THE ECONOMICS OF LAND DEGRADATION

Synthesis Report of the Activities under Component 1 of the ReGreening Africa Project

Findings and Lessons Learnt from Economics of Land Degradation (ELD) Country Studies

September 2020

www.eld-initiative.org

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Acronyms

BMZ	German Federal Ministry for Development and Economic Cooperation
CBA	Cost Benefit Analysis
EC	European Commission
ELD	Economics of Land Degradation Initiative
FCFA	Franc CFA
FMNR	Farmer Managed Natural Regeneration
GHS	Ghanaian cedi
GIZ	German International Development Cooperation
Ha	Hectare
ICRAF	World Agroforestry Centre
IRR	Internal Rate of Return
LDN	Land Degradation Neutrality
NGO	Non-government Organization
NPK	Nitrogen, Phosphorous, Potassium
NPV	Net Present Value
PV	Present Value
SDG	Sustainable Development Goal
SLM	Sustainable Land Management
UNCCD	United Nations Convention to Combat Desertification
USD	United States Dollar

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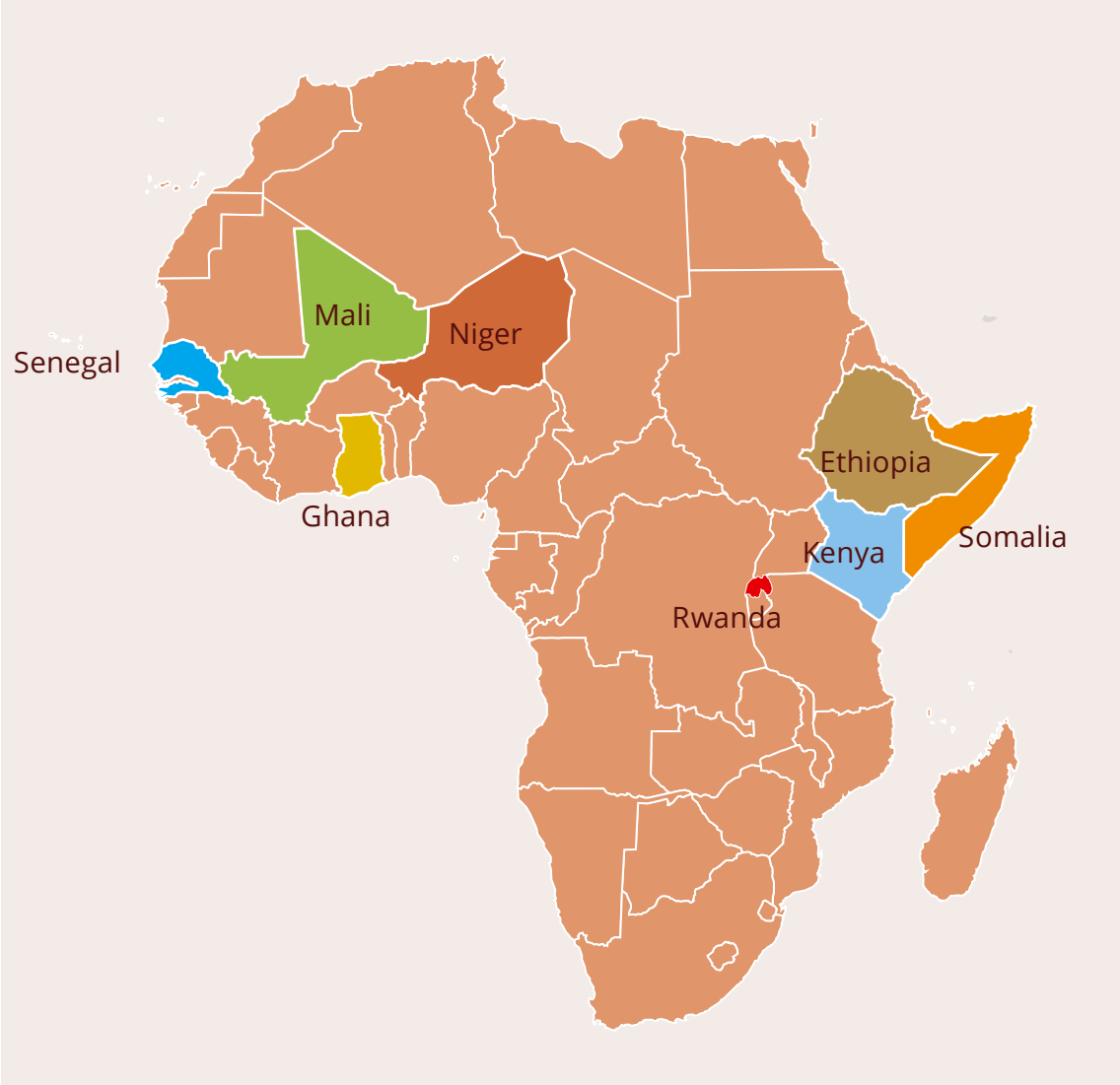
FIGURE 1:

Countries of ELD study reports under the ReGreening Africa Project

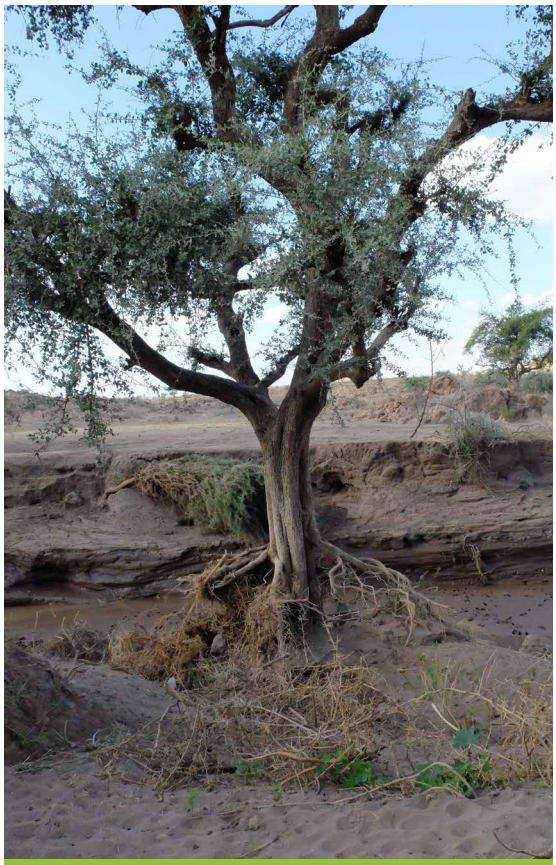


This report provides an overview of the results from research and capacity development activities led by the Economics of Land Degradation Initiative under Component 1 of the ReGreening Africa project.

This report focuses on the key findings of the cost-benefit analysis and recommendations of the eight ELD country study reports. It also highlights additional findings for SLM practices from the studies and lessons learned from capacity building activities. The report provides decision-makers with scientific information on the economic consequences of land degradation and possible pathways to improved rural livelihoods and land regeneration.

Context

Reversing Land Degradation in Africa through Scaling-up Evergreen Agriculture project



Land Degradation and SDG15.3

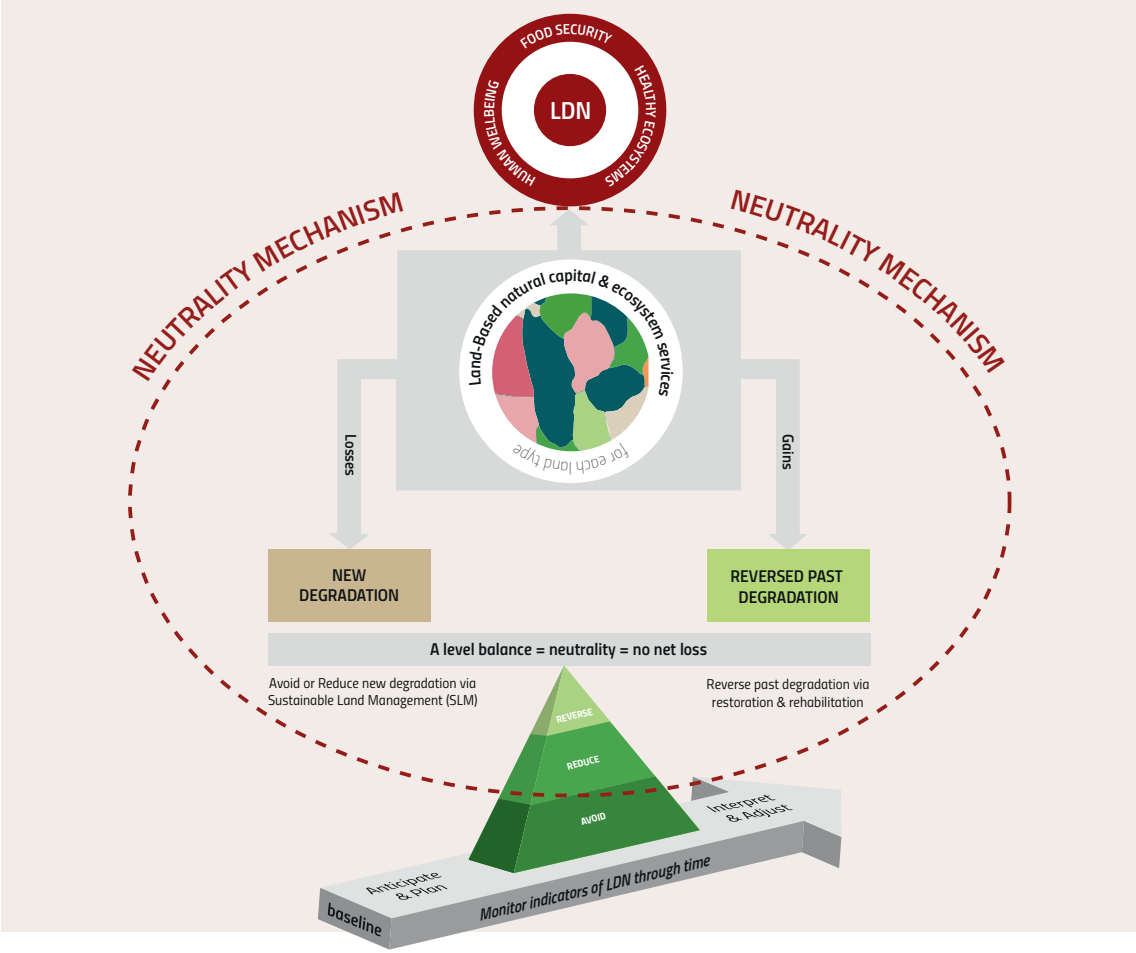
Following the adoption of the Millennium Development Goals and the declaration of the United Nations Decade for Deserts and the Fight Against Desertification (2010-2020), in September 2015, the global community agreed on "The 2030 Agenda for Sustainable Development", including 17 Sustainable Development Goals (SDGs) and 169 targets. Goal 15 urges countries to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Target 15.3 aims 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. The United Nations Convention to Combat Desertification (UNCCD) is the custodian agency for SDG indicator 15.3.1 "Proportion of land that is degraded over total land area" to monitor progress towards achieving SDG target 15.3. Indicator SDG 15.3.1 has been upgraded to Tier 2 in November 2017, meaning that it is conceptually sound based on internationally established methodology and standards but is not regularly collected by countries. At the twelfth session of the Conference of Parties of the UNCCD held in October 2015 in Ankara, Turkey, country Parties reached a breakthrough agreement to endorse the vision of Land Degradation Neutrality (LDN) and link the implementation of the Convention to the SDGs in general, and target 15.3 in particular.

UNCCD COP.12 also endorsed the definition of LDN as "a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales". In terms of natural capital this means that the aggregate level of natural capital should not decline. It furthermore…requested the Science–Policy Interface of the UNCCD to propose a conceptual framework to scientifically underpin the implementation of LDN. Key elements of the scientific conceptual framework for LDN are:

- LDN vision – to sustain the natural capital of the land and associated land-based ecosystem services;
- LDN frame of reference – to set a baseline based on agreed indicators, which becomes the (minimum) target with the intention to maintain (or improve) this state;
- LDN balancing mechanism – to categorize and account for land-use decisions with respect to neutrality and establish principles to limit unintended outcomes;
- LDN implementation pathways – to provide guidance on the pathways towards achieving neutrality;
- LDN monitoring & evaluation – to provide guidance on assessing progress towards neutrality.

FIGURE 2:

Land Degradation Neutrality Conceptual Framework (UNCCD, 2017)



LDN provides multiple environmental and societal benefits which help to address issues such as food security, income equality, poverty alleviation, and resource availability. The LDN targets address SDG target 15.3 and many other SDGs in a synergistic and cost-effective manner, and in accordance with countries' specific national contexts and development priorities. Working towards the achievement of Land Degradation Neutrality will simultaneously enable to reduce poverty (SDG 1), improve food security (SDG 2), manage water and wastewater sustainably (SDG 6), enhance economic development (SDG 8), encourage sustainable consumption and production (SDG 12), improve adaptation to climate change (SDG 13), and contribute to freedom and justice (SDG 16).

Taking action to achieve LDN by avoiding land degradation, upscaling Sustainable Land Management (SLM) practices and adopting restoration and rehabilitation measures is environmentally sound, socially responsible and economically viable to secure the healthy and productive land needed for equitable and sustainable development. The ELD Initiative, by providing scientific understanding of the cost of inaction and benefits of action in land investment and sustainable land use, feeds into the LDN framework and complements the work of the scientific and technical committee of the Convention, including the Science-Policy Interface, in supporting decision-makers.

Project

The project R*eversing Land Degradation in Africa by Scaling-up Evergreen Agriculture*, in short *ReGreening Africa*, was initiated by the Directorate-General for International Cooperation and Development of the European Commission in 2017 with the aim to improve livelihoods, food security, and climate change resilience by restoring land-based ecosystem services. The project is jointly carried out by the ELD Initiative (project Component 1 for the period 2017-2020) and the World Agroforestry Centre (ICRAF) (project Components 2 and 3 for the period 2017-2022) with financial support from the Euro-

pean Union and the German Federal Ministry for Economic Cooperation and Development. Focus countries are Ethiopia, Ghana, Kenya, Mali, Niger, Rwanda, Senegal, and Somalia.

ICRAF provided the focus countries with monitoring and analytic tools on land degradation dynamics along with supporting the scaling-up of evergreen agriculture by smallholder farmers. The ELD Initiative focused on raising awareness about the threats and opportunities of land-use options. The Initiative contributed to strengthenîng the capacity of national institutions and experts in assessing economic benefits of investments in sustainable land management taking into consideration the cost of land degradation, through training "on the job" in cost-benefit analyses in each focus country and disseminating the findings. After completion of Component 1 led by the ELD Initiative, the results will be further disseminated through the ELD Ambassadors at country level, bringing forward the economic arguments for SLM measures in the scope of Component 2 and 3. The Ambassadors will contribute to represent the ELD Initiative within the framework of further policy dialogue events organised by ICRAF and its partner NGOs.

Economics of Land Degradation

The Economics of Land Degradation (ELD) Initiative is an international collaboration that provides a global assessment of the economics of land degradation and highlights the benefits of sustainable land management. The initiative was established in 2011 by the European Union (EU), the German Federal Ministry for Economic Cooperation and Development (BMZ), and the United Nations Convention to Combat Desertification (UNCCD) to provide specific scientific support to decision makers on national and international levels. Working with a team of scientists, practitioners, policy-/decision-makers, and all interested stakeholders, the Initiative endeavours to provide a scientifically robust, politically relevant, and socio-economically considerate approach that is economically viable and rewarding. Ensuring the implementation of more sustainable land management is of critical importance considering the vast environmental and socio-economic challenges we are collectively facing – from food, water, and energy security, malnutrition, climate change, a burgeoning global population, and reductions in biodiversity, ecosystems, and their services.

Understanding the cost of inaction and benefits of action are important for all stakeholders to be able to make sound, informed decisions about the amount and type of investments in land for sustainable use. Even though techniques for sustainable land management are known, many barriers remain and the financial and economic aspects are often put forward as primary obstacles. A better understanding of the economic value of land will also help correct the imbalance that can occur between the financial value of land and its economic value. For instance, land speculation and land grabbing are often separated from the actual economic value that can be obtained from land and its provisioning services. This divergence is likely to widen as land scarcity increases and land is increasingly seen as a commodity.

Economic values can provide a common language to help entities decide between alternative land uses, set up new markets related to environmental quality, and devise different land management options to reverse and halt land degradation. It should also be noted that the resulting economic incentives must take place within an enabling environment that includes the removal of cultural, environmental, legal, social, and technical barriers, and also consider the need for an equitable distribution of the benefits of land amongst all stakeholders. Though there is a wide variety of possible methods, valuations, and approaches that may be available or appropriate, the ELD Initiative promotes the use of the total economic value achieved through cost-benefit analyses, as this can provide a broad and cohesive understanding of the economics of land degradation. It is a method that is generally accepted by governments and others as one of a number of decision-making tools,

Country level studies

In Component 1 of the ReGreening Africa project, the ELD Initiative supported the eight countries in assessing the economic cost of strategically selected areas subject to ongoing land degradation. The studies were based on scenarios for business-as-usual vs. alternative sustainable land use options in order to assess the economic costs and benefits of investment in sustainable land management. The research highlighted the potential benefits from implementing SLM, which formed the basis for recommendations regarding investments in sustainable land use to land users, policy makers, the pri-

vate sector and international development partners. The findings from the studies were widely shared to stakeholders and decision makers at the national and international level as well as with a wider audience.

Country-specific assessments were conducted directly by national institutions with the support of the ELD Initiative and its network of experts. Stakeholder consultations and close involvement of target groups were facilitated throughout the project.

During the inception phase, kick-off workshops were organized in each country and stakeholder consultations took place during the study phase to determine the SLM-related key issues and topics for the specific national context, allow for exchange and bring in the expertise and knowledge of all relevant stakeholders. Whenever possible, the country studies were linked with the national targets for Land Degradation Neutrality to inform the implementation of potential initiatives.

BOX 1

Land Degradation Neutrality targets in focus countries

KENYA

LDN is achieved by 2030 as compared to 2015 and an additional 9% of the national territory has improved (net gain)

Specific targets

- Increase forest cover through afforestation/agroforestry in existing forests; areas of shrubs/grassland; wetlands; croplands (by 5.1 million ha)
- Increase by 16% net land productivity in forest, shrubland/grassland and cropland showing declining productivity; achieved through SLM practices
- Increase soil organic carbon by 319,626 total tonnes in cropland land use achieved through SLM practices
- Halt the conversion of forests to other land cover classes by 2030
- Rehabilitation of all abandoned mining and quarrying areas through enforcement of by-laws
- Specific net gains are set for Ewaso Ngiro North (Lak Dera 2), Tana River catchment zone, Athi River catchment zone (Galana, Pangani, Kenya South east Coast), Rift Valley catchment zone (Lake Turkana, Naivasha, Natron), and Lake Victoria region (Nile basin)

ETHIOPIA

- By 2031, promote the implementation of community-based forest management, forest landscape restoration with indigenous species, avoiding overgrazing, area closure and, alternative livelihood systems, and ensure the restoration of 427,730 ha of forest land lost between 2000 and 2010
- By 2036, ensure the rehabilitation and improvement of the productivity of 21,359,490 ha of forest land by stopping uncompensated conversion of forest area, especially in slopes, into grassland, cropping or urban areas, and promoting agroforestry, energy saving stoves and, alternative livelihood systems, in order to avoid reduction of carbon sock and limit the risk of erosion
- Improve the productivity of 314,990 ha of shrubs, grasslands and sparsely vegetated areas by the year 2040 through avoiding overgrazing, promoting controlled grazing, and rangeland management/improvement
- By 2040, rehabilitate and improve the productivity of 12,578,714 ha shrubs, grasslands and sparsely vegetated areas through stopping uncompensated conversion of permanent grasslands in to croplands, promoting controlled grazing, and rangeland management/improvement so as to avoid reduction of soil carbon stock
- By 2031, ensure improved productivity of 14,193,615 ha of cropland by reverting negative trends of arable land deterioration, including acidification, alkalization and salinization, erosion by strongly discouraging inappropriate practices and supporting soil, water and vegetation long-term conservation practices; limiting drastically the size of individual parcel to the maximum permitted to conserve biodiversity and natural regeneration potential, through agroforestry and green corridors and biodiversity grids, especially in large-scale commercial farms; accelerating the conversation of unsustainable to sustainable cropping, grazing, forestry in the framework of scientifically grounded watershed management plans implemented under legally binding long-term agreements and contracts; and 100% cropland shows stable of increasing land productivity capacity

- By 2026 ensure improved productivity of 72,766 ha of wetlands and water bodies through stopping uncompensated conversion of wetlands into cropping or urban / industrial / infrastructure areas, in order to avoid depletion of carbon stock and critical biodiversity
- Take urgent and significant actions like stopping uncompensated artificialisation /urbanization of arable lands, through urban densification and "building city on city" approach; restoring as much as possible lands degraded by pollutions, originated by urban, industrial, mining untreated contaminants; revitalizing vegetation in degraded slopes, dried lands, closed mines, infrastructure (airports, harbours, roads, dams and reservoirs) using pools of endogenous species and further sustainable use and promoting plantation of indigenous tree species, and improve the productivity of 33,452 ha of artificial areas by the year 2026
- Through sustainable land management practices particularly implementing biophysical soil and water conservation practices improve the productivity of 3,751,173 ha of bare land and other areas by the year 2036
- By 2040, ensure the increase of carbon stock in the country by 148.67 million tons of carbon between 2016 and 2040 through achieving the above mentioned targets

GHANA

All listed targets should be accompanied by sustainable management of the resource and envisaged to be achieved by 2030.

- Reforest 882.86 km^2 of converted forest into other land use/cover types, and rehabilitate/restore all abandoned legal and illegal mineral mining and sand winning sites by 2030
- Improve productivity and soil organic carbon stocks in 18475.96 km^2 of cropland by 2030
- Rehabilitate/restore 5107.70 km^2 of degraded forest, including abandoned legal and illegal mineral mining sites for enhanced productivity by 2030
- Rehabilitate/restore and sustainably manage 4593.39 km^2 of degraded shrubs, and sparsely vegetated areas for improved productivity and reduction in bush/wild fires by 2030
- Reduce conversion of 45079.72 km^2 of remaining forest to other types of vegetation, and halt all illegal mining activities by 2030
- Increase the soil organic carbon of degraded croplands and rangelands by 66 % (i.e., 1.20 % to 2.0 %) by 2030

SENEGAL

- Over the 2020-2035 period, 18,809.96 km^2 of forest lands will be restored and sustainably managed
- Over the 2020-2035 period, 10,257.06 km^2 of grasslands and rangelands will be restored and sustainably managed
- Over the 2020-2035 period, 19,894.12 km^2 of cultivated lands will be restored and sustainably managed
- Over the 2020-2035 period, 1,147.58 km^2 of wetlands will be restored and sustainably managed
- Over the 2020-2035 period, 1,348.27 km^2 of marginal areas (artificial lands, bare lands and others) will be restored and sustainably managed

MALI

- To increase the forest area to 26 per cent of the total land area by 2030
- To reduce the proportion of annually cultivated land affected by declining fertility and prone to erosion, that is about 2.5 million ha

To reduce by at least 25 per cent the annual loss of forest area, that is around 125 000 ha, with the aim of increasing agricultural production and to preserve ecosystems with a net improvement in vegetation cover of 10 per cent

Specific targets

- Reduce the conversion rate between 2000 and 2015 of land cover causing degradation in forests, pastures and cultivated land from 35 to 20 per cent
- Reduce annual deforestation by 25 per cent, that is a reduction of 125 000 ha
- Increase the forest area by 10 per cent between 2015 and 2030, that is about 200,000 ha, through reforestation and afforestation
- Decrease by 50 per cent the area of forest, cultivated land and pasture, affected by a decline in net land productivity, that is about 1 000 000 ha
- Preserve the area of wetlands

NIGER

Niger commits to achieving LDN by 2030 and reducing the area of degraded land from 9% to 5%. This, with the aim of increasing vegetation cover from 17% to 19% and sustainably improving the living conditions of people.

Specific targets

- Restore 44% (4,440,500 ha) of the 10,761,076 ha of degraded land in 2010
- Reduce to 2% (252,101 ha) the area of cultivated lands showing negative trends of net primary productivity
- Reduce from 1% (100,074.3 ha) to 0% the annual rate of forest/savanna/wetland conversion into other types of land
- Halt sand encroachment and water erosion (gully erosion) along the Niger river
- Sequester 292,000 tons of carbon in the ground and/or biomass through good agroforestry practices (windbreak system, hedges, assisted natural regeneration, forage bank, food bank, etc.)

Capacity building

The project provided the opportunity for strengthening the capacities of research and government institutions to conduct holistic economic assessments of ecosystem services, to draw policy recommendations and scenarios based on economic information and include this information in decision-making processes. The ELD Initiative supported targeted national research and policy institutions in each country to develop the necessary skills to assess the benefits of SLM practices. The work of Component 1 also focused on translating the findings into recommendations for policy makers to inform strategic opportunities for developing integrated land policies. Training activities included training on the job for the researchers participating in the studies and a training of trainers for both policy makers and researchers, with a particular focus on young professionals/future decision makers and post-doctoral students. Selected national experts also benefitted from tutoring by international experts, joint development of economic monitoring and decision-making tools, the development of a relevant case study, and opportunities to join the international research community through learning events. The trained experts from local academic and/or scientific institutions able to integrate ecosystem valuation into their curriculum will act as national trainers for further capacity-building at country level beyond the present project. Trained ambassadors with a research and/or a policy background for each of the countries facilitated the inclusion of the study results into related SLM decision-making processes.

Ongoing consultations at the national level during the study phase also contributed to raising awareness and knowledge of local stakeholders on the Economics of Land Degradation, the concept of ecosystem services, economic benefits of SLM practices, the international context of the SDGs, as well as activities and goals of the overall project (including Components 2 and 3 managed by ICRAF). In each country, the macroeconomic benefits of sustainable land use methods were widely communicated to stakeholders and decision-makers of relevant sectors, targeting different levels of governance as well as the wider public, with the aim of initiating a multi-sectoral and multi-stakeholder policy dialogue to drive forward political action for sustainable land investments.

ELD country study topics and areas

In each country, the definition of the study areas was conducted in a two-stage process. First, overall study areas were identified by stakeholders from the public sector and the research community during the kick-off workshops that took place in each country in 2018. This was complemented by scoping mission reports to help identify the scope, spatial scale and strategic focus of the study. All but Ethiopia focused the studies on specific regions with the intent to be transposable to similar contexts in order to, first and foremost, induce action at the local level (Ethiopian stakeholders chose a national perspective for their study, built on regional examples). Then, the strategic focus of each study was defined by working groups during consultations with local stakeholders. Each study aimed at assessing land restoration measures that can be adopted by local stakeholders, and to identify key roles differentiated by type of stakeholder in order to facilitate the adoption of these measures.

The ELD Initiative ensured close coordination with ICRAF activities in all countries. The studies' focus was determined by the national stakeholders, but included relevant SLM practices such as natural regeneration, tree planting and management, natural infrastructures (terraces, stone lines etc.) and agroforestry that helped to inform the policy dialogues conducted by ICRAF. Institutions and experts involved in the studies and ICRAF activities implementation participated in joint events and exchange activities at country level which also contributed to the dissemination of findings and best practices emerging from all three project Components.

FIGURE 3:

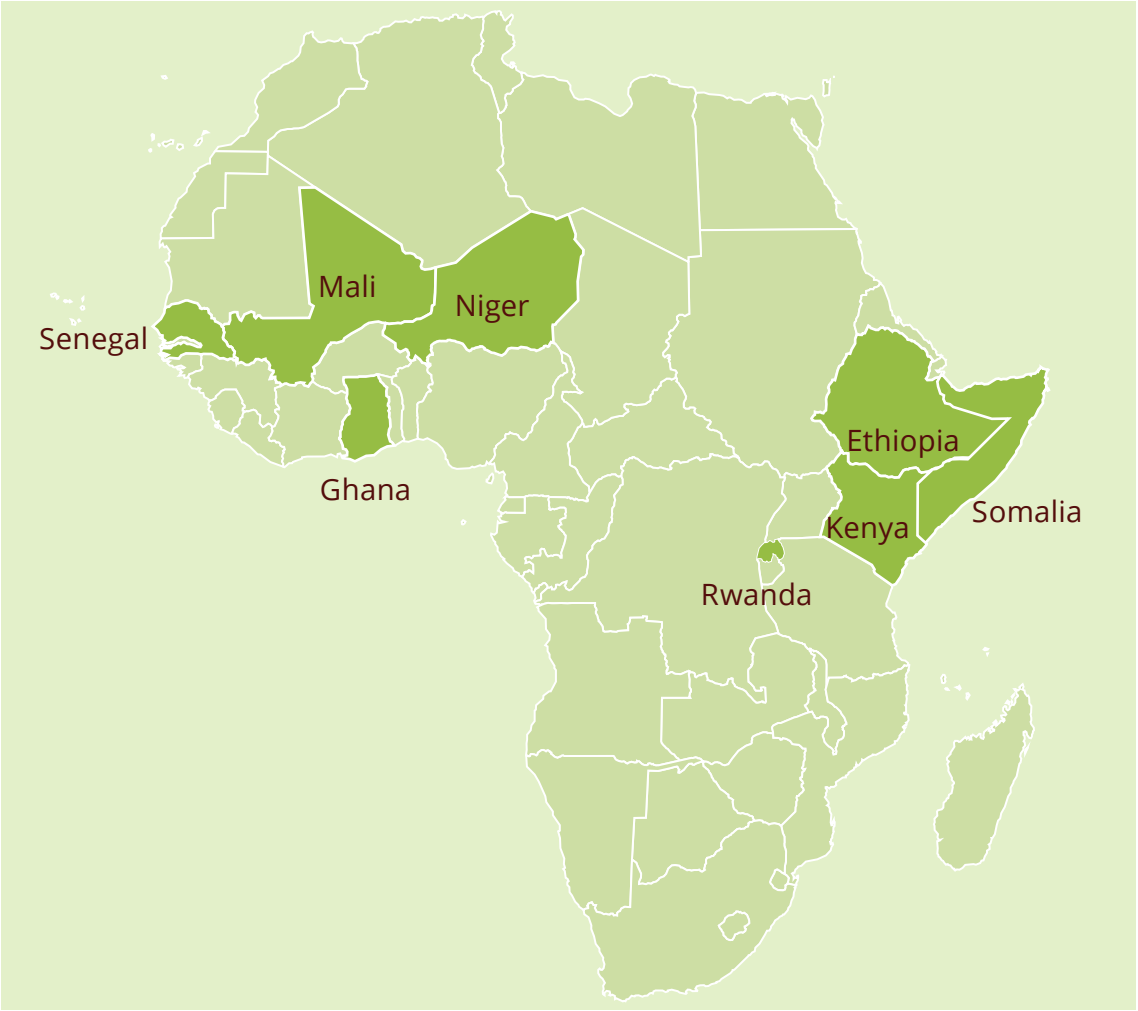


TABLE 1:

Study areas and topics for ELD studies in countries

Country	Areas	Study topics
 Ghana	**Lawra and Nandom districts of the Upper West Region of Ghana** Located in the savanna, both districts are profoundly affected by annual bush fires, substantial erosion and high population pressure.	In Upper West Ghana, three scenarios are assessed relative to a baseline of cropping maize with current practices (business-as-usual) and the abandonment of severely degraded lands: Low-till, cover crops and climate smart farming of maize cropping Agroforestry schemes in association with key staple crops (including maize) FMNR on severely degraded lands, as opposed to leaving it unutilised
 Kenya	**Kalama conservancy in Samburu County and Kinna in Isiolo County** These districts from Northern Kenya are home to pastoral community who are facing rangeland land degradation, resulting in deteriorating livelihoods for the majority of the rural poor who heavily depend on natural resources. **Aberdares Water Tower catchment in Nyandarua County** Severely affected by land degradation and one source of the water that feeds Nairobi, the capital city of Kenya and Nakuru County, one of the highly populated counties in Kenya. Nyandarua County is highly vulnerable to land degradation particularly deforestation and environmental degradation. **Western (Siaya, Kakamega and Bungoma Counties)**	**Kalama conservancy Samburu County and Kinna in Isiolo County** Economic valuation of selected sustainable rangeland management practices: community wildlife conservancy traditional rangeland management system known as the Dedha system **Aberdares Water Tower catchment** Economics of land use changes on ecosystem services, with focus on CBA and determination of farmers' preferences for adoption of different SLMs approaches to freshwater and soil fertility ecosystem services productivity.

 Senegal	**Kamb, Louga region** Located in the sylvo-pastoral zone of Senegal (Ferlo), the site covers an area of approximately 75,710 ha and is characterized by a diversity of ecosystems: plantations gum trees, rainfed crops, ponds, steppes. The Kamb area is marked by extensive breeding transhu-manance and a few farms sedentary. **Mbar Diop, Thiès region** A reforested zone on a mine concession, the region is subject to conflicts of use in particular between agricultural populations and extractive industries. **Kolda region in Casamance** The Pata classified forest is located at the border with the Gambia. It shows very high deforestation rates. *These areas are considered 'LDN hotspots' or key priority areas for achieving LDN* **Village of Daga Birame, Kaffrine region** The research-action village is located in a groundnut zone, with several actions implemented by ISRA with several partners for some years to limit environmental degradation. The interest of this case study is the study of the added value provided through measures to address land degradation. *ICRAF Intervention area*	The four case studies aimed at assessing the cost of land degradation and the viability of land restoration measures, both financially and economically.
 Mali	**Koutiala and Bougouni** Bougouni and Koutiala are part of Sikasso region. Cash crops (cotton and soya) are grown alongside food crops including rice, millet, sorghum and maize. Due to the intensive culture, the soils are more degraded in Koutiala, with no sign of improvement. In Bougouni, the soils will degrade further in the absence of preven-tive measures to improve the sustainability of cropping systems and reduce pressure from deforestation.	Both regions are experiencing a decrease in agricultural production, a loss of soil fertility and migration due to unsustainable land management practices, primarily intensive cotton production. The studies focused on conducting: A comparative study between conventional and bio-cotton including a study on cost realities of conventional cotton production which was comple-mented by a CBA of SLM measures from Benin A comparative study between food gardens with and without agroforestry component.
 Ethiopia	National study with additional focus on SNNP Region, Amhara Region and Tigray Region. The four regional states (Oromia, Amhara, SNNP, and Tigray) altogether account 97.7% of the country level.	The national Study focused on the economics of LDN in Ethiopia through an empirical analysis and policy implications to SDGs **SNNP Region** CBA of Borcha Adado sustainable watershed management interventions in the SNNP Region **Amhara Region** CBA of selected sustainable watershed management interventions in the Amhara Region **Tigray Region** CBA of selected sustainable watershed management interventions in the Tigray Region

 **Rwanda**	**Gishwati-Mukura corridor, Western Province** Gishwati-Mukura National Park is located in one of the most densely populated areas of Rwanda, with high concentrations of refugees and resettling Rwandans. Population pressure and various unsuitable development projects led to deforestation of these areas as they were converted for human settlements, grazing land, crop land and tree plantations, while unsustainable agricultural practices have led to reduced yields and driven forest adjacent communities to seek alternative livelihoods. **Nyagatare administrative area, Eastern Province** Nyagatare faces challenges of environmental degradation due to high biomass consumption, deforestation and rapid urbanisation. **Mayaga agro-ecological zone, Southern Province** Mayaga is a low altitude, dry and hot savannah region in the south of Rwanda. Forest degradation has taken three pathways in Mayaga: quantitative loss, qualitative loss and fragmentation caused largely by encroachment for agriculture and overharvesting of forest products.	For the tree case studies, action scenarios vs. business as usual were assessed to determine the most recommended SLM practices. **Western Province** Terracing & soil fertility management; restoration with non-native species and resettlement and restoration with indigenous species and resettlement **Easter Province**: Restoration of indigenous trees **Southern Province**: terraces, agroforestry and a combination of agroforestry and terraces
 **Niger**	Tillabéri (Simiri et Ouallam) *ICRAF intervention site* Tahoua Within the priority LDN watershed of Dallol Maouri Maradi Within the priority LDN watershed of Goulbi N'kaba **Gouré (Niger Est)** Within the priority LDN watershed of Komadougou Yobé 1 Partie Ouest	**Tillabéri (Simiri et Ouallam)** **Tahoua** Assessing the benefits from bunds, FMNR, zai (water retention practice), half-moons, and stone lines **Maradi** Assessing the benefits bunds, FMNR, zai, half moons **Gouré (Niger Est)** Assessing the benefits from the dune system through three successive investments in stabilisation
 **Somalia**	The study focuses on rangeland degradation in **Somaliland and Puntland r**egions. It targets economic assessments of four selected rangeland sites and their current and possible alternative future land use options.	Assessing the benefits of sustainable rangeland management to combat the increasing rangeland degradation. Fieldwork trips for the data collection have been delayed by the COVID19 pandemic and unforeseen challenges in the context of post-conflict country with limited data and administrative capacity and security risks. First results from cost-benefit analysis are expected to be produced by September 2020.

Methodology

Economic valuation of land degradation has been recognized as an important tool that can help decision makers to evaluate the trade-offs between the social welfare losses of inaction and the net welfare gains of alternative actions against land degradation. The concepts of total economic value and ecosystem services are important frameworks in the broader context of environmental and ecosystem service valuation and the valuation of land degradation at different spatial scales. Such assessments are also crucial in national capital accounting and the concepts of LDN and maintaining the aggregate level of natural capital.

The studies followed the initiative's 6+1 step approach, an analysis method that guides users through the process of establishing scientifically sound cost-benefit analyses to inform decision-making processes. The studies used a range of methods and models for ecosystem services valuations and cost-benefit analysis according to the objective of the study, but also to the availability of data and local capacity to implement each method.

BOX 2
The 6+1 methodology

The 6+1 step approach of the ELD Initiative

1. Inception 	Identification of the scope, location, spatial scale, and strategic focus of the study, based on stakeholder consultation. Preparation of background materials on the socio-economic and environmental context of the assessment. **Methods for:** stakeholder participation (consultation, engagement); systematic review and synthesis of academic and grey literature; selection of relevant existing case studies; extrapolation of existing case studies for global comparison; collection of background socio-economic and environmental data; policy analysis.
2. Geographical characteristics	Establishment of the geographic and ecological boundaries of the study area identified in Step 1, following an assessment of quantity, spatial distribution, and ecological characteristics of land cover types that are categorised into agro-ecological zones and analysed through a Geographical Information System (GIS). **Methods for:** stakeholder participation (consultation, engagement); definition and mapping of land covers and agro-ecological zones from the sciences (physical geography, ecology, soil sciences, landscape sciences, etc.).
3. Types of ecosystem services 	For each land cover category identified in Step 2, identification and analysis of stocks and flows of ecosystem services for classification along the four categories of the ecosystem service framework (provisioning, regulating, cultural, and supporting services). **Methods for:** stakeholder participation (consultation, engagement); identifying different ecosystem stocks and flows (from ecology); categorising ecosystem services into the four categories of the ecosystem service framework.

4. Roles of ecosystem services and economic valuation	Establishment of the link between the role of ecosystem services in the livelihoods of communities living in each land cover area and in overall economic development in the study zone.Estimation of the total economic value for each ecosystem service. **Methods for:** stakeholder participation (consultation, engagement); identification of available economic data from relevant case studies; data collection and surveys; multi-criteria analyses to identify important ecosystem services; valuation methods for estimation of "missing" economic values (no market price); extrapolation of case studies for global comparison.
5. Patterns and pressures 	Identification of land degradation patterns and drivers, pressures on sustainable management of land resources and drivers of adoption of sustainable land management (including determining the role of property rights and legal systems), and their spatial distribution to inform the establishment of global scenarios.Revision of previous steps if needed, to ensure the assessment is as comprehensive as possible. **Methods for:** stakeholder participation (consultation, engagement); identification of types of land degradation, patterns, and pressures (from soil sciences, ecology, agricultural sciences, physical geography, etc.); mapping methods (GIS); establishment of global scenarios.
6. Cost-benefit analysis and decision making	Cost-benefit analysis (CBA) comparing costs and benefits of an 'action' scenario to that of a 'business-as-usual' scenario to assess whether the proposed land management changes lead to net benefits. ('Action' scenarios include land management changes that can reduce or remove degradation pressures).Mapping of net benefits for identification of the locations for which land management changes are suitable from an economic perspective. This will lead to the identification of "on-the-ground" actions that are economically desirable. **Methods for:** stakeholder participation (consultation, engagement); cost benefit analysis with participatory establishment of action scenario and business as usual scenario, choice of discount rate, computation of indicators of economic viability; mapping methods (GIS); estimation of shadow interest rates. Tools to facilitate the building of cost-benefit analyses (micro-economic level): Toolkit for Ecosystem Service at Site-based Assessment (TESSA); Assessment and Research Infrastructure for Ecosystem Services (ARIES); Corporate Ecosystem Services Review (ESR); Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST); Multi-scale Integrated Models of Ecosystem Services (MIMES); Natura 2000, etc.w

6+1. Take action

Land users:

implement the most economically desirable 'on the ground' option(s) by changing land management practices or land use, at multiple scales and levels.

Methods for:

stakeholder participation (consultation, outreach, awareness raising, engagement).

Private sector:

engage in discussions with stakeholders from all sectors directly impacted by changes in ecosystem services to reduce risks associated with a weaker link in the value chain and increasing opportunities for investment in sustainable land management. This requires relevant and suitable impact pathways to be identified, to promote and facilitate actions that can be scaled up and out.

Methods for:

takeholder participation in relation to corporate social responsibility (consultation, outreach, awareness raising, engagement), land materiality screening toolkit, value chain analysis.

Policy-/decision-makers:

facilitate adoption of most economically desirable option(s) on the ground by adapting the legal, policy, institutional and economic contexts at multiple scales and levels. This requires relevant and suitable impact pathways to be identified, to promote and facilitate actions that can be scaled up and out.

Methods for:

stakeholder participation (consultation, engagement); identification and social construction of impact pathways (e.g., multi-criteria analyses that identify preferences over possible impact pathways). Tools at the macroeconomic level: Green accounting using UN System of Environmental-Economic Accounting (SEEA) or using the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) global partnership.

Findings from the ELD studies

Overview of cost-benefit analysis

Identification and valuation of ecosystem services

Studies have shown that individual sites are affected by land degradation, including soil degradation and loss of vegetation cover. These forms of degradation lead to enormous losses of ecosystem services at high costs. All studies identified relevant ecosystem services for the site(s) based on the following four categories:

- **Provisioning services** identified are mainly the agricultural products from individual plots of vegetable and rainfed crops, fuelwood, lumber, service wood, materials for crafts, livestock grazing, non-timber forest products derived from community wooded plots and forest products as well as products used in the pharmaceutical industries.

- **Regulatory services** include the storage of carbon in plants and soils, contributing to climate regulation at local, national and global levels, the regulation of nutrient flows in soils, and improving water availability.

- **Supporting services** are of two types: soil and plant organic matter, the latter used as a green manure for fertilization and the conservation or enhancement of biodiversity (wildlife sanctuary) by maintaining vegetation.

- **Cultural services** are linked to spiritual values and aesthetics of products used in ceremonies and traditional activities, as well as to recreational activities and ecotourism.

The valuation of ecosystem services identified the role of ecosystem services in the livelihoods of the communities living in each land cover area, and in the overall economic development of the study zone. This required estimating the total economic value of these services (use and non-use values), to estimate the benefits of action or the cost of inaction (i.e., the maximum benefits from action that could be derived). While acknowledging the importance of regulatory and supporting services, most studies focused on the valuation of provisioning services as being the most valued services among farmers and for which the economic value could be most reliably inferred.

Cost-benefit analysis and recommended SLM & FMNR practices

The economic valuation of ecosystem services serves as a basis for cost-benefit analyses. The cost-benefit analysis involves the assessment of sustainable land management options that can reduce or remove degradation pressures, including analysis of their economic viability and identification of locations for which they are suitable. Cost-benefit analyses are used for this purpose, as they compare the costs of adopting a sustainable land management practice against the benefits derived from it. Overall, findings from the studies indicate that investment in sustainable management practices and farmers managed natural regeneration activities yield positive results in terms of their net present value discounted over a variable time period and their cost-benefit ratios. In each area, the most cost-effective SLM practices were identified (*please refer to the separate report on FMNR activities created on the basis of the project outcomes*). Table 2 summarizes the findings of the cost-benefit analyses with a list of recommended practices. Table3 is illustrative of the range of financial indicators used in cost-benefit analyses for selected SLM options across the 7 countries.

TABLE 2:

 Ghana	Replacing slash and burn practices with FMNR in association with crop rotations, farmers can earn an additional 4 Ghana cedis (GHS) from enhanced forest and crop produce for every Ghana cedi invested. When accounting for the societal costs, notably the training of fire fighters and lead FMNR farmers, the net present value benefit of adopting FMNR with crop rotations is GHS 2,395 per acre over a 20-year horizon. For every Ghana cedi invested, society enjoys three Ghana cedis of return when accounting for direct provisioning services alone (i.e. enhanced forest and crop produce). FMNR combined with crop rotation will provide the typical farmer with an additional income of GHS 255/ acre/year (EUR 102/hectare) in present value terms, or GHS 590 per household per year (EUR 94). This is substantial improvement considering that the lower food poverty line, i.e. what is needed to meet the nutritional requirements is GHS 792 (EUR 126) per adult equivalent per year.	Within only five years of implementing FMNR, farmers can expect a 56 per cent increase in the productivity of farm crops and an 86 per cent rise in crop productivity if they also implement crop rotations. When implementing FMNR, the following practices lead to higher yields for farmers: intercropping with legumes crop rotations presence of higher tree densities, more mature trees in the field, tree pruning the exclusion of fire leads to higher crop yields
 Senegal	Over for the 4 areas, internal rates of return values representing the rate of return on all resources invested in the project not only in terms of capital but also in terms of human resources (labour) and natural resources - are higher than the opportunity cost of capital taken as 10%. The values suggest that one FCFA of resources invested in more sustainable land management - in the form of capital, human labour and natural resources - leads to a gain that represents a monetary value of at least 10 FCFA.	**Kamb - Sylvo-pastoral zone** Setting-aside of rain-fed areas is only profitable in the medium and long term, i.e. beyond four years. All other SLM options, such as organic fertilization, mineral fertilization, combination of organic and mineral fertilization, agroforestry and ANR are profitable regardless of the period considered. **Pata - classified forest** Assisted Natural Regeneration is more profitable financially and economically than the millet monoculture (food crop), the groundnut monoculture (cash crop), and the millet and groundnut cropping association. **Mbar Diop - Reforested zone on a mine concession** Remote area (about nine km from the mine): agricultural production in a is profitable for producers, both on a four-year and an eight-year horizon. Area close to the mine (less than three km): the farming activity is profitable only over four years. As mining activity intensifies and the mine moves closer to the areas of operation, the practice of farming becomes less and less profitable. **Daga Birame - Groundnut zone** Assisted Natural Regeneration Domestication of fruit and forest trees (Ziziphus mauritiana and Tamarindus indica), Areas under a local management agreement, which prohibits logging for ten years but allows fodder harvesting. All three SLM options are all profitable and preferable to the status quo in economic and financial terms over an eight-year period.

 Kenya	For both the Aberdare catchment areas and managed rangelands of Isiolo county the financial benefits of SLM options outweigh the costs and are generally associated with benefit/costs ratios in the range between 1 and 2. In the Aberdare catchment where resource-poor farmers tend to focus more on present conditions rather than the future, it is encouraging that the results reinforce the benefits of adopting SLM options even at relatively high discount rates of 12 to 15%. For rangelands in Isiolo and Samburu counties, the cost of taking action to rehabilitate lands was found to be lower than the cost of inaction over a 30-year period. The results show that the Net Present Value per hectare for Dedha and conservancy was positive irrespective of the discount rate. NPV per hectare for Dedha was £22,356, £64,911 and £9,680 using 8%, 3.5% and 12% discount rates respectively. For conservancy, the NPV was £38, 597, £78,297 and £23,792 using the 8%, 3.5% and 12% discount rates respectively.	**Aberdare catchment areas – mixed farming systems** In financial net present value terms, the best options were agroforestry combined with crop rotation followed by the use of vegetative strips on sloping land. This was followed by vegetative strips with mixed crops while mixed crops had lowest returns. In terms of benefit/cost ratios, vegetative strips, cover crops and organic crops and terracing with other practices gave the most favourable returns. Benefits of agroforestry are usually longer term and require greater initial investments compared with other options while vegetative strips are easy to establish and maintain and have relatively low costs. **Isiolo county -Rangeland management** Two forms of collective management, the traditional dedha system and a community wildlife conservancy both resulted in improved communally owned rangeland management and were economically viable in terms of net present values and benefit/costs ratios. Both systems enhanced land governance by providing rules, processes and institutional structures through which decisions can be taken on the use and control of land. These systems also address important issues such as unequal access to land, insecurity of tenure, unsustainable land use and weak institutions for dispute and conflict resolution. The most promising successful interventions include rotational grazing, reseeding, rehabilitation of gullies, afforestation and removal of invasive species, micro-catchment water harvesting and use of terraces.
 Ethiopia	The present values of total benefits of investment on SLM interventions are more than four times higher than the present values of total costs, with benefit to cost ratios are 4.05 for the periods 2020-2030 and 4.60 2020-2040. If investing in sustainable land management, Ethiopia could create a net present value of about 295 billion USD (23132 USD per ha) and close to 691 billion USD (54079 USD per ha) in present values to develop sustainable land management technologies on the 12.77 million hectares of agricultural land cultivated by smallholder farmers. This would represent: an investment USD 97 billion (7434 USD per ha) for estimated benefits of about 392 billion USD (30706 USD per ha) over the periods 2020-2030 *or* an investment of 192 billion USD (15008 USD per ha) for estimated benefits of net present value for about 691 billion USD (54079 USD per ha) over the period or 2020-2040. The present value of the establishment cost accounts for 23.09% of the total cost for the investment for the period 2020-2030 and for 11.65% for the period 2020-2040 of the present values and respectively. Maintenance costs, which are annual costs for maintaining established SLM structures, account 64.37% of the present value of the total cost over the period 2020-2030 and 77.14% of the total cost over the period 2020 to 2040.	The study was based on the average of costs and benefits of establishment and maintenance of the SLM technologies currently implemented in Ethiopia. All showed all showed a positive cost/benefit ratio for addressing land degradation (loss of soil nutrients), but the study could not differentiate on effectiveness due to data availability. Measures considered include: Agronomic measures: measures that improve soil cover (e.g. green cover, mulch), measures that enhance organic matter/soil fertility (e.g. manuring), soil surface treatment (e.g. conservation tillage or minimum tillage), sub-surface treatment (e.g. deep ripping), intercropping, precision agriculture etc. Structural measures: terraces (bench, forward/backward slopping), bunds, banks (level, graded), dams, pans, ditches (level, graded), walls, barriers and palisades. Vegetative measures: plantation/reseeding of tree and shrub species (e.g. live fences, tree crows), grasses and perennial herbaceous plants (e.g. grass strips). Management measures: change of land use types (e.g. area enclosure), change of management intensity level (e.g. from grazing to cut and carry), major change in timing of activities, and controlling/change of species composition.

 Mali	Taking into account public expenditure on subsidies as well as the health costs related to the use of pesticides and phytosanitary products, the societal benefit to cotton producers is: 74,340 CFA/ha for conventional cotton producers in Koutiala, 119,015 CFA/ha for conventional cotton producers in Bougouni 80,650 CFA/ha for organic cotton producers in Bougouni. Producers in Koutiala with a lower average profit than those in Bougouni. This difference can be explained by: the state of degraded land in Koutiala compared to Bougouni. Conventional cotton producers in Koutiala have an average yield of 950 kg/ha, compared to 1050 kg/ha for cotton producers in Bougouni. Koutiala cotton farmers' dependence on large quantities of organic fertilisers (cart transport of household waste and compost and manure) to maintain their yields. Koutiala producers have higher production costs compared to Bougouni farmers. Organic cotton farmers have an average yield of 450 kg/ha of cotton, half that of conventional cotton farmers. However, input costs are also significantly different, about half those of conventional cotton farmers, explaining the profit of 80,600 CFA/ha, slightly higher than that of the average conventional cotton farmer in Koutiala.	Cessation of crop residue burning in Bougouni. Farmers could favour the use of resides in compost or stock animals to browse on residues. Organic farmers for example can increase their yields 400kg/ha by ensuring that crop residues are browsed by their own animals instead of burned or consumed by other farmers' livestock. Likewise, with an additional 6 wheelbarrows of organic (compost and manure) fertilizer per hectare, Bougouni farmers increase their yields by an average of 100 kg/ha. Favouring agroforestry systems above the legally required minimum number of 10 trees/ha would be a fruitful approach. Agroforestry systems of approximately 20-30 trees per ha, increases yields by at least 100 kg/ha. Furthermore, an additional 10 trees per hectare of species types such as Shea nut, Dawadawa, Faidherbia Albida and Mango, provides farmers with an average additional income of 27.000 CFA/ha, from the collection of nuts, pods, fruits and fuelwood. Using leguminous species (e.g. Soy beans, Cashew nuts, Cowpea, Stylosantes) in crop rotations with cotton. Conventional farmers employing such measures enjoy 150 kg/ha higher yields, everything else equals. Adapting inorganic fertilizer recommendations to soil conditions. Evidence is found, that the generalized pan-territorial dose (150 kg NPKSB 14-23-14-5S-1B and 50 kg urea 46% N) is inefficient and unprofitable. Instead, recommended fertilizer doses should take into account spatial soil conditions, so that relatively small amounts are applied per ha when soils are not degraded, and vice-versa.
 Rwanda	Further data collection and analyses would be required to verify conclusions. However, based on the data and calculations presented in the training: **Western Province** Farmers in Western Province should invest in sustainable land management practices such as terracing, as doing so offers them higher yields and a better NPV in comparison to the BAU scenario. Given the sensitivity of NPV of the scenarios to both input and output prices, farmers would benefit from being able to better negotiate the prices for their agricultural products. **Eastern Province** The NPV for the Afforestation Scenario was substantially higher than the other scenarios for a 17-year time horizon. Sensitivity analyses explored how altering the discount rate, input prices and output prices. In all but one case, the Afforestation Scenario still offered the best NPV. **Southern province** Across all three crops, undertaking some form of SLM practice offered higher NPVs than continuing to farm under the BAU scenario. The higher NPVs associated with SLM practices were due to increased yields and, for agroforestry, as a result of profits from timber and non-timber products. For beans and cassava, agroforestry and terracing offered the highest NPV, irrespective of discount rate. For maize, sensitivity analyses revealed that in some circumstances undertaking agroforestry alone could offer a higher NPV than doing it in conjunction with terracing.	**Western Province** Sustainable land management practices such as terracing offers them higher yields and a better NPV in comparison to the BAU scenario. **Eastern Province** Land users in Nyagatare city should carry out afforestation due to its higher NPV. Benefits include a contribution to climate change mitigation. **Southern Province** The combination of terracing and agroforestry offers the highest NPV for farmers across three crop types (beans, maize, cassava). Land users should implement agroforestry as an economically sound SLM practice. Terracing can be used if slopes are suitable.

 Niger	**Farmer managed natural regeneration** Farmer managed natural regeneration is preferred to the status quo. There is no financial nor economic barriers to adoption. NPV is superior to zero. **Zaï (water retention practice)** When zaï are implemented following technical requirements, on the right type of soil and over 4 consecutive years, NPV is greater than zero and IRR, when computable, is greater than 10 % (opportunity cost of capital). Implementation of zaï (tassa) is preferred to the status quo in this case. There are no financial nor economic barriers to adoption. However, not respecting technical requirements in full (too short or wrong soil types) lead to target populations to become poorer than then would have been under status quo (financial NPV <0) and a loss for Nigerien society as a whole (economic NPV <0). Cash for work does not compensate for such loss at the individual level as well as on aggregate, leading to increase waste of public funding. The closest to technical requirements, the more profitability increases for land users as well as for Niger as a whole. **Half moons** Half-moons for agricultural purposes are preferred to status quo (i.e. no activity at all on the same land). There is no financial nor economic barrier to adoption. Costs are borne by the donor (2.7 million FCFA aggregated with a 10 % discount rate) and are greater than NPV of target populations, which could justify providing such form of funding to target populations to implement half-moons for agricultural purposes. In Tillabéri, status quo is preferred to half-moons implemented for agricultural purposes on sandy soils while in Maradi, status quo is preferred to half moons implemented for agricultural purposes on sandy soils – local population are yielding positive results from cash for work but no positive financial benefits overall. In Tillabéri, status quo is preferred to half-moons for silvo-pastoral and reforestation with gum-tree purposes while half-moons for silvo-pastoral and reforestation with eucalyptus purposes are preferred to status quo. **Bunds** In Tahoua, bunds are preferred to status quo while status quo is preferred to forestry bunds planted with gum trees in Tillabéri. **Stone walls and dunes** Stone walls and dunes are preferred to the status quo. There is no financial nor economic barriers to adoption, nor need to incentivise uptake by providing with cash for work in theory	Comparison of the viability of different measures across regions of Niger is challenging due to the variations in the parameters of the studies. The studies provide an overview of the range of situations occurring in Niger rather than a blueprint referential. Measures are viable if technically suited to the local conditions. As shown by the studies, some measures may be viable in some areas while not in other. Larger scale measures might sometimes, but not always, require some financial support. Most of current incentive schemes for the establishment of SLM practices (Zaï, half-moons etc.) involve cash for work. This scheme would need to be revised as it seems to create perverse incentives to degrade more rather than restore more, on top of impoverishing the State of Niger and/or target populations.

TABLE 3:

Summary of financial indicators used in the 7 countries (for farms and selected options only)

Country/Region	Indicator	Range of values	SLM options	Time period/ area
Ethiopia			Reversal of soil nutrient depletion	12.8 m ha agricultural land
	NPV	$30,706-69,088/ha (26,302 – 59,180 euros/ha)		10 and 20 years (2020-2030 and 2020-2040)
	BCR	4.5 to 4.6		
Ghana			Low till +cover crops, Agroforestry with cereals. Assisted natural tree regeneration	
	Farm profit	255GHS/acre/yr (102 euro/ha) from an 86% increase in crop production	Assisted natural tree regeneration with crop rotation	5 years
	NPV	3182 GHS/acre (1,272 euro/ha)		20 years/ha
	BCR	3.3 to 3.8		
	IRR	33%		
Kenya	NPV	1.83 m KSH (14,455 euros)	Agroforestry + crop rotation	20 years/ catchment
		1.18 m KSH (9,319 euros)	Agroforestry + vegetative strips	
		0.95m KSH (7,503 euros)	Agroforestry + terraces	
		1.01m KSH (7,977 euros)	Agroforestry + cover crop	
Nyandarau County, mixed crop-livestock		1.4 m KSH (11,957 euros)	Vegetative strips	
		1.04m KSH ((8,213 euros)	Crop rotation + organic fertilizer	
		0.55 m KSH (4,343 euros)	Crop rotation	
	BCR	1.7	Agroforestry + crop rotation	
		1.7	Agroforestry + vegetative strips	
		1.7	Agroforestry + terraces	
		1.6	Agroforestry + cover crop	
		2.1	Vegetative strips	
		2.0	Crop rotation + organic fertilizer	
		1.6	Crop rotation	
Isiolo county rangelands			Revival of traditional rangeland management system (Dedha) and conservancy system	
Conservancy management	NPV	78,297 $/ha (67,087 euros/ha)	Conservancy	
	BCR	1.45		
Dedha traditional management	NPV	64,911 $/ha (55,617 euros/ha)	Dedha	
	BCR	1.35		

Mali	Farm profits	27,000 CFA (41Euro) additional income / ha with forestry products	Biological cotton production; legume rotation, agroforestry	Seasonal/1 ha
Niger			Assisted natural tree regeneration, Zai/half moons for water collection, bunds for agroforestry/forestry, stone walls, dune fixation	20 years/1 ha
	NPV	505,587 CFA (771 euro)	Assisted natural tree regeneration	20 years/1 ha
	NPV IRR	-25284 CFA (-38.5 euro) Not calculable	Zai	8 years/1 ha
	NPV IRR	1501579 CFA (2,289 euro) -NPVs on sandy soils 7-26%	Half moons	8 years/3 ha
	NPV	466,299 to 4,000,352 CFA (710 to 6,098 euro)	Half moons with agroforestry/ reforestation	8 years/1 ha
	IRR	11%		
Rwanda **Western province**	NPV	$34.04 million (29.25 million euro	Soil fertility, terracing, afforestation	20 years
	NPV	-$9,49 (-8,160 euro)	Restoration with non-native species	
	NPV	$40.69 million (34.98 million euro)	Restoration with native species	
Eastern province	NPV	$59,393 (51,054 euro)	Retaining indigenous trees	17 years
	NPV	$248,117 (213,282 euro)	Afforestation	

Senegal			Fallow, rainfed crops, assisted natural tree regeneration, high value crop diversification, gum Arabic, mineral fertilizer, organic fertilizer	
Kamp, Louga	NPV IRR	-541 million FCFA Up to 3938 million FCFA (+6 million euro) 1083% with fertilizer	Fallow Rainfed crops, assisted natural tree regeneration, high value crop diversification, gum Arabic, fertilizer, organic fertilizers Mineral fertilizer	4 years/5200 ha
Pata forest, Kolda	NPV IRR	36 to 3716 million FCFA (55,000 to 5.6 million euro) 0 to 36%	Assisted natural tree regeneration with cereals, peanuts or both	8 years/ 5 ha
Daga Birame, Kaffrine	NPV IRR	325 to 1695 (495,000 to 2.5 million euro) 29 to 314%	Assisted natural tree regeneration, tree species introductions, tree management with forage production	8 years/1-182 ha

Table Notes:

The Net Present Value (NPV) is the sum of the discounted benefits over a time period minus the sum of the discounted costs over the same time period. If NPV is positive the intervention is considered to be economically viable. The Internal Rate of Return (IRR) is the discount rate where the discounted benefit equals the discounted costs and where the NPV is zero and the benefit-cost ratio is one. Normally an IRR of greater than 10% is a benchmark as this represents the opportunity cost of capital and a value less than 10% may not be economically viable. Note that all indicators, NPV, IRR and BCR are estimated by discounting and are therefore dependent on the discount rate chosen. All studies used a range of discount rates with the most frequently used being the national cost of borrowing money. A range of discount rates were applied in sensitivity analyses.

The indicators were estimated over different time periods and for different areas and are therefore not directly comparable in this Table. They just indicate whether or not an intervention is worth pursuing from a financial perspective. Sensitivity analyses can be undertaken by changing the discount rates and/or adding in aspects such as a drought or flood event that may affect provisioning and other ecosystem services for a particular year in a time series.

More information on individual country analyses are available at:
https://www.eld-initiative.org/en/where-we-work/africa

Key economic arguments for investing in sustainable land management

Findings from studies clearly indicate that investment in sustainable management practices and farmer-managed natural regeneration yield positive economic results.

Land degradation causes economic loss. Studies have shown that the various sites are affected by land degradation, including soil degradation and loss of vegetation cover. These forms of degradation result in overexploitation and conflicts of use, leading to great losses of ecosystem services at high costs. In addition, the cost of land degradation, i.e. the loss of earnings in agricultural production due to soil depletion and reduction in vegetation cover, is much higher than the opportunity cost. Farming on degrading land certainly generates benefits; however, the costs of degradation, in terms of economic loss and financial damage, far outweigh the benefits derived from agricultural production.

- In Senegal, land degradation represents 18% of the area of Kamb and a loss of ecosystem services representing 4.67 billion FCFA over 7 years, or on average 667 million FCFA per year (about 10 times the 2018 budget of the community). Similarly, in the classified forest of Pata, agricultural areas and human settlements currently represent 50% of the surface of the classified forest and a shortfall of 691 thousand FCFA.

- In Ethiopia, the annual aggregate crop production loss for the period 2003/04 to 2015/16 amounts 104 million tons with a market value of 48.35 billion USD at 2016 average weighted aggregate crop price due to soil nutrient depletion and loss. This implies that the country has the potential of increasing agricultural productivity from the 1.89 to 9.92 tons/ha/yr through investing in sustainable land management technologies.

Conventional agricultural practices using non-organic fertilizers yields low profits. In most studied areas, a mismatch between spatial differences in soil fertility and fertilizer doses applied leads to a depletion of soil nutrients and physical quality as well as to low efficiency and low profitability for the operator. In addition, it weighs heavily on public finances since most countries provide subsidized fertilizer and implement guidelines encouraging the over-utilization of fertilizers.

- In Kenya, only 3.2% of respondents in this study had taken their soils for nutrient analysis. This is despite the continuous and consistent use of different forms of fertilizers. In other words, farmers apply fertilisers without really knowing the real status of fertility in their soils. Soils in areas with continuous cultivation without appropriate management practices have low fertility levels due to over-utilisation.

- In Mali, organic cotton farmers have an average yield of 450 kg/ha of cotton, half that of conventional cotton farmers. However, input costs are also significantly different, about half those of conventional cotton farmers, explaining the profit of 80,600 CFA/ha, slightly higher than that of the average conventional cotton farmer. These calculations do not include the societal cost of production, which is much higher for conventional farming.

Sustainable land management measures are cost-effective. Most of the options assessed in these case studies are financially and economically viable for producers. Not only do the benefits from investing in sustainable land management practices exceed the costs of investment, but analyses show even greater benefits when taking into account costs and benefits to societies. There are therefore sufficient economic and financial reasons for large-scale adoption of sustainable land management measures.

- In Ghana, FMNR constitutes a long-term investment in soil quality. Through the use of FMNR and crop rotation, farmers can increase productivity of their cropland by an estimated 83 per cent within five years. As tree density increases so does the crop yield.

- In Mali, farmers can increase their yields by 110 kg / ha using agroforestry practices and their cash income, linked to the production of forest products (cashew nuts, shea nuts, néré, firewood) in the dry season by around 27,000 CFA / ha

SLM practices are profitable within specific timeframes. All SLM options have advantages over the status quo or business-as-usual scenarios and are economically feasible for adoption. Studies need to look at different time frames, both medium and long term to identify the most optimal SLM practices. Nevertheless, cost-benefit analyses also indicate that not all SLM practices are comparable over time. These should be carefully chosen based on a complete assessment of costs, benefits, soil suitability and local knowledge. For most SLM practices, investments require at least 3 to 4 years to start generating additional net value compared to business as usual. Benefits of agroforestry are usually longer term and require greater initial investments compared with other options while vegetative strips, organic fertilization, fertilization mineral, the combination of organic fertilizers are easy to establish and maintain and have relatively low costs.

- In Senegal, the fallow of rainfed crop areas in Kamb is profitable only in the medium and long term, that is to say beyond four years. All other SLM options such as organic fertilization, mineral fertilization, the combination of organic and mineral fertilizers, agroforestry and ANR are profitable whatever the period considered.

- In Kenya, the study shows in the business as usual scenario that agroforestry and crop rotation present the highest net present value followed by vegetative strips while mixed cropping combined with other practices has the lowest NPV. The benefit-cost ratio under the same scenario indicated that vegetative strips, cover crops and organic crops, and terracing in that order presented the highest BCRs.

Establishment and maintenance costs can be obstacles to the adoption of SLM practices. Transitioning from conventional land management practices, including subsidized practices, may require initial investments in terms of labour and equipment that could act as obstacles to a broader adoption of SLM practices. However, it may also provide an opportunity to create rural employment.

- In Mali, the transition to sustainable land management practices requires initial investments in labour and other agricultural inputs (tree plantations, construction of soil defence and restoration works). It is therefore important to stimulate access to low-rate credit for small farmers, and support investments in SLM, especially agroforestry.

- In Ethiopia, the developing econometric models of establishment and maintenance costs for better soil fertility show that labour cost on average

is 60.83 per cent of the establishment cost and 72.66 per cent of the maintenance cost for SLM practices. This labour cost could generate a maximum of 5.96 million rural job opportunities for the 5 years period at annual wage rate of 468.21 USD per person per year and a minimum of 3.92 million rural jobs at an annual wage rate of 712.88 USD per person per year

Financial engineering can be mobilized to help people remove financial barriers to initial investment. The lack of capital to invest and the shortfalls of years of investment could act as a barrier to the adoption of measures that are otherwise financially profitable over time. The assistance provided to mitigate this initial cost can be in the form of credit by financial institutions or a subsidy (partial or total) by communities, the state or international development aid organizations, and/or reductions in transaction costs associated with the various financial instruments. It can be for the benefit of an individual or a self-structured group (cooperative, association, etc.) and be adjusted according to the level of profitability expected.

- In Senegal, domestication of improved varieties in the Kaffrine region generates a financial loss of more than 1 million FCFA the first year, which will be difficult to bear by the village community even by pooling its resources. The losses in years 2 and 3 (of the order of 15 to 20,000 FCFA) should, on the other hand, be able to be borne by the community in view of their income. Funding from a financial institution, government agencies or international development aid organizations for a year may be sufficient to facilitate the domestication of species by helping to overcome this financial blockage to adoption.

Key additional findings

In addition to the economic arguments for investing in SLM, the studies highlighted underlying conditions that are key to the success of SLM investments as well as additional benefits.

SLM practices contribute to increase food security and climate resilience. Communities that have adopted SLM practices are more food secure than other communities that do not, through increased productivity and diversification of crops. Climate change also poses an increasingly severe challenge to agricultural livelihoods due to an increased frequency and intensity of extreme weather events. Thus, income diversification plays a crucial role in reducing food insecurity and vulnerability under these challenges. As such working on achieving SDG 15.3 through SLM also contributes to achieving other SDGs such as 2.3, 2.4 and 13.

- In Ghana, communities that practice FMNR are considerably more food secure and climate resilient. In qualitative terms, FMNR farmers are more food secure relative to non-FMNR farmers since they can harvest a wide range of on-farm forest products (fruits, nuts and pods) during the dry season when they otherwise would face food shortages. The average net present value of enhanced forest produce (e.g. ebony fruits, shea nuts, dawadawa seeds, mango fruits and fuelwood) as a result of adopting FMNR is in the order of GHS 190 per acre per year.

- In Mali, food insecurity could be one of the main reasons why people in Koutiala wish to abandon cotton in favour of food cropping. 17% of cotton producers had experienced times of hunger and were unable to eat due to lack of money or other resources during the year prior to the survey.

- In Ethiopia, it is calculated that investment in SLM to avoid soil nutrient loss and depletion and the corresponding crop production losses will increase the total per capita domestic food crop production from 348 to 1146 kg at country level by 2030.

Socio-economic factors are determinant in sustainable land management. The results of the studies show that equitable access to the economic benefits (both assets and incomes) of conservation, gender inclusion (particularly women in decision-making), accountability of resources and inclusivity and participation of all members in community meetings are the major determinants of the sustainability of all practices in communally owned land.

- Gender equality. Given gender-differentiated roles and responsibilities in natural resource management, sustainable rangeland management must address the specific needs and opportunities of women and men so as to reduce inequalities, stimulate growth, and reverse environmental degradation.

- Communities involvement. The results of planning and the implementation of measures can only be sustainable if plans are made with and by the local community. To ensure a feeling of ownership concerning activities, local communities who are affected by land degradation need to be involved in the planning process from the early beginning.

- Community-based natural resource management governance. Poor governance was identified as one of the land degradation drivers. By providing rules, processes and structures through which decisions are made about the use of land, and by controlling the manner in which the decisions are implemented and enforced, land governance is key in an environment of competing interests in issues of land management.

- Land tenure and benefit sharing. Unclear land tenure is one of the main obstacles to the uptake of sustainable land management practices. User rights may be difficult to secure, either because of the lack of clear and specific legislation known to the populations, because the exclusivity of benefits for an actor cannot be guaranteed, or because the collective organization seems dysfunctional. Supporting land tenure arrangements in combination with community-based governance are key to ensure the sustainability of adopted measures.

Institutional environment is key to the sustainability of SLM practices. The broader institutional

environment plays a major role in determining the sustainability of SLM practices, especially those aimed at conservation of communally owned resources. As land degradation is a cross-cutting issue that involves multiple sectors (land, environment, agriculture, forestry and water), there is a need for policy harmonization and institutional coordination in the preparation and implementation of policies and programmes at both the sub-national and national level.

Barriers to the uptake of SLM practices. The gradual abandonment or non-adoption of the measures assessed, despite their apparent overall financial and economic profitability, suggests that there are other barriers to adoption. ELD studies did not assess all barriers to action in a comprehensive manner, but assessed the economic viability of the implementation of specific measures within a given period. It is, however, possible to draw some elements from the contexts of the ELD studies summarized in this report to identify possible barriers to adoption that could benefit from further analysis.

- The lack of awareness, documentation and dissemination of technical information seems to limit the adoption of more sustainable land management measures by the populations. They have little control over their production system, which depends heavily on rainfall, the quality of the ecosystem and its ability to regenerate. They do not always seem to know or master the possible alternatives to their current practices, or the practices that could be adopted in addition to their current practices in order to sustain their livelihoods. Proper record keeping and documentation of the benefits of different SLM technologies and practices that are suitable for specific locations should be initiated. The enhancement and promotion of knowledge exchange and subsequent uptake of SLM practices can be facilitated.

- The lack of farmers' equipment (boots, cutlasses, wheelbarrows etc.), access to credit and labor are also considered among the main constraints of the farmers impeding a more widespread adoption of SLM practices.

- Farmers also consider that weak land and tree tenure is a constraint to investing in SLM. Well defined land and resource tenure is critical in the adoption of SLM practices and requires better enforcement of statutes to secure property rights to land and rangeland resources, including formal recognition of customary institutions.

Limitations

The results of the studies extend the knowledge beyond simpler relationships such as the effects of soil erosion on crop yields, providing further evidence for a range of viable SLM options to address land degradation and improving the livelihoods of resource-poor farmers. Nevertheless, studies showed some limitations related to the following aspects:

- While acknowledging the importance of all ecosystem services, most studies focused on the valuation of provisioning services as being the most valued services among farmers and for which economic value could be most reliably inferred. The valuation of ecosystem services may be incomplete for some studies due to the lack of data availability and could be further developed to fully take into account the value of regulatory, supporting, and cultural services.

- Although in most studies, the sensitivity analyses indicated that the results of the NPV and BCR are robust to changes in the different parameters used in the analyses, in some cases some are very sensitive to the discount rate used. Their results should be considered carefully and refined according to specific situations in order to derive scientifically robust recommendations. In particular, sustainable land management measures applied to activities aimed at generating cash income (cash crops) and maximizing income are very sensitive to the way in which cost-benefit analyses are structured. In turn, these could lead to important implications for policy and decision making in terms of planning and institutional capacities for implementation of the SLM technologies.

- The land under consideration is degraded and with a very high margin of progression, which could explain the values obtained. A cognitive bias may have induced during the surveys an overestimation by the populations of the benefits derived from the environment and an underestimation of the costs, particularly of family labour. This bias could distort the parameterization of cost-benefit analyses and increase the

viability of the measures studied in relation to the reality on the ground. This bias can only be reduced by working with stakeholders over the long term.

- Larger samples and additional time series would contribute to the robustness of analysis. Although relevant data is available, it would be interesting to undertake an in-depth survey with a larger sample of farmers and better take into account sustainable land management measures, and the use of pesticides when applicable.

Recommendations

The studies presented here provide land management stakeholders with scientific information on the economic consequences of land degradation and possible pathways to improved rural livelihoods and land regeneration. The implementation of the most economically desirable options requires the coordinated action of various stakeholders:

- land users to implement the most economically desirable 'on the ground' option(s) by changing land management practices or land use, at multiple scales and levels.
- private sector who might directly be impacted by changes in ecosystem services to reduce risks associated with a weaker link in the value chain and increasing opportunities for investment in sustainable land management.
- public sector that can facilitate adoption of most economically desirable option(s) on the ground by adapting the legal, policy, institutional and economic contexts at multiple scales and levels.
- development partners and international organizations that can provide financial and technical assistance for the uptake of sustainable land management practices

For each stakeholder group, studies identify investments to improve land productivity focus on:

- investment into restoration or rehabilitation of degraded land (state);
- investment into reduction of degrading land (pace of land degradation, process);
- improvement in productivity in non-degraded land.

Land users

- Investing in existing low-cost practices for long term benefits. Land users can choose from a number of options for more sustainable management of their land that are cost-effective at their scale and do not necessarily require subsidies for their adoption as such. To this end, it is economically advisable to use local, low-cost solutions that do not require imported inputs in order to build soil fertility in the long term. For

Dialogue with local stakeholders in Somalia" (c) Mohamud Hussein

instance, intercropping of crops such as cotton, maize, sorghum, groundnut, beans and millet with legumes will bring higher agricultural productivity. These measures can be combined with the use of manure, household waste, compost, use of leguminous using crop residues instead of burning them, terraces and animal housing. These measures are also known for their ability to mitigate the uncertainties around climate variability. Soils with a healthy tree cover are richer in organic matter, carbon and nitrogen; retain more moisture and are therefore more resistant to drought and flooding.

- **Land assessment.** Planting of any form of crops would benefit from the adoption of soil quality assessments by land users. This will save land users from purchasing fertilizer with low returns, while contributing to preventing further soil nutrient depletion and conserving soils and buffer against pollution and eutrophication.

- **Strengthening local governance.** Land users can mobilize themselves to review governance arrangements at the community level in order to facilitate collective actions that benefit all. Modes of social organization need to be reviewed by communities to allow for more efficient management and less resource degradation. Local, self-managed and self-financed options can greatly benefit the populations that implement them. At community or farmers' group level, improved governance can help sharing information between the land users that are practicing different forms of SLMs so that that information on which practices give better returns are available to the land users.

- **Encouraging sharing of best SLM practices.** Sharing of information among land users practising different forms of SLMs would support the uptake of important practices is accessible at the local scale. This could be further supported and documented by extension services or the creation of farmers' field groups. A deliberate effort in investing towards documenting and evaluating SLM practices and their impact on ecosystem services would also help to identify the benefits for communities and farmers.

- **Access to financing.** For sustainable management options that require it, financing options should be sought in parallel by land users to remove short-term financial barriers to adoption. This may be the case for agroforestry practices that improve land productivity but may only provide returns to land users in a period of 3 to 5 years. Access to financing schemes such as (micro)credits for the purchase of inputs and investment in equipment or insurance mechanisms should aim at accelerating adoption already initiated and not at initiating adoption, enabling farmers to scale up SLM practices, such as wheelbarrows, tree nurseries, composting facilities and small-scale water reservoirs close to farmland.

Private sector

- **Access to finance.** The private sector could assist in the uptake of SLM practices through enhancing farmer access to finance so that they can invest in the upfront costs of SLM practices. Lending institutions (credit unions, rural banks, money lenders, etc.) should therefore be encouraged to supply adequate short, medium and long-term financing for SLN and FMNR. Credits and insurance are financial instruments that could help to move away from immediate subsistence-oriented activities to commercial activities with a projection into the future. These instruments are currently not fully adapted to the needs of rural people, and do not support the transition from subsistence to commercial agriculture. Collaboration with governments and field actors from local to national levels could help to collaboratively identify win-win financing solutions, and bypass existing market, institutional or systemic failures.

- **Providing extension services.** Private enterprises (large producers and intermediaries) have a major driving role in the development of value chains by promoting horizontal and vertical integration of production chains. These companies can develop rural extension services as a complement allowing the development of their market activity. This action would facilitate the development and integration of production chains in a more direct and rapid manner. However, sensitivity to input prices has substantial impact on NPV so there is a need for the private sector to provide agricultural inputs (fertilisers, pesticides and veterinary medicines etc.) at affordable prices. Achieving this may require dialogue with policy

makers to ensure fairness to both farmers and the private sector.

Policy makers

- **Inter-ministerial coordination.** Proper coordination of sustainable land management practices will request that the line ministries complement each other on the basis of economic information to ensure successful strategy for the implementation of SLM practices. This could translate in integrating strategy for land management and country level and through an overall action and extension strategy that includes SLM practices as part of the technical packages and standards of supervisory bodies to ensure a comprehensive and sustainable approach to SLM investments.

- **Improving land and tree tenure and farmers' collateral.** Policy- and decision-makers need to clarify the customary and legal property rights that apply to land management, and their order of priority in implementation. The superimposition of too many formal and informal rules around the various, sometimes contradictory, benefits derived from land contributes to distorted perceptions of populations about their rights, in addition to contributing to the overexploitation of open access land resources. Clarification of these rights would contribute farmers and forest-adjacent communities to embracing forest management and sustainable land management practices by creating an incentive to invest in medium- and long-term benefits. The review of rights of ownership, use, enjoyment and usufruct, must be implemented through a multilevel approach, from the local to the national level.

- **Fostering a complementary action on delivery of rural extension services.** The public sector can complement the private sector in the provision of rural extension services. Land users need to be made aware not of a single, exclusive measure of sustainable land management, but rather a range of management options, sometimes exclusive and sometimes complementary, whose adoption should be considered according to the environmental, social and human context. Adequate agricultural extension services can also help farmers to keep records of their investments in the land and to raise awareness of the returns on investment for different SLM options. Capitalizing on past experiences in an objective, documented and accessible manner, will enable systematize best practices in comprehensive curriculums delivered to farmers.

- **Review the approach to financing local development.** Policy and decision-makers need to change their approach to financial support for local economic development. Instead of subsidising the adoption, it may be more cost-effective to finance activities that facilitate adoption of SLM practices. These could include production credit with a subsidy at rates that vary according to household size and expected benefits, investment in the development of commodity chains, financing of projects proposed by communities to meet the needs they themselves have identified, financing of collective organisation platforms (cooperatives, local governance platform), mixed financing (public-private), etc. The aim is to develop financing options that are complementary and mutually reinforcing, with a finite duration consistent with the time steps required for the sustainability of activities.

- **Review of subsidies for agricultural development.** Developing more inclusive agricultural programmes through policies to support investment in agriculture and providing incentives and/or subsidies can encourage land users to implement SLM practices. Subsidies and incentives to fertilizers or the use of non-native species for afforestation should be shifted to encourage the adoption of sustainable land management practices (agroforestry, crop rotations with leguminous species, direct seeding, mulch based system, etc.) as well as equipment such as smaller tractors and cultivators, one-row or handheld planters, roller-crimpers for conservation agriculture that are adapted to SLM.

- **Reconsider NPK fertiliser dose recommendations and fertiliser subsidies.** Government-led agricultural programmes promote the increase in fertilizer use and provides substantial subsidies, incentivizing farmers in practicing conventional, input-intensive production. However, the agronomic use efficiency of fertiliser application depends on the dose and how it combines with other farming inputs and practices. Lower spending on fertilizer programme while providing low interest loans and conditional grants

might instead support farmers in acquiring equipment that facilitate sustainable land management practices. In particular, it would support smallholders for who access to equipment is a main constraint, and who are not targeted by national fertilizers programs.

- **Capacity building on SLM.** Communities leaders and farmers would need to benefit from specific trainings on the implementation and economic benefits of SLM practices. To encourage a large-scale adoption level and to ensure the sustainability of the achievements by farmers, involvement of permanent government structures responsible for organizing and supporting rural development as well as the inclusion of a holistic economic view of SLM practices in training and teaching is key. SLM measures should be integrated into the specifications of these structures in order to be integrated in intervention strategies at local level.

NGOs, international development aid organizations, and rural lending institutions

- **Making the business case.** Given the scale of the challenges posed by land degradation and climate change, it is essential that private investment is used to mitigate and adapt to these circumstances. Organisations involved in promoting SLM should make the business case for re-greening investments and show that these pay off. By assisting selected SLM farmers in keeping track of their costs, revenues and profits, an evidence base may be built, which will help convince donors, governments, and lending institutions that SLM are low-cost investments with significant economic returns.

- **Facilitating access to finance.** International stakeholders can help policymakers to develop innovative access finance mechanism that can help communities and farmers to absorb the upfront cost of establishing SLM practices.

- **Technical assessment of local conditions and priorities.** International stakeholders are encouraged to review project design to ensure a better technical fit between measures and local conditions. This could include a technical diagnosis before any intervention, reviewing approaches and funding provided so as to avoid perverse incentives, building up on past experiences and actively engaging stakeholders in governance arrangements.

- **Awareness raising on SLM practices.** International development stakeholders can help raise awareness of the benefits of a range of more sustainable land management measures, complementing the rural extension services provided by the private and public sectors.

- **Community engagement and empowerment.** The selection and implementation of SLM measures should be an iterative process based on strong dialogue amongst all stakeholders. In particular, local communities who are affected by land degradation need to be involved in the planning process from the early beginning to ensure ownership and sustainability. The process should enable stakeholders to negotiate and decide on a sustainable form of land use in rural areas as well as initiate and monitor implementation.

Training methodology and ELD Campus

Participants provided positive feedback on the ELD methodology training organized in each country prior to conducting the studies to identify economic arguments to policymakers on the benefits of investing in sustainable land management practices. Almost all participants who participated in the ELD methodology training (94.12%) were also engaged in the ELD studies (80.39%) as a researcher or lecturer. After the training, two thirds of the participants felt that they could instruct others on ecosystem services valuation, the economics of land degradation and the ELD methodology.

Most participants, however, pointed out that further training would be required to deepen their knowledge. In particular, participants recommended further support to be able to apply the ELD methodology and to lecture on the ELD approach, including case studies for application of the valuation of ecosystem services; land degradation and investment scenarios; cost-benefit analysis methodologies and criteria for choosing the most appropriate methodology; development of reliable cash-flows from primary data; and further capacity building on the statistics software Stata. In order to further strengthen the science-policy linkages and uptake for decision-making, participants would welcome further support in the formulation of policy recommendations based on the results of ELD studies, drafting policy briefs for decision-makers and communication techniques to decision makers.

The ELD Campus, comprised of ELD learning and teaching materials, was complementary to the in-person training and helped researchers to gain additional knowledge and to go deeper in each step of the ELD methodology. For further improvement of the ELD Campus, users recommended to include additional country-level studies, exercises and assignments. More generally, the ELD Campus content should be streamlined for ease of understanding. It could potentially be integrated into academic programs as an elective course with accreditation, while part of it could be made accessible to non-academic stakeholders, for instance to policymakers, to encourage uptake of the ELD approach.

Conclusions

The ELD studies carried out in the eight countries analysed degradation from two perspectives: the economics of land degradation (losses) and the economics of improvement of land management (benefits). The case studies have shown that the degradation of land has a high cost in terms of lost profits and negative social impacts. They also showed that land restoration brings benefits to populations who have invested in sustainable land management practices. Most of the options assessed in these case studies are economically and financially viable for farmers. Studies show that SLM practices address multiple issues simultaneously: land degradation, soil infertility, food insecurity and loss of biodiversity as well as climate change. In addition, well-conceived FMNR projects facilitate good governance, greater collaboration and community cohesion. There are therefore sufficient economic and financial reasons for large-scale adoption of sustainable land management measures. Significant obstacles to up-scaling of SLM practices remain, however, ranging from high initial investment costs, lack of access to equipment and labour, limited availability of rural credit, contradictory policy incentives and the absence of strong land and tree tenure rights for smallholder farmers. NGOs, the private sector and government agencies can address different aspects of the situation and help create an enabling environment for farmers and communities to invest in sustainable land management.

The implementation of ELD methodology with prior training followed by field work, with the support of international experts, received consistently positive feedback from stakeholders. For most countries, it was the first time indeed that rigorous economic analysis was conducted to assess the costs of land degradation and the benefits of investment in sustainable land management. Despite a tight timetable and limited budgetary resources, the studies helped to create a better understanding of economic valuation by cost-benefit analysis, its implications, and its limitations. Members of ELD working groups and researchers have gained knowledge and have shown interest in further develop of this expertise.

Some key challenges regarding capacity building were the high number of participating institutions and of "trainees" as well as of ELD sites due to high interest and, in some cases, the limited availability of time the participants could contribute due to their regular work commitments. As group work was required, the joint development of scientific reports and publications across different sectors and different professional backgrounds of participants was a challenge for the participants. Also, depending on the participants' training and background, some groups experienced difficulties with the actual cost-benefit analysis, which required very close support by the study leaders. As most groups successfully progress and support each other, further project inter-institutional collaboration, knowledge sharing and data exchange were enhanced. Furthermore, new impulses for the science-policy dialogue on suitable solutions to fight land degradation and to promote SLM were given.

Future studies could expand to national level and/or other land management practices, since capacities have been built in countries and interest shown to replicate the approach. These additional studies would highlight the economic arguments to policy makers for investing in SLM practices in other types of ecosystems and at a larger scale. Complementary studies to include the social aspects including values that are difficult to express in monetary terms, revealed the major determinants of the sustainability of these sustainable land management practices. These are equitable access to the economic benefits (assets and incomes) of rangeland conservation, gender inclusion in decision making, accountability of resources and inclusivity and participation of all members in community meetings. Studies should also consider sharing the findings with stakeholders who participated in the study to ensure ownership of the process.

Finally, there is an urgent need at the country level to translate findings from ELD studies and political commitments to Land Degradation Neutrality into sustainable action on the ground. In addition to the barriers encounters by communities on the ground mentioned in the previous section, the weak inter-institutional coordination and dissemination to policy-makers has limited the uptake of SLM prac-

FIGURE 5 :

Economic valuation can reveal the true cost of continuing conventional agriculture, and the large potential gains of adopting more sustainable practices.

tices by policy-makers. In the context of the upcoming UN Decade on Ecosystems Restoration calling from strong commitments and efforts from countries to prevent, halt and reverse conversion of ecosystems, ELD studies can contribute to attract the interest of land users and other stakeholders (i.e. private investors) for the implementation of SLM practices by making the economic (and financial) case. In particular, recommendations from ELD studies could inform ICRAF's interventions in the countries where the studies were conducted. Further dissemination to policymakers who are developing projects and programmes to achieve Land Degradation Neutrality would also contribute to the uptake of results from the studies.

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