Recognizing local agro-ecological knowledge in sustainable intensification of tree-crop-livestock farming systems

Introduction

Decline in agricultural productivity due to severe land degradation is a common issue in many farming systems in Ethiopia. Several places, including the high potential agricultural areas, are dealing with highly degraded landscapes and severe soil loss.

Loss of soil in many parts of the country has long been deemed responsible for significant decline in grain yield. In addition, smallholder farming systems are facing a great threat from the changing climate. These systems have to adapt to climate changes and productivity has to be increased to meet food security objectives. To achieve this, system intensification is key, but it has to be sustainable. This can be done by integrating trees into the farming system in a manner that enhances sustainability of these systems.

Managing tree-crop-livestock mixed farming systems involve knowledge-intensive processes, as it comprises trade-offs and synergies. It is vital to match the right components and management practices to production systems and ecosystems. Beginning with the local people's understanding of their farming system is a good starting point. This will ensure identification of knowledge gaps and demand-driven entry points.

1. What do farmers know well?

Complex knowledge about ecological processes was obtained from three sites (one in Oromia Regional State, Arsi: Bekoji and two in Tigray Regional State: Abreha Wa Atsbeha and Adi Gudom), albeit with distinct variation in farmers' knowledge among the sites. To collect, record and analyse local knowledge of tree-crop-livestock interactions, the AKT5 (Agro-ecological Knowledge Toolkit) software and methodology was applied across the three sites in Ethiopia with contrasting agro-ecologies, farming systems and degree of success in terms of integrating trees in their farms.

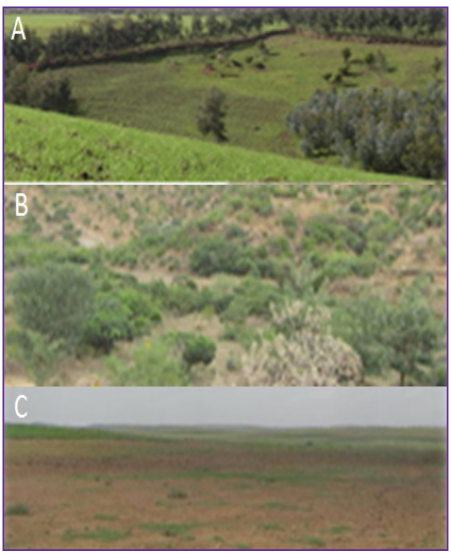

Figure 1: Typical landscapes in the study sites, Arsi midslope (A), Abreha Wa Atsbeha (B) and Adi Gudom (C)

In Abreha Wa Atsbeha farmers had detailed understanding of how conservation structures and vegetation in

the upper part of the watersheds contribute to the amount of ground water recharged in the lower part of the catchment. They explained conservation and re-greening activities in terms of what they call "the water bank" (Figure 2).

Figure 2: Round water well in Abreha Wa Atsbeha

One of the community members described this as *"…building conservation structures, making area closures and allowing regeneration of vegetation on the upper part of the watershed is like putting your money* [in this case water] *in the bank* [in this case water harvesting structures in the upper part of the catchment]. *The only difference is that we are withdrawing the cheque not from where we deposit it, the upper part of the catchment, but from another place, the lower part of the catchment*."

In addition, farmers in Abreha Wa Atsbeha were purposively managing a tree locally known as *momona* (*Faidherbia albida*) for soil fertility, fodder (Figure 3), shade and as a firewood source. There was a system where farmers who did not have this tree could rent it from those who had it on their land; this was especially practised when farmers had a calving cow because fodder from this tree was said to improve the quality of the milk.

Figure 3: Sheep browsing *Faidherbia albida* in Abreha Wa Atsbeha

2. Identifying knowledge gaps

It is important to note that farmers are aware of ecological processes based on their local opportunities and constraints. Gaps in knowledge also appear to be related to the opportunities and constraints that exist within the system.

A major difference between Abreha Wa Atsbeha and Adi Gudom, both in Tigray Region, was the management of livestock and its impact on vegetation cover. Since farmers had started implementing conservation activities and grazing exclusion zones in Abreha Wa Atsbeha, there had been a significant improvement in vegetation cover, groundwater recharge and soil stabilization. In Adi Gudom, there is still widespread free grazing. Soil loss and land degradation are apparent in the landscape (Figure 4).

Barriers to tree planting in Adi Gudom were cited as: land being rented for farming; lack of access to seedlings of appropriate tree species; lack of knowledge on tree management and land being far from homesteads which made it harder to protect and properly manage them.

Figure 4: Gully erosion in Adi Gudom

It is worth noting that 20 years ago Abreha Wa Atsbeha was in a similar situation. The current success was attributed to a strong and determined local community leader. It took a lot of effort, including farmer-to-farmer learning, to mobilize the community. As a result the village received the Equator Prize for community-led environment and poverty solutions in 2012.

3. Does local agro-ecological knowledge differ in different ecologies?

In Arsi, Bekoji, biophysical conditions were different from that of Tigray, and farmers' knowledge of ecological processes differed too. Productivity in this study site had not yet begun to show a severe decline.

Figure 5: A female farmer in Abreha Wa Atsbeha drawing a farm resource map

As the area was formerly covered by a variety of native vegetation species, farmers clearly explained how this decline has resulted in changes in different hydrological services. They explained how decline in vegetation cover within the landscapes can lead to soil erosion, fertility decline and loss of soil moisture. Farmers in Arsi, Bekoji, also explained that the impact of trees on crops and pasture through competition vary from species to species. Eucalyptus, although currently expanding in the region, was identified as the most competing tree for water and nutrients. One farmer noted "*… it* [eucalyptus] *depletes all the water for other uses; if planted next to water sources, it makes the water to dry up; if planted next to crop land, it has to be at least 10m away since the poison from its roots and leaves reduce crop production significantly*."

Figure 6: *Juniperous procera* on a cultivated field in Arsi

Another important piece of knowledge that can be used for sustainable intensification in Arsi, Bekoji was farmers' knowledge and explanation of cereal-legume rotation sequences (Figure 7).

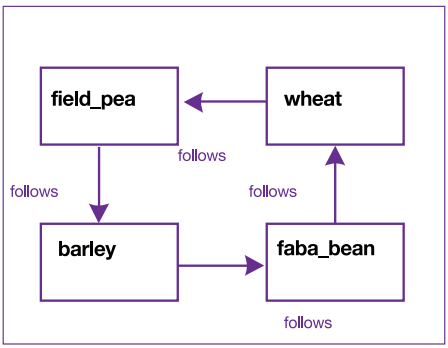

Figure 7: Common crop rotation sequence of one farm as represented in the Arsi knowledge base

Although the nitrogen-fixing ability of legumes was not explicitly described by these farmers, they explained the importance of including a legume after every cereal crop. Their main arguments were that legumes have taproot systems that improve soil structure and the broad leaves that fall from legume crops have the capacity to improve soil nutrients.

Recommendations

- There is valuable knowledge held within farming communities that can inform local interventions. However, it is important for farmers to be involved in the decision-making process, especially as they will be the ones actually implementing any changes to the farming system.
- Inclusion of local knowledge when designing interventions that aim for sustainable intensification is vital.
- As ecological and socio-economic constraints vary from place to place, we need to be careful when using this location-specific knowledge to scale up interventions.
- Analysis of local knowledge can reveal existing knowledge gaps, in which case, specific capacity building activities may need to be carried out to ensure farmers have the necessary skills to enhance their farming systems.
- For conservation efforts from successful areas to be replicated in degraded areas, farmer-to-farmer experience sharing platforms can be helpful.

Acknowledgements

The brief is the result of the Africa RISING 'Early Win' project on 'Sustainable tree–crop–livestock intensification as a pillar for the Ethiopian climate resilient green economy initiative' led by the World Agroforestry Centre. Many thanks to USAID and ILRI for funding. Our gratitude also extends to farmers and community leaders in Abreha Wa Atsbeha, Adi Gudom and Bekoji kebeles for their cooperation during the fieldwork and Mekelle University for collaborating throughout our work.

Contributors

Tesfaye Shiferaw Sida, Genevieve Lamond, Aster Gebrekirstos, Kiros Meles Hadgu, Ermias Aynekulu, Emelda Miyanda Hachoofwe, Jeremias Mowo, Dennis Garrity and Fergus Sinclair

World Agroforestry Centre

United Nations Avenue, Gigiri, P O Box 30677-00100 Nairobi, Kenya
Phone + (254) 20 722 4000, Fax + (254) 20 722 4001
Via USA Phone (1-650) 833-6645, Fax (1-650) 833-6646
Email: worldagroforestry@cgiar.org
www.worldagroforestry.org

 August 2013