THE ECONOMICS OF LAND DEGRADATION

Fact Sheet

The costs of land degradation and benefits of sustainable land management in Africa

A selection of studies conducted by the ELD Initiative

Closing the information gap

Africa is particularly vulnerable to land degradation and desertification (LDD), and it is the most severely affected region worldwide. Desertification has an impact on about 45% of Africa's land area. In dryland Africa, many people already suffer from poverty, food insecurity, and high mortality rates, among other hardships. This situation is exacerbated by land degradation and desertification, often leading to further impoverishment, migration, and conflict (UNCCD, 2012; Jones et al., 2013).

Due to land degradation and desertification, soils lose their structure and fertility, negatively affecting crop yields and vegetation for livestock browsing and, in turn, local livelihoods and regional as well as national economies. Furthermore, LDD reduce the ability of the entire ecosystem to provide other valuable goods and services, such as fuel wood and timber production, wildlife habitat, medicinal and food plants, carbon sequestration, groundwater recharge, hunting opportunities, and tourism activities (Solh, 2009; UNCCD, 2013). In addition, land degradation and soil erosion can impact the wider region, causing dust storms, changing stream flows, polluting drinking water, and causing siltation in water bodies. Impacts can be felt across borders and even on a global level, when LDD affects the climate and/or political stability (UNCCD, 2011).

To this day, much of the related scientific literature still lacks empirical underpinnings, quantifying the economic loss caused by LDD and assessing the cost of inaction, the cost of action, as well as benefits of action against the current development. However, up-to-date, relevant and reliable information about land degradation is needed at regional and continental scales in order to protect, sustainably manage and eventually restore soil resources in Africa and on a global scale, especially given the uncertainties of climate change and the impacts of increasing human pressures (Dewitte et al., 2012). The ELD Initiative works on closing this information gap.

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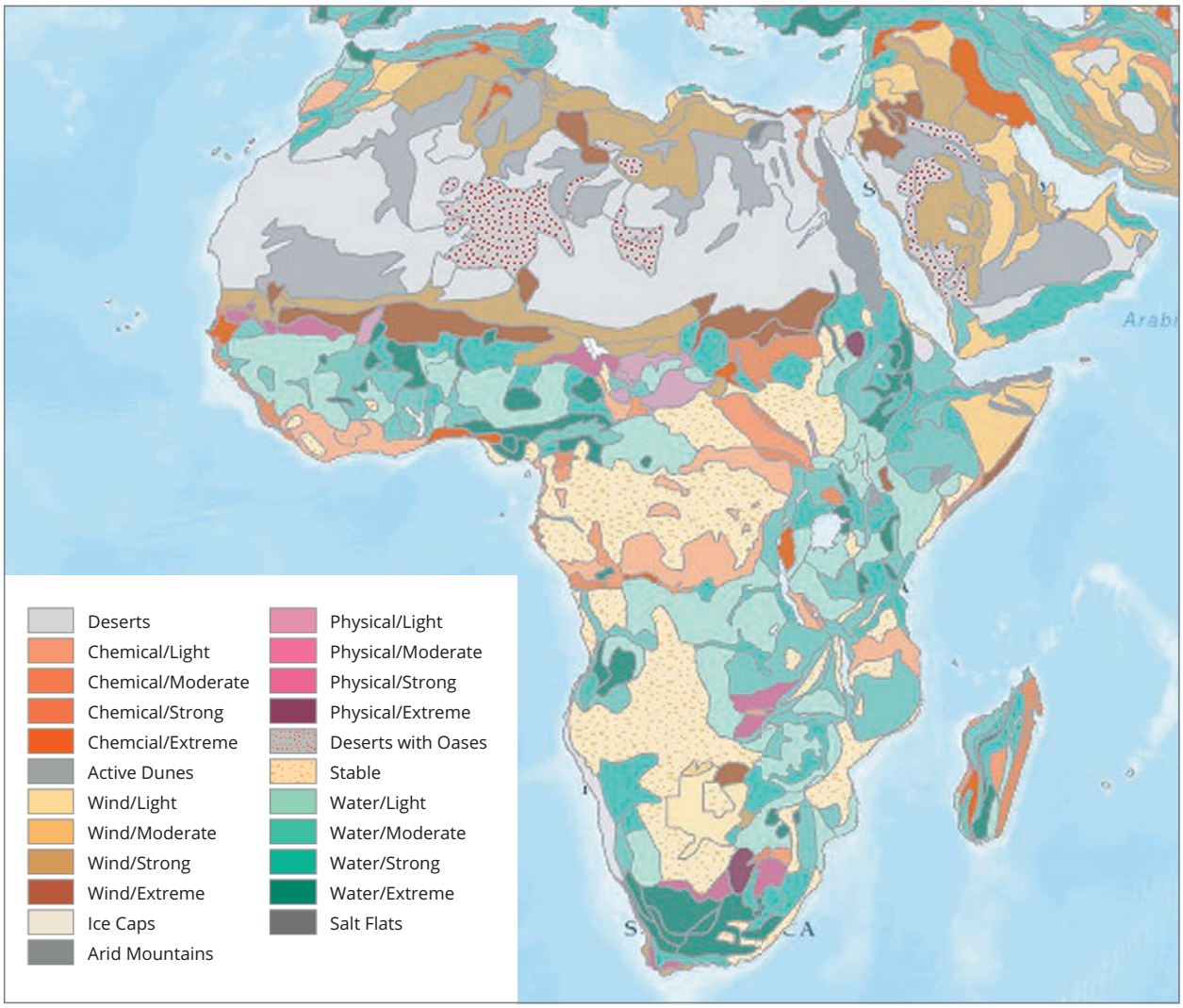
The aim of the ELD Initiative is to provide a scientifically sound approach to contribute to the solution of the problem of progressing land degradation by providing answers to vital questions:

- How high are the social and economic costs of land degradation?
- What are the short- and long-term benefits of applicable sustainable land management approaches?
- What actions are necessary to address the problem effectively and efficiently, and what specific measures need to be implemented?

The ELD Initiative seeks to draw the attention of public and private decision-makers from all levels to the socio-economic aspects of land degradation and to ensure that they are integrated into decision-making processes for improved natural resource management.

FIGURE 1

Soil degradation in Africa



Source: https://databasin.org/maps/new#datasets=7254137cabb042298cae0b769cba589f

Estimating the benefits of actions against soil erosion

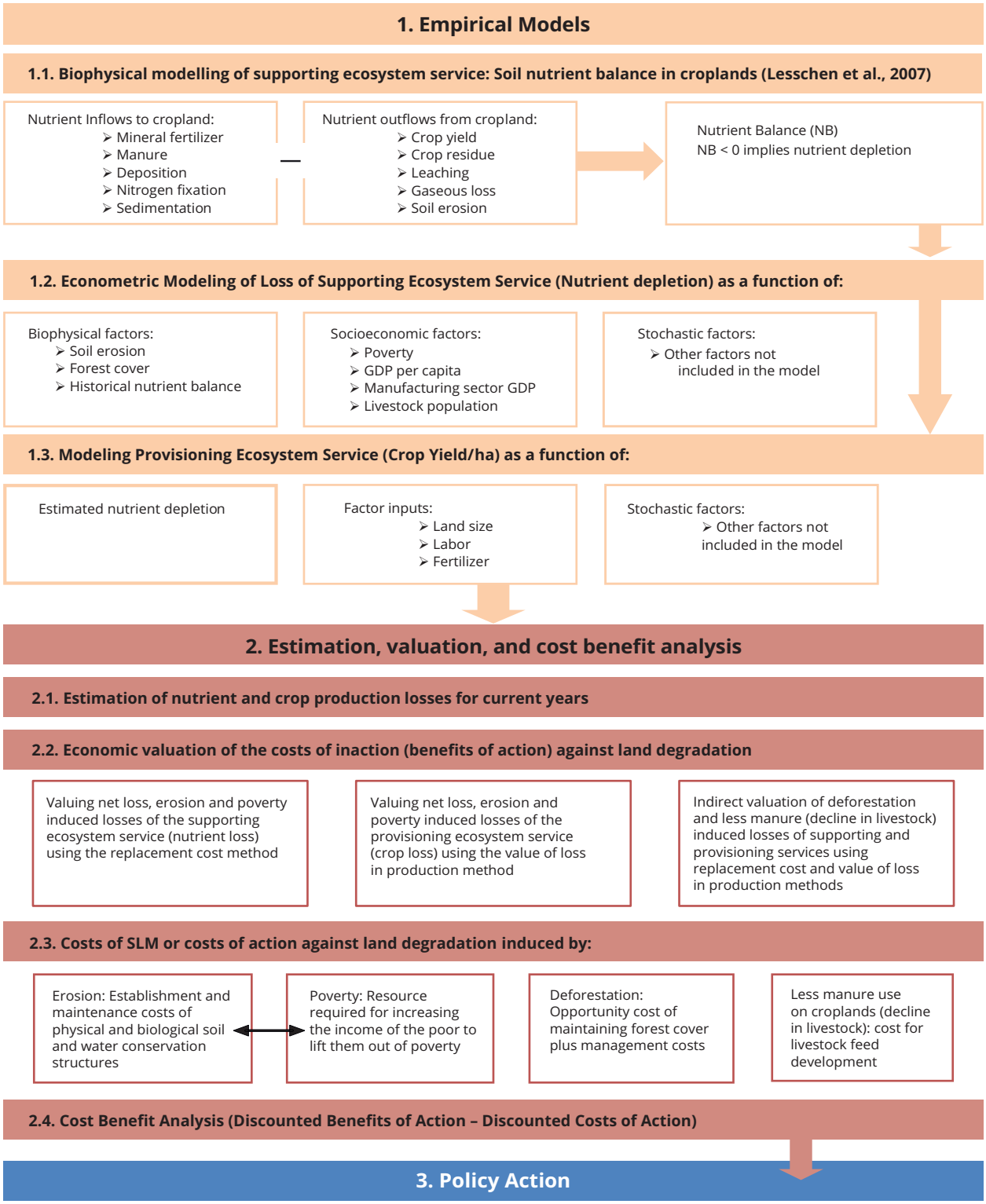
In October 2015, the ELD Initiative together with UNEP has published the report "The Economics of Land Degradation in Africa". The overarching aim was to assess the costs of inaction and the benefits of taking action. By providing continental level empirical analysis of a cropland area of 105 million hectares (accounting for 45% of total arable land in the continent) across 42 countries in Africa over a span of 15 years (starting from 2016), the fundamental objective was to align empirical data and economic valuation to help inform policy decisions in the future.

The goal of this cost-benefit analysis is to show how taking action against soil erosion induced nutrient depletion can potentially be combined with poverty reduction measures and hence harness the benefits of sustainable natural resource management for increasing agricultural productivity, and reducing food insecurity and poverty in the region.

The conceptual framework of the report follows a three-step model (see *Figure 2*). In the first part, econometric and biophysical modelling is used to elaborate the soil nutrient balance in croplands, the loss of supporting ecosystem service (average losses of Nitrogen, Phosphorous and Potassium (NPK) from croplands) and the provisioning ecosystem service (crop yield/ha).

FIGURE 2

Conceptual Framework



The second part provides estimations and valuations of costs of inaction, costs of action (implementing sustainable land management) and the derived benefits, concluding with a cost benefit analysis. In the final part, the information obtained is used to provide recommendations for policy actions.

Benefits of sustainable land management outweigh the costs

The results of the modelling show a **net NPK depletion of 5.2 million tons per year or 50 kg/ha/year**. Thereby, the average nutrient loss shows a statistically significant, positive correlation with national level socioeconomic and biophysical factors, such as poverty gap[1,2], and soil erosion. Statistically significant, negative correlations were observed for three factors: manufacturing GDP, livestock population[3], and forest cover.

Costs of inaction

The loss of supporting ecosystem services will cost the 42 countries under evaluation about 278 million tons of cereals per year. In present value terms, **the cost of inaction against soil erosion induced nutrient depletion to all countries accounts for about 4.6 trillion PPP[4] USD over the next 15 year.** This is equivalent to about 127 billion USD per year. The cost of inaction against poverty induced land degradation accounts for about 665 billion PPP USD in present value, which is equivalent to 11.3 billion USD per year.

Costs of action

The present cost for establishing and maintaining sustainable land management structures on about 105 million hectares of cereal croplands, defined as the **cost of action against soil erosion induced nutrient depletion, was estimated at about 344 billion PPP USD** with an annuity value of about 9.4 billion USD. In addition, reducing poverty and achieving a zero poverty gap in all countries by the year 2030 and hence reducing poverty induced nutrient depletion requires the continent to increase the income level of the poor to at least the poverty line level of income[5]. This requires resources accounting for about **764 billion PPP USD in present value as the cost of action against poverty and poverty-induced nutrient depletion**, or about **25.2 billion USD** per year.

Benefits of action and net present value

For the 42 countries in total, **the benefits of action against nutrient depletion caused by soil erosion account for about 2.83 trillion PPP USD**, or 71.8 billion USD per year. Thus, taking action against soil erosion from the 105 million hectares of croplands in the 42 countries over the next 15 years will generate benefits of about **2.48 trillion PPP USD or 62.4 billion USD per year in net present value.**

The study showed that African countries have the opportunity to address the problem of national-level food insecurity by the year 2030, if they take optimal action against soil nutrient depletion in agricultural lands cultivated with cereals, by investing in sustainable land management technologies.

The benefits of action against poverty induced nutrient depletion can cover up to 57.6% of the full cost or income required in the next 15 years to lift all the poor population to an income level equal to the poverty line.

Policy recommendations

- Integrate poverty reduction measures into actions against soil erosion induced nutrient depletions;
- Harness the benefits of sustainable natural resource management for increasing agricultural productivity, reducing food insecurity and poverty in the region;
- Invest in sustainable land management technologies to take action against soil nutrient depletion in agricultural lands cultivated with cereals and thereby address the problem of food security on a national level by 2030.

Sustainable land management pays off for African countries

Additionally to the comprehensive report on Africa, the ELD Initiative together with its partners conducted several studies in selected African countries, including Sudan, Kenya, Namibia, Botswana, Mali and Ethiopia. In these case studies, the costs and benefits of different sustainable land management (SLM) practices have been investigated. The SLM methods include

1 *Poverty gap is the mean shortfall of the total population from the poverty line (counting the non-poor as having zero shortfall), expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence.*
2 *Every 1% increase in poverty gap causes on average a depletion of 48 kg/ha/year of NPK nutrient and vice versa*
3 *For every 1% increase in livestock population, nutrient losses decreases by 0.0462 kg/ha/year.*
4 *Purchasing Power Parity*
5 *$ 1.25 a day (PPP)*

agroforestry, land restoration, terracing and manuring, but also practices to combat bush encroachment. The evaluation of the cases mainly based on cost benefit analyses. In case of Botswana, a Multi-Criteria Decision Analysis (MCDA) was employed. In each study, potential land use scenarios are developed and compared to the baseline ("business as usual") scenario.

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Botswana

The ELD case study in Botswana used a multi-criteria decision analysis (MCDA) approach to identify key ecosystem service trade-offs associated with four different land uses in Botswana's Kalahari rangelands, namely communal livestock grazing, private cattle ranches, private game ranches and wildlife management areas. Thereby the approach provides an interdisciplinary framework that allows the integration of monetary based techniques with an analysis of non-monetary ecological and cultural values, ranking alternative options. In this study, the ecosystem services provided by the different land uses included food, fuel, construction material, ground water, genetic diversity, climate regulation, recreation and spiritual inspiration.

Findings suggest communal livestock grazing to deliver the widest range of these ecosystem services. The eligibility of this land use is mainly linked to the provision of commercial food production, but also the potential for wild food production, fuel, construction material, climate regulation and spiritual values.

Sudan

Gedaref State in Eastern Sudan was previously known as the food basket of the country. Over several decades, unsustainable agricultural practices that combined near-monocropping with low nutrient replenishment have led to significant degradation of soils, which are no longer able to sustain farmer livelihoods. The ELD study found that adopting an integrated sustainable land use and forest restoration scenario could reverse the current land degradation trend.

The results show that the net present value returns to society as well as to the individual farmer of intercropping *Acacia senegal* trees with sorghum crops is significantly higher than that of continuing pure sorghum cultivation over a 25-year time horizon. At the farmer level, benefits of using an intercropping system outweigh the investment and management costs between three to four years after their establishment.

Kenya

Food production in Kenya is suffering from low yields, partly due to land and soil degradation caused by poor land management practices. In this research, ELD and its partners worked with smallholder farmers in three counties in Western Kenya (Bungoma, Kakamega and Siaya) to examine the costs and benefits of different SLM practices, namely manuring, intercropping, agroforestry and physical terraces, that were already being used.

The results showed that manuring and intercropping deliver universal benefits quickly, and can be implemented with minimal initial outlay. Physical terraces and agroforestry, on the other hand, take longer to provide benefits, and the yield effects are smaller, but they deliver more ecosystem services to the wider public.

Mali

The majority of livelihoods in Mali are dependent on rainfed agriculture systems, which are vulnerable to events such as droughts, storms, and floods. The ELD research was conducted in the Kelka forest in the Mopti region, which is important for the provision of ecosystem services like maintenance of the hydrological cycle or carbon sequestration. To assess the potential contribution from agroforestry and reforestation initiatives to societal wellbeing, the intervention scenarios were compared to the present situation in the Kelka forest and economically valuated.

The study demonstrated that benefits of large-scale landscape restoration from reforestation and agroforestry largely outweigh the costs both at the local and global levels. Every invested USD may create a 6 USD benefit to local farmers and even a 13 USD benefit to global society due to improved ecosystem services and carbon sequestration.

Ethiopia

The Ethiopian highlands are favourable for rainfed agricultural activities, a main source of livelihood for about 87 per cent of Ethiopia's population and around 75 per cent of the country's livestock. The case study provides an assessment of the extent of land degradation and the costs and benefits of sustainable land management measures.

The results of the future crop production estimation analysis show that by continuing "business as usual", crop production would decrease by more than 5 per cent in a 30-year time period. In contrast, by applying sustainable land management practices on all sloping croplands, crop production would rise by 10 per cent.

Namibia

In Namibia, one of the major challenges is bush encroachment. It is defined as the invasion or thickening of woody species, resulting in a reduction of the natural grass vegetation, a decrease in biodiversity, and consequently a decrease in carrying capacity of cattle. An increasing spread of bush can have significant impacts on ecosystems and the services they provide. One option to control the increase of bush encroachment is the concept of de-bushing.

On a national scale, cost-benefit analysis suggest a programme of de-bushing to generate an estimated and aggregated net benefit of around USD 3.8 billion over 25 years when compared with a scenario of no de-bushing. For a regional study from the Otjozondjupa region, total net benefits are estimated to amount around USD 359 million.

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For more information regarding the work of the ELD Initiative, please visit the website:
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