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Summary report of the small-scale dairy participatory GIS expert workshop, Embu, Kenya, 19 June 2014

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Comprehensive Livestock Environmental Assessment Value Chains (CLEANED VCs) Project

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Introduction

This report describes the results of an assessment of the small scale dairy production systems in the Embu county of Kenya. The work is part of the ILRI project entitled Comprehensive Livestock and Aquaculture Environmental Assessment for improved Nutrition, a secured Environment and sustainable Development along Value Chains (CLEANED VCs).

Workshop aim and purpose

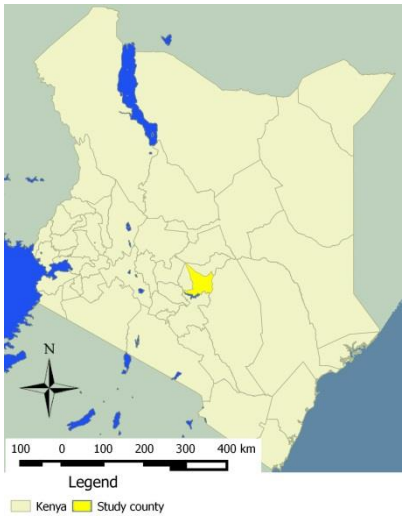
The assessment, conducted in a workshop in June 2014, aimed to obtain a geographical representation of dairy production and the interacting environmental elements in the study area. This was achieved by asking district-level experts to describe, through mapping, the dairy livestock and feed production systems across the district and assess the distribution of production in relation to available resources.

Study area

Embu county is located on the southern foothills of Mt. Kenya, with altitude ranging from 1,200 to 4,500 meters.
The rainfall is bimodal, with long rains between March and June and short rains from October through to the end of the year. Annual average rainfall is approximately 1,200 mm on average.

The soils in the county are volcanic and slightly acidic, with varying degrees of fertility.

Map 1: Location of the study county in Kenya



Methodology

Introduction

The data was gathered using Participatory GIS workshops; an approach where a set of structured discussions are carried out and the resulting information mapped by the local stakeholders, so that the knowledge produced is rooted in the participants understanding within a spatially explicit framework (Cinderby et al. 2011, Elwood 2006). Participating experts came from the central highlands, representing stakeholder groups from across the county and the smallholder dairy value chain including: chairpersons of dairy farmer groups, input and service providers, local government extension officers and milk traders/ vendors (Table 1).

Table 1: Stakeholders represented at the workshop

Organisation/occupation	Male participants	Female participants	Total participants
Total:	***7***	***4***	***11***
Local government	3	1	4
District officers (livestock, veterinary)	2	0	2
Farmer	1	0	1
Feed processor	0	1	1
Milk processor	1	1	2
Local researcher	0	1	1

Data gathering

The expert workshop was held on 19th June, with three PGIS sessions. The participants were divided into 2 smaller groups, each gathered around a base land cover map, with towns, roads and rivers. In each exercise, the groups were asked to map out a different aspect of the dairy production systems in Embu. Both groups answered the same questions, and reported their summary results to the other groups in an open plenary at the end of each exercise.

Session 1: The first session activities verified the common categories of **dairy livestock keeping** and **feed production** and asked the following questions for the different production systems:

1.1 where would you find each category, across the whole study area?
1.2 where are other supporting services for dairy production located?
1.3 for each category, which feeds are used?
1.4 where, across the whole map, are these feeds obtained?

Session 2: In the second session, having derived a district-level distribution of dairy and feed production, the activities discussed **environmental resources** that are important for, or affected by, dairy production, asking the following questions:

2.1 what is the availability and accessibility of each resource?
2.2 are there variations in quality of each resource?
2.3 are there competing users for each resource?
2.4 are there particular risk areas, or examples of sustaining or regenerative management for each resource?

A concluding plenary discussion involved a discussion of dairy industry constraints and scenarios to increase milk yield.

The workshop was carried out mainly in English and Swahili. The expert conversations were documented primarily in the maps drawn by the participants, complemented with notes taken on flipcharts. The mapping was conducted by drawing with permanent coloured markers on layers of acetate (transparent plastic sheets) that were fixed on top of the basemap. The method allows for several new maps showing different features to be drawn over the base map, each new set of features on a fresh acetate sheet. The acetate layers were blank, except for the major road network and towns as georeference points so that they could be digitised in a GIS based software after the workshop (see section below on data processing).

All proceedings were recorded and subsequently transcribed. All notes written on flipcharts, and maps drawn on acetate layers by the participants were clearly photographed at the end of each day. This workshop report reflects the voices of the participants, unless otherwise stated, and is based on the transcriptions, flipchart notes, the digitised maps and team reflections. This methodology is illustrated in Figure 1.

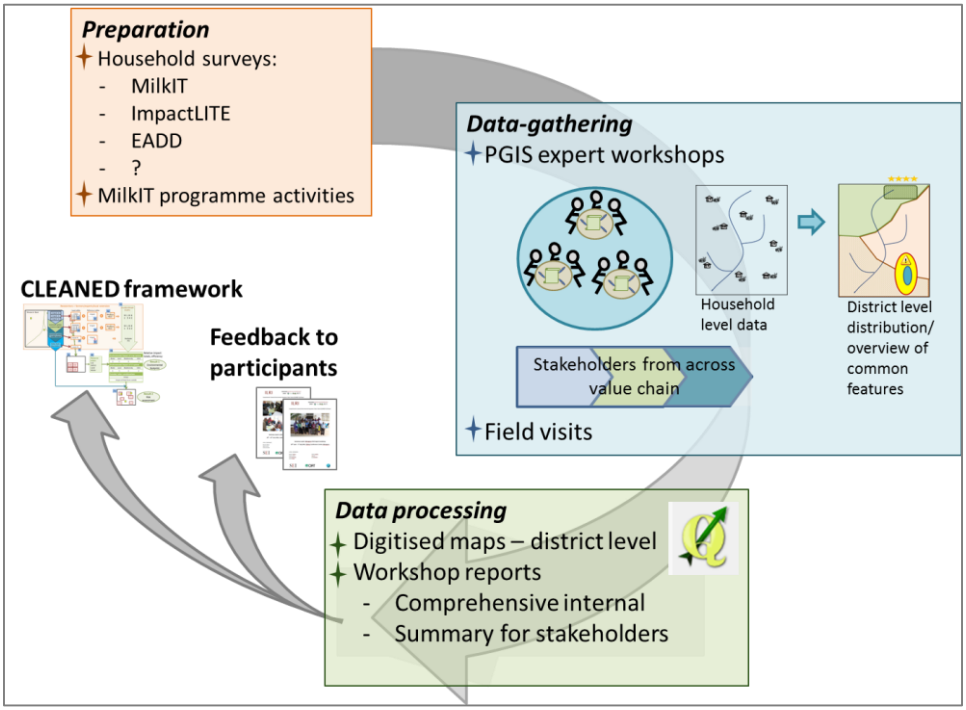


Figure 1. Methodology of CLEANED the participatory GIS sessions and the outputs

Data processing

The maps were digitised into Q-GIS (an open-source GIS software, http://www.qgis.org/en/site/) by first geo-referencing the photographs and then tracing the features into new layers, compiling the attributes at the same time. Initial analysis of the maps included synthesising maps of the same topic drawn by different groups, merging the information into single layers. Conflicts in data drawn were resolved based on the transcripts of plenary discussions, notes on individual group discussions, and

discussion within the team where necessary. In general, if there were points in quite close proximity (ie. same town), they were merged, otherwise all points were kept.

Results

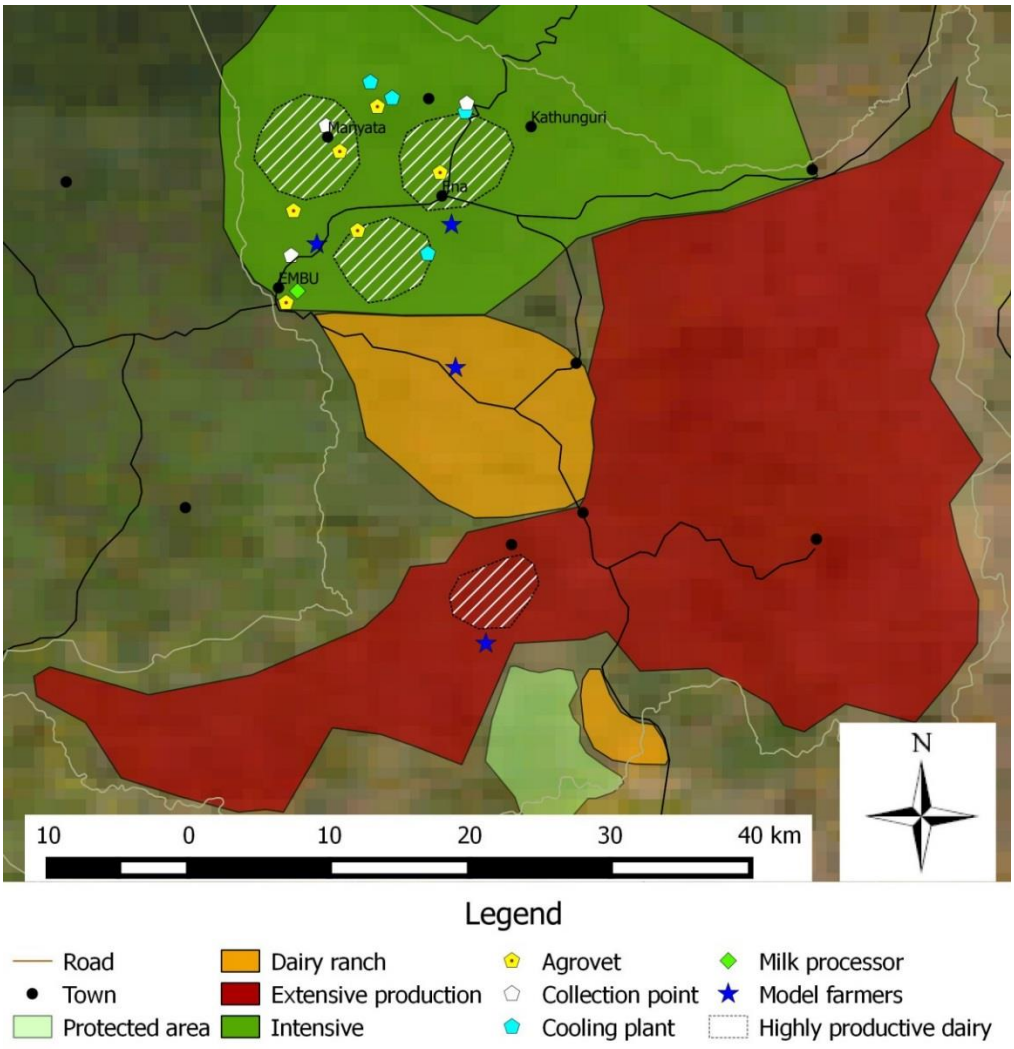
Spatial distribution of dairy farming types and dairy infrastructure

In the higher altitude zones, cut-and-carry production systems are more prevalent, where the feed is cultivated or collected elsewhere and brought to the livestock. There is a 50/50 mix between semi-zero and zero grazing (represented by the green area in map 2), zero-grazing implies that the animals are kept in a pen all the time and all feed is brought to them. In semi-zero-grazing, the animals are let out to graze pastures or communal grazing areas for part of the time, and kept in a pen for the rest. The presence of these systems (rather than fully grazing) is in part driven by the high potential for dairy farming, as well as the small land parcels from subdivision. The lowlands, dairy systems are more extensive, meaning that animals obtain most of their feed from grazing, with very little cut-and carry. Private/leased land dominates the landscape and common grazing areas in a few locations (extensive systems represented by red in map 2). Cattle in the more extensive systems are utilised for draught power, meat and milk. There are also ranching zones south of Embu and one near the Tana river (represented by orange in map 2). There are highly productive zones across several of these locations, represented by white shading in map 2. A number of 'good farmers' and interesting case studies were identified, represented by the blue stars on map 2.

Participants noted that there is the potential to expand livestock production into the rice producing area of Mwea, as tsetse fly infestations have subsided.

Milk market infrastructure and supporting services are distributed across the more intensive production system zone. There are seven milk collection points, (four with cooling plants and three without) and one small scale processors in the area. There are also more than six agro-vets, supplying feed and health inputs (six are identified on the map, but there may be small agro-vets in most villages). Communal cattle dips were seen as obsolete, where only some private farmers would utilise the technology.

Map 2. Embu livestock systems and infrastructure



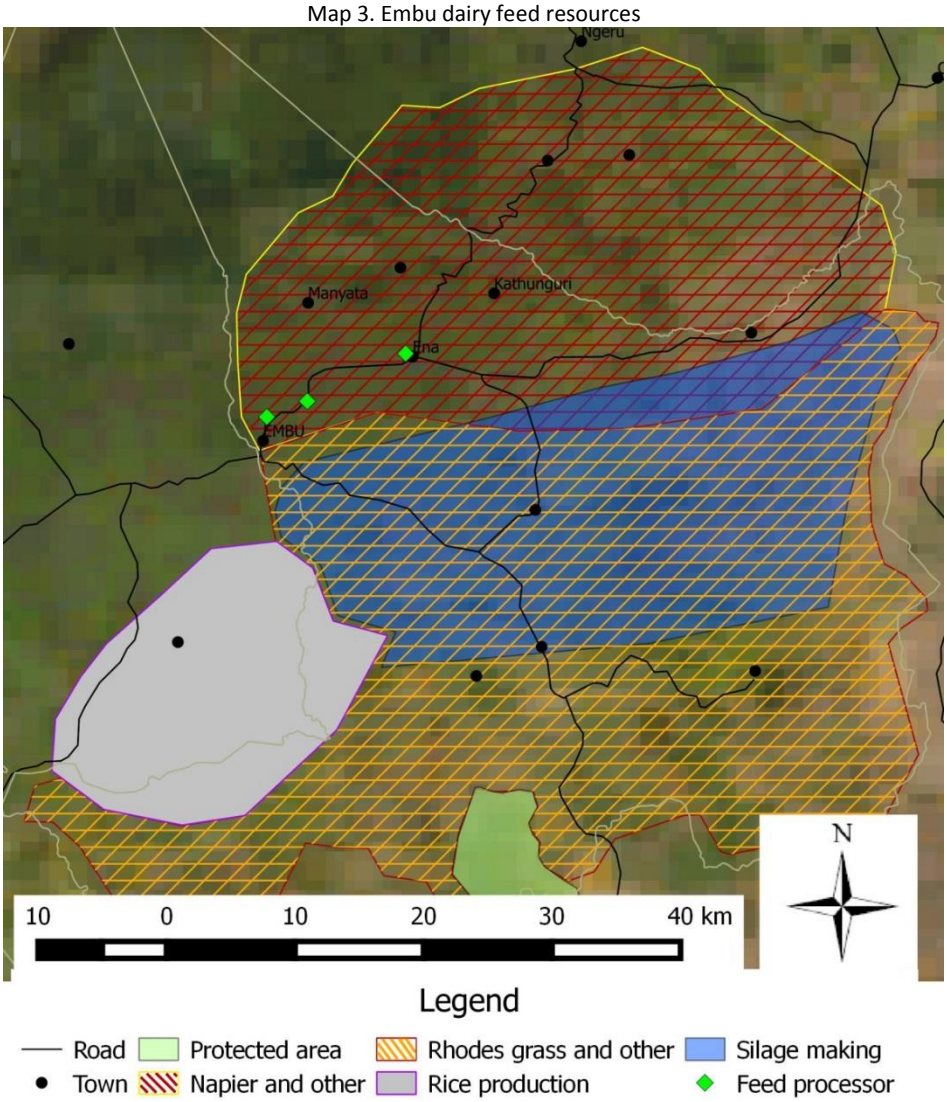
Location of feed sources and production

In the highlands, it was noted that almost every farmer grows Napier grass, and 20-25% of these farmers also grow Calliandra. In the lowlands, Rhodes grass was the main source of feed. Crop residues were important supplements in both systems: with maize and bean utilized throughout; sweet potato vine additionally used in the highlands; and millet and sorghum residue harvested in the lowlands. Silage making is common practice, with some farms utilizing maize stover, and others utilizing Napier grass (represented by blue area in map 3).

Feeds were also bought in from outside of the dairy producing areas. Rice residue is bought in largely from Mwea (pink-grey area on map 3); hay is bought in from Nanyuki and concentrates are bought in from Nairobi, Thika and Nyeri.

Several issues were noted in relation to feed production and utilization. Concentrates were seen as being expensive, limiting the utilization. This was in part due to government taxes. Imported feed did have some quality control issues, often being infested with ticks. Locally produced feed was seen to be sub-optimally managed, with Napier grass in particular harvested too late, resulting in more biomass but with a lower nutrient content.

Map 3. Embu dairy feed resources



Environmental resources, status and risks

Participants stated that it was difficult to ascertain the status of soil and water resources. For soil, participants mapped the points of erosion that they were aware of, but commented that there would be variability across the landscape which would be better assessed by a wide range of farmers. Of the erosion locations identified in Map 4, the small northern area was due to one individual farm with a high stocking density, and the larger southern sights occurring in the communal grazing areas.

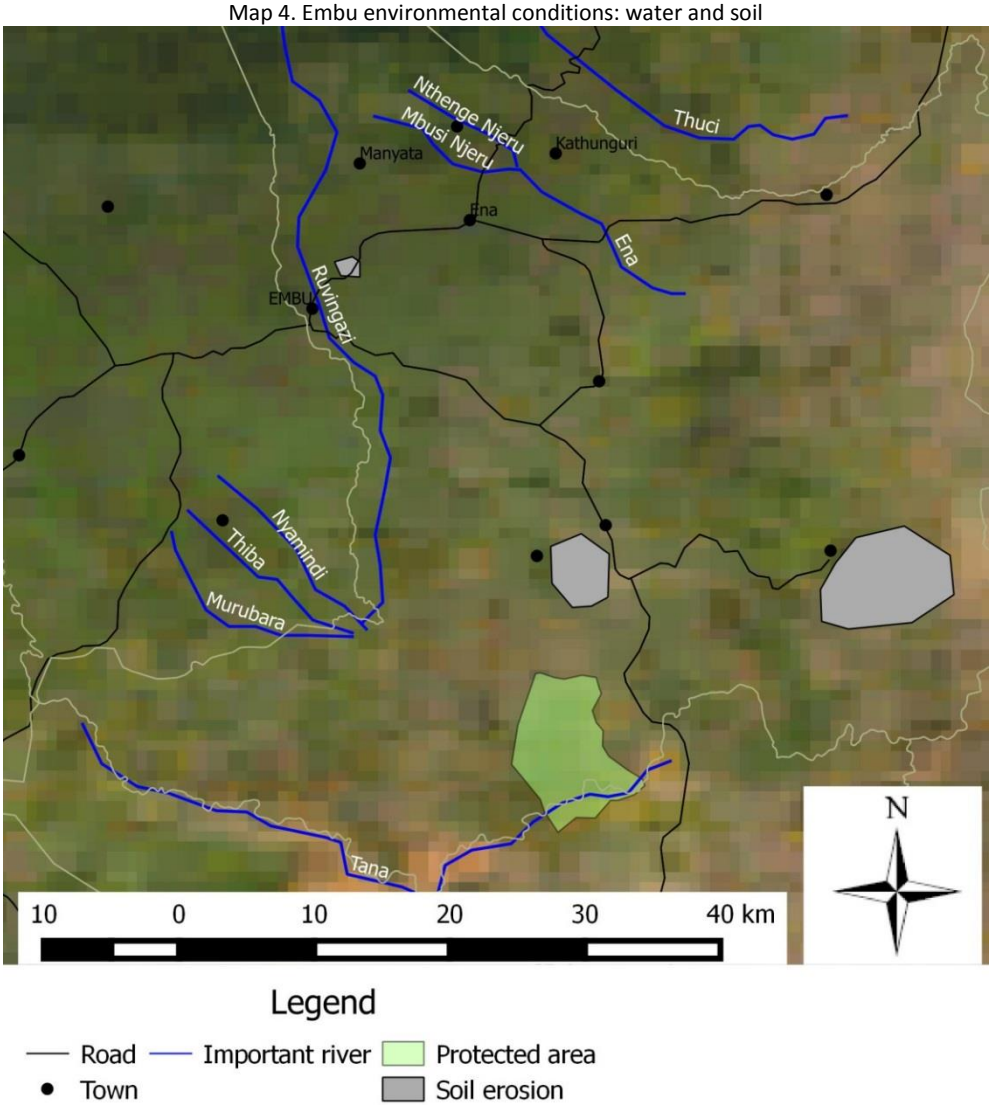
Manure application was, in general, diverted to cash crops first, and then the remainder to napier grass. Manure is often heaped until the growing season, over which time nutrients can be washed into surrounding water ways. Termite infestations in the lowlands were also discussed, which are so severe that reforestation efforts are challenging.

For water resources, participants asserted that the majority of rivers had some level of degradation - most commonly by sedimentation. Participants identified the important rivers in the area (map 4).

Genetics was raised as an important environmental resource. Indigenous cows, for example, have co-evolved with the local ecosystems and climatic conditions, making them more resistant to disease and drought. This resource has been maintained despite intensification in the area, but could be at risk in the future.

Participants asserted that market forces stop farmers from being concerned about the environment. This was particularly raised in relation to input back into land resources, where the economics of low fertilizer input and low milk output was better than high output production systems which also require high input and maintenance.

Map 4. Embu environmental conditions: water and soil



Scenarios of smallholder dairy development

Participants identified several key challenges to increasing milk yield in Embu county, along with the related environmental impacts.

The main production related challenge was in the shortage of feeds during the dry season. Fodder conservation, increased fodder yields and new fodder production areas were proposed as three means to overcome this challenge. It was asserted that such activities would have increasing

demands on water across the landscape, and increased pressure on the soil of intensive systems and reduced degradation in the grazing areas. However, increased silage production was suggested as a potential cause of conflict with surrounding communities due to the smell.

The reality of increasing milk yield very much depended on market conditions, the genetic potential of the area and availability of training to manage resources efficiently.

Other topics

There was a particular concern raised over misinformation provided for milk quality. In the past, there had been confusion over the standardisation of aluminium milk containers, appropriate milk handling techniques and methods for preserving milk (peroxidasis).

Silage production was discussed as a source of bad smell, impacting the local community rather than the environment. One farm in Tujenge was particularly pointed out on this issue.

Participant reflections

Three participants were eager to progress on to the environmental impact assessment of the whole value chain. The workshop, however, was limited to dairy production systems, infrastructure, feed and the current environmental situation.

Conclusions

This workshop has gathered information required to communicate the current status of the dairy industry and environmental base in Embu. This information can be extended to assess the environmental impact of proposed scenarios.

Three distinct types of dairy farming systems were identified and mapped, namely: cut-and-carry, extensive and ranching. Some highly productive zones and farms were marked, as well as specific points of dairy infrastructure, including: collection points, chilling plants, processors, and agrovets.

Feed production and imports varied by agroecology/production system. Higher altitude, more intensive systems produced a mix of cultivated forages and utilised a range of crop residues – including sweet potato vines. Lower altitude, more extensive systems relied on pastures (predominantly Rhodes grass) and crop residues, including: maize stover, sorghum and millet. Silage was produced in the northern part of the extensive systems and the southern part of the more intensive systems. Imports of hay and concentrates were common practice.

A limited assessment of environmental resources was undertaken. Three locations of soil erosion were identified and important rivers mapped.

This report can be used to communicate the existing setting of the dairy industry in Embu, and if a specific set of interventions are proposed, it can be used as a basis for assessing the environmental impact of the proposed interventions. A full environmental assessment of dairy related interventions would require further specification of scenarios and further details on the existing environmental condition.

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