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Complementary methods to understand land-use changes: an example from the Ethiopian Rift Valley

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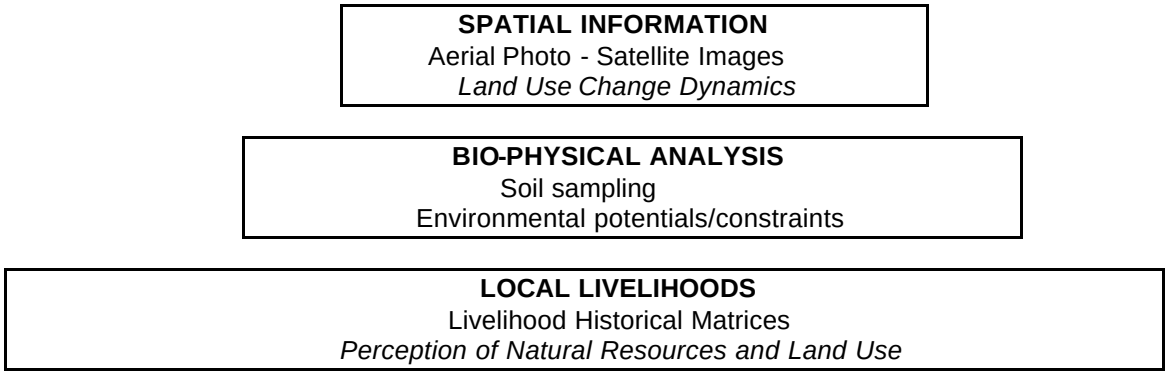
· Introduction

This case study examines agro-pastoralism in sub-Saharan Africa, exploring recent land use changes by analysing social and environmental processes. The project area is in the Ethiopian rift valley (see Box 1). We aimed to explore land use changes in the research area by using an 'holistic approach' to soil science: that is, by focusing our attention '*not just towards the physical, chemical and biological aspects, but also to those environmental, economic, social, legal and technical elements that affect soil use'*. This has been achieved by interweaving bio-physical information (obtained with the analysis of satellite imagery, soil sampling, aerial photography and mapping) with socio-economic and cultural data derived from local communities using PRA. We hoped that this mixing of methods would give us a deeper understanding of local land-use patterns (Figure 1).

BOX 1
THE PROJECT AREA

The landscape is flat, with major undulations in the western portion, delimited by the Guaraguè highlands. The Ziway, Langano and Abjiata lakes represent the southern and eastern boundaries of the research area. Local ecological conditions are characterised by low and variable rainfall. Thus, it is not surprising that the area had historically only been used seasonally by pastoralists. Agricultural intensification and related deforestation are recent processes and are fresh in people's memories. Socio-economic and cultural conditions are characterised by the coexistence of two different ethnic groups with contrasting livelihood patterns: the Arsi-Oromo inhabit the eastern and drier portion of the area and have a traditional pastoral economy, while the Silte-Guaraguè, whose society is based on agriculture and trading, live on the western side.

Figure 1. The relations between the three levels of analysis. These relations include both time and space scales. The different analysis took place at different levels (region, landscape and communities) and over different time periods (starting with remote sensing, then soil sampling and then PRA matrices)



Source: PLA Notes (1999), Issue 35, pp.16–20, IIED London

· Methods

The PRA fieldwork period (ten months in total) partly overlapped with the rainy season, enabling us to avoid a 'dry season bias'. In the beginning sample communities were identified, based on ethnic group and distance from the main roads. The latter is an indicator of market and service availability and also an expression of development: transport and communication are physical structural limits in the area. Specific issues were then selected to highlight the local human-environment system and its recent development (e.g. the importance of different crops, availability of fuelwood, changes in herd size etc.). These issues were selected for discussion with different interest groups within local communities (such as men, women, young people and the elderly), in order to grasp key elements for deeper participatory analysis.

As to the recent history of the country, discussions based on land-use changes were linked to changes in government, as this has defined structural changes in land use (see Table 1). Two PRA tools were selected and combined to gather qualitative information with local people about livelihood change over these time periods. These were the *'historical matrix'* and '*livelihood analysis'*, resulting in a 'Livelihood Historical Matrix' (see Waters Bayer 1994*)*. Matrices were completed with groups of 5-8 people over a 2-3 hour time period. Most of the matrices were completed in sample communities, but other locations, such as markets or watering places, were chosen to address key issues.

After a brief discussion on the specific issue, some local parameters were defined and the matrix was constructed by looking at these parameters over time. Once the matrix was completed, a discussion was raised, by analysing each parameter in each time period. For example, Table 2 shows how the livelihood historical matrix helped further understanding of how local people are presently more inclined to invest in manure and labour inputs to get higher crop productions.

Table 1. Variations of the socio-political environment

Time period	Land tenure	Services	Market
Hailé Selassiè (1930-1974)	Semi-feudal system	Lack of institutional services in rural areas	Barter economy with feudal structure
The Derg (1974-1991)- Agrarian Reform in 1975	Semi co-operative system with land granted by the government	Social services diffused according to the 'Villagisation' pattern	Socialist economy with local co-operatives system
Federal Democratic Republic (from 1991)	New land-granting on individual basis	Cuts to social services local 'de-Villagisation' processes	Free market economy

Table 2. Example of the Livelihood Historical Matrix produced with 5 adult men in an Oromo community on the criteria to define lands to be cropped. The higher the score, the more important the parameter is

Agricultural lands	Hailé Selassiè	The Derg	Fed. Dem. Rep.
Sandy	10	5	3
Manured	3	7	9
Water-logged	2	6	7
Eroded	0	0	1
Slopey	5	2	0

In the debate following the matrix compilation, it resulted that 'Sandy' soils had been preferred. This was when agricultural production was secondary to livestock rearing and when rainfall patterns were less uncertain. 'Water-logged soils' are now preferred and are increasingly being cropped because they retain more water (due to their clayish nature as compared to 'sandy' soils). More tillage and water management interventions are therefore necessary and these, together with higher manure utilisation, show agricultural intensification processes.

Source: PLA Notes (1999), Issue 35, pp.16–20, IIED London

• Results

Integrating information derived from aerial photographs, satellite imagery and participatory analysis shows interesting trends in land use patterns. The 1972 aerial photos refer to the time of Hailé Selassiè, the 1985 satellite image represents the Derg government ten years on from its first day in office, whilst the 1994 satellite image corresponds to the new Federal Democratic Republic.

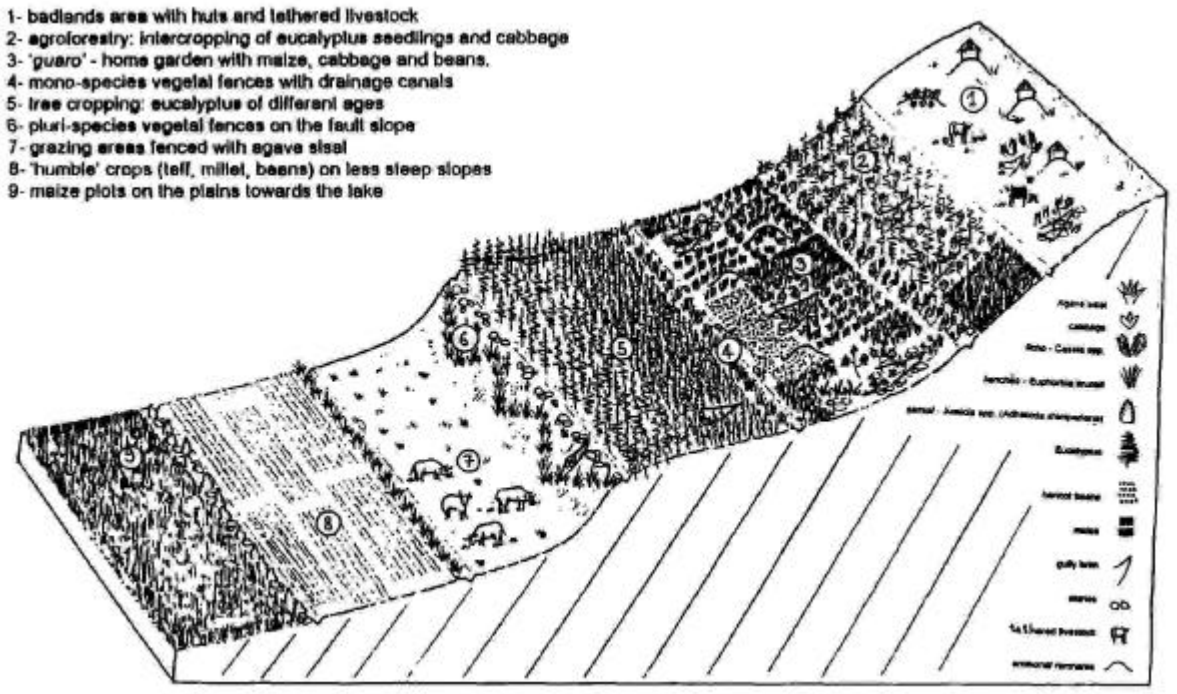
Analysis of the livelihood historical matrices shows that the relationship between the two cultural groups, the Arsi-Oromo and Silte-Guraguè, has been a driving force for land use and landscape changes detected with aerial and satellite imagery.

Two maps have been produced by integrating remote and participatory information: one linking local people's soil perceptions to land use patterns, the other relating population density dynamics with natural resources degradation. What we have so far understood is that official parameters and theoretical assumptions are inadequate in explaining the local situation. While more densely populated areas show more intense land use patterns, this does not necessarily correspond to environmental degradation, but can lead to better management. This shows that people's knowledge and livelihood strategies represent a key resource in the area. Two case studies illustrate this further.

• Case studies

On the western side of the project area, where erosion is intense because of geo-morphological conditions, reclamation of eroded 'badlands' has been carried out by local people in recent years. A local increase in population density and concentration has taken place, initially due to the 'Villagisation' government policies and subsequently because of boundary disputes between the two ethnic groups. Population pressure has encouraged people to farm all cultivable land and to introduce cycles of fallow to rest the soil and to encourage fodder for specific livestock. This corresponds to an effective recovery of degraded and marginal areas (see Figure 1).

Figure 1. Land reclamation in the Tora area



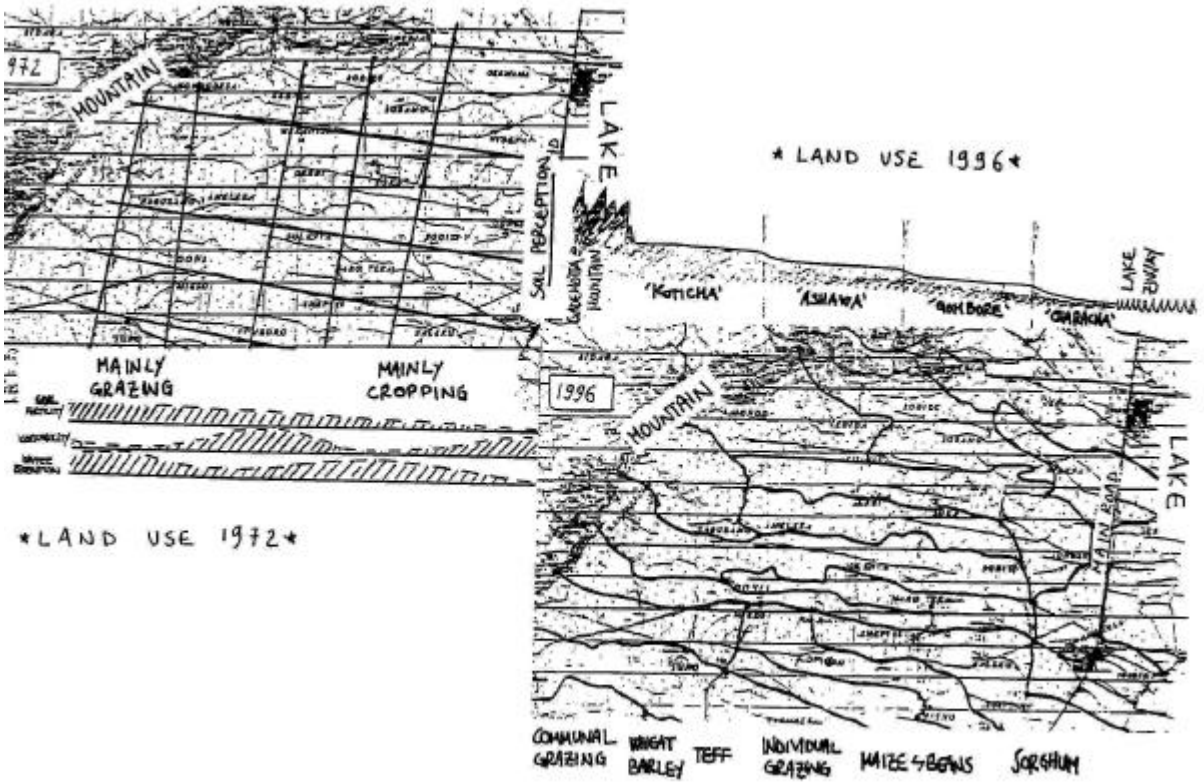
Source: PLA Notes (1999), Issue 35, pp.16–20, IIED London

Another example is provided by the way the Arussi, who inhabit the drier eastern side of the research area, have recently redefined their patterns of exploitation of the soil. The change has taken place with the passage from a feudal land tenure system to a system of community land redistribution and was accompanied by the dynamics of sedentarisation that follow the abandonment of nomadic practices. These processes together changed the perception and the value of soil resources.

Analysis of the 1972 aerial photos shows square areas where groups of families were living (see Figure 2). These square areas were internally homogenous and represented the possessions of different landlords in the feudal system. The present boundaries among groups of families (*kebelè*) follow different lines. These reflect landscape variations and involve diverse soil characteristics within each community area. This is the result of land redistribution, introduced by the 1975 Land Reform Act and implemented by local communities. As is shown in Figure 2, geographical and pedological landscape features underpinned land redistribution. The diverse landscape enables each household to exploit a range of local natural resources. By investigating local perceptions on soil and land use changes, we have been able to understand the rationale behind this new pattern of land distribution.

Thus, land redistribution has been a key force in local land use processes, as it has brought changes in people's attitudes towards natural resources and new strategies of land management and exploitation have developed. 'Land fragmentation', usually seen as a negative phenomenon, represents a conscious strategy by people to diversify production, minimise risks and maximise total production.

Figure 2. Soil perception and land use change in the Arussi area



Source: PLA Notes (1999), Issue 35, pp.16–20, IIED London

• Discussion and conclusions

The project area is characterised by physical diversity and uncertainty. If investigated only with 'classical' methods and analysed according to 'objective' parameters, it is likely that the area would be described as desertified. However, with an 'holistic approach', it has been possible to understand endogenous development processes. This has led to a different vision of the area itself, where the problems concerning social poverty and environmental degradation are tackled each day by local people with specific and often appropriate strategies. We are convinced that the use of 'objective indicators', such as carrying capacity, crop yield, demographic data etc. by themselves provide an inadequate analysis of local dynamics. People's knowledge and livelihood strategies are two important parameters that must be considered when understanding how local social needs and natural resources can be integrated into a sustainable development process.

The information was valuable for understanding recent changes in cultural values, access to resources and related land use and landscape alterations from a locally based perspective. The integration of participatory analysis to the aerial photos, satellite images and soil analyses highlighted some of the processes linking social relations and environmental conditions in the shift from a pastoral to an agro-pastoral production system.

The three types of investigation that we combined are complementary. Their integration enabled a reliable scaling-up of information and enabled us to uncover an historical sequence of events. In particular, aerial photos showed great potential for promoting dialogue with local actors. However, practitioners should consider the time needed to allow discussion. Unfortunately, women's groups did not get involved in the construction of the matrices, as they were usually too busy to spare much time on group discussions. This problem was partly overcome with the collaboration of Mrs. Taddelech Millo, a local villager, but time was a major constraint to successfully integrating these different methods.

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NOTES

The research was based on the 'Land Resources Inventory, Environment Changes Analysis and their application in the Lake Region (Ethiopia)' STD3-CEE project no. TS3-CT92-0076, co-ordinated by the Earth Sciences and Soil Sciences Departments of the University of Florence (Italy).

Other references are to be found in research projects in the area and in documents provided by the 'Land Resources Inventory, Environment Changes Analysis and their application in the Lake Region (Ethiopia)' STD3-CEE project no. TS3-CT92-0076.

REFERENCE

Waters Bayer A. W. (1994). *Planning with Pastoralists'*, GTZ, Germany.