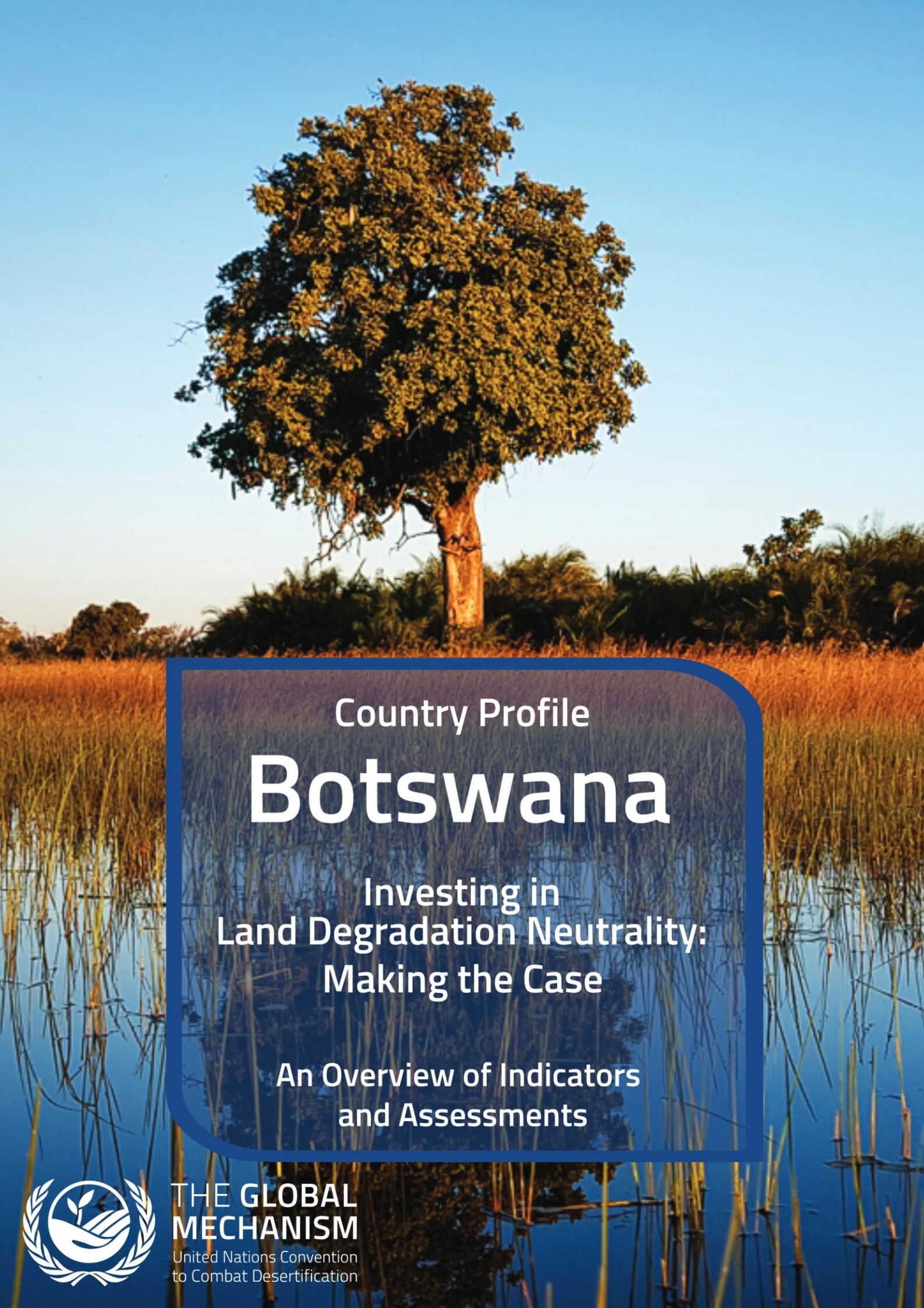

Country Profile

Botswana

Investing in Land Degradation Neutrality: Making the Case

An Overview of Indicators and Assessments

THE GLOBAL MECHANISM
United Nations Convention to Combat Desertification

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1. Quick Facts

The annual cost of land degradation in Botswana is estimated at 353 million United States dollars (USD). This is equal to 3.2% of the country's Gross Domestic Product. Land degradation leads to reduction in the provision of ecosystem services that takes different forms – deterioration in food availability, soil fertility, carbon sequestration capacity, wood production, groundwater recharge, etc. – with significant social and economic costs to the country.

The returns on taking action against land degradation are estimated at 6 USD for every dollar invested in restoring degraded land in Botswana. Assessments of the costs of action against land degradation through restoration and sustainable land management practices versus the cost of inaction highlight the strong economic incentive for bold actions against land degradation.

In Botswana, the Agriculture, Forestry and Other Land Use (AFOLU) sector is responsible for 59 % of the total greenhouse gas emissions of the country. The removals of carbon emissions by forests are estimated at 61% of the total emissions of the country. Due to the role of terrestrial ecosystems as a source and sink of emissions land is positioned as a key point of intervention for climate change mitigation and adaptation as also reflected in Botswana's Nationally Determined Contributions (NDC).

Land-based mitigation options rank among the most cost-effective opportunities to sequester carbon emissions. Economic evaluations of various climate change mitigation alternatives show that capturing carbon through restoring degraded lands (including degraded-forest) is a cost-effective option that offers multiple co-benefits.

Sustainable Development Goal 15, 'Life on Land', and its target 15.3 on Land Degradation Neutrality (LDN) is a unique opportunity for countries to curb the growing threats of land degradation and to reap multiple socioeconomic benefits of LDN. Botswana has committed to set a national voluntary LDN target, establish an LDN baseline, and formulate associated measures to achieve LDN.

2. Economics of Land Degradation

2.1 National Overview

Land provides valuable ecosystem services for human well-being, but land degradation leads to a reduction in the provision of these services with significant social and economic costs to the country. The decline of ecosystem services can take different forms, including decline in food availability, soil fertility, carbon sequestration capacity, wood production, groundwater recharge, among others.[1,2,3]

The costs of land degradation for the country are measured in terms of the changes in land productivity by considering two aspects: changes in land cover from a high-value biome to a lower-value biome (e.g. forest land converted to cropland); and the decline in ecosystem services provision within a certain land cover type due to degrading land-use practices (e.g. reduced cropland productivity over time).[2]

Table 1: Economics of land degradation (LD) in Botswana[2,5,6]

Total annual cost of land degradation (base year 2007)	353 m USD
Cost of LD due to the decline in provisioning ecosystem services (as % of total cost)	73%
Cost of land degradation as % of GDP	3.2%
Cost of action (30-year planning horizon)	6.8 bn
Cost of inaction (30-year planning horizon)	41.8 bn
Returns on action against land degradation per dollar invested	6 USD
GDP 2016 (USD)	15.3 bn
Share of Agriculture in total GDP 2015	2%
GDP per capita 2016 (USD)	6,788

Note: m = million; bn=billion

In Botswana, the total annual cost of land degradation is estimated at 353 million United States Dollars (USD) — this is equal to 3.2% of the country's Gross Domestic Product (GDP).[i] Moreover, a considerable share of the costs of land degradation (73%) is due to the decline in provisioning ecosystem services (e.g. food availability, wood production, etc.), which has a significant impact on the population of the country (see table 1). The remaining share refers to the regulating ecosystem services (e.g. carbon sequestration, water regulation flows), which has an impact not only at the country level, but also on the regional and global scale due to the transboundary nature of these services that provide incentives for international cooperation.[ii]

Land degradation often stems from land-use decision-making processes driven by high market prices of specific ecosystem services — for example, food. In this context, land-use decisions may largely neglect the significance of other ecosystem services for which no markets exist, but which are also of high value to the society.[4]

Given the significant economic burden of land degradation, research has also focused on the study of the costs of action against land degradation through restoration and sustainable land management practices. These costs of action are often compared to the costs of inaction — the latter being derived from the projection of past degradation rates to the future.

In this context, a recent global assessment on land degradation[2] shows that for Botswana the returns on taking action against land degradation versus inaction are estimated at 6 USD for every dollar invested in reverting degraded land,[iii] underlining the strong economic incentives for bold actions on achieving LDN.

2.2 Regional and Global Overview

For Africa, the total annual costs of land degradation are estimated at 65 billion USD, which amounts to about 4% of the total GDP of the region. This share, however, varies considerably among countries.

On a global scale, the costs of land degradation are estimated at about 297 billion USD.[iv] As illustrated in table 2, Asia accounts for the largest share of the total global cost of land degradation (28%), followed by Africa (22%), Latin America and the Caribbean (20%), Northern America (12%), Europe (12%) and Oceania (5%).

Assessments of the cost of action against land degradation versus the cost of inaction show that the latter significantly outweighs the former. On the regional level, the costs of action for Asia are estimated at 976 billion USD, whereas the costs of inaction equal about 4.3 trillion USD[iii] (see table 2). The regional breakdown reveals social returns ranging from about 4 USD in the case of Asia, Africa, and Latin America and the Caribbean, and up to 6 USD in Europe, Northern America, and Oceania (see table 2).

On a global level, estimates show costs of action in the amount of 4.6 trillion USD, whereas the costs of inaction equal about 23.2 trillion USD.[iii] That means that the expected social returns of taking action are estimated at about 5 USD for every dollar invested in the restoration of degraded land and sustainable land management.

Table 2: Cost of land degradation at regional[v] and global scale[(2)]

Regions	Cost of Land Degradation (LD)		Cost of action and inaction		
	Total annual cost of LD (in billion USD; year 2007)	% of the annual cost of LD in the world total	Cost of action in 30-year time horizon (in billion USD)	Cost of inaction in 30-year time horizon (in billion USD)	Returns on action against LD (in USD)
Africa	65.1	22%	731	3,112	4
Asia	84.3	28%	976	4,359	4
Europe	35.1	12%	945	5,652	6
Latin America and the Caribbean	60.6	20%	789	3,107	4
Northern America	36.2	12%	759	4,599	6
Oceania	15.4	5%	407	2,442	6
World Total	296.7	100%	4,606	23,272	5

Note: Due to rounding, some figures in the text may not correspond with those reported in the tables or the sum of separate figures.

3. Land and Climate Change

Land plays an important role in the global carbon cycle because terrestrial ecosystems continuously exchange carbon fluxes with the atmosphere. The exchange is two-way: on the one hand, terrestrial ecosystems sequester carbon through natural processes, and on the other hand, they release carbon through respiration as well as anthropogenic activities related to agriculture, forestry, and other land use. The role of terrestrial ecosystems as a source and sink of emissions positions land as a key element of intervention for climate change mitigation and adaptation.

3.1 National Overview

Land as a Source of Emissions

The Agriculture, Forestry and Other Land Use (AFOLU) sector is an important source of Greenhouse Gases (GHG). Figures vary on how this sector contributes to the national emission inventories across countries. In Botswana, the AFOLU sector is responsible for 9% of the total emissions of the country (see table 3).

Within Botswana's AFOLU sector, the larger share of the emissions is from Forestry and Other Land Use (FOLU) subsector (50%). Emissions from Agriculture plays a minor role.

Table 3: Land as a source and sink of emissions[7] in Botswana (year 2012)

Sectors	GHG (Mt-CO_2e)	%
Sources total	26.53	100.0
AFOLU sources	15.62	58.9
Agriculture	2.30	8.7
FOLU net sources	13.32	50.2
Other sectors	10.91	41.1%
FOLU net sinks	-16.21	
FOLU total	-2.88	
Total net emissions with FOLU	10.3	
Total net emissions per capita with FOLU (in tonnes of CO2e)	5.0	

Note: GHG=Greenhouse Gases; Mt-CO_2e = million tonnes of carbon dioxide equivalent.

Land as a Carbon Sink

Terrestrial ecosystems also play an important role as carbon sinks, offsetting emissions released by various sectors of the economy. The removals of carbon emissions through forest are estimated at 16.2 million tonnes of CO2 in 2010 for Botswana (see table 3). This is equal to 61% of the total emissions of the country. The potential carbon storage per hectare (ha) and year varies considerably depending on the type of biome, the practice on the ground, and the prevalent climate.[8] The mean rate of sequestration is estimated at 1.5 tonnes of carbon (tC)/ha per year, where 0.5 tC is from soil organic carbon sequestration and an additional 1.0 tC from biomass.[vi][8]

In general, terrestrial ecosystems have a significant potential for carbon sequestration linked to the cumulative historic loss of carbon from land-use change. The capacity of land to further store carbon is crucial for bridging the time until new technologies to tackle climate change are adopted on a larger scale.[8]

The UNCCD Science Policy Interface developed the Land Degradation Neutrality (LDN) conceptual framework[9], which refers to three hierarchical policy responses to achieve LDN that go hand in hand with climate actions: i) **avoid** further land degradation by halting conversion of land types, for example, not converting forest land into agricultural land; ii) **reduce** the impact of land-intensive activities by using Sustainable Land Management (SLM) practices, so that less carbon is released from soil, crops and other biomass; and iii) **reverse** land degradation, for example, by restoring or rehabilitating land that has lost productivity.[9]

Land as a cost-effective mitigation option

Within the various climate change mitigation alternatives, land-based mitigation options rank among the most cost-effective opportunities to sequester or avoid carbon.[10] The cost of capturing one tonne of carbon (tC) by restoring degraded land is estimated at 51 USD per tC; while alternative engineering techniques such as 'gas plant capture and carbon sequestration' have a cost of 306 USD per tC (see table 4). Moreover, land-based mitigation options are estimated to be more cost-effective than other widely-used strategies to avoid emissions — for example, the substitution of fossil fuels by solar or wind energy.[10,11]

Moreover, it is worth noting that the option of storing carbon in terrestrial ecosystems by restoring land generates several other co-benefits that should also be factored in. They include for instance improving soil health, reducing food insecurity and enhancing water regulation flows.

Table 4: Cost of carbon sequestration using different techniques.[vii] [10,11]

Technique/Strategy	Cost of abatement USD per tC
Second-generation biofuels	25
Pastureland afforestation	51
Degraded-land restoration	51
Degraded forest restoration	61
Agriculture conversion	128
Biomass co-firing power plant	153
Coal-C capture and sequestration	229
Gas plant capture and sequestration	306
Solar VP[viii]	92
Wind[viii]	76

Note: tC= tonne of Carbon

Land matters play a key role in developing climate change mitigation and adaptation policies. The following box presents the leading land-based mitigation and adaptation strategies considered in Botswana's Nationally Determined Contributions.

Box. Highlights on Climate Change and Land from Botswana's Nationally Determined Contributions[12]

Land-based mitigation plans

Agriculture: Promote agriculture

Land-based adaptation priorities

Climate Smart Agriculture: Improve genetic characteristics of the livestock breed (i.e. Musi breed); Improve livestock diet through supplementary feeding; Switch to drought resistant, high temperature tolerant and short maturity crops

Mitigation and adaptation policy frameworks: Climate Change Policy and Institutional Framework; National Water Master Plans; Sustainable Land Management; The Second National Communication; National Adaptation Plan (NAP)

3.2 Regional and Global Overview[ix]

In Africa, 63% of the total emissions released were from the Agriculture, Forestry and Other Land Use (AFOLU) sector in the year 2010. This percentage represents 2,610 Mt-CO2e out of the total 4,109 Mt-CO2e emitted in the region (see table 5). In the AFOLU sector, the 'Forestry and Other Land Use (FOLU)' subsector accounts for 44% (or 1,816 Mt-CO2e), while the 'Agriculture' subsector is responsible for 19% (or 794 Mt-CO2e) of the total emissions from the region.

At a global level, it is estimated that the AFOLU sector is responsible for 23% of the GHG emissions, which is equal to 11,380 Mt-CO_2e (see table 5). Breaking down the AFOLU sector into 'Agriculture and 'FOLU' shows that the majority of emissions come from the latter subsector with a total amount of 6,304 Mt-CO_2e; while Agriculture emitted 5,075 Mt-CO_2e.

Regarding the regional contributions to the global emissions of the AFOLU sector, green-house gas (GHG) inventories report that the Asia region is the leading contributor of global AFOLU emissions. Asia is responsible for 35% of global AFOLU emissions, followed by Latin America and Africa which are responsible for 24% and 23% of emissions respectively. Table 5 displays further details of the regional contributions of the AFOLU sector in relation to the total global emissions as well as the regional breakdown for the Agriculture and FOLU subsectors.

Evidence also shows that the global forest ecosystems alone removed 3,234 Mt-CO_2e from the atmosphere in the year 2010 (see table 5). More generally, out of the total global carbon emissions to the atmosphere by human activities, an estimated 42% are accumulated in the atmosphere; another 23% is sequestered by the oceans; and the remaining 34% is attributed to sequestration by terrestrial ecosystems,[10] highlighting the essential role of land-based ecosystems to mitigate climate change.

Table 5: Regional[v] and global emissions/removals from the Agriculture, Forestry and Other Land Use (AFOLU) sector and related indicators[13]

Regions	Sources total		AFOLU Net sources		Agriculture		FOLU net sources		Forest net sink		Total emissions per capita
	Mt-CO_2e	in %	Mt-CO_2e	in %	Mt-CO_2e	in %	Mt-CO_2e	in %	Mt-CO_2e	in %	Mt-CO_2e
Africa	4,109	8	2,610	23	794	16	1 ,816	29	-159	5	3.8
Asia	23,421	47	3,974	35	2,262	45	1,712	27	-936	29	5.4
Europe	8,268	17	875	8	567	11	308	5	-847	26	10.1
Latin America and the Caribbean	4,838	10	2,724	24	896	18	1,828	29	-545	17	7.2
Northern America	7,711	16	752	7	406	8	346	5	-494	15	21.0
Oceania	1,001	2	445	4	150	3	295	5	-253	8	20.7
World total	49,349	100	11,380	100	5,075	100	6,304	100	-3,234	100	6.7

Note: Mt-CO2e = million tonnes of carbon dioxide equivalent; FOLU= Forestry and Other Land Use.

4. Ongoing Projects and Programmes

To illustrate land-based approaches, the following section features some of the ongoing projects and programmes supported by national and international organizations.[x]

Managing the Human-wildlife Interface to Sustain the Flow of Agro-ecosystem Services and Prevent Illegal Wildlife Trafficking in the Kgalagadi and Ghanzi Drylands. The objective of the project is to promote an integrated landscape approach to managing Kgalagadi and Ghanzi drylands for ecosystem resilience, improved livelihoods and reduced conflicts between wildlife conservation and livestock production. Funding Source: GEF Trust Fund. Implementing Agency: United Nations Development Programme. GEF Project Grant/Co-financing Total: 6.00 million USD/22.50 million USD. Link: for further information click here.

Using Sustainable Land Management (SLM) to Improve the Integrity of the Makgadikgadi Ecosystem and to Secure the Livelihoods of Rangeland Dependent Communities. The purpose of the project is to mainstream SLM in rangeland areas of the Makgadikgadi Sub-region productive landscapes for improved livelihoods of rangeland dependent communities. Funding Source: GEF Trust Fund. Implementing Agency: United Nations Development Programme. GEF Project Grant/Co-financing Total: 792.832 USD/6.80 million USD. Link: for further information click here.

Mainstreaming Sustainable Land Management (SLM) in Rangeland Areas of Ngamiland District Productive Landscapes for Improved livelihoods. The objective of the project is to build institutions, policies and markets for mainstreaming SLM in managing rangelands in Ngamiland Botswana. Funding Source: GEF Trust Fund. Implementing Agency: United Nations Development Programme. GEF Project Grant/Co-financing Total: 3.08 million USD/28.60 million USD. Link: for further information click here.

Interventions to Improve the Food Security of Communities in Wildlife Dominated Landscapes in Northern Botswana. Financier: Technical Cooperation Programme. Total Budget: 496.000 USD. Link: for further information click here.

5. Opportunities – The Way Forward

The 2030 Agenda for Sustainable Development offers opportunities for countries to curb the growing threats of land degradation and to reap multiple socioeconomic benefits of LDN. Sustainable Development Goal 15 'Life on Land' and its target 15.3 on Land Degradation Neutrality (LDN) particularly encourage countries to 'combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world by 2030'.

In October 2015, UNCCD country Parties decided that striving to achieve SDG target 15.3 is a strong vehicle for driving the implementation of the Convention and requested the UNCCD secretariat and appropriate UNCCD bodies to take the initiative and invite other relevant agencies and stakeholders to cooperate on achieving SDG target 15.3 (decision 3/COP12).

To achieve SDG target 15.3, the following five elements have been identified:

(1) **LDN targets**: setting targets and establishing the level of ambition;
(2) **Leverage and impact:** catalyzing the multiple benefits that LDN provides from climate change mitigation and adaptation to poverty reduction;
(3) **Partnerships and resource mobilization**: rationalizing engagement with partners, overcoming fragmentation and systematically tapping into increasing finance opportunities, including climate finance;
(4) **Transformative action**: designing and implementing bold LDN transformative projects that deliver multiple benefits; and
(5) **Monitoring and reporting**: tracking progress towards achieving the LDN targets.

As of April 2018, 116 countries have made the commitment to translate the global goal of achieving LDN by 2030 into national action by setting national voluntary targets with the support of the LDN Target Setting Programme (LDN TSP) – a programme established by the Global Mechanism in collaboration with the UNCCD secretariat and supported by various partners. Botswana is among the countries that have committed to set a national voluntary LDN target, establish an LDN baseline, and formulate associated measures.

The LDN targets provide Botswana with a strong vehicle for fostering coherence of policies and actions by aligning the national LDN targets with measures from the Nationally Determined Contributions and other national commitments. Investing in LDN also accelerates the advancement of other SDGs due to the close linkages between land and other goals and targets, such as: Goal 1 (No poverty), Goal 2 (Zero hunger), Goal 5 (Promote gender equality), Goal 6 (Clean water and sanitation), Goal 8 (Decent work and economic growth), and Goal 13 (Climate action).[14]

Regarding SDGs in general, Botswana has embraced sustainable development as its development approach, and is fully committed to the 2030 Agenda for Sustainable Development, its principles, goals, targets and indicators. Botswana's SDGs implementation process can be captured in four distinct phases: First, a strong campaign to ensure ownership of SDGs at all levels. Second, the integration of the goals into national development frameworks, programs and sector plans. Third, establishment of institutional mechanisms for their effective coordination. Fourth, a plan of action (Roadmap) to rollout SDGs. Simultaneously, the country embarked on developing a sustainable development framework that will set out how the country will implement all its programmes using a sustainable development approach.[15]

6. Country Studies

As further readings of this country profile, the current section offers additional country studies that may be useful in making the case for investing in Land Degradation Neutrality[x].

National Action Programme of Botswana. — (2006).

A Case Study of Botswana's Kalahari: Assessing the Socio-Economic and Environmental Dimensions of Land Degradation. — Favretto, N. et al. (2015).

Assessing the Socio-economic and Environmental Dimensions of Land Degradation. — ELD. (2014).

Making Land Management More Sustainable: Experiences Implementing a New Methodological Framework in Botswana. — Perkins, J. et al. (2011).

Reorienting Land Degradation towards Sustainable Land Management: Linking Sustainable Livelihoods with Ecosystem Services in Rangeland Systems. — Reed, M.S. et al. (2014).

Land Degradation Assessment in Southern Africa: Integrating Local and Scientific Knowledge Bases. — Stringer, L. C. et al. (2006).

7. Supplementary Information

7.1 Glossary

This subsection provides a brief description of the indicators presented above.

Annual Cost of Land Degradation

The UNCCD defines land degradation as 'any reduction or loss in the biological or economic productive capacity of the land resource base. It is generally caused by human activities, exacerbated by natural processes and often magnified by and closely intertwined with climate change and biodiversity loss.' In the study featured here on the cost of land degradation, Nkonya and colleagues[2] approach the study of land degradation by investigating declines in land productivity in the past due to: i) land cover changes from a high value-biome to a lower-value biome, such as the conversion from forest land into cropland; and ii) declines in the ecosystem services provision within a land cover type due to the use of degrading practices.

Cost of Action

The costs of action are estimated by taking into account the following two cost categories: i) initial fixed investments and maintenance expenses that are related to the restoration of the high-value biome until it reaches biological maturity; ii) the inclusion of the opportunity cost given by the forgone benefits from the lower-value biome under replacement. The analysis of the cost is carried out over a planning period of 30 years.[2]

Cost of Inaction

Cost of inaction represents the 'business as usual' (BAU) scenario. In this case, future land degradation trends are assumed to continue along patterns similar to those of the past. The total costs of inaction are calculated by the sum of future annual costs of land degradation over a 30-year planning horizon - where land degradation is captured by land cover changes from a high-value biome to a lower-value biome.[2]

Returns of Action

Nkonya and colleagues[2] measure the benefit of action as the difference between the cost of inaction minus the cost of action. When this difference is positive, then taking action is justified in economic terms. Moreover, the figures on returns on investment are calculated as the cost of inaction over the cost of action. For further methodological details on the annual cost of land degradation, cost action, inaction and returns on action, see Nkonya and colleagues.[2]

Sustainable Land Management

SLM is the use and management of land resources– soil, water, animals and plants – for the production of goods to meet changing human needs, while ensuring the long-term productive potential of these resources and the maintenance of environmental functions. Degradation of water, soil and vegetation as well as emissions contributing to climate change can be limited through SLM practices that simultaneously conserve natural resources and increase yields.

7.2 Notes

i. Estimates of the economic costs of land degradation illustrated in this country profile are based on the work of Nkonya and colleagues.[2]

ii. The relationship between food production (provisioning ecosystem service) and the supply of other ecosystem services often depicts important trade-offs.[16]

iii. These figures correspond to a 30-year planning horizon in terms of quantification of costs and benefits.

iv. Global estimates of the costs of land degradation vary to a great extent depending on the study. A study led by the Economics of Land Degradation Initiative[4] estimates the global costs of land Degradation at 9.6 trillion USD. In this regard, the figures presented in the current publication are conservative.

v. Country grouping is based on geographic regions as defined by the United Nations Statistics Division (see: https://unstats.un.org/unsd/methodology/m49/.)

vi. This is a global average coefficient used as a default in this publication, and it should be replaced with that of national level when available. Note also that one tonne of carbon (C) is approximately equivalent to 3.66 tonnes of carbon dioxide (CO2).

vii. This version of the country profile uses the 'Global GHG Abatement Cost Curve' as default information.[11] National GHG Abatement Cost Curve should be used when available.

viii. Although solar and wind power are not sequestration techniques, but rather technologies that avoid (or reduce) emissions from the source, figures still show how competitive is restoring degraded land in comparison with solar or wind abatement alternatives.

ix. Figures related to Greenhouse Gases in this section are retrieved from FAOSTAT.[13]

x. The information on projects and programmes presented in this section has been obtained from the websites of the following organizations: Climate Investment Funds, Food and Agriculture Organization of the United Nations, Global Environment Facility, United Nations Development Programme, United Nations Environment Programme and the World Bank.

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7.4 Photos

Cover "Tree Okavango Delta" by Walter Schärer is licensed under Creative Commons BY 2.0
p.5 http://pexels.com
p.7 Central District of Botswana. Source: Department of Forestry and Range Resources of Botswana.
p.8 http://pexels.com
p.10 South East District of Botswana. Source: Department of Forestry and Range Resources of Botswana.
p.12 Gantsi District of Botswana. Source: Department of Forestry and Range Resources of Botswana.
Back cover "Waterhole" by Matthijs Strietman is licensed under Creartive Commons BY 2.0

7.5 About this Publication

This country profile is intended to provide a brief overview of recent studies, assessments and indicators that demonstrate multiple benefits of taking bold actions to achieve Land Degradation Neutrality.

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United Nations Convention to Combat Desertification

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