



Zentrum für Entwicklungsforschung  
Center for Development Research  
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# ZEF

## Policy Brief No. 24

Economics of Land Degradation and Improvement  
A Global Assessment for Sustainable Development

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# MAIN FINDINGS

1. About 30% of the global land area, inhabited by 3.2 billion people, has experienced severe land degradation over the past three decades, causing an estimated annual cost of about 300 billion USD<sup>1</sup>.
2. Land degradation – defined as a long-term loss of terrestrial ecosystem services and biodiversity – occurred in all agro-ecologies around the world, both in developed and developing countries. However, sub-Saharan Africa accounted for about a quarter, therewith the largest share, of the global cost of land degradation.
3. Only about 46% of the cost of land degradation is borne by land users whereas the remaining 54% consist of off-farm costs. The global patterns and effects of land degradation strongly suggest that taking action to restore degraded lands requires strong collaboration of both local and international communities.
4. Land degradation on cropland and grazing lands shows that higher investment in the agricultural sector is needed. Investment in research and extension, as well as improved access to markets and other rural services are key drivers for agricultural production.
5. Despite an increased demand for milk and meat, livestock in developing countries remains a neglected sector. Yet, the sector holds a big potential for addressing poverty and achieving food and nutrition security.
6. The problems in high-income countries for both crops and livestock can be tackled by developing and promoting sustainable land management practices that minimize the use of fertilizer and agrochemicals and reduce heavy tillage practices.
7. The returns to taking action against land degradation are very high. Globally, each USD invested in the restoration of degraded lands yields five USD in return. Yet, investments in restoring degraded lands remain very low – especially in low-income countries. This study finds that improvement of the rule of law, policies that provide incentives for land investments, improved market access and secure land tenure are the key drivers for sustainable land management practices.
8. The recent rising prices for land as well as global attention surrounding the sustainable development goals (SDG) provide a conducive environment for taking action against land degradation. Such actions need to be guided by careful empirical evidence to formulate context-specific sustainable land management policies and cost-effective land investments. This study presents strong empirical evidence to help design appropriate actions against land degradation at international and national levels.

<sup>1</sup> Unless otherwise specified, all values are 2007 US dollars.



## Land degradation challenge and the United Nations Sustainable Development Goals

Sustainable Development Goal (SDG) no. 15 specifically focuses on the protection, restoration and promotion of sustainable use of terrestrial ecosystems and biodiversity. This focus is necessitated by the loss of biodiversity and by the pressure that human activities exert on the Earth's ecosystem services, which are the goods and services derived from the interconnected system of biological communities and their physical environment. One of the nine targets listed under Goal no. 15 aims to achieve a "land degradation-neutral world" by 2030. This is an ambitious target that requires concerted efforts to mobilize resources and investments in restoring degraded lands and preventing land degradation. These efforts need to be guided by careful empirical evidence of the costs and benefits of such investments. This study analyzes the cost of land degradation and the actions to be taken for combating it. Accordingly, we use the Total Economic Value (TEV)<sup>1</sup> approach to determine the cost of land degradation.

## Land degradation is a global problem – occurring in high and low- income countries and in temperate and tropical regions

Our findings, based on satellite imagery data, show that land degradation hotspots cover about 30% of the global land area, where about 3.2 billion people reside.

Grassland areas experienced the most severe degradation. A third of the global grasslands and a quarter of croplands and about 29% of forest mosaics with shrubs and grasslands

Unlike many past studies, the present study shows that land degradation is a global problem occurring in both developed and developing countries as well as in tropical and temperate regions (Figure 1). Ground-truthing data in our six case-study countries showed a high degree of congruity between satellite imagery data and community perceptions of land degradation, and an intermediate congruity on areas that experienced land improvement – suggesting our land degradation results are robust.

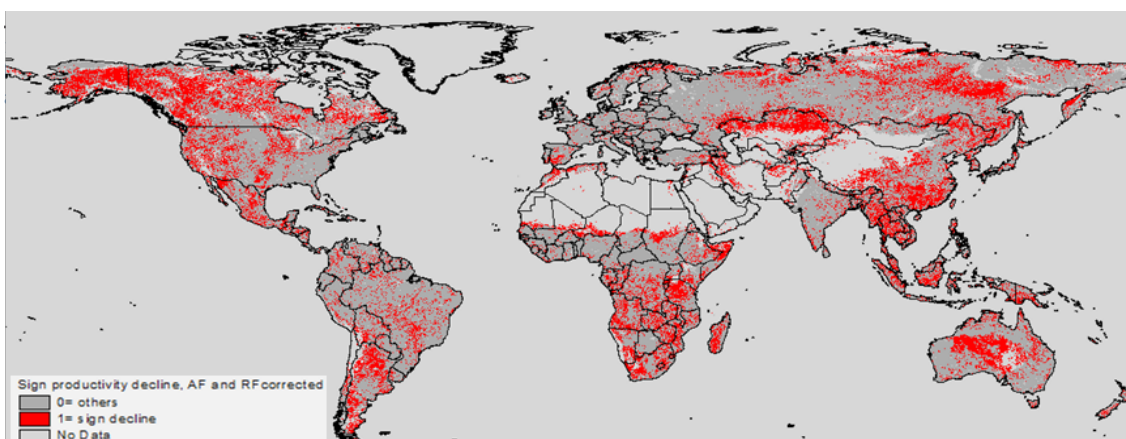


Figure 1: Land degradation hotspots (corrected for carbon fertilization and rainfall variability)



## Land degradation on static grazing lands

Global meat and dairy consumption is projected to increase by, respectively, 173% and 158% (from 2010) until 2050 – with even higher expectations for developing countries. In addition to this rising demand, development of the livestock sector is particularly important because livelihoods of 70% of the 1.4 billion people living below the international poverty line (1.25 USD per capita per day) depend on livestock (FAO 2009). Livestock production is the most common livelihood in the arid and semi-arid areas in developing countries and plays a key role in health and nutrition of the poor, e.g. through banking and socio-cultural exchanges. The cost of loss of milk and meat as a consequence of the degradation of grazing land is about 6.8 USD billion or about 1% of the global value of livestock production.

North America accounts for 55% of the total cost of degradation of grazing lands due to the high value of productivity of its livestock sector and the severity of degradation. The contribution of sub-Saharan Africa is only 12% due to its low livestock productivity. One of the constraints facing the livestock sector in sub-Saharan Africa and other low-income countries in other regions are limited public and private investments in livestock, although the sector often occupies a much larger area of land than cropland<sup>2</sup>. For example, sub-Saharan Africa countries allocated only 5% on average of their governments' budgets to livestock.

<sup>2</sup> For example grazing land covers 26% of the global ice-free land area (Steinfeld et al. 2006) compared to only 12% covered by crops (FAOSTAT 2012).

## Cost of land degradation of croplands

The loss of maize, rice and wheat production due to soil fertility mining is about 15 billion USD per year or 1.4% of the global crop output value. The land degrading management practices also result into a loss of carbon sequestration equivalent to 75% of the 57 USD billion total cost of cropland degradation of maize, rice and wheat. Contrary to expectations, we observed an inverse relationship between the adoption of soil fertility management practices and their profitability in sub-Saharan Africa and Bhutan. The major causes are poor knowledge among advisory service providers of integrated soil fertility management (ISFM)<sup>3</sup> practices and limited access to markets.

<sup>3</sup> ISFM is use of organic inputs, judicious amount of inorganic fertilizer and improved seeds.

**Box 1: Approach to assessment of cost of land degradation**  
To take into account the definition of land degradation, our analysis uses the Total Economic Value (TEV) approach, which assigns values to all ecosystem services and biodiversity. We used over 3,000 global data on ecosystem valuation compiled by the economics of ecosystem and biodiversity (TEEB) to assign values to biomes that experienced land degradation through land use and cover change (LUCC). Our study divided land degradation into two major groups: (a) land degradation due to LUCC – occurring when a high value biome is replaced with low value biome (e.g. deforestation in order to plant crops), and (b) land degradation arising from the use of land degrading management practices on land that did not experience LUCC.



## What are the major drivers of land degradation?

We conclude that the major factors affecting land degradation at the global level can be grouped into three factors: Governance; incentives for land users to invest in land improvement; and access to rural services. Results show a very strong association between land improvement and an increase in government effectiveness in developing countries (Figure 3). Similarly, secure land tenure was associated with higher adoption of sustainable land management in many of the case studies. However, in areas with poor markets and limited rule of law, secure land tenure may have little effect on the adoption of sustainable land management. Consistent with Tiffen's et al (1994) famous statement, referring to Kenya, "more people less soil erosion", higher population densities led to an increased adoption of sustainable land management practices. Yet, a favorable outcome was only found in areas with good governance and dynamic non-farm sectors.

Contrary to past studies suggesting a vicious cycle of poverty and land degradation, our results reveal land improvement in areas with severe poverty but with good governance and market access. The results suggest that improvement of government effectiveness and market access are key determinants in low-income countries. For example, even though Niger is one of the poorest countries in the world, the country's improvement of rule of law has led to significant land improvement (Figure 5 and Box 2). In high-income countries with good governance and

market access, other policies – e.g. aiming at the protection and restoration of land – are required.

## What is the cost of land degradation?

Based on analytical approaches (see Box 1) our results show that the annual cost of land degradation is about 300 billion USD per year or about 0.5% of the global GDP of 56.49 trillion USD in 2007. Sub-Saharan Africa accounts for 26% of the total global cost of land degradation due to LUCC, but 19% of the TEV of the major biomes' ecosystems (Figure 6). Latin America accounts for 23% of both the total cost of land and TEV of ecosystem endowment. Combined, 57% of the total cost of land degradation and 61% of TEV of ecosystem services endowment are found in only three regions – sub-Saharan Africa, Latin America and North America – accounting for 46% of the global land area and 26% of the global population. This further shows the global nature of land degradation and its large extent in areas with the three highest values of ecosystem endowment.

## Who bears the largest burden of the cost of land degradation due to Land Use and Cover Change?

The tangible local losses (mainly provisioning services) account for only 46% of the total cost of land degradation and the rest of the cost is due to the losses of ecosystem services (Figure 7), accruable largely to beneficiaries other than the local land users. This suggests that the global community incurs larger losses than the local communities experiencing land degradation.

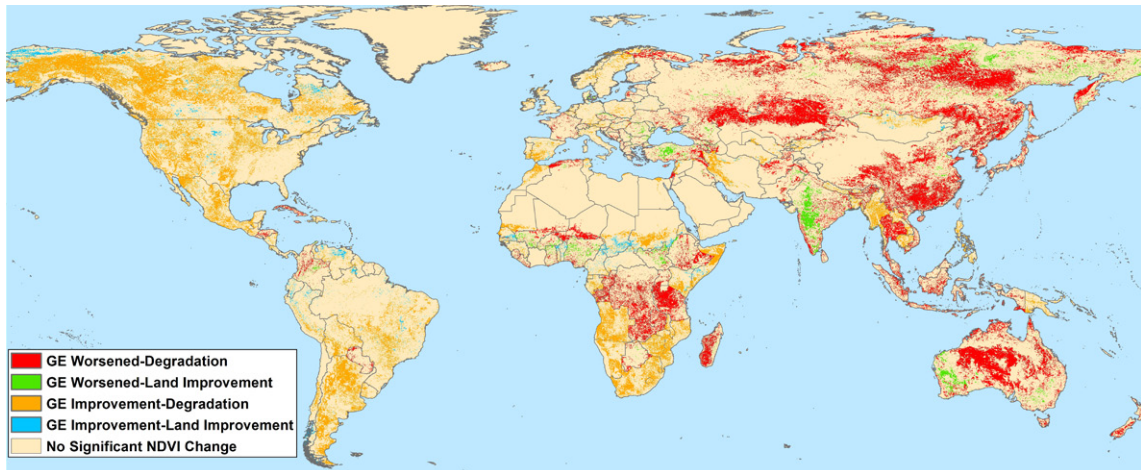


Figure 3: Relationship between land degradation/improvement and government effectiveness

### Does restoration of degraded lands pay off?

Our simulations show that, globally, returns on investments in action against land degradation are five USD per each USD invested. Yet, investments in combating land degradation and restoring degraded lands are limited. Inability to internalize the benefits from sustainable land management investment and tenure insecurity are drivers of low investment in sustainable land management.

### Conclusions and policy implications

- The Sustainable Development Goals (SDGs) and growing private

investments in land have created a conducive environment to redesign policies and strategies for addressing the significant loss of terrestrial ecosystems and biodiversity.

- This study provides empirical evidence to inform the formulation of cost-effective policies and strategies for the restoration of degraded lands and the prevention of land degradation at local and global levels. The study also provides a consistent conceptual framework for economic assessment of land degradation and restoration at subnational, national, regional and global levels.

- Land degradation due to land use and land cover change (LUCC)

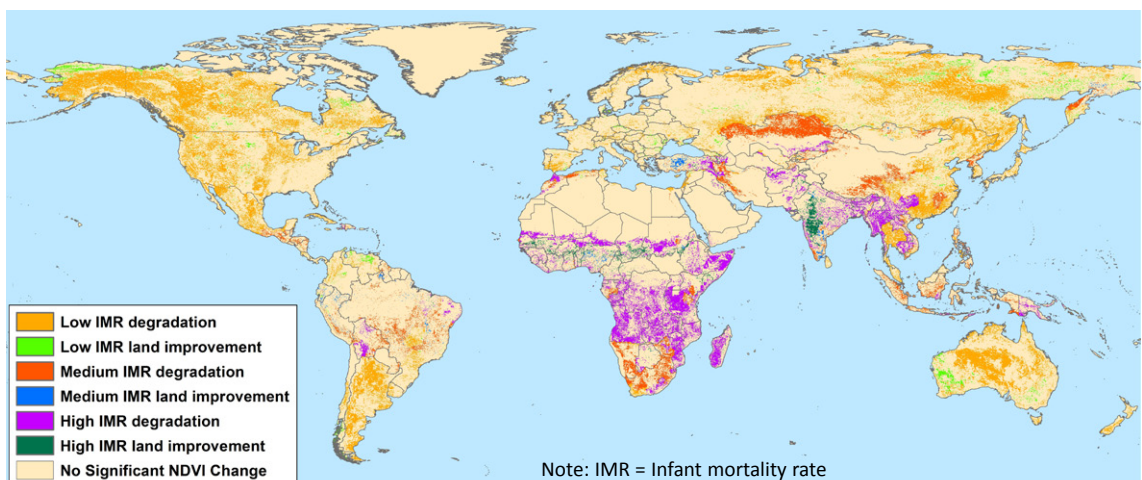


Figure 4: Relationship between land degradation and poverty

Note: IMR = Infant mortality rate



constitutes the highest cost of loss of ecosystem services and biodiversity. The strategies required for addressing LUCC are daunting given that restoring high-value biomes involves an opportunity cost of about 94% of the total cost of restoration and that more than 50% of the benefits of restoration of degraded lands are accrued by off-farm beneficiaries. This shows that there is a need for reinvigorating international payments for ecosystem services and investing in the restoration of degraded lands through other approaches.

- Costa Rica and Niger, though with different HDI levels, reveal a common pattern of positive preconditions for investment in the restoration of degraded lands, such as supportive policies and incentives for land users.
- Strategies should be developed that give incentives for better land management and reward those who practice sustainable land management. The “payment for ecosystem services” mechanisms that saw large investments in carbon markets in the early 2000s should be given a new impetus to address the loss of ecosystem services through LUCC. Allowing land users to internalize some of the positive externalities created by sustainable land management through payments for ecosystem services schemes may be key to achieving a “land degradation neutral” world.
- Land degradation on cropland and grazing lands shows the urgent need to invest in research and extension in developing countries. As crop productivity remains low farmers often clear high value biomes to plant crops and/or grazing lands. Even when technologies are available, adoption rates are low due to poor market infrastructure, and other advisory rural services.

### Box 2: Costa Rica and Niger: Success stories of restoration of degraded lands

Costa Rica – a country ranked in the high human development index (HDI) group in 2014 (UNDP 2014) is a success story on restoration of deforested lands (Salazar and Chacón. 2011). Its political constitution and the 1996 Forestry Act provide the framework for rewarding land users who provide off-farm ecosystem services through certified forest conservation. Revenues for financing such payments for ecosystem services are collected from fossil fuel taxes, water fees, and from donors. The land users also enjoy tax breaks and carbon trading payments from local and international buyers. The country has also invested significantly in environmental awareness, which has led to changes in people’s perceptions on ecosystem services. All this has led to a successful restoration of deforested lands and other sustainable natural resource management.

Niger – a country with the lowest HDI in 2014, passed its Rural Code in 1993 that gave tree tenure to land users who planted or protected trees on their farms (Toulmin and Quan 2000). The Rural Code also increased the mandate of local institutions to manage natural resources using customary institutions and local governments. This increased incentives for land users to protect and plant trees, enhanced the greening of the Sahel (Anyamba et al. 2014), and provided the institutional structure required for sustainable natural resource management. Deforestation rates fell from 12% in 1990-2000 to 1% in 2000-10 (FAO 2012). This shows the key role that incentives and local institutions can play.

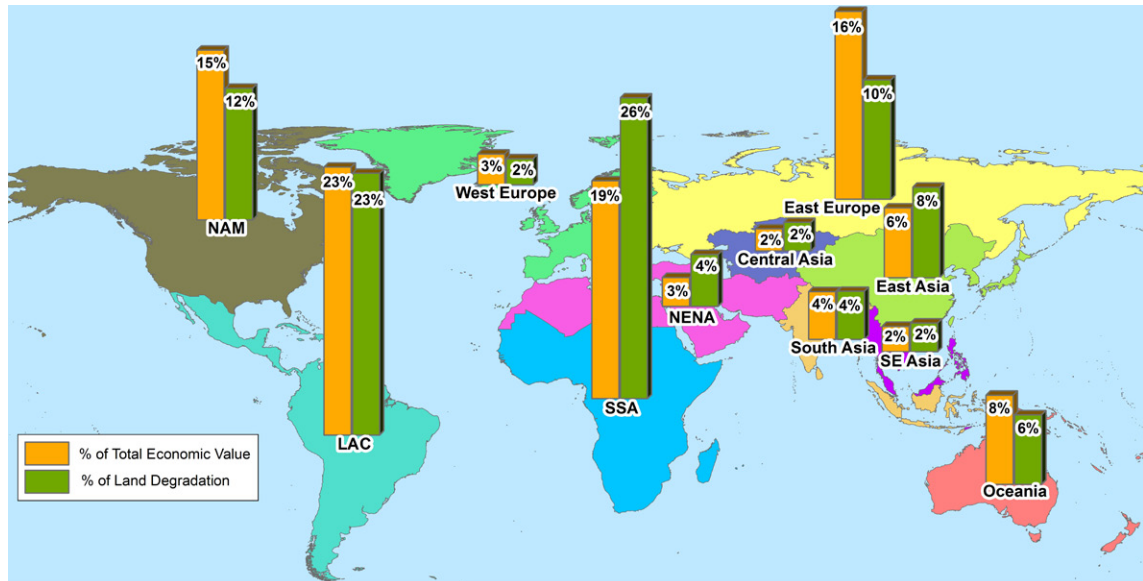


Figure 6: Regional contribution to TEV of ecosystem services endowment and corresponding cost of land degradation

- Livestock is a neglected sector in developing countries despite the increasing global demand for meat and milk. Its low productivity is due to limited public and private investments. This raises great concerns given that grazing lands occupy a much larger area than crops and the majority of poor livelihoods depend on this key sector. Governments in developing countries should therefore invest more in livestock to ensure successful poverty reduction and food security. Like in the case of crops, improving market access and advisory services as well as securing land tenure are required.
- The problems in high-income countries for both crops and livestock could be tackled by developing and promoting sustainable land management practices that minimize the use of high amounts of fertilizer and agrochemicals and reduce heavy tillage practices. For land use and land cover change, high-income countries have successfully halted deforestation but still experience other forms of loss of terrestrial ecosystem services that heavily gravitate around policy programs that do not promote protecting the environment successfully.

- Sustainable land management is fundamental for humanity’s sustainability in general. The land degradation trends must be reversed to ensure that the world achieves the goals set by the Sustainable Development Goals.

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