
- Facilitate access to finance and/or incentives (for example credits, subsidies, inputs, carbon credits, payment for environmental services, grant schemes, taxing privileges)
- Increase environmental awareness (through mass media)
- Set-up effective and accessible extension services and knowledge transfer (re-education of extension workers, farmer-to-farmer, ICT, soil testing, etc.)
- Provide risk insurance (for example conversion/retention premiums, crop and livestock insurances, etc.)
- Improve market infrastructure and access, i.e. for ecological labelling/bio-markets
- Improve access to machinery and improve community collaboration to reduce labour intensity including financing food for work/cash for work schemes
- Reduce perverse and adverse incentives, e.g., review fertiliser subsidies, harmonise intersectoral planning, etc.

International level

- Put land degradation higher on the (cross-sectoral) political agendas
- Link climate adaptation and mitigation with SLM
- Adapt trade conditions and eliminate perverse subsidies in the agricultural sector which promote unsustainable land use
- Change the way economic accounting is done/value ecosystem services within plans and strategies (e.g., Natural Capital Accounting)
- Open up more funding mechanisms for SLM, by including SLM into payment for environmental services schemes and climate funds (for example the Green Climate Fund)

In order to transform the agricultural sector and to ensure that land is managed sustainably, there is need to create new multi-stakeholder partnerships between different actors (private sector, governments, land users, etc.) and to foster inter-institutional cooperation. Only joint action will ensure that the framework conditions for land use will favour the use of sustainable practices.

International policy framework of action against land degradation

The international community has long recognised that land degradation and desertification is a major economic, social and environmental problem of concern to many countries in all regions of the world. In 1977, the UN Conference on Desertification adopted a Plan of Action to Combat Desertification. Despite this and other efforts, the UNEP concluded in 1991 that the problem of land degradation in arid, semi-arid and dry sub-humid areas had intensified, although there were "local examples of success". As a result, the question of how to tackle desertification was still a major concern for the UN Conference on Environment and Development, which was held in Rio de Janeiro in 1992. The Conference supported a new, integrated approach to the problem, emphasising action to promote sustainable development at the community level. The Rio Conference called on the United Nations General Assembly to prepare a Convention to Combat Desertification. The Convention was adopted in Paris in 1994 and entered into force in 1996. Meanwhile 196 countries and the European Union are parties as of August 2018 (adapted from the UNCCD website).

United Nation's Convention to Combat Desertification (UNCCD)

Established in 1994, the UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. The convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. The UNCCD is particularly committed to a bottom-up approach, encouraging the participation of local people in combating desertification and land degradation. The UNCCD secretariat facilitates cooperation between developed and developing countries, particularly around knowledge and technology transfer for sustainable land management.

The new UNCCD 2018–2030 Strategic Framework is the most comprehensive global commitment to achieve Land Degradation Neutrality (LDN) in order to restore the productivity of vast expanses of degraded land, improve the livelihoods of more than 1.3 billion people, and reduce the impacts of drought on vulnerable populations.

As the dynamics of land, climate and biodiversity are intimately connected, the UNCCD attempts to collaborate closely with the other two Rio Conventions; the Convention on Biological Diversity (UNCBD) and the United Nations Framework Convention on Climate Change (UNFCCC), to meet these complex challenges with an integrated approach and the best possible use of natural resource (UNCCD Convention).

The Land Degradation Neutrality (LDN) policy framework

Land degradation neutrality (LDN) was born out of the UN Conference on Sustainable Development (Rio+20) and is based on the critical idea that the cost of action is significantly lower than the cost of inaction. LDN forms an integral part of the Sustainable Development Goal (SDG) 15. SDGs include seminal targets for addressing poverty, hunger, equality (gender, income, opportunities, education, etc.), climate change, sustainable resource use, etc.

SDG 15 envisages to protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG 15.3 says: *By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.*

At the heart of the land degradation neutrality targets are sustainable land management practices that help to close yield gaps and enhance the resilience of land resources and communities that directly depend on them while avoiding further degradation.

What is meant by land degradation neutrality?

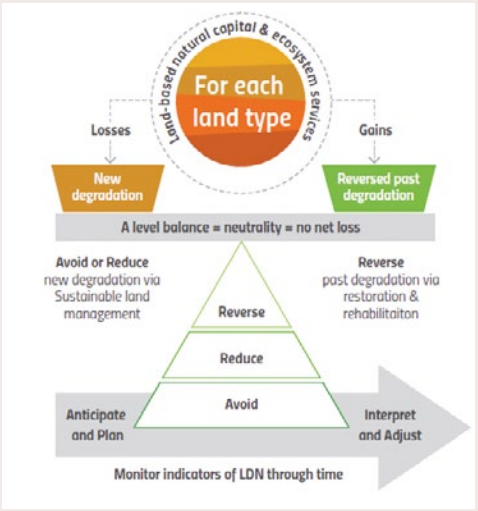
LDN can be understood as a state where the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases. This can happen within different scales and ecosystems. It can occur naturally or due to better land management. It is really the combination of avoiding or reducing the rate of land degradation and increasing the rate of recovery.

The UNCCD defines LDN as a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems.

LDN means no net loss of healthy land. "Neutrality" implies that degradation processes cannot be stopped completely, but counteracted by restoration of degraded land to achieve a net balance.

FIGURE 6

LDN means net loss of healthy land
Source: UNCCD 2017, p. 313 (layout modified)



The LDN response hierarchy foresees several fields of action. It is to be noted that prevention (avoidance) measures are usually less costly than reduction or restoration measures.

Based on SDG 15.3, 121 countries have meanwhile set themselves voluntary targets to stop and reverse land degradation.

FIGURE 7

LDN response hierarchy
Source: UNCCD 2017, p. 313 (layout modified)

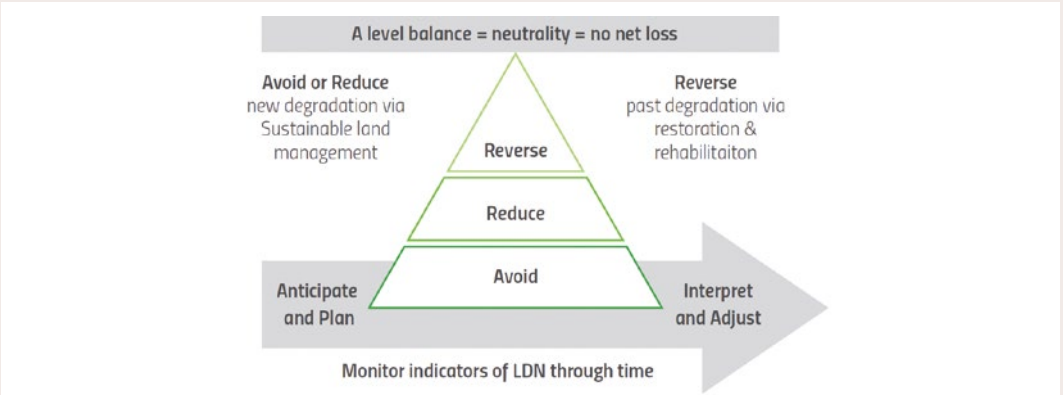
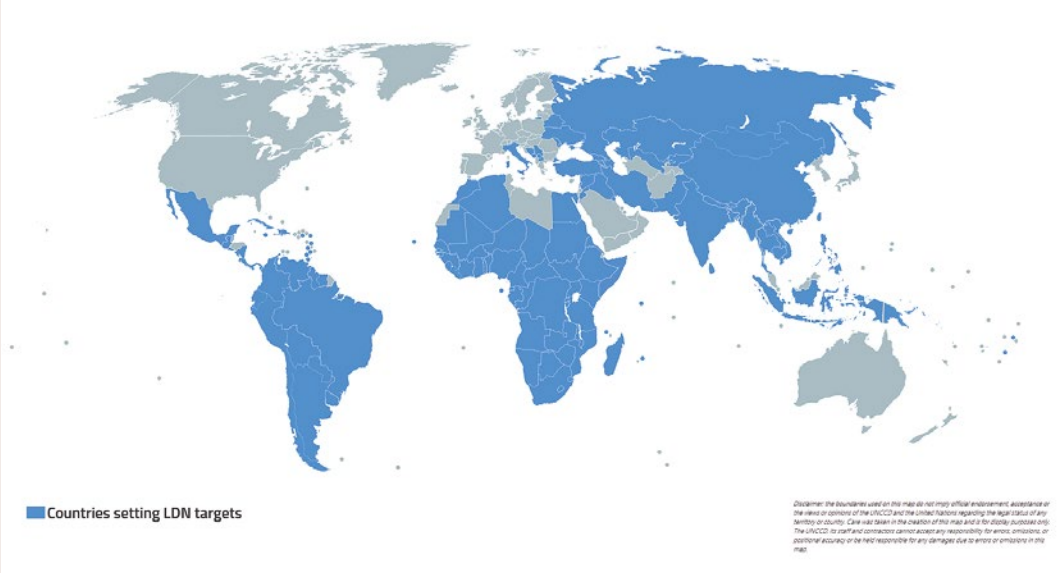


FIGURE 8

Countries setting LDN targets
Source: https://www.unccd.int/actions/ldn-target-setting-programme



Land degradation monitoring

In order to define and monitor LDN targets a baseline is needed. The UNCCD suggests three LDN indicators that will be used for reporting under the Convention and the SDG, i.e. to assess progress towards indicator 15.3.1: "proportion of land that is degraded over total land area":

1. land cover and land cover change;
2. land productivity; and
3. soil organic carbon.

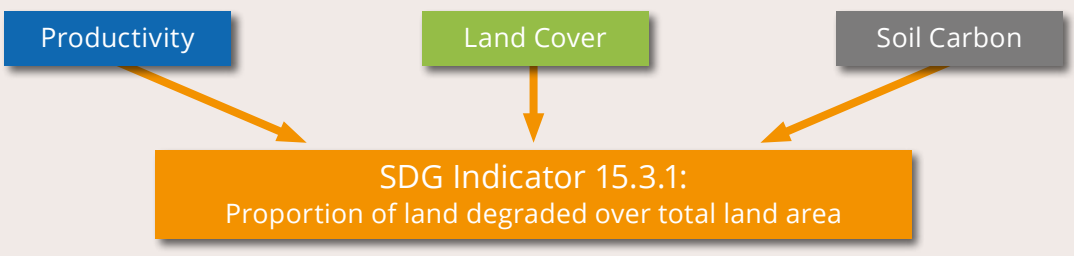
These indicators can be adapted and complemented according to specific contexts.

Degradation occurs when

a) detrimental land cover change occurs, and/or
b) the net primary production decreases significantly and/or
c) the soil carbon decreases significantly.

FIGURE 9

Indicators for LDN monitoring
Source: http://catalogue.unccd.int/972_Trends.Earth.pdf



LDN process support

The UNCCD and the Global Mechanism as well as international organisations like the German International Cooperation (GIZ) support the LDN process in different action areas. These range from capacity building to improved access to soil data to the development of national LDN strategies.

FIGURE 10

Areas of action towards land degradation neutrality
Source: UNCCD 2017 (layout modified)

UN Decade (2021 – 2030) on Ecosystem Restoration

In March 2019, the UN General Assembly adopted a declaration on the **UN Decade (2021–2030) on Ecosystem Restoration**.

The declaration stresses *"the importance of the ecosystem approach for the integrated management of land, water and living resources and the need to step up efforts to tackle desertification, land degradation, erosion and drought, biodiversity loss and water scarcity, which are seen as major environmental, economic and social challenges for global sustainable development"*.

It furthermore recognises the important linkages between climate change and land use as well as biodiversity, diversity and land use and highlights the importance of SDG 15, specifically 15.3 (LDN) for the achievement of the other SDGs.

All UN Member States are encouraged to

a) foster **political will, the mobilisation of resources, capacity-building, scientific research and cooperation** and momentum for ecosystem restoration at the global, regional, national and local levels, as appropriate;
b) **mainstream ecosystem restoration into policies and plans** to address current national development priorities and challenges due to the degradation of marine and terrestrial ecosystems, biodiversity loss and climate change vulnerability, thereby creating opportunities for ecosystems to increase their adaptive capacity and opportunities to maintain and improve livelihoods for all;
c) **develop and implement policies and plans to prevent ecosystem degradation**, in line with national laws and priorities, as appropriate;
d) build on and reinforce existing **restoration initiatives in order to scale up good practices**;
e) facilitate synergies and a holistic view of how to achieve international commitments and national priorities through the restoration of ecosystems;
f) promote the sharing of experiences and good practices in ecosystem conservation and restoration.

In light of these frameworks, policy and implementation processes using objective metrics like economic values provide a way for different stakeholders to compare the trade-offs of alternative future options or scenarios and thus deliberate on land issues from an equally informed position.

Considering land issues from the perspective of the economic values that nature provides people involves measuring and valuing all of the benefits of land and land-based ecosystems and the services they provide, including what losses are incurred when they are degraded. Combining this information with a thorough understanding of the economic drivers of land degradation, stakeholder needs, and SLM approaches – practices that ensure renewable, resilient and rewarding land uses, and which are becoming increasingly available and accessible – can support better decision-making.

Important links and further reading

Land degradation

Video on desertification (UNCCD, 2011)

This video explores innovative agricultural methods – supported and promoted by the UNCCD – to prevent land degradation and maintain fertile soil. It highlights desertification's effects on biodiversity loss, food security and hunger for the global community

Main reports on land degradation

The Status of the World's Soil Resources Report (FAO, 2015)

The Value of Land (ELD Initiative, 2015)

Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development (Nkonya et al. 2016)

Global Land Outlook, first edition (UNCCD, 2017)

Assessment Report on Land Degradation and Restoration (IPBES, 2018)

World Atlas of Desertification (JRC, 2018)

Special Report on climate change and land (IPCC, planned for August 2019)

Sustainable land management

SLM Mainstreaming Tool (WOCAT)

Video on Land for Life – India (UNCCD, 2014)

Sustainable land management for upscaled climate action (GIZ, 2018)

Potentials for Greenhouse Gas Mitigation in Agriculture (GIZ, 2018)

Rapid climate smartness assessment of GIZ soil protection and rehabilitation technologies in Benin, Burkina Faso, Ethiopia, Kenya, and India (CIAT, 2017)

Agriculture Transformation Review (VDW, 2018)

Sustainable Land Management in Practice: Guidelines and Best Practices for Sub-Saharan Africa (TerrAfrica, WOCAT, FAO, 2011)

Sustainable rangeland management

https://www.wocat.net/library/media/174/ (WOCAT)

Policy framework

Video on LDN (UNCCD, 2015)

SDG 15: Life on Land. On 25 September 2015, 193 countries came together in New York to adopt the Sustainable Development Goals or SDGs. SDG 15 calls for the protection, restoration and sustainable management of land-based ecosystems. In doing so target 15.3 specifically aims to achieve a Land Degradation Neutral World by the year 2030.

Land Degradation Neutrality – why it matters, how it's done. Video (BMZ, 2019)

Over 75% of our land has been transformed from its natural state, and almost a quarter is degraded. How can we bring land back into balance? This video introduces a policy framework that help us reverse this trend.

Target-setting programme of UNCCD:

https://knowledge.unccd.int/knowledge-products-and-pillars/land-degradation-neutrality-target-setting-building-blocks

LDN Country Profiles:

https://www.unccd.int/actions/ldn-target-setting-programme/ldn-country-profiles

Technical aspects regarding the monitoring of LDN indicators:

http://trends.earth/docs/en/background/understanding_indicators.html

Policy and Financing for Sustainable Land Management in Sub-Saharan Africa (TerrAfrica, 2009)

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