THE ECONOMICS OF LAND DEGRADATION

Policy Brief

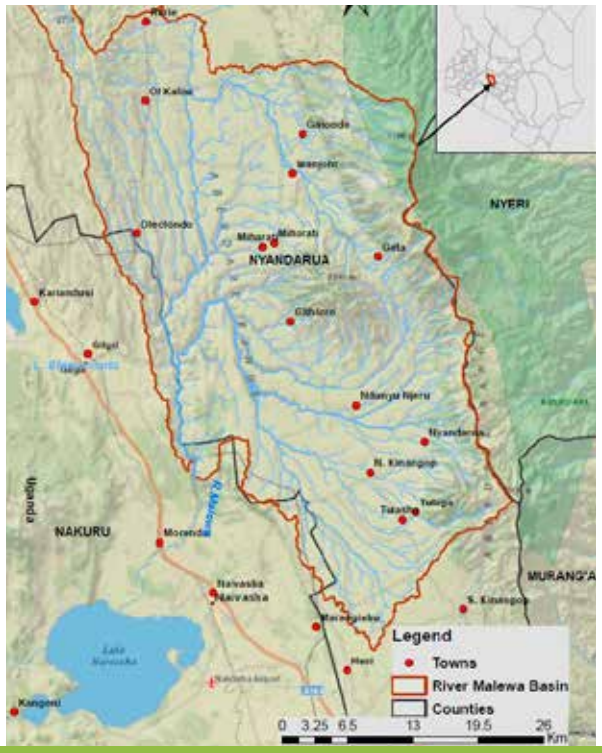
Economics of Land Use Management and Ecosystem Services in the Aberdare Water Towers, Nyandarua County, Kenya

Summary

Land degradation is a key challenge that continues to limit the current and future land productivity and the provisioning of ecosystem services. Therefore, there is a need for urgent and coordinated efforts to restore already degraded lands and prevent degradation of non-degraded lands. Key stakeholders such as farmers, land managers, and policymakers are likely to accelerate action to reverse land degradation if they better understand the economic value of productive land. In this study, we worked with farmers in the Aberdare water tower in Nyandarua county in Kenya to examine the costs and benefits associated with sustainable land management (SLM) practices. Several SLM practices – including the combination of agroforestry and crop rotation, vegetative strips, and the combination of cover crops and organic farming – emerged as the most economically viable for farmers in the study region. Based on our findings, we propose the following policy

FIGURE 1:

Map of the Malewa river catchment showing the levels of land degradation



recommendations for investments in SLM practices in the study region:

- the promotion of soil testing by farmers in the region through increased awareness and the establishment of soil testing facilities at community and/or farm level;
- more widespread sharing of information among land users and other actors such as policymakers in order to raise awareness on the economically viable SLM practices and their associated benefits;
- the establishment and implementation of incentives schemes such as the provision of subsidies to support farmers to invest in SLM practices that may have very high upfront costs (e.g. agroforestry) and may also provide other ecosystem service benefits to the wider society beyond individual farms;
- the undertaking of a more comprehensive valuation of the impacts of land degradation and the proposed interventions to restore or halt degraded lands before their implementation.

Study area and methods

In this study, we worked with farmers from 253 households in the Malewa river catchment, located in the Aberdare water catchment in Nyandarua county, Kenya (Figure 1) to assess the costs and benefits of different SLM practices and farmers' preferences for the adoption of different SLM practices that were already being used in the study region . We also analysed the land use changes in the region over a period of 28 years (between 1990 to 2018) to assess the changes in areas occupied by forests, grasslands, crops, and other land use, as well as the implications for the provision of ecosystem services in the area.

Besides providing critical ecosystem services to local, adjacent, and off-site communities, the Aberdare water tower serves as the main catchment for both the Sasumua and Ndakaini dams and provides over 90 per cent of the water to Nairobi, the capital city of Kenya, whose estimated population now amounts to 4.4 million people. Most of the communities in the study region – the majority of whom rely on rainfed agriculture for their livelihoods – depend on the water that originates from the Aberdare Ranges. Rapid growth in human population, poor soil conservation practices, and deforestation have contributed to the deterioration of land productivity and affected the provision of ecosystem services in the area.

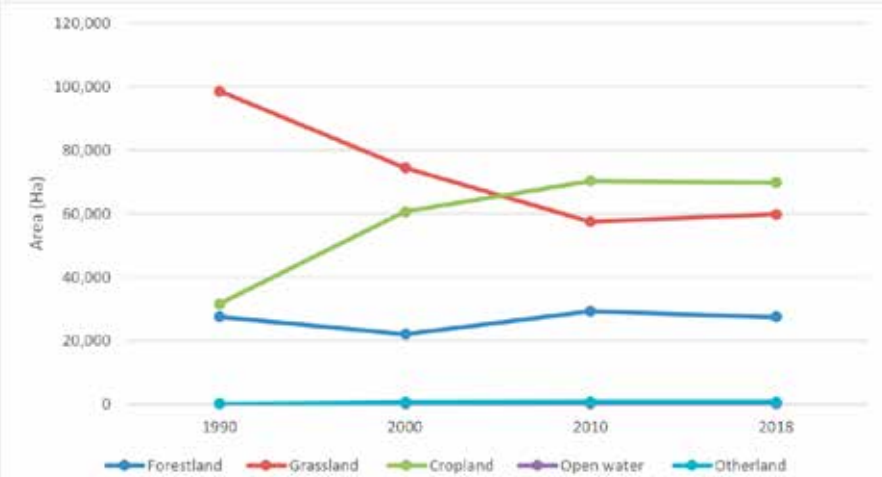
Cost-benefit analyses (CBA) were performed using a discount rate of 7 per cent which is the current prevailing bank deposit interest rate in Kenya. In order to test the robustness of the CBA results vis-a-vis changes in some of the key numbers, sensitivity analyses were also carried out using a lower interest rate of 3 per cent (reflecting a lower discount rate of future values) and a higher interest rate of 15 per cent (showing a higher discounting rate of future values).

Results

Our analysis shows major changes in land cover between 1990 and 2010, mainly on cropland and grassland. During this period, the areas under cropland increased by about 40,000 hectares and those under grassland decreased by about 50,000 hectares, and thereafter stabilised until 2018 (Figure 2).

FIGURE 2:

Land cover changes between 1990 and 2018.



The combination of agroforestry and crop rotation emerged as the most viable practice across all three discount rates considered. Although agroforestry yields positive net benefits to farmers which also accrue over a longer period of time, investments in agroforestry require high initial capital costs. This calls for additional public financial support to farmers, especially as agroforestry provides other ecosystem services that benefit the wider society beyond the individual farmers. Our analysis shows that other SLM practices such as vegetative strips and the combination of cover crops and organic farming are also viable for farmers in the study region. Vegetative strips and cover crops in particular give faster returns to farmers within the first year of investment and can therefore be widely adopted since they do not require high capital costs. Table 1 provides a summary of the results from our analysis and their policy implications are further elaborated below:

TABLE 1:

Summary of the cost-benefit analyses with three different discount rates.

Discount rate	Results from the CBA analyses
Prevailing discount rate (7%)	• The combination of agroforestry and crop rotation had the highest NPV followed by vegetative strips. • The BCR estimations showed that vegetative strips, cover crops with organic crops, and terracing plus other practices have the highest BCRs. • Mixed crops had the lowest positive NPV.
Lower discount rate (3%)	• Agroforestry and crop rotation had the highest NPV and benefits to farmers accrued after a longer time but they require a high initial investment. • Mixed crops had the lowest NPV. • Vegetative strips had the highest BCRs, followed by cover crops with organic farming. • Agroforestry and organic farming presented the lowest BCRs.
Higher discount rate (15%)	• Agroforestry and crop rotation had the highest NPV followed by vegetative strips. • Mixed cropping had the lowest NPV. • Vegetative strips were the most profitable (high BCR) followed by cover crops with organic farming. • Mixed cropping presents the least preferred option.

BCR = benefit-cost ratio, NPV = net present value.

Our study also revealed two major challenges to addressing land degradation and implementing of the appropriate SLM practices in the study region. First of all, the majority of farmers are not aware of the soil quality of their farms. Only 3 per cent of the 253 farming households (i.e. eight respondents) that we surveyed had taken their soil samples for nutrient analysis. This situation has led to inappropriate application of chemical fertilisers by farmers, which often results in too much or too little application of nutrients needed by the plants to grow. This imbalance in nutrient supply over the years has led to a depletion of native reserves of secondary nutrients and micronutrients, ultimately resulting in a decline in soil health and crop productivity. Secondly, there is a low level of awareness among stakeholders such as farmers and policymakers at the county level regarding the potential benefits of investing in currently available SLM practices. This requires that information about SLM practices are made broadly available for land users, policymakers, researchers, and the private sector in order to provide a range of options for decision-making at different levels.

Policy recommendations

The following policies can be applied to stimulate the adoption of the viable SLM practices by farmers in the study region:

1. Promote the establishment of soil testing facilities by both the public and private sectors to enable farmers to undertake soil testing more widely before the application of soil nutrients such as fertilisers on their farms. Soil testing will ensure that fertilisers and other organic nutrients are used more efficiently to increase farm productivity and provide better financial returns to the farmers.
2. Support a more widespread sharing of information among land users and also with other actors such as policymakers in order to enhance awareness of the economically viable SLM practices and their associated benefits, ultimately leading to their wider adoption. This can be achieved through the establishment of Farmer Field Schools (FFS), community demonstration farms, and building capacity of agricultural extension service providers. Moreover,

knowledge of these practices should be shared with decision-makers at the county levels.

3. Establish and implement incentives schemes such as the provision of subsidies in the form of Payment for Ecosystem Services (PES) and other tools that can support farmers to invest in SLM practices that have very high upfront costs (e.g. agroforestry) and which also provide other ecosystem service benefits to the wider society beyond individual farms. This can be actualised by both the county and national governments through the ministries responsible for agriculture and also by NGO actors and the private sector.

As the study was limited to SLM practices only, there is a need for a more comprehensive valuation of the impacts of land degradation on ecosystem services and the effects of potential interventions before their implementation.

For more information about this ELD study and the findings, please contact:

- Dr. Moses Kirega
  Email: mgichua@jkuat.ac.ke
- Dr. Philip Osano
  Email: philip.osano@sei.org
- Lutta Alphayo
  Email: lutaalpha@gmail.com

For further information about the ELD Initiative, please visit our website:

- www.eld-initiative.org
- ELD Secretariat
  info@eld-initiative.org
- Mark Schauer
  c/o Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
  Friedrich-Ebert-Allee 32
  53113 Bonn, Germany

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