

**The role of livestock in soil no fertility, biodiversity, land use, cultural and welfare change in Nduuri Embu, Kenya.**

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***Abstract:***

*Population pressure is one of the major constraints in Nduuri, Embu, Kenya. More than 60% of the farmers own less than 1 ha land. Coffee monocropping is the major land use system. Both coffee and dairy industries went down affecting the land use and peoples' livelihood as dairy cows were acquired through sales of coffee. Livestock reduction was associated with reduced production of manure which improved farm agrobiodiversity through nutrient recycling. Surface cover was also degraded due to soil fertility decline. Little livestock remaining was further sold instead of coffee to meet domestic needs. The vegetation was dominated by *Digitaria scalarum* and *Rhynchelytrum repens* which are indicators of low soil fertility.*

**Introduction**

Nduuri is situated in the South East slopes of Mt. Kenya in the Agricultural ecological zone (AEZ) UM 2, the main coffee growing zone. The population pressure, has led to subdivision of land to such an extent that over 50% of the household live in less than 1 ha. of land. Only 13.5 % of the household has 2 ha or more of land. About 69% of household cultivate in their own land while 29% cultivate undivided family land and about 2% on rented land. The most common land use type has been coffee mono crop with a few *Grevillea* trees to provide shade. Coffee has been the main cash crop while the food crops includes a wide range of crops which are in most cases intercropped. However, the major food crops includes: maize, beans, bananas and the tuber crops (Cassava, Irish potatoes and sweet potato). Livestock keeping is practiced by majority of the farmers in Nduuri as it is prestigious to own some and also serve as source of food and income.

In the recent past, farmers in Kenya have been going through a hard time with the dairy and coffee industry which has affected the way of living and the land use. There was need therefore to clearly identify these changes as it affect biophysical and socioeconomic environment, the role of livestock in the dynamic land use system and the

way forward. A study was undertaken in July 2001 to elucidate this role in a changing economy.

### **Methodology**

A team of 6 scientists including a vet, agronomists and animal productionists were involved in a survey in which 51 representative household were selected randomly in the 9 villages of Nduuri sub-location. A senior member of each household was interviewed alone or together with his or her spouse using a semi structured questionnaire. A farm visit was made to verify the biodiversity and also see the state and condition of soil, crops, animals, people and house structures. These were listed, scored and recorded. The information was entered into computer and analyzed using SPSS.

### **Findings**

#### **Role of various farm components in the household.**

##### **Role of Coffee:**

The main source of the households income is derived from agriculture. Out of farm employment contribute little to Nduuri households. 68% of the household interviewed relied on agriculture only for their livelihood. Of those with extra farm income, 12% had a steady income and constituted mainly school teachers and retired pensioned civil servants. The bulk of income used to come from coffee as the main cash crop. Good permanent and semi permanent houses were constructed from coffee proceeds. Education and hospital fees were also met easily by coffee as a farmer would collect a cheque in advance to pay the school and hospital fee and this was recovered from his sales. Coffee directly provided food security during the drought as farmers cooperative bought food in bulk and this was distributed to its needy members and payment recovered from their coffee sales. Most of domestic needs were met by the income generated from coffee.

Coffee also provided funds for investment in other non agricultural and agricultural enterprises. This is because although coffee was paid after sometime i.e. 3 or 4 times in a year, the amount was large and enabled the farmer to invest without a loan. Most dairy cattle were acquired through coffee revenue. Poultry keeping has a very high initial capital investment and this too in many households were possible through coffee sales. The number of coffee trees also indicate the potential to pay any borrowed money and therefore used as a guarantee to effect payment of loans in local market. Coffee also

serviced other farm enterprises, Such as livestock for feeds and veterinary services, and the food crops for fertilizers, seeds, pesticides and labour.

Coffee was therefore given a lion share of all the production resources such as land, manure, fertilizers, pesticide and labour over the other farm enterprises. In most farms, Coffee received more than two thirds of farm yard manure generated in the farm and the arable land.

**Role of food crops:**

Food crops grown by many households provide the food security and ease of survival while waiting for the coffee sales to be paid. It helps in providing cheap balanced diet for the family through out the year so long as there is adequate rain. This also reduces dependence on coffee as source of every households need. This sector also provides a large quantity of herbage in form of crop by-product or residues for ruminant feeding. This sector receives little of the available production resources. In many farms a large proportion of land is under coffee and therefore little portion is spared for food crop. It also receives less than one third of manure generated in the farm. In many farms food crops got manure only if some remained after fertilizing coffee. The Major food crops include: Maize, Bananas, Beans, cassava , sweet potatoes, yams, and vegetables. They are usually intercropped among themselves but farmers have started to intercropping them with coffee. Quality score for the various socio-economic conditions and farm enterprises are presented in table 1. During the survey, maize which is the major food crop was scored as a representative of the food crops and coffee for cash crops. Among the farms under study only 22% had good to excellent maize crop. The others were either fair or poor crop. In 33% of the farms visited maize was poor or miserable. The other crops except bananas and arrow root (Nduma) had similar score as maize.

**Table1 Quality score for various farm socio-economic conditions and enterprises**

<b>Description</b>	<b>Maize</b>	<b>Coffee</b>	<b>Household Welfare</b>	<b>Livestock</b>	<b>Condition of people</b>
Very good	7.8	3.9	3.9	5.9	3.9
Good	13.7	51.0	17.6	31.4	23.5
Fair	46.1	27.5	60.8	41.2	52.9

Poor	25.5	17.6	17.6	3.9	15.7
Very poor	7.8	nil	Nil	5.9	4.0

### Role of Livestock

Livestock was second to coffee in order of importance. 90% of the farmers in Nduuri had at least one type of livestock. The most popular being chicken found in 71% of the households and dairy cattle which was owned by about 69% of the households Table 2. The most popular dairy cattle breed is the cross breed between exotic breeds or between the Zebus and the exotic cattle. Aryshire is the most popular of the purebred dairy cattle (Table 3). The number of cattle in the farm is dictated by the household land size, the larger the farm the more the feed available and the more the animals are kept. Table 4 presents the number of dairy cattle and percentage of the farm who had such number. Majority of the farms had one or two cattle. Within the herd structure only 49% of the households had one mature cow and the rest 20% had either a heifer, a bull calf, or a draft animal. About 70% of the household had 3 or less hens, 1 or 2 cock and a total of about 7 chicks. Here the chick mortality is high due to predation and disease under the free range management.

**Table 2 distribution of livestock species**

species	% of the farmers with
Cattle	69.0
Sheep	15.7
goats	36.4
Chicken	71.0
Rabbits	20.0
ducks	2.0

**Table 3: Distribution of the dairy breeds**

Breed	popularity (%)
Crossbreed/upgrade	21.6
Aryshire	15.7
Friesian	11.8
Jersey	11.8
Guernsey	7.8

**Table 4. Number of cattle per farmer**

Number of cattle	Percentage of the farmers with cattle
Nil	29.4
1	29.2
2	17.9
3	2
4	7.8
5	2
10. or over	1

Livestock, though very important have been allocated very little land for fodder or pasture production. In about 45% of the farms there was no land spared for livestock. In such farms, animal are maintained on food crop by-products like maize stover, banana pseudo stem and leaves, bean straw, sweet potato vines, weeds, multipurpose fodder trees etc. Table 5 presents the percentage of households and the land they have spared for livestock. Most fodder crops, the main one being Napier grass, are grown on terraces and in small portions not exceeding one fifth of the farm. The small ruminants are usually tethered on the roadsides, home stead or stall fed. All the cattle are zero grazed except draft cattle which are semi-zero grazed. In most cases chicken are free range except during the flowering of low laying food crops or when they are likely to destroy vegetable like kales and spinach. In this method the birds fend for themselves most of the time and are only supplemented with some grains in the morning or some where during the day.

**Table 5. Land allocated for livestock fodder production**

land spared in acres	% of the farms	Cumulative %
Nil	45.1	45.1
0.07- 0.17	9.9	55
0.2-0.25	15.7	70.7
0.5-0.75	13.8	84.5
on terraces and boundries only	15.5	100

Chicken are mainly kept for Meat, eggs and sales. Their manure output is low because they spread it in the farm as they forage around. However, the little manure that is collected in the pen where they are housed at night is used in banana or coffee crops. The eggs provide regular income from chicken which is used to meet the minor domestic needs. Mature birds are sold to meet slightly larger domestic need. Such as purchasing cooking fat, sugar, pesticides and even casual labour. Chicken also contribute in the improvement of family nutrition through regular supply of easily accessible quality protein.

Sheep is not very popular in Nduuri only about 16% have kept them. While goat is kept by about 36% of the farmers. Goats are popular as they do not compete with cattle for pastures as most of them were maintained on weeds and indigenous fodder trees like *Bridelia micrantha* *Trema orientalis* *Vernonia lasiopus*, *Lantana camara* etc which grow wildly on uncultivated niches. Their meat is also cherished than sheep and quite a number of people take it as a ceremonial animal. A few dairy goats have been introduced in the area especially by those with smaller pieces of land and business minded people who have discovered that their is unsatiable demand for dairy goats and they fetch good market price. The two small ruminants (Sheep and goat) are kept for meat, sales, manure and ceremonies. They are more prolific and multiply faster than cattle, are easy to dispose and requires less initial capital out lay. They also produce more manure than other smaller stocks. The income generated from small ruminants provide for major domestic needs such as fees, clothes, purchase of fertilizer and seeds. This is currently more dependable than the coffee.

The zero-grazing system of managing dairy cattle has made dairy keeping the major farmyard manure generator in the farms. In some farms milk used to be the secondary, the primary product being manure. About 65 % of the households generate farm yard

manure ranging from 0.9-20 ton per season per household. Table 6 presents the range of cattle manure produced by different households per season. This is generated by collecting crop residues which could not be eaten by cattle and any other trashes in the farm, mixed up as bedding in the zero grazing unit and be trodden to form manure. Toward the end of dry season manure is removed from the stall and heaped to decompose before applying it to crops. Rarely do farmers use inorganic fertilizers singly, but often either manure alone or in combination with inorganic fertilizers.

**Table 6. Cattle manure generated per season**

Cart loads/season	Ton/season	% of people producing manure
3-6	0.9-1.5	21.6
10-16	2.5-4	23.6
18-40	4.5-10	11.9
48-80	12-20	7.9

Milk and bull calves are sold to generate income for the family. Milk payments were and still are more regular and reliable than coffee sales. This can be depended on to pay the school fees, or supplement the coffee income. Dairy income is used also to service other productive farm enterprises through purchase of such variables inputs like seed, pesticide, feed, labour, etc. When coffee income is not available then sale of cows has been taking place to pay the school fees or meet hospital bill. Ownership of dairy cattle and indeed other livestock contribute to household food security directly as food, indirectly through the revenue which can be used for food and through manure which improve the soil fertility and productivity of the land. Livestock also enhances the welfare and the status of the household.

**Effect of livestock change in the change of people, land, and biodiversity.**

The livestock role in biodiversity is effected through the nutrient cycle. Since most nutrient flows from food crops to livestock in form of crop residues and weeds and back to the crop as manure, removing livestock results in break of this flow. In Nduuri since the deterioration of coffee industry, many animals have been sold to pay for urgent domestic needs which were previously easily met by coffee. The collapse of dipping

services since 1992 and the drought of year 2000 resulted in loss of many dairy cattle through tick borne diseases and lack of feeds. The 30% of the household who did not have cattle reported in table 4., are among those who lost their animals during this bad period. Therefore the cycle has been broken and severe adverse changes are being manifested.

Biodiversity is changing due to the fact that some indigenous plant flourish well in fertile soil. Since manure is no longer available, these plant species are also disappearing and are being replaced by others that stands low fertility. Some of the wild valuable species that are disappearing include: *Amaranthus sp* Terere, *Solanum nigrum* managu and *Pennisetum clandestinum* Kikuyu grass which were common in land rich with organic matter or fertilized with manure. These are being replaced by *Rhynchelytrum repens* poverty grass, *Digitaria scalarum* coach grass and *Digitaria ternata*. Species manifesting severe signs of low soil fertility and decline in productivity include both food and cash crops. Some are listed below.

Some vegetables, such as Kales, spinach, cabbages, tomatoes and carrots; Maize; Irish potatoes; Bananas and Coffee.

The effect on the plant is manifested through low biomass production which is consumable as leafy vegetables and as livestock feed, reduced fruit and tuber size in banana, and potato respectively and low grain and cherry yield in maize and coffee. This has not only affected the food security but also the wealth situation, nutrition status of some families and their general welfare. There is an increase in school dropouts in Nduuri and many people can not afford good health services. Malaria is common in the area and most of it is resistant to chloroquine. Treatment of malaria nowadays is effected through expensive drugs. Therefore to reduce the cost of treatment, many families have deliberately planted one or two malaria curing herbal botanicals and are using them for treatment of selves and their neighbours.

Once the livestock mitigated nutrient cycle in a farm ecosystem breaks, to bring it back to normal requires that the livestock be reinstated to its niche in the farm food chain. Coffee payment which come in large quantity is the only way which can enable a farmer to buy a dairy cow back into the farm. This does not seem to be happening soon and the situation is deteriorating unless they change to other income generating agricultural enterprises. Already one innovative farmer, Mr. Njagi Mbarire has turned to strategic vegetable production where maize is harvested and sold when green and vegetable



grown in its place. This is timed in such a way as to coincide with the lucrative market prices. Two self help irrigation projects one on-going and another one on pipeline have been formed to help in providing water for irrigating high value crops.

### **Conclusion**

Livestock plays a major role in land use system and does effect change in soil fertility, agrobio-diversity, peoples welfare and culture in long run. Effort to revive coffee industry even if the market price improved requires that, it be accompanied with revival of dairy industry to ensure complimentality of the three farm sectors (livestock, food and cash crop) is restored. The restocking of dairy cattle should be incorporated in coffee revival packages as a policy. If coffee does continue to deteriorate in price the farmers should be encouraged to divert to other lucrative enterprises either by uprooting coffee or intercropping without intimidation from any quarters. This calls for change in coffee growing regulations and policies which are currently unfavourable to farmers. This is the way to go for the reduction of poverty.