



# ZERO NET LAND DEGRADATION

## A Sustainable Development Goal for Rio+20

To secure the contribution of our planet's land and soil to sustainable development, including food security and poverty eradication

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Desertification, along with climate change and the loss of biodiversity were identified as the greatest challenges to sustainable development during the 1992 Rio Earth Summit. Established in 1994, the UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention specifically addresses arid, semi-arid and dry sub-humid areas, collectively known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. In the 10-year strategic plan and framework to enhance the implementation of the Convention (2008-2018) adopted in 2007, Parties to the Convention further specified that the aim for the future is “to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.”

The Convention's 195 parties work together to improve the living conditions for people in drylands, to maintain and restore land and soil productivity, and to mitigate the effects of drought. 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 regarding knowledge and technology transfer for sustainable land management.

This policy brief has been prepared by Ralph Ashton for and in collaboration with the Secretariat of the United Nations Convention to Combat Desertification (UNCCD). It draws on existing UNCCD material and a study conducted for the UNCCD secretariat by Lal, R. Safriel, U., and Boer, B (forthcoming). It also extracts sections from a forthcoming United Nations Environment Programme discussion paper “Safeguarding and enhancing the ecological foundation of agricultural and food systems to support human well-being: bridging the implementation gap” by McKenzie, F., Ashton, R., Boccucci, M., and Zandomeneghi, M.

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# ZERO NET LAND DEGRADATION

## A Sustainable Development Goal for Rio+20

To secure the contribution of our planet's land and soil to sustainable development, including food security and poverty eradication

...the time has come for the international community to commit itself to a land degradation neutral world by setting sustainable development goals on land use, with targets towards achieving zero net land degradation

*Africa Consensus Statement to Rio+20, Addis Ababa, 25 October 2011*

# FOREWORD



This policy brief is based on a detailed and comprehensive analysis of relevant scientific and technical information and discussion papers, as well as inputs and comments from various experts. These references have been analyzed in a discrete report. The conclusions can be found in the report “UNCCD Secretariat Policy Brief on Zero Net Land Degradation – a Sustainable Development Goal for Rio+20” with a focus on securing the contribution of our planet’s land and soil to sustainable development, including food security and poverty eradication.

The time is ripe for the international community to commit itself to a land degradation neutral world by setting a sustainable development goal at Rio+20 of Zero Net Land Degradation (ZNLD) in order to secure the continuous availability of productive land for present and future generations. We need to take bold action to protect, restore and manage land and soils sustainably. If we do not act, we cannot achieve our commitments to climate change adaptation and mitigation; conservation of biodiversity and forests and the Millennium Development Goals; we will not alleviate rural poverty and hunger, ensure long-term food security or build resilience to drought and water stress.

Lessons from the implementation of existing targets for the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity need to be learned in setting and operationalizing a ZNLD target for the United Nations Convention to Combat Desertification. This target offers us the opportunity to establish a virtuous circle where viable environment and conditions are created for all stakeholders to assess progress and take appropriate action to both address the issues of desertification, land degradation and drought and accelerate the achievement of all the existing targets. Clearly, this will require collaboration and innovative partnerships, such as the Changwon Initiative, to ensure that appropriate management policies, practices and mechanisms are properly identified, adopted and implemented.

During this year’s observance of the World Day to Combat Desertification, we need to rethink the fundamental importance of land. Land is the Earth’s very infrastructure for life and is crucial for human well-being, social inclusion and environmental sustainability. A new target of ZNLD is ambitious but it is not impossible. This assertion is supported by this policy brief which suggests pathways to ZNLD by arresting further degradation and restoring and rehabilitating degraded land, pursuing sustainable land management, avoiding degradation of non-degraded lands, involving community-based and traditional approaches, and improving payment for ecosystem services. In this context, this policy brief is expected to contribute to the development of effective strategies and policies which will steer a new course to a safer future.

I express my sincerest gratitude to the UNCCD secretariat and experts for their contributions to this important undertaking. The Korea Forest Service is honored to support the work of the UNCCD secretariat on the ZNLD as a sustainable development goal to better secure our land and soil.

A handwritten signature in black ink, reading "Don Koo Lee".

Don Koo Lee  
President, UNCCD COP 10  
Minister, Korea Forest Service

# PREFACE



## *Land degradation and drought are drying up the Future We Want*

Land is our natural ally. But the natural conditions of land and soils are not eternal, and must be protected. Soil is the most significant geo-resource we have for ensuring water, energy and food security for present and future generations. Healthy soils are also vital for building resilience and adapting to climate change.

Competing claims on our finite land resource are sharply increasing. In its report released earlier this year, the High-level Panel on Global Sustainability states that by 2030 – and compared to present levels – the demand for food, energy and water will increase at least by 50 percent, 45 percent and 35 percent respectively. This means that the decision on all land uses should be made after the full consideration of options for synergies and trade-offs.

But, policies and sustainable development frameworks often overlook the caring capacity of soil and do not effectively address land degradation. As a result, this problem remains pervasive in all ecosystems, with a particular impact on drylands, home to many of the world's poorest and most vulnerable people.

I am honored to present to you this paper, which urges the international community to adopt a goal on land use to complement those of climate change, biodiversity loss and poverty. In it we propose setting a sustainable development goal for a land-degradation neutral world. This is a goal of Zero Net Land Degradation.

Zero net land degradation means that we prevent the degradation of productive land and restore land that is already degraded. This is possible through sustainable land management policies and practices.

In the past, such a goal was unattainable. But today, scientific findings and technical know-how indicate that we can achieve a land degradation neutral world. Zero net land degradation is scientifically sound, technically feasible, and economically advantageous. It is not only possible, but prerequisite for sustainable development.

“Upon this handful of soil, our survival depends. Husband it, and it will grow our food, our fuel, and our shelter, and surround us with beauty. Abuse it, and the soil will collapse and die, taking humanity with it.” This was written 3,500 years ago in the Vedas of ancient India and it is still true today.

It has been twenty years since the Rio conference brought global decision-makers together to set a common agenda for sustainable development. But today, land degradation, desertification and drought are drying up the future we want.

Let's agree on a solution. If we don't do it today, it will be more costly tomorrow and impossible the day after tomorrow. We all know it, and future generations will know that we knew it. Let's take a bold action by setting a goal of zero net land degradation at Rio+20.

A handwritten signature in blue ink that reads "L. GNACADJA".

Luc Gnacadja  
Executive Secretary  
United Nations Convention to Combat Desertification

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# KEY DEFINITIONS AND ACRONYMS

**CBD:** Convention on Biological Diversity

**COP:** Conference of the Parties

**Desertification:** “Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities” (Article 1 of the Convention). Desertification is a subset of land degradation under dry climates. Combating desertification subsequently “includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development and which are aimed at: the prevention and/or reduction of land degradation; the rehabilitation of partly degraded land; and the reclamation of desertified land” (Article 1 of the UNCCD).

**DLDD:** desertification, land degradation and drought

**Drought:** “means the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems” (Article 1 of the UNCCD).

**FAO:** Food and Agriculture Organization of the United Nations

**Food security:** Food security exists “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life” (World Food Summit 1996).

**Land:** “The terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system” (Article 1 of the UNCCD).

**Land degradation:** Reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation.

**Land degradation neutrality:** Land degradation neutrality is achieved when globally or in a given landscape or terrestrial ecosystem the area of productive land (and therefore sustainable land use) remains stable or increases.

**Land restoration:** Reversing land degradation processes by applying soil amendments to enhance land resilience and restoring soil functions and ecosystem services.

**LDD:** Land degradation and desertification, which constitute a persistent decline in the provision of all services that land would otherwise provide, they adversely affect food security, water security, biodiversity, and many ecosystem services, as well as associated recreational, heritage and cultural values.

**MDGs:** Millennium Development Goals

**PES:** Payment for Ecosystem Services

**Sustainable land management (SLM):** “A knowledge-based combination of technologies, policies and practices that integrate land, water, biodiversity, and environmental concerns (including input and output externalities) to meet rising food and fibre demands while sustaining ecosystem services and livelihoods” (World Bank, 2006).

**UNCCD:** United Nations Convention to Combat Desertification

**UNDP:** United Nations Development Programme

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**UNEP:** United Nations Environment Programme

**UNFCCC:** United Nations Framework Convention on Climate Change

**Water security:** “The sustainable use and protection of water systems against floods and drought, the sustainable development and use of water resources, and the safeguarding of (access to) water functions and services for humans and the environment” (Schultz and Uhlenbrook, 2007).

**WOCAT:** World Overview of Conservation Approaches and Technologies

**Zero net land degradation (ZNLD):** The achievement of land degradation neutrality, whereby land degradation is either avoided or offset by land restoration. Promoting the ZNLD target would secure the currently available productive land for the use of present and future generations.

# EXECUTIVE SUMMARY

**“The great opportunity of the Anthropocene is that we can choose to learn the lessons of the past and steer a new course to a safer future.”**

Soils are the most significant non-renewable geo-resource that we have for ensuring water, energy, and food security for present and future generations while adapting and building resilience to climatic change and shocks. But soil's caring capacity is often forgotten as the missing link in our pursuit of sustainable development.

The time is ripe to agree on a new **Sustainable Development Goal at Rio+20 for Zero Net Land Degradation** to secure the continuing availability of productive land for present and future generations.

## LAND AND SOIL IN THE ANTHROPOCENE

We have entered the Anthropocene, a new geological period in our planet's history. For the first time ever, the major cause of change on planet Earth is our human activity. Change to the carbon, nitrogen and water cycles. Change to biodiversity. Change to soil productivity. Change to our climate. We seven billion humans are in the driver's seat as never before. How we steer will determine our future and that of the generations to come. Generations of human ingenuity and struggle have led to an unprecedented quality of life for many people in many parts of our globe. However, at the same time, too many endure entrenched poverty. Our economic and development successes and failures (including enduring poverty) have degraded the environment, the very natural capital that will form the foundation of our future success.

Land and soil are no exception. Our use and management of land and soil are no small parts of the influence we will have – indeed are already having – on life on Earth, including our own.

Urban, rural and remote people across the planet have multiple and growing demands on land. The most prominent are food, feed, fibre, and fuel (including

biofuels); settlements and infrastructure; environmental services; carbon sequestration in soil and vegetation and metals and minerals.

The ability of the Earth's land-, water- and nutrient-constrained systems to meet all those demands is being tested by a wide range of factors: population growth, land degradation and desertification, climate change, water and nutrient depletion, increasing living standards, changing diets, urbanization, supply chain waste and losses and globalized trade.

At the same time in this 21<sup>st</sup> century land will continue to play a central role in national development strategies and plans while retaining its role as a fundamental basis for global prosperity.

**Land degradation** is the “Reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation” (UNCCD, Article 1).

**Desertification** is a subset of land degradation under dry climates (arid, semi-arid and dry sub-humid areas).

Land degradation and desertification constitute a persistent decline in the services that healthy land provides, especially food. Given the extremely slow pace of soil formation, once the physical, biological and chemical properties of soils begin to deteriorate, their natural regeneration rate is practically unattainable.

Large swathes of land around the globe have been degraded or become deserts. Although estimates vary, over 20% of the planet's land is considered degraded. Hotspots include Africa south of the equator, South-East Asia, and south China (Bai et al., 2008).

The principal cause of land degradation and desertification is the unsustainable

exploitation of land productivity by pastoral, farming, and agro-pastoral land uses. This is often exacerbated by misguided or missing policies.

Overpopulation and livestock are often seen as the culprits of land degradation and desertification. But they are ultimately the consequence of poor decisions and mismanagement.

For instance livestock are often referred to as the major cause of overgrazing leading to desertification, but with appropriate decision-making and management techniques such as Holistic Management (Savory, A., 1999) livestock could become an essential part of the solution.

The Food and Agriculture Organization of the United Nations expects an 11% increase in average per capita calorie consumption between 2003 and 2050 (FAO, 2006). An estimated additional 120 million hectares will be needed to support the required growth in food production by 2030 assuming current practices (FAO, 2003). That's a brand new farm the size of South Africa. Unless degraded land is rehabilitated, forests and other natural lands will have to be converted to make way for agricultural production.

Soil degradation and greenhouse gas emissions are two serious side effects. Moreover, availability of suitable land is already being tested by land degradation and desertification, and by water and nutrient depletion (OECD-FAO 2011). Meanwhile, investment in foreign land for food and biofuel

Production continues apace: Western Europeans in Eastern Europe and Africa; the Gulf States in Asia and Africa; Japanese and Chinese in Brazil and other parts of Latin America; South Koreans in Russia and Africa. Asian countries will make up 60% of the world's population by 2050. It is no surprise then that Indians and Chinese are investing in Africa's land.

As the World Bank points out in “Rising Global Interest in Farmland” (2010), the “rediscovery” of investment in the agriculture sector could be an opportunity for land-abundant countries to gain better technology and create rural

jobs. However, if improperly managed, it could result in “conflict, environmental damage, and a resource curse”.

Land degradation and desertification adversely affect food security, water security, energy security, biodiversity, and many ecosystem services. They also compromise the associated recreational, heritage and cultural values. Global peace and political stability are threatened when basic needs of food and water are not adequately met.

## LAND IN THE ENERGY-FOOD-WATER NEXUS

Land is central to the “nexus” that links energy, food, water, and environmental health in an interdependent loop (PBL, 2009). So, any action on land must be nested within a more holistic approach that takes into account all the elements of the nexus and the feedback loops between them.

For instance, the United Nations Environment Programme highlights in “The Environmental Food Crisis” (2009) that projections of a required 50% increase in food production by 2050 have not taken into account environmental degradation and a changing climate, which could reduce agricultural yields by 13 to 45%. Another study suggests that climate change, water scarcity, invasive pests and land degradation could cause up to 25% of world food production to be lost this century (Nellemann et al., 2009). Land degradation over the next 25 years may reduce global food production by up to 12% resulting in an increase of up to 30% in world food prices (IFPRI). As another example, improved management of the world’s land represents one half of the climate solution in 2020 (Project Catalyst, 2009). This includes both maintaining the carbon in forests, grasslands, and peatlands, and restoring natural systems.

Much attention is rightly focused on avoiding emissions from deforestation in developing countries (REDD+). However, carbon in other natural systems is critical. The Terrestrial Carbon Group estimates that if land expansion for food and other

products continues on current trends (12 million hectares annually, the size of Cuba, Benin, Bhutan, or Honduras), even if all forests in developing countries were protected, mitigation from forest protection would be reduced by up to 50% because of emissions from “deflected” expansion into non-forested land (TCG, 2010). We must act on all lands to maintain the health and productivity of our interconnected system. On the restoration side, sequestering half a billion tonnes of carbon in the tropics per year (equivalent to 1.8 billion tonnes of carbon dioxide, or 10% of the solution in 2020) would require between 50 million hectares (slightly less than Thailand) and 150 million hectares (slightly less than Mongolia) (Lovejoy and Ashton, 2011).

As global population hurtles towards 9.2 billion in 2050, difficult land use decisions will have to be made. Many will entail trade-offs.

## A SUSTAINABLE DEVELOPMENT GOAL FOR RIO+20 ON ZERO NET LAND DEGRADATION

Global trends such as population dynamics and the increasing demands for energy, food, and water are expected to dramatically increase pressure on the land. By 2030 – and compared to present levels – the demand for food, energy and water will increase at least by 50%, 45% and 30% respectively (High-level Panel on Global Sustainability, March 2012). Meeting those demands would require 175 million to 220 million hectares of additional cropland (McKinsey Global Institute, Nov 2011). These needs will not be met unless we preserve our land.

Poverty is largely rural and land is the main, if not the sole asset of those poor. If we do not take bold action to protect, restore and manage land and soils sustainably, we will not achieve our commitments for climate change adaptation and mitigation, biodiversity conservation, forest and MDG targets; we will not alleviate rural poverty and hunger, ensure long-term food security or build resilience to drought and water stress.

This will lead to severe consequences including more political conflicts over scarce resources and continued forced migration. Setting goals and targets for addressing climate change, biodiversity loss, and poverty while ignoring land degradation and desertification can have only limited success.

So, we have no real medium-to long-term choice. We can only reach our goals with the help of our planet’s land. We must ensure that land degradation is avoided as far as possible and that any further degradation of the Earth’s land is balanced by new restoration of degraded land. In that regard, we must set to ourselves a target of **Zero Net Land Degradation by 2030**. This must be our common vision, our North Star, shining at a global level and a national level.

But our ambition should not stop there.

As we welcome another two billion people to our planet over the next 30 years, we must restore more land than we degrade. We must bring productive land back to life. Land is our natural ally, but its patience is not eternal.

The great opportunity of the Anthropocene is that we can choose to learn the lessons of the past and steer a new course to a safer future. But it is not predestined; it requires a choice and significant effort. Indeed, we have already set ourselves ambitious goals through the Rio Conventions (on climate, biodiversity and desertification) and the Millennium Development Goals. We are in the early years of the United Nations Decade for Deserts and the Fight against Desertification (2010-2020) as well as the United Nations Decade on Biodiversity (2011-2020). We are taking serious steps to curtail the destruction and degradation of forests, particularly because of the large contribution deforestation makes to climate change. We have understood the links between agriculture and forests. We have begun to think and act within the framework of the energy-food-water nexus. And there is an expectation that the nations of the world will agree to

sustainable development goals at the Rio+20 Summit in June 2012.

**The time is ripe to agree on a Sustainable Development Goal at Rio+20 on Zero Net Land Degradation to secure the continuing availability of productive land for present and future generations.**

*Goal: Sustainable land use for all and by all (in agriculture, forestry, energy, urbanization)*

*Target 1: Zero net land degradation by 2030*

*Target 2: Zero net forest degradation by 2030*

*Target 3: Drought policies and drought preparedness implemented in all drought-prone regions/ countries by 2020*

## REASONS FOR HOPE

The good news is that we know how to reach a goal of Zero Net Land Degradation. More than two billion hectares of land worldwide is suitable for rehabilitation through forest and landscape restoration. Of that, 1.5 billion hectares would be best suited to mosaic restoration, in which forests and trees are combined with other land uses, including agroforestry and smallholder agriculture (WRI).

In the last two decades, significant land recovery and improvement have occurred in drylands. In many cases, local communities have taken charge. For instance, farmer-managed natural regeneration and agroforestry techniques, such as planting of “fertilizer trees” on farmlands and grazing lands, have already been adopted in many regions. Such techniques have contributed to improving millions of hectares across Africa. Recommendations to Reach Zero Net Land Degradation by 2030: Proposed Intergovernmental Action

Achieving Zero Net Land Degradation by 2030 will require the commitment, the support and the active investment of all public and private sector actors, and all parts of the supply and value chain related to land use, as well as local and community stakeholders. Current and future generations will benefit from

the return on investment in terms of gains in efficiency, resilience, and social inclusiveness.

**These four key actions can be taken by the international community to ensure progress on Zero Net Land Degradation:**

1. Agree on a Sustainable Development Goal at Rio+20 for Zero Net Land Degradation
2. Agree on a new legal instrument (such as a **Protocol on Zero Net Land Degradation**) to the UNCCD as a global policy and monitoring framework to focus efforts and empower the international community to act with the speed and scale required to address this crucial problem
3. Establish an Intergovernmental **Panel / Platform on Land and Soil** as a credible and transparent global authority on scientific and technical knowledge on land and soil, including land degradation and desertification
4. Undertake a comprehensive assessment of the **Economics of Land Degradation**.

# 1. NEED FOR A ZERO NET LAND DEGRADATION GOAL



## 1.1 THE IMPORTANCE OF LAND TO THE THREE INTERTWINED STRANDS OF SUSTAINABLE DEVELOPMENT

Land is the Earth's infrastructure for life. The rate and quality of production generated from land depend on its major components: soil and its fertility. Soil organic matter, derived from the vegetation growing on soil, is the major component that controls soil fertility.

People in urban, rural and remote areas across the planet have multiple and growing demands on land. The most prominent are food, feed, fibre, and fuel (including biofuels); settlements and infrastructure; environmental services; carbon sequestration in soil and vegetation; and metals and minerals.

The ability of Earth's land-, water- and nutrient-constrained systems to meet all those demands is being tested by population growth, land degradation and desertification, climate change, water and nutrient depletion, increasing standards of living, changing diets, urbanization, supply chain waste and losses, and globalized trade.

At the same time, land will continue to play a central role in national development plans in the 21st century and will retain its role as a fundamental basis of global prosperity.

Land and soil not only support direct users but also indirect users. The entire human population benefits from soil through vegetation cover, atmospheric oxygen, climate regulation, and water filtration. Soil functions and services acquire the status of a global common whose protection benefits all. It requires

partnership and cooperation at the global scale to prevent land and soil degradation.

Indeed, our most significant non-renewable geo-resource is productive land and fertile soil. Nevertheless, each year an estimated 75 billion tons of fertile soil are lost. Desertification, land degradation and drought (DLDD) directly affect 1.5 billion people globally and have a disproportionate impact on women and children.

The degradation of land is a major threat to life on Earth, including human beings. When occurring in drylands, where productivity is constrained by water availability, land degradation is termed 'desertification'. Land degradation results from various factors, including human activities and climatic variation induced disasters such as drought and floods. It manifests itself in a persistent reduction in biological productivity, driven by the overexploitation of land resources by users striving to increase economic productivity, resulting in soil depletion and fertility loss.

Repercussions of land degradation and desertification, both biophysical and socio-economic, can range from local to trans-boundary. They are often felt globally, impacting global climate and food security, causing significant health problems and fuelling political instability.

Sustainable development links human well-being, social inclusion and environmental sustainability. Land contributes to all of these, but the pursuit of the three intertwined strands of sustainable development can also have negative impacts on land, often resulting in unwanted feedback loops.

Poverty, food insecurity and

vulnerability to climatic shocks are likely to remain the major global challenges for sustainable development in the next decades. Land degradation and desertification contribute to and compound these challenges. Land rehabilitation can be part of their solution.

If we do not take bold action to protect, restore and sustainably manage the planet's land and soils, we will miss our goals on climate change adaptation and mitigation, biodiversity and forests. We will not alleviate rural poverty and hunger. We will not ensure long-term food security, nor build resilience to drought and water stress. This will lead to severe consequences, including more conflict over scarce resources and continued forced migration.

## 1.2 THE CONTRIBUTION OF LAND TO INTERNATIONAL COMMITMENTS

The world has recognized the importance of land and soil in many international agreements, statements and goals. These include the three Rio Conventions (on climate, biodiversity and desertification), spawned at the first Earth Summit in Rio de Janeiro in 1992, and the Millennium Development Goals.

We are in the early years of the United Nations Decade for Deserts and the Fight against Desertification (2010-2020). We are taking serious steps to curtail the destruction and degradation of forests, particularly because of the large contribution deforestation makes to climate change. We have understood the links between agriculture and forests. We have begun to think and act within the framework of the energy-food-water nexus.

And there is an expectation that the nations of the world will agree to sustainable development goals at the Rio+20 summit in June 2012.

However, the global community's awareness on land degradation and desertification has lagged in comparison with its awareness on climate change and biodiversity loss; the significance of land and soil to humanity remains obscure to many. As a result, the risk to livelihoods deriving from land and soil degradation does not receive the attention it deserves.

This has resulted in increasing and persistent land degradation and poverty, especially in drylands.

### 1.3 LEARNING FROM THE CONVENTION ON BIOLOGICAL DIVERSITY AND THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE TARGETS

The international community has already agreed to set several long-term, outcome-oriented targets for achieving sustainable development, by reducing biodiversity losses, mitigating climate change and alleviating poverty.

Since DLDD substantially contributes to biodiversity loss, climate change impacts, and poverty, a globally agreed, quantitative sustainable development target focusing on DLDD is required and needs to be underpinned by appropriate policies and legal mechanisms. Such a target can help shape expectations and create the conditions for all stakeholders to assess progress and take appropriate action in addressing DLDD. It would also expedite the achievements of existing targets. In addition, the lessons learned from implementing these targets can assist in effectively operationalizing the ZNLD target.

The CBD 2010 Biodiversity Target, to "achieve by 2010 a significant reduction of the current rate of biodiversity loss..." became an MDG ["Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" (MDG Target 7.B)], but it has been missed (United Nations, 2010). As a result, the CBD has set the 2020 Aichi Biodiversity Target. This goes beyond the 2010 target indicators, which addressed assets, e.g. the size of areas receiving legal protection and the number of endangered species. The 2020 target indicators address processes, such as the links between the loss of biodiversity and drivers of Land Degradation and Desertification (LDD), which lead to loss of ecosystem resilience and ecosystem services, and their impact on human well-being. They also include the contribution of biodiversity conservation "to climate

change mitigation and adaptation and combating desertification".

UNFCCC's COP 15 addressed emissions by setting the 2 °C target to be achieved by halving emissions relative to 1990 by year 2050. The indicators to be monitored are greenhouse gas emission rates and forest area changes resulting from afforestation offsetting deforestation. However, the combined pledged emissions reductions to date would not contribute to achieving this target. On the contrary, based on these pledges, warming is likely to exceed 3 °C by 2100 (Rogelj et al., 2010). However, attaining ZNLD through arresting further degradation and restoring already degraded land has the potential to further contribute to reducing atmospheric greenhouse gas concentrations, thus expediting achievement of the 2°C climate target.

Setting such targets and learning lessons from efforts towards achieving them are useful precedents for setting specific targets for land degradation and desertification.

### 1.4 A SUSTAINABLE DEVELOPMENT GOAL: ZERO NET LAND DEGRADATION

ZNLD is achieved when land degradation is either avoided or offset by land restoration. Given the importance of land explained above and the state of the world's land explained in the following section, it is now the time to set the goal of ZNLD.

This goal might seem ambitious, but it is achievable as suggested below:

- First, even though the precise spatial dimension of land degradation and desertification is in dispute (Wessels, 2009), the fact that DLDD prevails in many areas is undisputed (Safriel and Adeel, 2005);
- Satellite image time series backed by ground truthing have detected areas where non-degraded land has recently become degraded. Globally, land degradation is currently expanding. Furthermore, the drivers of degradation are projected to

persist, so the expansion of LDD is projected to continue (Adeel et al., 2005; Lepers et al., 2005);

- Some land has been in continuous use for protracted periods without degradation. This shows that practices for using lands sustainably are available. By applying these practices more widely, the rate of LDD can be slowed down; and,
- Finally, a number of well-studied cases, both in drylands (Fatonji et al., 2006) and non-drylands (Macedo et al., 2008) demonstrate that degraded soil can be rehabilitated and land productivity can be restored.

While completely halting LDD by 2030 may be difficult, setting a target of Zero Net Land Degradation by 2030 is realistic if some of the degraded lands can be restored while non-degraded land keep their status quo. Indeed, current uncertainty over the exact extent of LDD is no reason to wait. An early step should be better measurement.

There is a strong synergy between the strategies for achieving both ZNLD and the MDGs. Designed and prepared jointly by developed and developing countries, ZNLD programmes, could address the needs of these countries by providing funding and capacity-building to introduce new agricultural practices. These should be geared towards reducing land degradation and achieving ZNLD while also advancing food security, ecosystem services and other MDGs at the same time.

## 2. SNAPSHOT: THE STATE OF THE WORLD'S LAND

This snapshot is extracted from a forthcoming United Nations Environment Programme discussion paper (McKenzie et al.).



### 2.1. DEMAND FOR AGRICULTURAL LAND CONTINUES

- Agriculture requires more land (40 percent of the world's terrestrial surface), water and human labour than any other industry (Kiers et al., 2008; PBL, 2009);
- Between 1985 and 2005, the world's croplands and pastures expanded by 154 million hectares (Foley et al., 2011);
- Between 1980 and 2000, more than half of new cropland came from intact rainforests and another 30 percent from disturbed forests (Gibbs, 2009);
- In the last two centuries, humans have cleared or converted 70 percent of the grassland, 50% of the savannah, 45 percent of the temperate deciduous forest, and 27 percent of the tropical forest biome for agriculture (Foley et al., 2011);
- Many regions of the world now face a shortage of land for additional cropland expansion (Morton et al., 2006);

In the drylands, due to drought and desertification, 12 million hectares of land are transformed into new man-made deserts each year. That is an area with the potential to produce 20 million tons of grain every year.

(UNCCD, 2011b)

- Globally, the average amount of arable land per person fell from 0.39 hectares in 1960 to 0.23 hectares in 2000 and then to 0.21 hectares in 2007 (Evans, 2010; FAO, 2009).

### 2.2. AGRICULTURAL PRODUCTIVITY GROWTH IS SLOWING

- From 1961 to 2008, the average annual growth rates of yields (output per hectare) for grains were 1.5 percent in developed countries and 2.1 percent in developing countries. Since 1985, there has been a reduction in these growth rates (Foresight, 2011);
- Up to 25 percent of the world's food production may be lost during the 21st century owing to climate change, water scarcity, invasive pests and land degradation (Nellemann et al., 2009);
- Agricultural intensification has dramatically increased in recent decades, outstripping rates of agricultural expansion, and has been responsible for most of the yield increases of the past few decades (Foley et al., 2011).

### 2.3. INTENSIFICATION AND ENVIRONMENTAL IMPACTS

- The productivity of many intensive systems cannot be maintained under their current management (World

Bank, 2008; Khan and Hanjra, 2009);

- Intensification has caused water degradation, increased energy use and widespread pollution (Foley et al., 2011);
- 70 percent of global freshwater withdrawals are devoted to irrigation (Foley et al., 2011);
- Over the past 50 years, global fertilizer use increased by 500 percent, causing water degradation, increased energy use and widespread pollution (Foley et al., 2011);
- Industrial agriculture now uses 2-3 times more fertiliser and 1.5 times more pesticides for the production of 1 kilogram of food than it did 40 years ago (UNCTAD, 2010);
- Between 1961 and 1999, the production of pesticides increased by 854 percent (Green et al., 2005);
- Current farming practices are responsible for 3-5 million cases of pesticide poisoning and over 40,000 deaths every year (UNEP, 2011);
- Over half a million ton of banned, obsolete and unwanted pesticides are threatening the environment and human health (FAO, 2009);
- More than 1 billion people already live in areas experiencing land degradation and productivity decline (Nellemann et al., 2009);
- More than 20 percent of the global land area is thought to be degraded, with much of this area concentrated in Africa south of the equator, South-East Asia and southern China (Bai et al., 2008);

- Up to 40 percent of global crop lands may be experiencing some degree of soil erosion or reduced fertility (Foley, 2005).

## 2.4 COMPETITION FOR FOOD, FUEL AND FIBRE

- Globally, only 62 percent of crop production is allocated to human food, versus 35% to animal feed and 3 percent to bioenergy, seed and other industrial products (Foley et al., 2011);
- North America and Europe devote only about 40 percent of their croplands to direct food production, whereas Africa and Asia allocate typically over 80 percent of their cropland to food crops (Foley et al., 2011);
- Cropland is being converted to other uses owing to increasing urbanization, industrialization, energy demand and population growth (Nellemann et al., 2009);
- The purchase of quality agricultural land by foreign actors is increasing, particularly in Africa and Asia (Anseeuw et al., 2012). In 2009 approximately 56 million hectares worth of large-scale farmland deals were announced (although not all announced deals proceeded) (Deininger et al., 2010).

## 2.5 FOOD SYSTEM INEFFICIENCIES

- Global fertilizer use reflects 'hotspots' of low nutrient use efficiency and large volumes of excess nutrients. Nutrient excesses are especially large in China, Northern India, the United States of America and Western Europe. Only 10 percent of the world's croplands account for 32 percent of the global nitrogen surplus and 40 percent of the phosphorus surplus - (Foley et al., 2011);
- Developing countries lose more than 40 percent of food post-harvest or during processing because of problematic storage and transport conditions. Industrialized countries have lower producer losses, but at

the retail or consumer level more than 40 percent of the food may be wasted (PBL, 2009; Foley et al., 2011).

## 2.6 FOOD, NUTRITION INSECURITY AND HUNGER

- Today chronic hunger affects over 900 million people worldwide - almost 16 percent of the population in developing countries (FAO, 2012), the majority of whom are small-holder farmers and landless poor in rural areas. This number will increase substantially without policy interventions (Nellemann et al., 2009).
- Worldwide obesity has more than doubled since 1980. In 2008, 1.5 billion adults 20 and older were overweight. 65 percent of the world's population now live in countries where overweight and obesity kills more people than underweight (WHO, 2011).

## 2.7 CLIMATE CHANGE

- In the next two decades, climate change is predicted to cause major crop losses in the world's poorest regions (Kiers et al., 2008);
- Climate change may depress agricultural yields by up to 15-50 percent in most countries by 2050 given the current agricultural practices and crop varieties (WDR, 2010).

## 2.8 ALTERNATIVES

- Sustainability-related global business opportunities in natural resources (including energy, forestry, water, metals, and food and agriculture) may be worth USD 2-6 trillion by 2050 (TEEB, 2010);
- Global sales of organic food and drink have recently been increasing in recent times by over USD 5 billion a year, reaching USD 46 billion in 2007 (TEEB, 2010);

- The global market for eco-labelled fish products grew by over 50 percent between 2008 and 2009, attaining a retail value of USD 1.5 billion (TEEB, 2010);

- Between 1974 and 2008, the area cultivated using conservation agriculture grew 35-fold from just under 3 million hectares to more than 105 million hectares (FAO, 2009);

- The market for certified agricultural products was valued at USD 40 billion in 2008 (2.5 percent of global food and beverage market) and may increase to US\$210 billion by 2020 (TEEB, 2010);

- Sales of certified 'sustainable' forest products quadrupled between 2005 and 2007 (TEEB, 2010).

## 2.9 TRADE-OFFS AND INTER-LINKAGES CANNOT BE IGNORED

- Agricultural systems are becoming increasingly linked to other sectors and trends, including the global energy system, human-induced land-use change, biodiversity, water scarcity and climate change (PBL, 2009);

- Changing the way we manage land not only requires changing the way we live, but changing the way we think. Energy and food are converging in a world where energy can become food and food can become energy. More intensive farming practices usually mean more intensive energy use. Longer supply chains, transport and distribution infrastructure, biofuels and increased water use all drive these feedback loops (TCG, 2011).

## 3. LAND DEGRADATION AND DESERTIFICATION

### 3.1. CHARACTERISTICS

Land degradation and desertification may be as old as the beginnings of pastoralism and agriculture themselves. They constitute a persistent decline in the services that healthy land provides, especially food. Given the extremely slow pace of soil formation, once the physical, biological and chemical properties of soils begin to deteriorate, their natural regeneration rate is practically unattainable.

Hydrologic balance, soil characteristics and vegetation cover point to land degradation and desertification. Hydrologic balance is influenced by rainfall and snow, evapotranspiration, terrain characteristics, radiation as well as by soil characteristics and vegetation cover. Soil organic matter, derived from the vegetation growing on soil, is the major component that controls soil fertility. Removal of vegetation cover is caused by anthropogenic factors including deforestation, excessive and inappropriate ploughing and over-grazing, and is often exacerbated by natural causes like drought and spontaneous fires.

Land degradation and desertification result in poorer soil quality (especially on agricultural lands with annual rainfall of less than 250 mm) because of:

- Accelerated erosion
- Salinization
- Loss of soil organic matter
- Decline in soil structure and tilth caused by reduction in the magnitude and stability of aggregates
- Nutrient mining and imbalance
- Decline in the capacity to infiltrate and retain water leading to decline in the water available in the root zone for plant growth.

The downward spiral is accelerated by crusting, compaction, surface runoff and increased erosion by water and wind, and is strongly driven by extractive farming practices including: removal of crop

residues, excessive tillage, little or no application of manure and fertilizers, and excessive and uncontrolled grazing.

Drylands cover 41 percent of Earth's land surface and are home to approximately 38 percent (2.7 billion) of the current global population of 7 billion. Significant tracts of drylands are affected by some degree of LDD (Reynolds et al., 2007; Bai et al., 2008), with adverse impacts on food and water security as well as the lives and livelihood of people.

Drylands are especially vulnerable to land degradation because of their soils' coarse texture, low organic matter content, low water and nutrient retention capacities, low inherent fertility and low resilience. This vulnerability is aggravated by land misuse, soil mismanagement and unsustainable exploitation.

#### A SYSTEM IN DISTRESS: LAND DEGRADATION AND DESERTIFICATION (RATES OF CHANGE PER MINUTE)

##### CAUSES

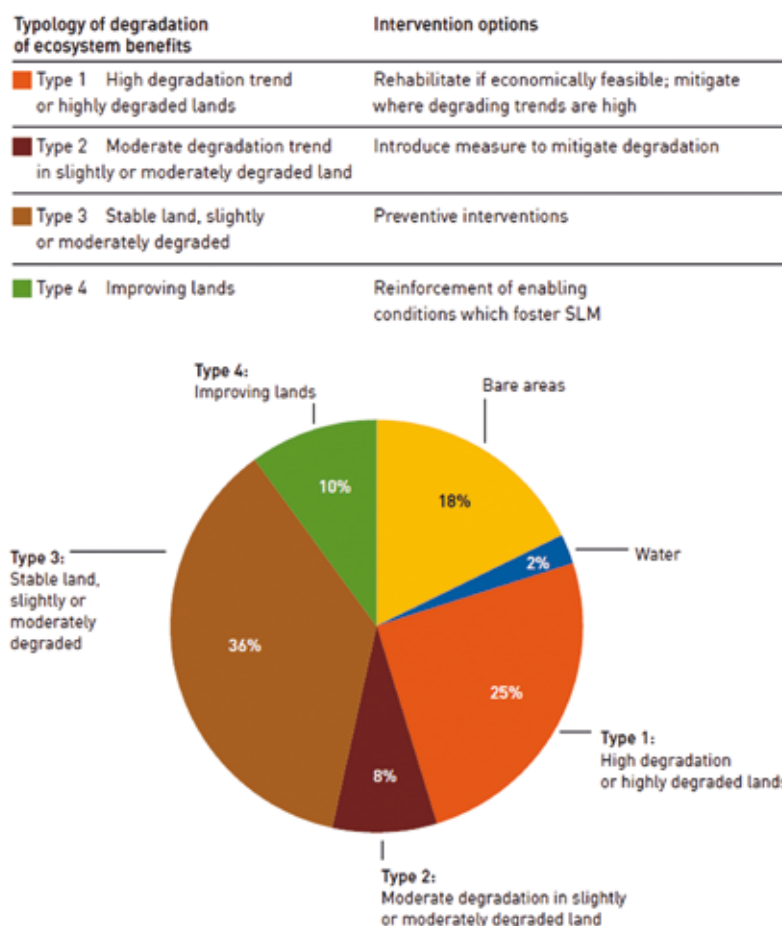
- Population increase: 150 people
- CO<sub>2</sub> increase: 6,150 tons
- Tropical deforestation (total dryland and non-dryland): 25 ha
- Soil degradation: 10 ha
- Desertification: 23 ha
- Urban encroachment: 5.5 ha

##### CONSEQUENCES AND COMPOUNDING EFFECTS

- Food insecurity
- Deaths from hunger: 16 people (including 12 children)
- Political instability
- Civil strife

(Adapted from Lal, 2011)

FIGURE 1: STATUS AND TRENDS IN GLOBAL LAND DEGRADATION



Source: FAO SOLAW 2011

## MEASURING AND MONITORING LAND DEGRADATION AND DESERTIFICATION

Regular monitoring can detect a decline in the production of crops or forage, which can identify lands that are becoming degraded, thus helping quantify the global extent of land degradation and desertification. However, declines in agricultural production often have social, economic and policy drivers, over and above the biophysical drivers, which impact the land. This has motivated scientists to monitor land and soil characteristics, which serve as indicators of productivity.

Different studies have used different indicators and measurement methods, and this has led to conflicting opinions on the extent of land degradation and desertification. Thus it is not surprising that five global assessments over the last four decades resulted in degradation estimates ranging from 15% to 63% of global land and 4% to 74% of its global drylands subset (Safriel, 2007). One study suggests that LDD is a much greater threat in drylands than in non-drylands (Adeel et al., 2005).

Most 20th century research understandably addressed the extent of already occurring cumulative degradation. The development of regular and accessible time series monitoring from space has enabled a more accurate assessment of the current rates of land degradation and desertification.

A recent study at the global scale addressed the reduction of biological productivity at large, rather than singling out reduction in terms of economic value alone (Bai et al., 2008). An analysis of a time series of remote sensing images between 1981 and 2003 reveals a persistently declining productivity throughout this period on over 20% of the global land, on which 1.5 billion people reside. This mainly occurred in sub-equatorial Africa, South-East Asia and southern China, north-central Australia, the Pampas and swathes of the Siberian and North American taiga. The study found that LDD in China is more severe in forests than in croplands (40% and 21% of current China's land degradation, respectively) with 44% of China's forest lands viewed as degraded, compared with 24% of its arable lands. The results of this study have been contested (Wessels, 2009).

Such diverse estimates and lack of clear academic consensus demonstrate the need for developing a credible data base (including a baseline) of land degradation and desertification.

## 3.2 CAUSES

There are currently 1.3 billion land users (19 percent of the world's population) producing food and other agricultural products for themselves and the other 5.7 billion people on Earth (FAOSTAT, 2012). Pastoralists, farmers, and agro-pastoral communities draw on land and soil productivity to produce biological products of economic value, especially food. In many areas of the world, this results in various degrees of land degradation and desertification. In other words, the land use is unsustainable.

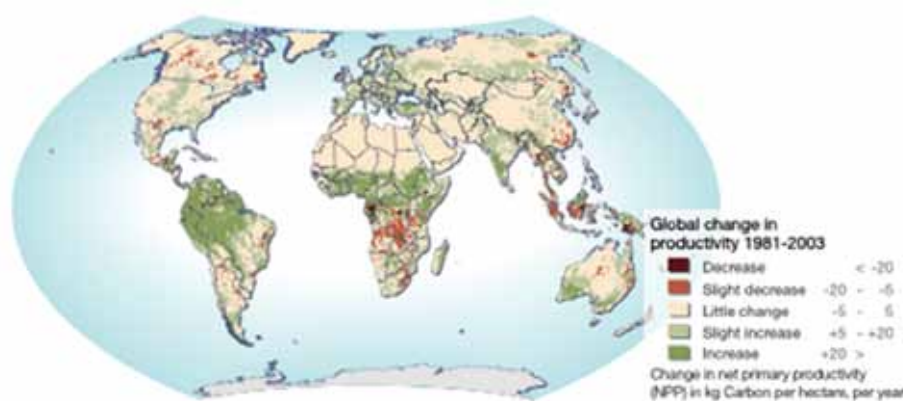
Most lands can continue to produce food (and other biological products) at an average constant rate as long as the natural resources underpinning the land's productivity are not over-used or depleted. However, land users are often not satisfied with this natural production rate, especially where and when it is inherently low, including in drylands. By forcing the land to produce more than its natural capacity allows, initial successes are often followed by protracted failures, with inevitable declines in productivity.

For example: "Unsustainable practices in irrigation and production may lead to increased salinization of soil, nutrient depletion and erosion. An estimated 950 million hectares of salt-affected lands occur in arid and semi-arid regions, nearly 33 percent of the potentially arable land area of the world. Globally, some 20 percent of irrigated land (450,000 km<sup>2</sup>) is salt-affected, with 2,500–5,000 km<sup>2</sup> of lost production every year as a result of salinity" (UNEP, 2009 citing UNEP, 2008).

Pastoralists contribute to this by increasing stocking rates so that forage consumption is faster than the regeneration of vegetation. Vegetation removal exposes land to erosion, thus depleting soil fertility. Similarly, farmers seeking yields beyond the land's natural capacity use tillage, irrigation and harvesting practices that gradually weaken the renewability of soil resources.

Pastoralism and farming often fail to balance the demand to produce food and other items with the natural production rate of the underlying ecosystems. As shown in figure 1 below, these

FIGURE 2: TRENDS IN LAND PRODUCTIVITY 1981-2003 (GREENING AND LAND DEGRADATION)



Source: Bai ZG, Dent DL, Olsson L and Schaepman ME 2008. Global assessment of land degradation and improvement 1. Identification by remote sensing. Report 2008/01, FAO/ISRIC – Rome/Wageningen

unsustainable practices result in reduced food production as well as the loss of natural regulating and cultural ecosystem services, thus impacting the well-being of all dependant on these services.

Inappropriate uses of land for agricultural production, particularly on steep slopes and near watercourses, as well as ineffective soil conservation techniques, can also lead to LDD.

The reasons that people engage in activities that cause LDD are many and varied. They include pressure from poverty or external commercial interests to increase the productivity of land for food, forestry and a range of other purposes.

Cultural factors can entrench unsustainable land use. Unsustainable land management practices built up over generations have often become part of the cultural fabric of traditional pastoral and farming communities.

Progress towards sustainable land use is aided by:

- Appropriate land tenure regimes;

- Regulatory, planning, and zoning frameworks; and
- Effective controls and sanctions to force changes in behaviour.

In absence of these measures, the downward spiral becomes more difficult to reverse.

### 3.3. COST OF INACTION

If scientific predictions are correct with regard to the reduction of agricultural land caused by DLDD, it is inevitable that poverty rates would increase and food security would decline in many countries. In the worst case scenarios, famine and widespread starvation would result. Long-term inappropriate forestry practices, especially in tropical countries, will lower the productivity of forests on which the livelihoods of its users depend, and hence further aggravate poverty. Declining productivity would lead to economic and political unrest and the destruction of the social and cultural fabric of society

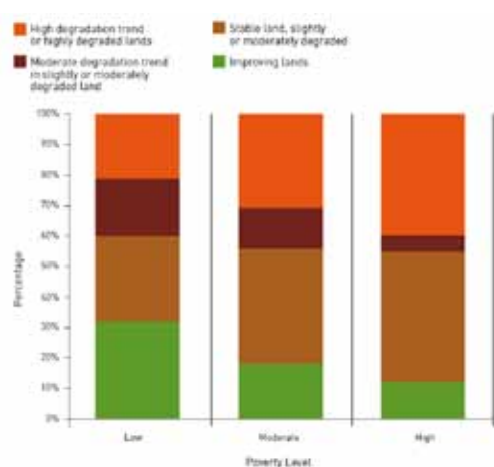
in many more countries. Global peace could also be threatened because of food, water and energy unavailability and /or insecurity.

Whilst it is difficult to predict the cost of inaction, as opposed to the cost of introducing programmes for ZNLD, the annual economic cost of DLDD on a global basis is clearly unacceptable (Nkonya et al., 2011).

The introduction of adequate and successful large-scale and long-term programmes for the achievement of ZNLD would cost hundreds of millions of dollars. However, failing to strongly promote ZNLD would likely be more costly in the long term than the costs of promoting it.

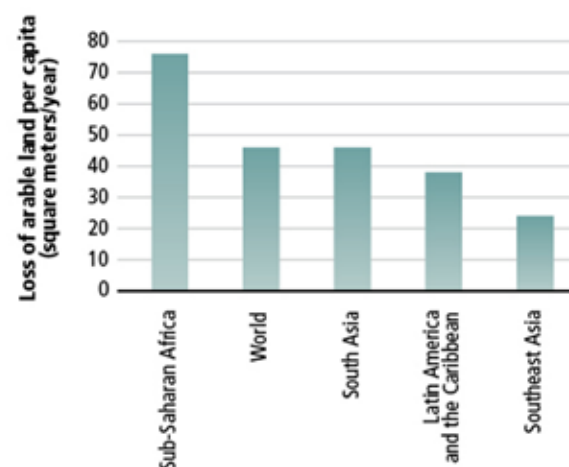
There will undoubtedly be increasing pressure on countries with high populations and low agricultural productivity (due to inadequate availability of arable land or historic mismanagement) to take diplomatically sensitive measures such as purchasing or leasing large tracts of agricultural land from other countries. The host countries

FIGURE 3: RELATION BETWEEN LAND DEGRADATION AND POVERTY



Source: FAO, 2011

FIGURE 4: ANNUAL LOSS OF PER CAPITA ARABLE LAND IN DEVELOPING COUNTRIES (1961-2009)



Source: IFPRI, 2012 (Preliminary analysis based on linear regression model from data from FAO, FAOSTAT database)

## COSTS OF INACTION: NIGER CASE STUDY

Soil nutrient depletion, overgrazing, salinity in irrigated plots and deforestation are major problems in Niger. Due to limited rainfall and relatively flat terrain, water-induced soil erosion is limited in Niger. [...]

We evaluated the cost of action and inaction at the farm level. The cost of action is the cost the farmer will incur in addressing land degradation, whereas the cost of inaction is the loss the farmer will incur due to land degradation. In the case of salinity, the cost of action is the cost of water and labor required for leaching. The cost of inaction is the benefit lost due to salinity. This cost is obtained by determining the difference between the net present value (NPV) of practices with desalinization and the NPV without desalinization. [...] **cost of action is only about 10 percent of the cost of inaction per hectare**, which indicates the high cost that farmers experience by not addressing the salinity problem.

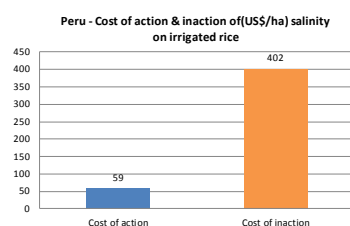
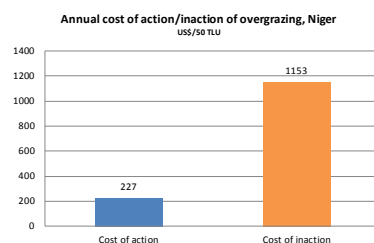
We also examined the costs of action and inaction to control overgrazing. Simulation results showed that **overgrazing leads to a 22 percent reduction of fodder productivity** and a loss of profitability amounting to USD 1,156 per household with 50 tropical livestock units. [Focusing on rice, millet, overgrazing and sorghum] alone, **Niger loses about 8 percent of its GDP due to land degradation**. The results underscore the large cost of inaction to address land degradation.

Extracted from IFPRI, 2011 (emphasis added)

are often developing countries whose domestic agricultural base may barely be adequate to supply sufficient nutrition to their own citizens.

The recent OECD report, "Environmental Outlook to 2050: The Consequences of Inaction" (OECD, 2012) states that "the costs and consequences of inaction are colossal, both in economic and human terms. These projections highlight the urgent need for new thinking. Failing that, the erosion of our

FIGURE 5: COSTS OF ACTION AND INACTION

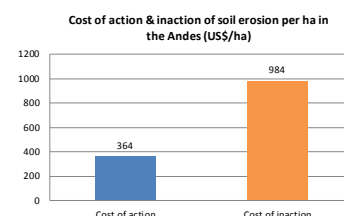


Source: IFPRI, 2011

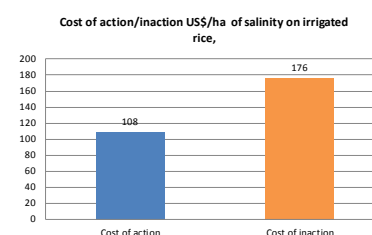
natural environmental capital will increase the risk of irreversible changes that could jeopardise two centuries of rising living standards. We are already witnessing the catastrophic collapse of some fisheries from overfishing, and severe water shortages damaging agriculture. However, these enormous environmental challenges cannot be addressed in isolation. They must be managed in the context of other global challenges, such as food and energy security, and poverty alleviation."

There remains a large degree of uncertainty about the costs of both inaction and action. It is therefore important for any response to LDD to include a comprehensive assessment of the economics of land degradation and desertification, as recommended in this policy brief. Parties to the UNCCD have also decided that the topic of the Second UNCCD Scientific Conference (to be held in March 2013) is about the "Economic assessment of desertification, sustainable land management and resilience in arid, semi-arid and dry sub humid areas".

Peru  
Major forms of land degradation  
- Erosion in the Andes. Covering 30% of the country  
- Deforestation. Rate of deforestation =0.08% per year (FAOSTAT)



India  
Major of land degradation  
• Salinity in irrigated crops



There are various LDD-related impacts on water, including: lower recharge of groundwater and runoff; water degradation, for example through pollutants, and changes in turbidity, sedimentation and siltation; and salinity. All of these LDD-related impacts have severe implications for development potential in drylands. They negatively affect agricultural production, ecosystem health and the sustainability of industrial/ energy projects and infrastructure. A major concern for sustainable development in drylands is the increasing threat of water scarcity. The availability and quality of water are existing challenges to potential dryland development that are expected to be exacerbated by the impacts of climate change.

(WWAP, 2012)

### 3.4 IMPACTS AND INTER-LINKAGES

#### 3.4.1 FOOD SECURITY AND THE FOOD-WATER-ENERGY NEXUS

Food security is attained “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life”. It includes food availability, food access, food quality, food safety and use.

Human food security is partly dependent on the security of fodder for livestock raised for food production (e.g., dairy and meat). Human and animal food security depends on water security. The production of energy from bio-energy sources can impair both food security and water security.

We often blame overpopulation or livestock as the culprits of land degradation and desertification. But they are ultimately the consequence of poor decisions and mismanagement. For instance livestock are often referred to as the major cause of overgrazing leading to desertification; but with appropriate decision-making and management techniques such as Holistic Management

(Savory, 1999) livestock could become an essential part of the solution.

In 2010, the number of undernourished people in the world was 925 million, of which 98 percent live in developing countries. Because of harsh conditions caused by complex interactions between climatic and human factors, many people in drylands in developing countries are internally food insecure. Drylands are fragile environments with vulnerable people who face many social, political, economic, cultural and environmental challenges that make it hard to achieve sustainable development and the MDGs (UNCCD, 2011a).

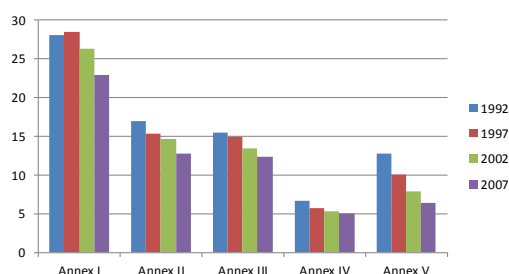
The current famine in the Horn of Africa demonstrates the need to develop more drought-resilient production systems that increase the capacities of farmers and herders to cope with prolonged drought. The current global economic crisis and developments on the world food market all add to a sense of urgency. In the near future, food aid may no longer be available at the scale needed to cope with famine (UNCCD, 2011a).

There is a clear link between undernourishment (or food insecurity)

and DLDD. In 2007, countries included in the UNCCD Regional Implementation Annexes (i.e., those most affected by DLDD) accounted for more than 93 percent of the world’s undernourished people. Africa presented the highest prevalence rate, with almost 23 percent of the continent’s population considered to be undernourished (figure 5). Asia had two-thirds of the overall undernourished population with 577 million undernourished people (figure 6).

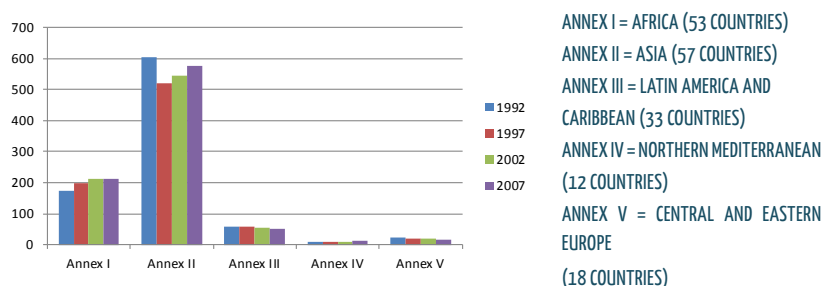
Water security refers to “the sustainable use and protection of water systems against floods and drought, sustainable development and use of water resources, and safeguarding of (and access to) water functions and services for humans and the environment” (Schultz and Uhlenbrook, 2007). The number of water-insecure countries may increase to 30 by 2030 (Rosegrant, 1997; Webb and Iskandarani, 1998; WHO, 1998). The per capita availability of fresh water resources is severely limited in regions prone to DLDD.

FIGURE 6 PREVALENCE OF UNDERNOURISHED POPULATION BY UNCCD ANNEX



Source: UNCCD, 2011a

FIGURE 7: UNDERNOURISHED POPULATION BY UNCCD ANNEX



Source: UNCCD, 2011a

ANNEX I = AFRICA (53 COUNTRIES)  
 ANNEX II = ASIA (57 COUNTRIES)  
 ANNEX III = LATIN AMERICA AND CARIBBEAN (33 COUNTRIES)  
 ANNEX IV = NORTHERN MEDITERRANEAN (12 COUNTRIES)  
 ANNEX V = CENTRAL AND EASTERN EUROPE (18 COUNTRIES)

### 3.4.2 MIGRATION, ENVIRONMENTAL REFUGEES, POVERTY, AND SOCIAL AND POLITICAL UNREST

It is widely recognized that human-induced LDD as well as the effects of climate change have forced a large number of people to move from degraded land to other land within the country (sometimes referred to as internally displaced persons), or to cross borders in order to resettle in other countries.

Although there is no universal definition of environmental migration, Jacobson (1988) has identified three different types of environmental refugees: those displaced temporarily due to a local disruption such as an avalanche or earthquake; those who migrate because environmental degradation has undermined their livelihood or poses unacceptable risks to health; and those who resettle because DLDD has resulted in loss of land or because of other permanent and untenable changes in the habitat.

While other factors such as political and religious animosity play a role in some of these migrations, sheer pressure to find productive land for human survival remains a fundamental reason behind mass migration, and will continue to be for the foreseeable future.

The pressure to find productive land has created many hardships; poverty and the loss of livelihood, identity, culture, access to ecosystem services, and in some countries, life. It has also created major political upheavals and marginalization, and has imposed economic and social stress in the refugees' host countries while also creating more pressure on their lands.

### 3.4.3 FORESTS

One of the direct and long-lasting adverse impacts of DLDD is the decline in vegetation cover and biomass production. Trees and other deep-rooted perennials are affected by severe and strong DLDD over long periods. In severe cases, net biomass production and overall canopy cover may be reduced through the elimination of perennials.

The decline in forest cover is partly due to a loss of top-soil through water

and wind erosion, and a reduction in available water capacity in the root zone. In extreme cases of DLDD, all perennials can be lost and the surface soil becomes highly prone to wind and water erosion and other degradation processes.

LDD is also one of the major causes of the expansion of crop and pasture lands, especially in the developing world, to the detriment of existing forests. About 80 percent of the new crop and pasture land added in tropical regions between 1980 and 2000 came from the clearing of primary and secondary forests. (Holly K. Gibbs et al., 2010)

Land devoid of its protective tree cover loses the following services: soil conservation, the provision of biomass, water, nutrients and biodiversity habitat, carbon sequestration and its recreational, tourism and other cultural values.

### 3.4.4 CLIMATE AND CLIMATE CHANGE

Harsh climate and extreme events aggravate LDD, which in turn provides unwanted positive feedback and accentuates radiative forcing. LDD depletes soil organic matter and reduces carbon in soils and vegetation with the attendant emission of CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). LDD creates a positive feedback to climate change through:

- Depletion of soil organic matter and nutrient pools;
- Reduction in the fraction of rainfall that infiltrates into the soil and is thus available to plants;
- Decrease in ecosystem productivity; and
- Emission of greenhouse gases (Lal, 2001; 2004).

The current global temperature increase of 0.6 °C compared with pre-industrial times may reach 4 °C or more with business as usual (IPCC, 2007), and may be aggravated by LDD (Lal, 2001). Thus, re-carbonization of the biosphere, especially by addressing degraded lands and implementing ZNLD, is a key strategy

for adapting to and mitigating risks of global warming (Lal et al., 2012).

Over and above the effects of gaseous emissions and reduction in soil organic matter, reduction in vegetation and ground cover also strongly impacts the hydrologic cycle. It increases surface runoff and evaporation, and decreases soil water storage, ground water recharge, evapotranspiration and green water storage. Because of the strong link between water and energy budgets, the green water component is severely jeopardized. Consequently, the vegetative or canopy cover is regressively reduced. Furthermore, productivity of agro-ecosystems is low and the resource use efficiency (water, nutrient, energy) regressively decreases over time.

### 3.4.5 BIODIVERSITY

The major service of land is the provision of food and other ecosystem services required to sustain this provision. Interacting micro-organism, plant and animal species, that is biodiversity, are closely involved in the provision of all services from land (Safriel and Adeel, 2005). However, human impact reduces the land's plant cover and its rich biodiversity, which, among other benefits, provides for soil conservation. The eroded topsoil then blows or washes away along with its biodiversity, whose recovery on the denuded land is impaired. This biodiversity loss leads to failure in plant nutrient recycling, soil conservation, soil moisture regulation, local climate amelioration, pest control, pollination and the ecosystem's resilience and stability. These combined effects lead to LDD, as well as to the loss of many significant ecosystem services at local, regional and global scales.

Thus, if LDD continues unabated, many of the CBD's 2020 Aichi Biodiversity Targets will not be achieved. These include the following:

- "By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced" (Target 5, CBD, 2012);

- 
- “By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable” (Target 14, CBD, 2012);
  - “By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification” (Target 15, CBD, 2012);
  - But also targets 7, 11, 13 among others.

## 4. PATHWAYS TO ZERO NET LAND DEGRADATION



### 4.1 ARRESTING FURTHER DEGRADATION AND RESTORING AND REHABILITATING DEGRADED LAND

The world's productive land is finite, and the global area of productive land decreases with every new episode of degradation. Two approaches that reinforce each other when applied in a coordinated manner can set us on a path to ZNLD:

- Arresting further degradation: manage productive and protected lands in ways that prevent or minimize LDD
- Restoring and rehabilitating degraded land

We have included tools and examples to make progress on both in this section.

### 4.2. SUSTAINABLE LAND MANAGEMENT

Sustainable land management (SLM) is defined as a knowledge-based combination of technologies, policies and practices that integrate land, water, biodiversity, and environmental concerns (including input and output externalities) to meet rising food and fibre demands while sustaining ecosystem services and livelihoods (United Nations 1987; Wood and Dumanski, 1994; World Bank, 2006).

In the context of ZNLD, the SLM options are defined as those land use and soil / vegetation management practices that create a positive carbon,

water, and elemental balance in the used land, enhance net primary productivity, mitigate climate change by absorbing atmospheric CO<sub>2</sub> and sequestering it in biomass and soil, and can be adapted to environmental conditions.

The overall goal is to adopt SLM practices that protect topsoil, conserve and enhance plant available water in the root zone, and strengthen nutrient cycling while improving soil fertility. Decreasing water losses through run-off and evaporation is critical to enhancing and sustaining productivity. Thus, the importance of water harvesting and recycling to minimize risks of agronomic drought by increasing the storage of green water cannot be over-emphasized.

With reference to cropland, SLM practices that will assist in achieving ZNLD include residue retention and mulching, growing cover crops, using manure and compost, and adapting complex rotations to enhance the soil organic carbon pool and improve soil quality.

With reference to pastoral land, important strategies include reducing stocking rates through conservative grazing, and adopting controlled grazing while conserving soil and water. Establishing forage trees, along with grasses and legumes, is essential to enhancing biodiversity, which is instrumental in the provision of most services, including primary productivity.

With reference to plantation and forestry land use, in drylands, an important SLM technology is the one that produces stable agronomic yield even in bad, mainly drought, years, rather than

### FREEZING THE FOOTPRINT OF FOOD

The single largest impact on our finite planet comes from producing food. By 2050, we may need three Earths to meet the demands of our consumption. We urgently need to find ways to do more with less.

I have identified eight strategies that, if applied globally and simultaneously, will help to reform the food system and protect the planet. Work has started on each of these 'food wedges', but no group is tackling them all at once.

(Clay, 2011)

producing the best yield only in good years. In addition, SLM must enhance resilience, which can be jeopardized with a myopic focus on maximizing production in the short term. Supplemental irrigation using brackish water, especially for growing halophytes (salt-tolerant plants), can be useful in improving vegetative cover and enhancing the ecosystem carbon pool (Lal, 2001).

While the principles and practices of SLM are known and widely recognized, DLDD continues to be a major global threat. Therefore, SLM practices are either not being adopted, or have not been as effective as perceived.

The problem of slowly adopting SLM can be addressed by ZNLD as a Sustainable Development Goal; as it will empower actors to take bolder steps. This would have a knock-on benefit because SLM is a key to achieving the goals of the UNCCD and its sister conventions, UNFCCC and CBD (Dudley et al., 2009).

Indeed, there are several promising examples of successful implementation of SLM (Schwilch et al., 2011), which can be applied to achieve ZNLD. In addition to the efforts of governments, intergovernmental organisations like the UNCCD, FAO, UNEP, United Nations Development Programme (UNDP), and the World Bank and many non-governmental organizations, the World Overview of Conservation Approaches

and Technologies (WOCAT) has been operational since 1992 as a global network of SLM specialists. It aims to improve the knowledge base on the global application of SLM and reducing LDD. WOCAT focuses on local solutions to global problems, which can significantly contribute to achieving ZNLD.

### 4.3 AVOIDING DEGRADATION OF NON-DEGRADED LANDS

With harsh climate and fragile soils, recent LDD has been driven by human activities that disturb the delicate but dynamic equilibrium between soils, vegetation, and climate. Thus, rather than bringing new land into production, productivity must be enhanced on land already devoted to arable and pastoral land uses by pursuing SLM practices.

Avoiding degradation of new lands is preferably achieved by enhancing the productivity of cropland and pastoral land per unit area, per unit of time and per unit of input (i.e. water, nutrients, energy, labour) rather than expanding the area of land in production.

Drylands by nature have limited water and plant nutrients. Therefore, the goal in pursuing ZNLD in drylands is to integrate three strategies for achieving resilience and thus enhancing sustainability, and for reversing the downward spiral of LDD. These strategies are to:

- Improve the supply of soil water in the root zone and also increase water productivity;
- Enhance soil quality with regard to plant available water and nutrient retention capacities; and
- Create positive ecosystem carbon and nutrient budgets.

While enhancing the productivity of land already using SLM approaches, laws and policies must be in place to protect/preserve natural ecosystems against unauthorized cutting of firewood, grazing, etc. The protection and enhancement of vegetation cover are essential to erosion

control. Afforestation of denuded lands with adaptable species is essential to conserving soil and water and strengthening nutrient cycling.

### 4.4 COMMUNITY-BASED AND TRADITIONAL APPROACHES

There is an increasing realization that local communities have an important role to play in environment management. The use of customary SLM practices - both in forested areas and in agricultural and pastoral regions - that are officially supported by government programmes and, where appropriate, regulatory frameworks, has the potential to counter the causes and reduce the effects of LDD processes, thus contributing to ZNLD.

Lessons can be learned from jurisdictions that have engaged in various community-based activities for SLM as well as water management. Local natural resources conservation groups such as Land care in Australia (<http://www.landcareonline.com.au/>) are one such example that could be adapted for other countries suffering from LDD.

### 4.5 PAYMENTS FOR ECOSYSTEM SERVICES

Payment for ecosystem services (PES) is an economic, market-based approach for sustainable ecosystem services management.

Although it has been in use since the wake of the American Dust Bowl (paying farmers to avoid farming on land with high degradation risk) (Burke et al., 1995), the PES instrument is in its infancy, especially in its application to address LDD. However, it is rapidly developing in theory and practice.

The flow of ecosystem services often crosses boundaries at various scales, from farm to district, national, regional and global. Therefore, beneficiaries of ecosystem services are often located away from the ecosystem that provides the services. These services are therefore “public goods”. However, if their provision is intentionally amplified by the owner or user of the relevant ecosystem, a scheme

of PES can be established, in which the beneficiaries pay the owner / user for that service.

Depending on governance and the social system structures, the payments can be provided by individuals, communities, local governments, national governments or even international institutions.

Land users can benefit from PES schemes, both for doing something or for refraining from doing something:

- A farmer who adopts SLM practices would not normally be eligible under a PES scheme because only the farmer will benefit from the practices. However, if the farmer adopts SLM practices beyond the requirements of the farm for the benefit of the wider community (e.g. maintaining vegetation cover to promote rainfall penetration to the aquifer that is used by farmers miles away), the farmer could be entitled for PES from the beneficiaries of the water. Since maintaining vegetation cover also reduces LDD risks, the PES scheme would also promote a reduction in the rate of LDD;
- Farmers could reduce pesticide use to reduce pollinator mortality and promote pollinator biodiversity, which would benefit others in the community. The farmer would, however, suffer increased pest damage. A PES scheme could provide these farmers compensation for their loss.

Payment for ecosystem services can also be used to restore abandoned degraded lands once the degradation driver is identified. PES can be most effective in restoring degraded lands by paying land users for managing these lands for the primary purpose to restoring the natural functions of the land's ecosystems. Similarly, farmers that degraded their land could be paid to restore the productivity of their degraded land rather than encroaching on non-cultivated productive land.

# 5. RECOMMENDATIONS TO REACH ZERO NET LAND DEGRADATION BY 2030

## 5.1 REQUIRED ELEMENTS OF A STRATEGY TO REACH A ZERO NET LAND DEGRADATION GOAL

Achieving Zero Net Land Degradation by 2030 will require the commitment, the support and the active investment of all public and private sector actors, of all parts of the supply and value chain related to land use, including local and community stakeholders. Current and future generations will benefit from the return on investment in terms of gains in efficiency, resilience, and social inclusiveness.

Any successful ZNLD strategy will require the following elements:

### 5.1.1 GOVERNMENTS

- a. Supporting the creation of enabling environments (including a comprehensive policy-change) that allow for the implementation of the ZNLD, as part and parcel of the national priorities on sustainable development and poverty eradication
- b. Set up the national goal and targets, support to regional, and sub-national level goals and targets
- c. Measuring LDD, including the establishment of global, regional, national, and sub-national baselines
- d. Monitoring LDD at the global, regional, national, and sub-national levels
- e. Approve regulatory frameworks and legal instruments including on land restoration, anti-land degradation policies and accounting for rights-based approaches
- f. Rewarding progress through domestic and, where necessary, international resources, mechanisms and schemes
- g. Funding, including from innovative sources such as the Green Climate Fund, the Adaptation Fund and other existing funds

- h. Promote and foster the continuous improvement and sharing of the knowledge base (scientific and practice) for addressing LDD
- i. Reporting and verifying LDD at least at the global and national levels

### 5.1.2 PRIVATE SECTOR

- a. Engage in investments that increase efficiency in land use and resilience of related ecosystems functions and services, and reduce or mitigate risks
- b. Invest in R&D on SLM
- c. Establish and implement public-private partnerships on SLM that also ensure social inclusiveness
- d. Support the development of information – sharing mechanisms especially at the local level with a focus on SLM-related goods and services
- e. Within the framework of corporate responsibility, the private sector could also be engaged in reporting at the national and international levels on actions towards the achievement of the ZNLD target and on best practices, lessons learned and management models that are in use and suitable for attaining such target.

### 5.1.3 FARMERS AND PASTORALISTS

- a. Engage in actions that improve farmers and pastoralists capacities and strengthen community-based service systems (through training, information and knowledge sharing, technology transfer within the value chain, income-generating activities, etc., that can be undertaken at the local level), improve access to market and resources
- b. Involve in preparedness and risk management schemes designed and/or suitable for farmers and pastoralists

## 5.2 PROPOSED INTERGOVERNMENTAL ACTION

The following four key actions can be taken by the international community to ensure progress towards ZNLD. Details are provided in the remainder of this section:

1. Agree on a Sustainable Development Goal at Rio+20 on Zero Net Land Degradation
2. Agree on a new legal instrument (such as a Protocol on Zero Net Land Degradation) to the UNCCD, as a global policy and monitoring framework to focus efforts and empower the international community to act with the speed and scale required to address this crucial problem
3. Establish an Intergovernmental Panel/Platform on Land and Soil as a global credible and transparent authority on scientific and technical knowledge on land and soil, including land degradation and desertification
4. Undertake a comprehensive and integrated assessment of the Economics of Land Degradation.

### 5.2.1 SUSTAINABLE DEVELOPMENT GOAL AT RIO+20 ON ZERO NET LAND DEGRADATION

The time is ripe to agree on the following Sustainable Development Goal at Rio+20 on ZNLD. This would secure the continuing availability of productive land for present and future generations.

**Goal:** Sustainable land use for all and by all (for agriculture, forestry, energy and urbanization)

**Target 1:** Zero net land degradation by 2030

**Target 2:** Zero net forest degradation by 2030

**Target 3:** Drought policies and drought preparedness measures implemented in all drought-prone regions/ countries by 2020

### 5.2.2 NEW LEGAL INSTRUMENT SUCH AS A PROTOCOL TO THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION ON ZERO NET LAND DEGRADATION

A legal instrument on Zero Net Land Degradation under the UNCCCD should be developed as a global policy and monitoring framework to focus efforts and empower the international community to act with the speed and scale required to address this crucial problem. Such a protocol could incorporate the setting of ZNLD targets by individual countries, for example as a percentage of arable land in their jurisdiction or regions within their jurisdiction.

The provisions of a new UNCCD protocol on zero net land degradation could facilitate:

- a. The incorporation of emerging economic instruments, such as payments for ecosystem services (e.g., carbon sequestration, water conservation) to be used in preventing degradation of non-degraded land, as well as supporting the restoration of already degraded land;
- b. The negotiation and setting of achievable and verifiable targets for ZNLD at Conferences of the Parties to the Convention under advice of the CST;
- c. The development of policies, measures, guidelines and mechanisms for the implementation of ZNLD at national and regional levels; and
- d. The provision of legal frameworks, guidelines and models for national and sub-national policies to promote ZNLD.

### 5.2.3 NEW INTERGOVERNMENTAL PANEL/ PLATFORM ON LAND AND SOIL

Progress on DLDD requires a solid and up-to-date scientific and technical basis and the wide availability of knowledge and lessons learned from previous experience, thus the imperative to establish a globally agreed and recognized, credible and transparent authority on

scientific and technical knowledge on land and soil, including land degradation and desertification.

An Intergovernmental Panel/ Platform on Land and Soil should be established, for providing a science-policy interface that would support land-related policy making, and especially the implementation of the ZNLD goal. It would also translate economic, social, and ecological knowledge into tools to support improved policy-making and practices in land management at various levels.

Such a body has been discussed over a number of years and most recently at COP 10, “Measures to enable the United Nations Convention to Combat Desertification to become a global authority on scientific and technical knowledge pertaining to desertification/ land degradation and mitigation of the effects of drought” (Decision 20/COP.10)

The scientific basis for the implementation of ZNLD should also be strengthened:

- a. Establishing a global data base for measuring and monitoring the extent and severity of DLDD and its impact on productivity, the environment and populations affected at national and regional levels
- b. Generating pilot projects in regions with global DLDD ‘hotspots’, and quantifying the impacts of adopting SLM and other interventions (on soil quality, water resources, populations affected, and land cover) in cooperation with key global institutions such as the FAO and its WOCAT, UNEP and the Global Environment Facility
- c. Increasing awareness of and providing training on implementation of ZNLD
- d. Promoting ZNLD actions by encouraging community involvement
- e. Promoting further synergies with the UNFCCC and the CBD
- f. Determining baseline and establishing procedures

- g. Developing recommendations at the global and regional levels to implement strategies and policies to reach a ZNLD goal, and
- h. Working with the IPCC to include in its Fifth Assessment Report the peer reviewed research on land / soils as recommended by the Committee for the Review of the Implementation of the Convention (document ICCD/ CRIC 10/19)

### 5.2.4 COMPREHENSIVE ASSESSMENT OF THE ECONOMICS OF LAND DEGRADATION

Finally, a comprehensive assessment of the economics of land degradation is needed in order to:

- a. Increase public awareness of the costs and benefits of individual and collective decisions affecting land and land-based ecosystems and their services; and
- b. Raise land stewardship or SLM to a higher level of priority on global and national agendas.



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