

Land use changes, optimization strategies and the role of institutions for sustainable natural resources management in the Bale Eco-Region

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Summary

This study was carried out in the Bale Eco-Region (BER) of Ethiopia to assess and empirically analyze the dynamics and influences of land use/land cover (LULC) changes and institutional arrangements vis-à-vis the bioeconomic optimality and efficiency of alternative land-use and -management practices. A cross-sectional survey of 479 households covering three distinct agroecological zones was carried out in 2016. Additional data were collected from satellite images, field assessments and key informant interviews. Findings from the study showed that forest and woodland areas have declined with an estimated 2,879 and 10,000 ha/year which amounts to 0.6% and 2% of its area in 1986, respectively over the last three decades (1986-2016). Farming and settlement areas showed the highest increase, with an estimated 5,779 ha/year, an average increase of about 2% compared to the base year, 1986. The overall rate of decline of forest cover of the BER has steadily fallen since 2006. Deforestation and land-use conversion

A community living in an area being rich in natural resources in Harena District, Bale Eco-Region.

rates in areas under Participatory Forest Management (PFM) and Participatory Rangeland Management (PRM) have significantly declined. Positive outcomes in biodiversity conservation through the PFM/PRM systems were also accompanied by emerging trends of income generation by local households from alternative green economic activities. Yet, the aggregate economic returns of land uses and farming practices under PFM/PRM are much lower under regional and federal administration systems. The study concluded that participatory natural resources management, through joint PFM/PRM schemes, cannot significantly improve biodiversity conservation. However, its apparent economic trade-offs to the local poor need to be critically addressed. This could be achieved through greater intensification of current farming systems and adoption of higher-value green livelihood sources supported with prudent value addition and market networks.



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Background

The Bale Eco-Region (BER) is known for its rich biodiversity and high level of ecosystem services. However, over the last few decades the region has been under increasing threat from a wide range of sources. Addressing these multifaceted threats facing the ecoregion, the institutional gaps and ineffectiveness of strategies require an understanding of the trends in LULC change, the role and influence of formal and informal institutions vis-a-vis land and Natural Resources Management (NRM) strategies. The research addressed temporal and spatial LULC dynamics and its proximate and underlying drivers that are imminently leading to ecological damage that is affecting the whole BER. The institutional dynamics governing the interaction between community, the environment and land use dynamics in the BER over different governance periods and among different institutional arrangements were analyzed. The study also included analysis of the bioeconomic optimality, synergies and trade-offs between different land-use and optimization strategies for improving local livelihoods and the environmental sustainability of the BER.

Methodology

This study was carried out in the BER located in the Bale administrative zone of the Oromia regional state of Ethiopia.

Purposive and multi-stage stratified random sampling approaches were used to collect primary and secondary data. In the 1st stage, the 14 districts in the BER were categorized into three clusters (Highland, Midland and Lowland). Then, five districts (Dinsho and Goba from highland; Harena Buluk from midland and Delo Mena and Berbere from lowland) were selected based on: representativeness to major LULC types, farming system, land management practices, natural resources interdependence and interlinkages, existing land and NRM systems and institutional arrangement vis-a-vis land use trends and land-management interventions, environmental degradation and local livelihoods. In the third stage, two representative Kebeles from all five district (i.e., 10 Kebeles) were purposively selected.

In the fourth stage, stratified-random sampling was used to select sample households. Accordingly, 479 farm and agropastoral households were interviewed. Participatory assessment and score ranking of environmental

performances of land use practices of farm/pastoral households were carried out, involving researchers, households and land users, local development agents and experts. To supplement the households and field data, interviews of key informants with experts at zonal/district/Kebele level were carried out and two Focus Group Discussions (FGDs) were conducted in each district. Review and retrospective analysis of relevant government policies and laws, formal and informal institutions and development strategies were carried out. Data were analyzed using SPSS software and interpreted descriptively.

Findings from the study

Land use and land cover changes in time and space in BER

The BER has experienced significant changes in LULC during the period of 1986–2016 (Figure 2).

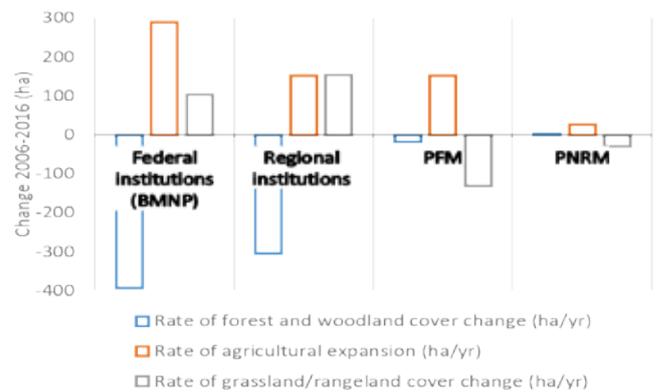


Figure 2: Land use change and NRM in BER under different

Most notably, woodland cover has shown the largest decline, annually shrinking about 10,000 ha, which is equivalent to about 2% of its area in 1986. The area of forest has declined as well, with an estimated 2,879 ha/year which is 0.6% of its area in 1986. Agriculture/settlement showed the highest increase, with an estimated 5,779 ha/year, indicating an average increase of about 2% compared to the base year, 1986.

LULC change analysis under different institutional arrangements (2006–2016) showed a decline in forest and woodland cover and an increase in agricultural land except under PFM and PRM where it showed the lowest rate of decline compared to other land cover types. The increased agricultural land and settlement area at the expense of woodland and forest area is understood to be due to the influx of migrants and settlers along the mid (Harena-Buluk) and lower altitudes (Delo-Mena) of the BER. The FGDs and key-informant interviews (KIs) confirmed that immigration into the BER coupled with the natural population increase has been a major driver of changes in LULC.

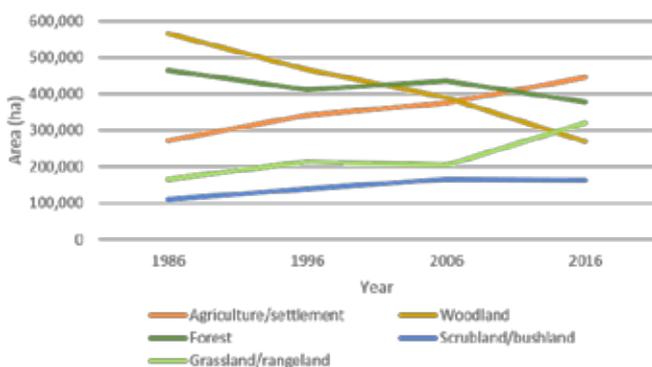


Figure 1: Trends of LULC changes in BER between 1986 and 2016.

Institutional Changes and NRM in BER

NRM and conservation in BER under different institutional arrangements at present

Comparative analysis of the rate of deforestation and change in grazing land (grasslands) in the highlands, midlands, and rangelands in the lower altitudes of the BER has shown remarkable differences among the four NRs governance institutions: i.e., the federal government (Bale Mountains National Park, BMNP), regional government (district), PFM and PRM (Figure 2). Evidently, the rate of deforestation and conversion of woodlands into other LUs was highest under the first two NRM institutional arrangements. The main reason for the high rate of deforestation and expansion of grassland cover under the federal (BMNP) and regional (district) administrations, especially in the highland and midlands of the BER, is the need for more agricultural and grazing land for the increasing number of households in the areas.

A possible explanation for the significant decline in the rate of deforestation under PFM and PRM especially under PFM could be due to improved conservation of forests, partly as a result of livelihood diversification and/or positive influence (restriction to advance into forest/woodland areas) of the PFM and PRM institutions. Conversely, the sizeable decline in grassland or rangeland cover under PFM and PRM is due to expansion of agriculture and illegal settlements through converting grasslands and rangelands along with the decline in the number of livestock holding per household in these Kebeles or a combination of those factors.

According to KIIs, some of the economic challenges of PFM and PRM for households are the small landholding sizes, restrictions to access and use of resources and ecological stress factors such as insufficient and erratic rainfall that are hampering the full-size practicing of conventional cropping and livestock production systems in these areas. As a result, tendencies and acts of sporadic illegal agricultural expansion and settlement as well as illegal wood harvesting in PFM and PRM frontiers especially by poorer households and jobless and/or landless youth are common in Kebeles under PFM and PRM. Despite the economic trade-offs, natural resources management and use under PFM and PRM institutions has shown remarkably higher environmental sustainability.

Land management and land use optimization strategies in BER

Assessment and evaluation of the contribution of different Land Management Practices (LMPs) in BER in improving farm productivity and local livelihoods showed significant variations across agroecologies. In the highland agroecology, adoption of manure/ compost, modern terracing, fallowing and hay-making were strongly correlated with higher crop yield and income. In the mid-altitude, inter-cropping, traditional terracing and agroforestry showed a higher rate of adoption but generally an insignificant impact on crop yield and income.

On the other hand, cut and carry, rotational grazing and traditional terracing were the LMPs showing the best impact on farm/livestock yield and household income in the lowland agroecology. The results suggest that despite the increased economic returns, many of the LMPs and

optimization strategies being promoted in the BER fall short of improving the environmental integrity and reducing land degradation, soil erosion and deforestation.

Bioeconomic optimality analysis of major land use/farming systems in BER

A farm-level static bioeconomic model was used to quantify and model the interactions between the economic production processes (input-outputs) and environmental effects (soil quality, forest, biodiversity) of major land uses/farming systems of rural households in BER. The results imply that crop-livestock mixed farming (in highlands), tree-crop-coffee agroforestry and tree-crop-livestock agropastoralism (in midlands and lowlands) have promising potentials to provide higher economic returns while also maintaining the ecological integrity and sustainability of the BER.

Major challenges for optimal land use and sustainable NRM in BER

Only three among the eight farming or land use practices studied in the BER, showed a fairly good (≥ 0.5) combined optimality (economic efficiency and environmental sustainability). A fundamental question that needs to be addressed is why rural households in the BER are engaged in the other five farming practices when they are not environmentally sustainable? A more intriguing question is why these households are engaged in farming practices that are not even economically rewarding? What is driving the decision of households in the BER to adopt certain types of farming practices?

Answering these questions is not simple but it is clear that many rural households in the BER take conscious decisions on whether or not to adopt a certain land use practice on the grounds of several endogenous and exogenous factors. Endogenous factors include: need to fulfill food requirement for household consumption, gender, family labor, education, economic status and livelihood traditions. However, most determinants are exogenous and strongly linked to local agroclimatic conditions, market demand for crop variety/ farm produce, government policy and development packages, among others.

Conclusions

This study has shown that over the last few years rates of deforestation and environmental degradation are significantly declining in the BER, particularly in areas that are managed through PFM and PRM. Although exact quantitative measure could not be produced on how much of the improvement is exclusively due to PFM/PRM interventions, much of the evidence manifests that PFM/PRM interventions are bringing substantial positive results to the sustainable management of natural resources in the BER.

The positive outcomes include: improvements in participation and benefit of local people from the joint NRM, increased access and income of local households from alternative green businesses, and improvements in livelihoods from adopting some integrated farming systems and improved range management approaches. As a result, the awareness, sense of ownership and commitment of local people for sustainable management and use of forest and biodiversity resources of BER have considerably increased. In contrast, deforestation, agricultural expansion and land degradation remain relatively unabated with existent threats to sustainable NRM in

most parts of the BER administered by the federal (BMNP) and regional government institutions. The study has also uncovered that embracing participatory NRM (PFM or PRM) is not a panacea by itself for all problems of unsustainable NRM in the BER. In a nutshell, the study demonstrated that recent PFM and PRM interventions by the SHARE Bale Eco-Region project have significantly improved the environmental sustainability of NRM in the BER; implying the promising potential of joint NRM for sustainable biodiversity conservation in the BER. However, both the BER and the joint NRM still face serious challenges remain in dealing with population growth, institutional gaps and economic trade-offs. Hence PFM-PRM schemes need to improve their economic competitiveness to balance short-term lost benefits of local households due to increased conservation. Ensuring sustainable NRM and optimal land use essentially requires maximizing the synergy between economic and ecological outputs of farming practices of rural households through increased intensification of bioeconomically optimal farming systems with higher yielding crop and livestock production models and effective LMPs and PRM systems with competent alternative green income sources.

KEY RECOMMENDATIONS

- Maximize current synergies and minimize economic trade-offs between PFM/PRM and local livelihood activities.
- Further build entrepreneurial skills, business capacities and work towards higher-value farm production by households in PFM/PRM.
- Strengthen the effectiveness of the institutions working in PFM and PRM.
- Create and influence higher-level (federal, regional, inter-regional) policy dialogues and prospective land use and development plans.
- Enhance the bioeconomic optimality and current land use and land management technologies for sustainable biodiversity conservation.
- Harness the pressure from human population growth and immigration on land and natural resources within and downstream of the BER.

About the SHARE Bale Eco-Region project

Conservation of Biodiversity and Ecosystems Functions and Improved Well-being of Highland and Lowland Communities within the Bale Eco-Region (BER) is one of the European Union (EU)-funded projects that stands for Supporting Horn of Africa Resilience (SHARE). In Ethiopia, the project covers 16 districts (*Woredas*) in West Arsi and Bale Zones of Oromia Regional State, with around 22,000 km², comprising a population of about 3.3 million. The life span of the project is 42 months starting in July 2014 and ending in November 2017. Five partners are implementers of the project, which are: Farm Africa, SOS Sahel, International Water Management Institute (IWMI), Frankfurt Zoological Society (FZS) and Population Health and Environment (PHE).



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