AGRICULTURE

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ABSTRACT

Coast Province is characterised by large expanses of semi-arid and almost empty wilderness and small areas of densely populated agricultural land. Dominant crops in terms of area, yield and value are maize, cassava, tomato, citrus, mango, banana, coconut and cashew which are widespread and grown by many farm households. Other crops that are of localised importance are sisal, rice, common beans, pineapple and bixa. The history and performance of the individual crops are discussed in detail. Considerable differences in agriculture exist between districts as shown by the farming systems in the Lower Tana area, the Kaloleni Uplands and the Taita Hills. Variations also exist between nearby areas and between farms in the same area , exemplified by four villages in the Kaloleni Uplands.

The agricultural potential of Coast Province is limited. Low agricultural potential and high population density (in the high potential areas) make it difficult to gain a living by farming. Although farmers are resourceful in their cultivation methods and in the pool of genetic plant materials they maintain, most areas now experience food deficits and off-farm employment is the major supplier of additional maize and stability. It is important that farming systems are allowed to maintain their flexibility in the future. A major challenge, however, lies outside the farm and production as such, and consist of the difficulty of efficient marketing of agricultural produce given the dispersed settlement of producers.

INTRODUCTION[1]

Coast Province is one of the most diverse areas of Kenya, as it includes vast stretches of dry land, the subhumid coastal belt, the delta of the Tana River and the relatively well watered Taita Hills. Other important economic activities in the province are industry and commerce around the port of Mombasa and mass tourism on the beaches of the Indian Ocean and in the game parks of Tsavo and Shimba Hills. Although these activities are

1 Mohamed Salim and Mweni Maitha distinguished themselves among the numerous persons who contributed to the collection and interpretation of information. Munga Mwangemi and Samson Kalachu Mwinyi with their families were shining examples of the hospitality of Kenyan farmers and officials.

spatially separate, they are all linked to agriculture through the exchange of labour and/or produce.

The review starts with an overview of the land use potential of the various agro-ecological zones of Coast Province, based on Jaetzold & Schmidt (1983). Then it describes the major groups of annual and perennial crops in terms of production, problems and prospects according to Kenya (1993) and Waaijenberg (1994). Next, in order to show the spatial variation in agriculture, three characteristic areas and farming systems are presented in detail: Pokomo farmers in the Lower Tana basin; Mijikenda farmers in Kaloleni; and Taita farmers in the Taita Hills which resemble highlands elsewhere in Kenya. At a more detailed level the differences between farms and farmers within a single area are illustrated with data from the Kaloleni case. The review ends with a discussion of some factors that have influenced rural development in Coast Province.

LAND AND POPULATION

Table 1 gives a summary of information on land availability and population density. It appears that the general picture of Kenya is repeated on a smaller scale in Coast Province. The total rural area of 82,000 km^2 consists for one quarter of non-agricultural land, one half can be used for ranching and one quarter is suitable for crops. However, on most of the latter land only hardy crops such as cashew nut, cassava, sisal and millets can thrive. Most land in Coast Province has been mapped on exploratory or detailed scales by the Kenya Soil Survey (Sombroek, Braun & Van der Pouw 1982; Boxem, De Meester & Smaling 1987).

The non-agricultural land contributes to the economy via the harvest of forest produce, the protection of watersheds and the provision of scenery or wildlife for tourism. These activities generate little employment and usually the people that live – or might live – on such land derive only a minor part of the benefits generated.

Coast Province has large expanses of thinly populated land suitable for ranching, especially in Tana River District. Here development suffers from lack of drinking water for livestock and humans, poor infrastructure, veterinary problems and lack of organisation. The capital required for improving land and herd management may have to come from outside the areas concerned, which could reduce the say of the people who have lived there for long.

At first view there is still enough agricultural land in Coast Province: 34,300 km^2 in total or 7.75 ha per household, which is more than most farmers can work with the present technology. However, less than 10,000 km^2 are in the better rainfall classes and suitable for more demanding crops than sisal and millet (LH2, UM3, UM4, LM4, CL2, CL3 and CL4 in Table 1; see also Figure 1). Farmers are facing an uphill task to grow the food and earn the cash required for housing, clothing, education and health care on the 2.1 ha the average household has available here.

Table 1 Human population and availability of land by district

	Mombasa	Taita Taveta	Kwale	Kilifi/ Malindi	Tana River (a)	Lamu	Coast Province (b)
Estimated population 1997 (persons)	600,000	244,000	490,000	767,000	65,000	76,000	2,242,000
Estimated population 1997 (households)	162,000	52,000	86,000	116,000	12,000	15,000	443,000
Total agricultural land (km^2)	140	5,824	7,313	6,973	8,550	5,517	34,317
Agricultural land (ha/person)	0.02	2.39	1.49	0.91	13.15	7.26	1.53
Agricultural land (ha/household)	0.09	11.20	8.50	6.01	71.25	36.78	7.75
Medium and high pot. land (km^2)	130	703	2085	2,411	418	3,887	9,634
Medium & high pot. land (ha/person) c	0.02	0.29	0.43	0.31	0.64	5.11	0.43
Medium & high pot. land (ha/household) c	0.08	1.35	2.42	2.08	3.48	25.91	2.17

a) Garsen Division b) Excluding Central and Northern Tana River (Galole, Bura, Madogo and Bangole Divisions).
c) Agro-ecological zones LH2+UM3+UM4+LM4+CL2+CL3+CL4.

Sources: Jaetzold & Schmidt 1983; Kenya 1994, 1996a, 1996b.

As shown by Table 1, there are considerable differences in the quantity and quality of land between the districts of Coast Province. Around the town of Mombasa suitability for agriculture is less relevant as roads and buildings will soon be the dominant land use. In the Taita Hills the altitude modifies the hot and dry climate and increases the range of cash crops that can be produced. In the basin and delta of the Tana River there is still untapped potential for irrigation. On the mainland of Lamu District the lack of infrastructure and security problems, for long, were more limiting than the availability of land. Kilifi and Kwale Districts support large populations on land with low or unreliable rainfall and with little ground or surface water.

CROP PRODUCTION[2]

Appendix 2 provides basic statistics on crop production in Coast Province. The numbers show that in 1992 only 2,200 km^2 of the 9,000 km^2 of land in the better rainfall zones were under crops. The remainder was used for livestock production or under fallow vegetation, which for poor farmers is the principal means to restore soil fertility.

As mentioned, there are large differences between districts due to variation in ecology, history, population and access to markets. For example, crop production in Lamu and Tana River Districts is hampered by drought, floods, long distances and recurrent insecurity. Such factors affect both the choice of crops and the amounts being produced.

Dominant crops in terms of area, yield or value are maize, cassava, tomato, citrus, mango, banana, coconut, cashew and sisal. With the exception of the last crop they are widespread and grown by large numbers of farm families. However, there are numerous minor crops which are of major importance in specific areas and/or for smaller numbers of farmers such as rice in the Tana River delta, common bean in the Taita Hills, pineapple in the Malindi hinterland, and bixa in parts of Kwale and Lamu.

2 A list of plant names is given in Appendix 1.

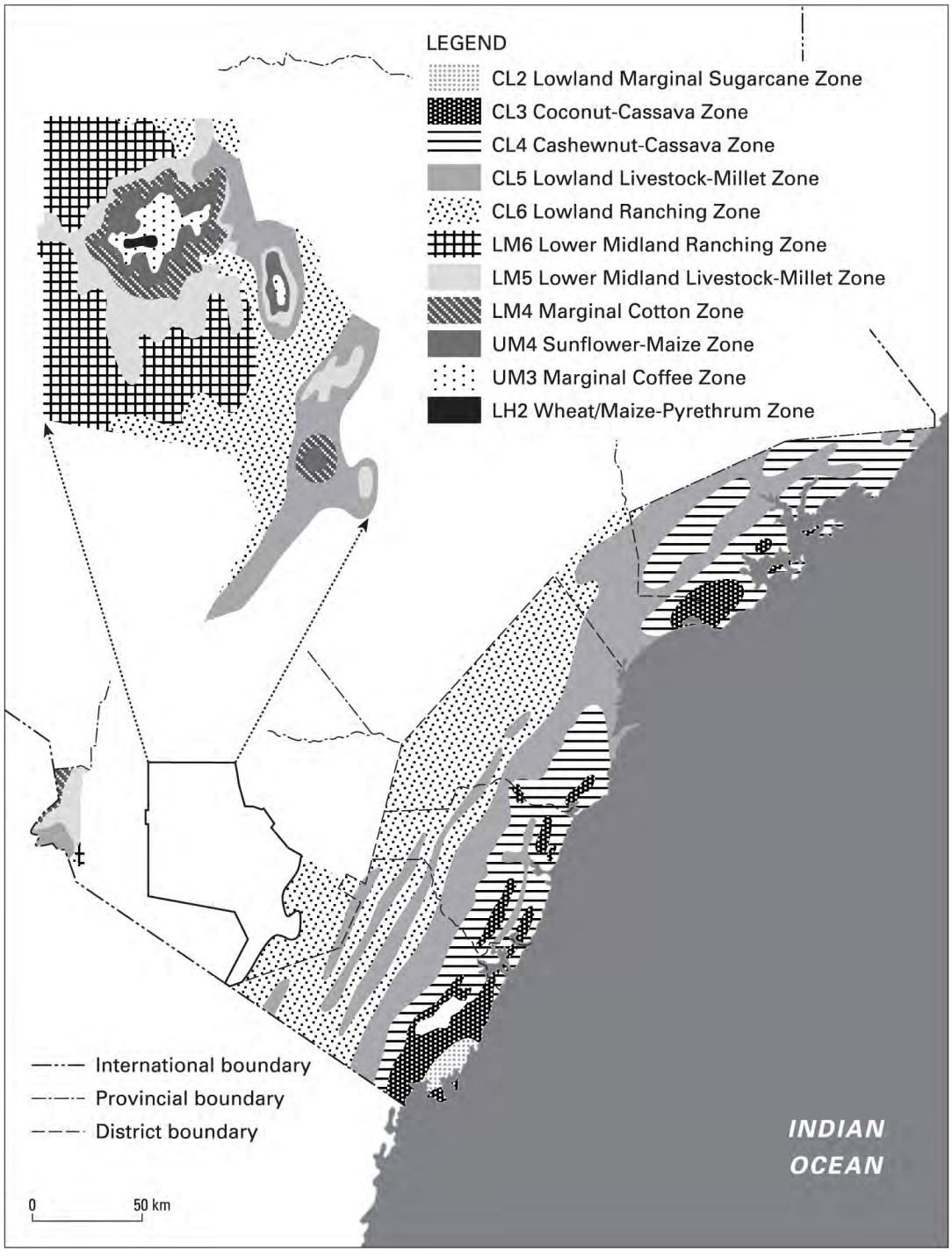


Figure 1 Main agro-ecological zones
(Source: Jaetzold & Schmidt 1983)

The statistics in Appendix 2 about the value of crops leave out minor products such as leaves (cowpea), thatch (coconut) and fodder (various crops). Other factors not shown are the seasonality and stability of yields and incomes. Some annual crops produce only once or twice a year, whereas most fruit crops apart from being seasonal suffer from price fluctuations. The coconut palm, on the other hand, provides relatively stable yields of a wide variety of products.

In the next sections the major groups of crops are discussed briefly. The following publications give additional information on agronomic practices (Acland 1971), weeds (Ivens 1967; Terry, Matthews & Boonman 1984; Terry & Michieka 1987), pests (De Pury 1968), fruit trees (Griesbach 1992), cashew (Van Eijnatten & Abubaker 1983), coconut (Floor 1981; Herlehy 1985), maize and coconut (Waaijenberg 1994).

Cereal crops

• Maize. In the nineteenth century, maize replaced sorghum and millets as the staple food crop of the coastal areas of Kenya. Most of the area is sown with 'local' cultivars, a diverse mix of materials introduced by the Portuguese and the English (Harrison 1970). The modern cultivars H-511, H-512 (Taita Hills), Coast Composite, Pwani Hybrid (coastal belt) and Katumani Composite (dry areas) are less common. Their seeds are not easily available or are more expensive and their yields are comparable to those of the local, cheaper seeds. In most of Coast Province unreliable rains and high weed and pest incidence are probably more limiting than the genetic potential of the plant material.

Maize yields in Coast Province are among the lowest in the country. During 1981 to 1984 farmers' yields in the Kaloleni area ranged from less than 200 kg/ha to more than 2000 kg/ha, with an average of about 1000 kg/ha. There were large differences related to soil type, rainfall, weed control and pest damage. On the average, fertile soils gave an advantage, but sometimes factors not foreseen such as excessive rainfall or army worm attack caused surprises. For example, in one year plot A could yield 1800 kg/ha and plot B 500 kg/ha, whereas next year plot A gave only 700 kg/ha and plot B as much as 1400 kg/ha.

The results of experiments also varied from one season to the other; the below figures are the highest yields obtained under farmers' conditions. In trials around Kaloleni (1981-1984), the local cultivar Mdzihana with 50 kg nitrogen and 20 kg phosphorus per ha produced up to 4000 kg/ha (Waaijenberg 1994). In experiments with nitrogen, phosphorus and farmyard manure in Shimba Hills (1987-1990) the highest yield was 4200 kg/ha (Smaling *et al*. 1992). These experimental yield levels are still quite modest. For comparison, farmers' yields in favourable areas up-country are in the 2000 to 5000 kg/ha range (Jaetzold & Schmidt 1982).

• Rice. The crop is grown in the valleys and bottom lands of Kwale and Kilifi and in the flood plains of the Tana River. Although there are several old and new introductions which can yield more than 5000 kg/ha of paddy in fertiliser experiments, the yields of the local farmers are much lower, being limited by lack of water control, weed problems and low soil fertility (Budelman 1981).

The large numbers of maize and rice cultivars can be explained by two factors. The

first is that farmers in Coast Province show great interest in trying out any kind of new seeds and in conserving the seeds left to them by their parents. The other is that during the frequent famines that have struck the area many farmers were forced to eat all their seeds and later to look for new seeds to plant (Waaijenberg 1994).

Root crops

• Cassava. It has been grown for more than a century and half in Coast Province (Emery 1833). In some parts of Kwale it is the staple food. Although numerous cultivars are known, two produce the bulk of the harvest: the local cultivar Kabandameno in Kilifi and the hybrid 46106/27 (Kaleso) in Kwale. In spite of the African Cassava Mosaic Virus (ACMV) – which many farmers consider a normal habit of the crop – cassava has always been appreciated for its reliable yields. Most plants produce 1-2 kg fresh tubers per plant; less than 10 t/ha with the usually low plant densities because of intercropping. The yield of cassava in pure stand on the better soils may be in the 10-20 t/ha range. More recently pests and diseases such as bacterial blight, (spider) mites and mealybugs are threatening the position of the crop. A review of cassava production in Coast Province is given by Adamson (1983). Most cassava is consumed on the farm, but increasing amounts are sold for urban consumption or production of starch.

• Sweet potato. This is the second and less important root crop. A major limitation is that after a long dry season few vines are left to be planted for the next crop. The Ministry of Agriculture tries to solve this problem by establishing bulking sites where farmers can get planting material (Kenya 1993). In the bottom lands and valleys of Kwale and Taita Taveta some taro and tannia are grown.

Pulse crops

The figures in Appendix 2 underestimate the value of leguminous crops such as cowpea and bean. Their seeds provide protein for the poor (in the case of cowpea also the leaves are eaten) and cash income for numerous farm households. Leguminous crops also contribute to the maintenance of soil fertility by means of symbiotic nitrogen fixation; replacing natural fallows with pigeon pea doubled the yields of the following sorghum and maize crops (Kenya 1937, 1938; Clarke 1962).

• Cowpea. This is the main pulse crop of the lowlands. Numerous local cultivars or old introductions are grown, but also new materials such as 'K80' and 'M66' find easy acceptance (Kenya 1993). Yields vary from almost zero to occasionally more than 1000 kg/ha. Pod borers are a major pest of the crop. Rainfall during ripening can be disastrous.

• Beans. They are mainly grown at the higher altitudes of the Taita Hills. The cultivars Rose Coco (GLP-2), Mwezi Moja (GLP-1004), New Mwezi Moja (GLP-1127A), Mwitemania (GLP-92) and Canadian Wonder (GLP-24) are resistant to common mosaic, angular leaf spot and anthracnose (Kenya 1993). Pulse crops of minor importance are green gram, pigeon pea, lablab bean and bambara nut. As with cowpea, all pulses require dry weather during ripening.

Most cowpea and beans are relay cropped with maize, after tasseling, to avoid the heavy rains and the incidence of pests and diseases of the early season. Leguminous crops

might play a more beneficial role in the farming systems, but a strong limitation for expansion is the recurrent lack of seeds. Many farmers do not have money to buy them and those who do may fail to find the proper material at the local markets.

Vegetable crops

Most vegetables are produced for home consumption, cultivated in small gardens, sown in between staple food crops or collected as weeds in crop fields and fallow lands. Common types are *pili pili* (hot peppers), *mchicha* (amaranth leaves), *tindi* (creeping tomatoes with small fruits), *mafa* (local species of eggplant), *mnavu* (black nightshade) and *mutsunga* (wild leaf vegetable). They require few inputs, their production is inconspicuous and little is marketed. Nevertheless, these 'invisible' vegetables play an important role in the nutrition of the rural population.

There is also commercial production of vegetables for urban markets, tourist industry and export. The most widespread crop is tomato; of lesser importance are cabbage, kale, onion (highlands), aubergines and peppers (lowlands). A more extensive list of species, cultivars, areas, yields and prices is given in Kenya (1993).

For vegetables there is "an insatiable demand in Coast Province" (Kenya 1993: 19). However, the markets are dominated by traders from up-country, where the rains tend to be more reliable and commercial vegetable growing had an earlier start. In most of Coast Province rainfall, surface and underground water are scarce and numerous small local producers find it difficult to enter the markets of Mombasa. They have to grow and sell their crops when the rains are well under way and consequently prices are low.

In intensive vegetable production more use is made of external knowledge and inputs than in the conventional staple food and cash crop growing. Although experience with vegetables may stimulate improvements in farming methods, there is also the danger of a widespread and indiscriminate use of pesticides.

Fruit crops

As with vegetables, most fruits are produced by small farmers with modest numbers of various species and cultivars grown dispersed in food crop fields and coconut plantations. Citrus, mango and banana are found in all humid areas and account for more than 90% of the value of the production. Pineapple is of local importance in the dry hinterland of Malindi. Most farmers produce for both home consumption and the local markets.

Some estates in the coastal strip produce quality mangoes for export: Ngowe, Boribo and Apple are the best among the old cultivars; Haden, Kent, Sensation and Tommy Atkins are recent and well adapted introductions; there is a large number of other materials under observation (Griesbach 1992). The requirements of strict timing and high quality make it difficult for small farmers to participate in the export market.

The high temperature and humidity of most production areas favour pests and diseases such as gummosis, fruit flies, scales and mites (citrus), anthracnose, powdery mildew and weevils (mango), nematodes, weevils and black sigatoka (banana). Whereas most problems are old and farmers have learnt to cope or live with them, the recent arrival of black sigatoka may seriously affect the areas and yields of bananas and plantains. Among the

solutions may be a shift from susceptible AAA (Cavendish subgroup) and AAB (plantain subgroup) towards more resistant ABB cultivars (Bokoboko, Pelipita). Planting the crop under light shade of coconut palms may diminish the severity of the disease (Stover 1987).

The seasonality of production – punctuated by a long dry period – in combination with lack of storage and processing facilities reduces the benefits farmers can obtain from growing fruits. The harvests of citrus, mango and pineapple come in peaks, the markets are quickly glutted and prices drop to low levels. Attempts at processing fruits commercially have been small scale and short lived.

Industrial crops

The term 'industrial crops' encountered in many statistics includes a number of widely different species. What they share is that before consumption they undergo some kind of processing such as oil or pigment extraction, roasting or ginning.

• Coconut. The coconut palm for long has been the mainstay of the small farmer economy at the Coast, yielding an abundant supply of leaves, palm wine and nuts. Tiles plaited of dry coconut fronds were used for thatching the homes of the rural and urban poor. An increasing proportion of these *makuti* is being absorbed by tourist hotels and houses of the exotic rich, whereas in low-cost building the use of metal sheets is growing (Macoloo 1991). The tapping and selling of palm wine – except for ceremonial purposes – were forbidden in 1981. In spite of strong verbal resistance and extensive smuggling, the prohibition effectively reduced the role of palm wine in the economy of especially the Rabai, Ribe, Kambe, Jibana, Chonyi and Giriama tribes of the Mijikenda (Herlehy 1985).

For the nuts, which are presently the main product of the coconut palm, there are two competing uses: the production of copra for the industrial extraction of vegetable oil and the sale of immature or ripe nuts for drinking or for cooking. Especially during the fast of Ramadhan the demand for nuts is high.

Kenya is an importer of vegetable oils, in spite of thousands of hectares of sunflower in the Rift Valley and of coconut palms in Coast Province. As for the latter, the average yield is only 30 nuts per palm per year (Van Eijnatten 1979). Limiting factors are the marginal rainfall in the area, the poor management by some farmers and the old age of many palms.

The Mijikenda show interest in planting new coconut palms but they are reluctant to cut down old ones. As good land with better than average rainfall and well drained deep soils is scarce and also in high demand for food crops, too little replanting of coconut palms takes place, mostly with farmers' seeds of the 'East African Tall'.

There has been little selection and breeding of coconut in Kenya. The hybrid PB-121 can yield more than 100 nuts per palm and over 4000 kg of copra per ha, with supplementary irrigation (Griesbach 1992). However, hybrids may not perform equally well under farmers' conditions. In Tanzania their performance was affected by drought and 'lethal' disease such that hybrid seed production was suspended in 1991. The 9x15m spacing recommended in that country allows permanent intercropping between the palms.

In that way the land remains available for food crops and the palms are weeded properly (Behrens *et al*. 1993).

• Coffee. Compared to coconut, coffee is a very minor crop in Coast Province. In the Taita Hills less than 300 ha are planted with Arabica coffee, K-7, SL-28, SL-34 and Ruiru-11 being the most common cultivars. In Kwale and Kilifi, Robusta coffee was introduced recently; plants under shade of coconut palms performed better than those without protection from the harsh climate (Kenya 1993). However, intercropping with an all-season perennial competitor for moisture may increase the drought stress of the coconut palms (Floor 1981).

• Cashew nut. The commercial production of cashew nut in Kenya started in the 1930s. The ability of cashew trees to grow on poor soils and with little rainfall in combination with the presence of a factory in Kilifi quickly made it a successful cash crop. However, the care given to old stands and the planting of new trees go up and down with the prices paid to the farmers. The 1980s were a period of disappointment, but in the early 1990s prices started to improve (Kenya 1993).

The average yields of cashew nut are low, 2-6 kg per tree per year or 300-500 kg per ha per year. Most of the area consists of old plantings, composed of low yielding trees planted in a haphazard way, which receive little attention and frequently suffer from bush fires. Also diseases such as powdery mildew and anthracnose attacking leaves and flowers take their toll. There are better plant materials and husbandry practices available. Studies of the clone A81 planted in hedgerows showed that yields far over 2000 kg per ha per year are attainable (Van Eijnatten & Abubaker 1983).

• Bixa. This is a shrub whose seeds are covered with the red dye anatto. Most of it is grown in Kwale and Lamu, where the crop was introduced during the 1950s and 1970s, respectively. The shrub is easy to grow and demands little care. The main problem is powdery mildew and the major labour peak is during the harvest. The fortune and neglect of the crop are linked to the fluctuating demand for natural colourings for foodstuffs (Nalugwa 1993).

• Cotton. It is grown in the Hola and Bura schemes (irrigated) and in the Malindi area (rainfed). Since early last century the government has played a role in promotion and extension, provision of inputs, and marketing of the seed and lint. The recent liberalisation of the market may solve some inefficiencies but places the burden of the production costs – cotton is a showcase of pests usually controlled with chemicals – on the farmers.

• Simsim**.** The importance of simsim, for centuries a major cash crop in Coast Province, appears to be declining. It is usually cropped in relay with maize and receives little attention apart from an occasional weeding. The harvesting, stocking and threshing are time consuming, the yields are quite moderate, and the prices are low compared to the efforts.

Estate crops

A few sisal estates in Kilifi, Kwale and Taita Taveta Districts are the remnants of the once numerous colonial Ceara rubber, coconut, sugar and sisal estates in Coast Province (Rodwell 1984). Among the problems faced, are fluctuating market prices and lack of motivated labour. The peoples of Coast Province have never felt attracted by the arduous

and dangerous work in sugar or sisal plantations, so that often labourers had to be recruited from western Kenya.

REGIONAL VARIATION

As mentioned, there exist great differences in quality and type of land within Coast Province. In this section three areas are presented in detail. They do not cover all the spatial variation that exists but by describing relatively densely populated areas they do give a picture of the ecology and land use conditions of most farmers of Coast Province. There are numerous other case studies of similar and different places or aspects of agriculture: Digo and Duruma farmers and traders (Gerlach 1963; 1964), households around Kikoneni (Gillette 1978), acquisition of palms and land in Kaloleni (Parkin 1972), economics of coconut production in Rabai (Herlehy 1985), farming systems and food security in subhumid and dry parts of Kwale (Van Oosten 1989), and the rise and fall of the Magarini Land Settlement Scheme in Malindi (Porter, Allen & Thompson 1991).

Lower Tana River

The Pokomo farmers practice sedentary agriculture in the valley and delta of the Lower Tana River utilising local rainfall and river water. Rainfall is low, from about 1000 mm/year near the coast to 500 mm/year at 50 km inland, with large fluctuations between seasons and years. The availability of river water – which rises and falls twice a year in the periods April to June and October to November – depends on the topography which determines where the various crops can be grown (Figure 2). The edges of terraces and higher levees, with better drainage and less risk of flooding, are planted with mango and occasionally coconut. On the levees along past and present river courses banana and sugarcane are grown. Maize, pulses, cassava, tobacco and vegetables are grown on the transitions from levee to basin after recession of the floods, whereas rice is usually grown in the basins themselves. Few external inputs are used (Muchena 1987). The diet is supplemented with mudfish (*Clarias* sp.) caught in the river courses and swamps after recession of the floods (Budelman & Eisses 1983)

The major agronomic problem is irregular flooding. Whereas in some years the crops are swept away by the water, in other years the river does not rise enough to flood the land required for cropping. In good years there are the problems of wildlife; rats, birds, monkeys, pigs, hippos and buffaloes may devastate the entire crop. As hunting is restricted by law, farmers have few defences against these pests. The main economic bottlenecks are the poor infrastructure and long distances which make it difficult to market cash crops so that most produce is consumed on the farm. As farmers understandably see no benefit in planting more than the necessary, food shortages and imports of maize meal are common, in spite of low population density and ample arable land being available. The risks and uncertainties of production and marketing have stimulated interest in off-farm employment, especially in the more accessible villages (Budelman & Eisses 1983).

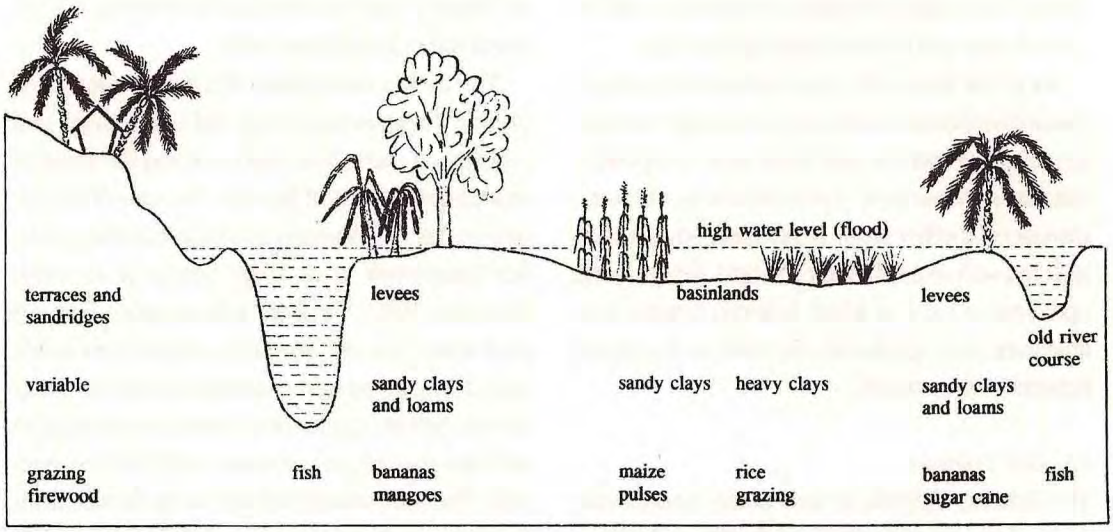


Figure 2. Schematic cross-section of the Lower Tana River: Topography, soil types and products of Pokomo flood- and rainfed agriculture (Budelman & Eisses 1983)

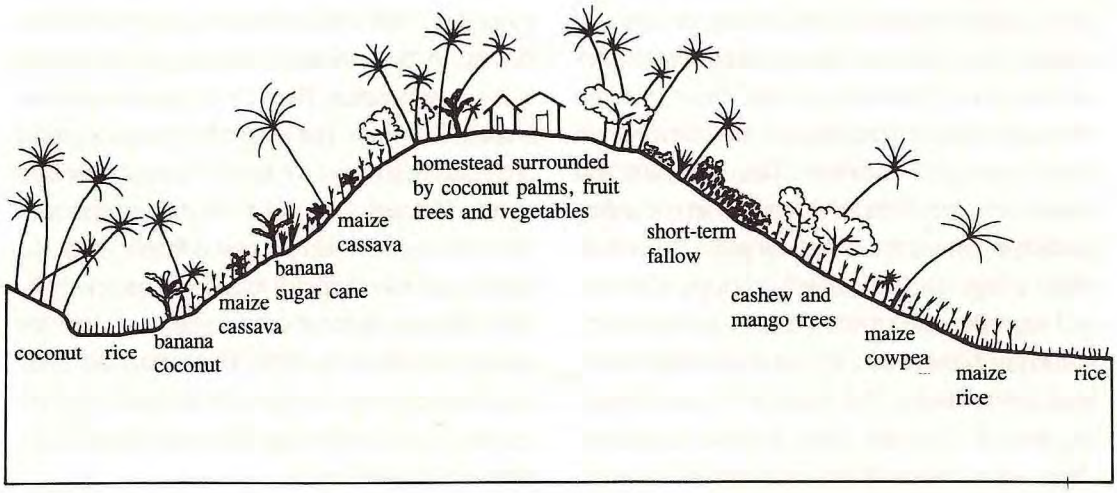


Figure 3. Typical toposequence of crops related with moisture availability in the palm belt of the Kaloleni area (Waaijenberg 1994)

Elsewhere in Kenya many attempts at development consisted of piecemeal introduction of cultivars or breeds, and improvement of crop or livestock husbandry. In the Lower Tana River area more radical approaches have been followed. The establishment of large-scale irrigation schemes in Hola and Bura falls outside the scope of this paper. In the area described, during the 1970s and 1980s several small-scale irrigation schemes were rehabilitated or newly constructed. The major crop was to be rice of which several productive local cultivars are available (Budelman 1981). However, such schemes are expensive as they need dikes to keep the river out and pumps to get the water in, whereas in years with favourable flooding they offer little advantage. Moreover, they require regular maintenance of the infrastructure and close cooperation between farmers. Therefore, from 1984 onwards the focus of the Lower Tana Village Irrigation Programme shifted towards rain- and flood-fed farming (Van Eijk)

As for the future, the improvement of the Mombasa-Malindi-Garsen-Lamu road and bridge connection will make Pokomo agriculture more competitive, but may also lure away potential farm workers and managers. Another factor is that there are few areas in Kenya with so much water and land. New projects, upstream or local, in which Pokomo farmers have little voice, may significantly alter their ecological and economic environment.

Kaloleni Uplands

The Kaloleni Uplands are one of the most diverse areas of the coast. Just behind the flat sisal plantations of Vipingo begins a steep hilly landscape of poor sandy soils covered with forests of old cashew alternated with shrub land and small gardens or an occasional homestead or village. Behind the hills is a lower lying area with fertile but hard to work clay soils cropped intensively with maize, cassava and cowpea. Locally also rice, simsim or bambara groundnut are grown. Fruit trees do not thrive on these alternately sticky or hard soils and most farmers have their homesteads elsewhere. Then the maize and cassava fields are displaced abruptly by an undulating landscape covered by tall coconut palms in between which a large variety of staple food crops, fruit trees and vegetables are grown. This area is dotted with numerous homesteads, several small villages and a small town, Kaloleni, that counts with a small hospital, several churches, some schools, numerous shops, restaurants and bars and a roadside bus station. Northwest of Kaloleni the palms gradually give way to a drier landscape with small plots of maize or cassava and degraded shrub and woodland used for grazing and extraction of firewood and charcoal. Then the uplands slope down to dry and empty plains stretching across cattle ranches and game parks to the distant Taita Hills. These changes do not happen over hundreds of kilometres, but are found within a single day's walk!

The factors that shaped this diverse landscape include the geomorphology and soils, rainfall and evaporation, the natural vegetation and the action of various generations of farmers. The soils of the uplands are of heterogeneous origins and characteristics (Sombroek *et al*. 1982; Boxem *et al*. 1987; Oosterom 1988). The steep hills are relics of an old dune formation with leached, acid and poor sandy soils. Those of the next area were formed on shales and are rich in crop nutrients, but less well drained and hard to work, as

is common with 'black cotton' soils. The soils around Kaloleni were derived from limestones and sandstones, well drained and of moderate to low fertility. The fine sandy soils north-west are porous and poor. In brief, most soils in the Kaloleni Uplands are deficient in one or more aspects.

The annual rainfall in the Kaloleni area varies from more than 1100 mm in the south-east to less than 800 mm in the north-west, becoming more bimodal in the same direction. The annual evapo-transpiration is about 2100 mm. The relatively low and seasonal precipitation is one of the major constraints for agriculture. Although Kaloleni has the most reliable rainfall of the southern Kenya coast (Okoola 1978), the highest and lowest rainfall totals in the period 1981-1984 differed a factor of two for years, and three for seasons (Waaijenberg 1994). That means that farmers do not only have to cope with seasonal crop production, but also with large differences in yields between seasons and years.

Until the sixteenth century the Kaloleni Uplands were covered by a natural vegetation reflecting the prevailing soil and climate conditions. The classic study of Moomaw (1960) distinguished four lowland vegetation types, whose boundaries coincide with the landscape described: *Cynometra-Manilkara* dry forest; *Manilkara-Dalbergia/Hyparrhenia* cultivation savannah, *Sterculia-Chlorophora/Memecylon* rain forest, and *Brachystegia-Afzelia* woodland. The present vegetation and land use are described by Van Leeuwen (1982).

The ancestors of the Mijikenda people, to whom the Jibana, Chonyi and Giriama tribes of the Kaloleni area belong, lived in *makaya*, protected villages on forested hill tops. They practised shifting cultivation growing sorghum, millets, cowpea, simsim and eggplant; maize, cassava and rice were introduced later (Waaijenberg 1993; 1994). Their diet was supplemented with wild plants and by fishing or hunting. They also kept some goats, sheep and chicken. Amongst the Mijikenda themselves there was exchange of the agricultural products grown in the varied environments of the *makaya*. With their neighbours in the coastal strip and the interior they traded in agricultural surpluses (cereals, simsim), forest products (gum copal, rubber) and wildlife products (ivory, rhino horn). In the mid-nineteenth century they left their crowded *makaya* and spread over the countryside. By the end of the century trading opportunities had diminished due to the reduction of wildlife and the construction of the Mombasa-Nairobi railway.

The Mijikenda had to look for other ways to complement their maize-cowpea-cassava based subsistence agriculture. From the early nineteenth century onwards the cultivation of coconut palms has been expanding until it reached the limits imposed by soil and climate. Although also the nuts (fresh or copra) and leaves (thatch) were appreciated, the possibility of tapping wine was the strongest attraction of the coconut palm. The Rabai, followed by most of the other Mijikenda tribes, became the major producers and sellers of palm wine to the inhabitants of drier areas and the coastal towns. The Jibana planted rice in the numerous minor valleys and bottom lands that cross the coconut fields of their country. The Chonyi exploited their access to fertile land suitable for maize and pulses and from the 1930s onwards planted the sandy dunes with cashew nut trees. The Giriama of the drier hinterland sold firewood and charcoal and increased their herds. The similar and divergent pathways followed by thousands of farm families resulted in diverse land-

scapes, with present land use transitions following previous vegetation boundaries and with also remarkable variation within zones, farms and fields (Figure 3).

Today, the ingenuity of the farmers in making the best of their natural resources is no longer enough. Although the average population density in Kilifi District appears low (about 60 persons/km^2; Table 1), in several areas the population has increased to more than 300 persons/km^2 and food production is unable to keep up. Around Kaloleni even in good years most farmers produce at best half of the staple food required for subsistence (Waaijenberg 1994). The incomes from cash crops and livestock sales are too low to meet the demands for maize meal, clothing and education. Social events such as labour sharing, marriage payments and funeral ceremonies help to distribute the few resources available, but do not generate any extra income (Waaijenberg 1993).

In the course of the twentieth century most farm households had to turn to off-farm work to supplement their meagre farm income (Hoorweg, Foeken & Klaver 1995; Waaijenberg 1993). For example, 131 rural households in the Kaloleni area were interviewed in 1981: two-thirds had one or several men working off-farm, on a quarter of the farms that included the heads of the household, two-thirds of these also slept elsewhere, and less than half of males over 15 years worked on-farm. The poor education infrastructure and late entry in the labour market – until a few decades ago most Mijikenda frowned upon both – make it difficult to find well-paid jobs. Therefore, it remains to be seen whether the balance will turn negative (with low salaries and less farm labour) or positive (with salaries invested in farming).

Taita Hills

Standing on the dry western edge of the Kaloleni Uplands on a clear day, one can see in the distance the outlines of tall and green hills. Vuria, the highest peak of the Taita Hills, rises 1500 m above the surrounding plains and reaches 2209 m above sea level (Ojany & Ogendo 1973). The effects of the topography – altitude and position with regard to prevailing wind directions – on temperature and rainfall have created quite distinct land use zones (Jaetzold & Schmidt 1983).

On the dry plains and foot slopes, less than 1000 m above sea level and with less than 800 mm annual rainfall, most land is occupied by wildlife parks, cattle ranches and sisal plantations. Locally maize, sorghum, bean, cowpea, pigeon pea, sweet potato, cotton, chillies and some vegetables are grown. Leftovers of the natural vegetation are being turned into charcoal or firewood. In the hills, between 1000 and 1700 m above sea level and with 800 to 1400 mm annual rainfall, maize and beans are the main crops. Other staples grown in the diverse niches of the hills are banana, sweet potato, cassava, taro, tannia and Irish potato. In higher and wetter zones coffee, dairy production and horticulture are common. At all elevations wetter valleys or bottom lands are found which are used intensively for the production of bananas, tubers and vegetables. Locally small-scale irrigation systems are found (Fleuret 1988).

Until the middle of last century most farmers used to have access to land in various zones, which enabled them to cope with climatic risks and provide their families with a varied diet. The adjudication, consolidation and registration of land envisioned by the so-

called Swynnerton Plan (Swynnerton 1954) and implemented during the 1960s reduced the fragmentation and dispersal of land, although most farmers still have several parcels. The land tenure reforms reduced the within-farm variation in ecological conditions and confirmed inequalities in access to land (Mkangi 1983; Fleuret 1988).

Private ownership and unequal access to land did exist well before the land tenure reforms. Members of the *kichuku* (kin group) that had settled first in a given *izanga* (neighbourhood) tended to have more land than those of kin groups that had settled later. As at present most suitable land is occupied; settlement and clearing of bush no longer are ways to obtain land. Buying has become the principal mechanism, with wage earners (civil servants) obtaining land from those in need of cash (Fleuret 1988).

Through a long history of immigration – the hills were a relatively safe place – and population growth the Taita Hills have become densely populated. The amount of crop land in the hills is about 1-2 ha per household (see also Table 1). To make a living out of so little two strategies are followed. The first is the intensive production of vegetables, fruits and livestock (dairy under zero-grazing) that give higher returns per unit area than the classic combination of maize, bean and coffee. The different production choices and their effects on child nutrition are elaborated in detail by Fleuret & Fleuret (1991). The second strategy is based on labour migration, especially to Mombasa and Nairobi. Pressured by demographic growth and favoured by education in mission schools, the Taita ventured early into off-farm employment and often secured better jobs than their later and less educated Mijikenda neighbours (Mkangi 1983).

FARMING SYSTEMS

Distribution of resources

In this section the variation between farms and farmers within a single area is illustrated with data from four villages in the Kaloleni Uplands. To outsiders all Mijikenda farms look similar at first view. They consist of a small house covered with metal sheets or coconut thatch, surrounded by coconut palms and cashew nut trees. Most men are away on some kind of work, while the women grow a few acres of maize mixed with cowpea or cassava. A dozen of chicken scratch the home yard and a few goats are tied to shrubs on a piece of fallow land. Also many farmers tend to stress the similarities rather than the differences with their neighbours. According to this view all Mijikenda farms are minor variations on one farming system or "class of similarly structured farms" (Fresco & Westphal 1988).

However, in some villages cashew clearly dominates the land use and in others maize and cassava, coconut or livestock. Differences between farms in the same village are more difficult to spot, but half a day of interviewing is enough to reveal large variations in the numbers of trees and animals per household. Figure 4 presents some examples from an interview in four villages in 1981. The distributions of off-farm workers, tree crops and livestock indicated that when separate resources or activities were considered, some farmers had a much larger share than others. None of the variables, not even after

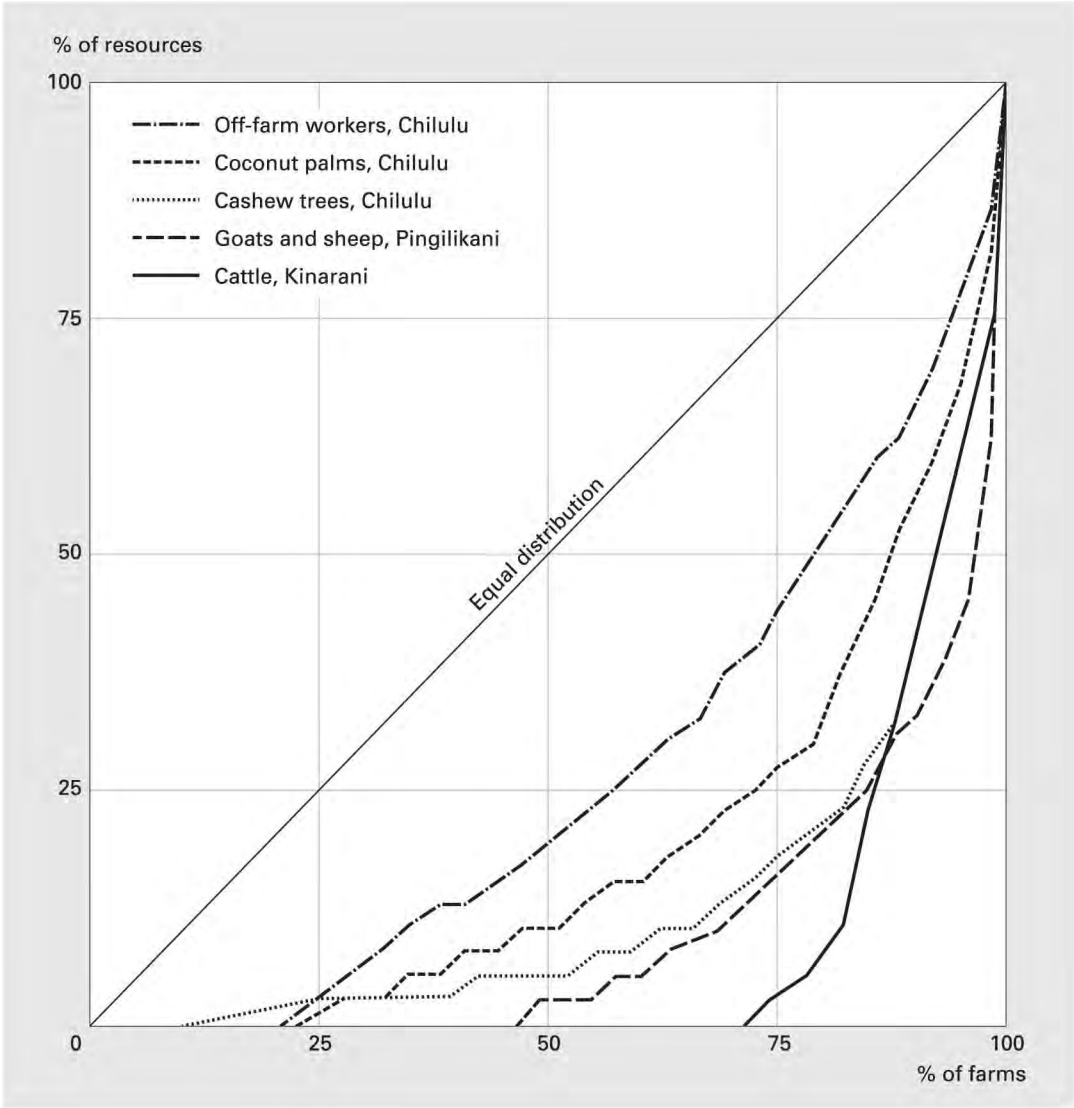


Figure 4 Examples of the distribution of off-farm workers, tree crops and livestock between farm households in four villages in the Kaloleni area
(Source: Waaijenberg 1994)

correction for household size, approached an equal distribution among households, represented by the diagonal line. When evaluated per variable, some farms appeared more equal than others.

Classification of farms

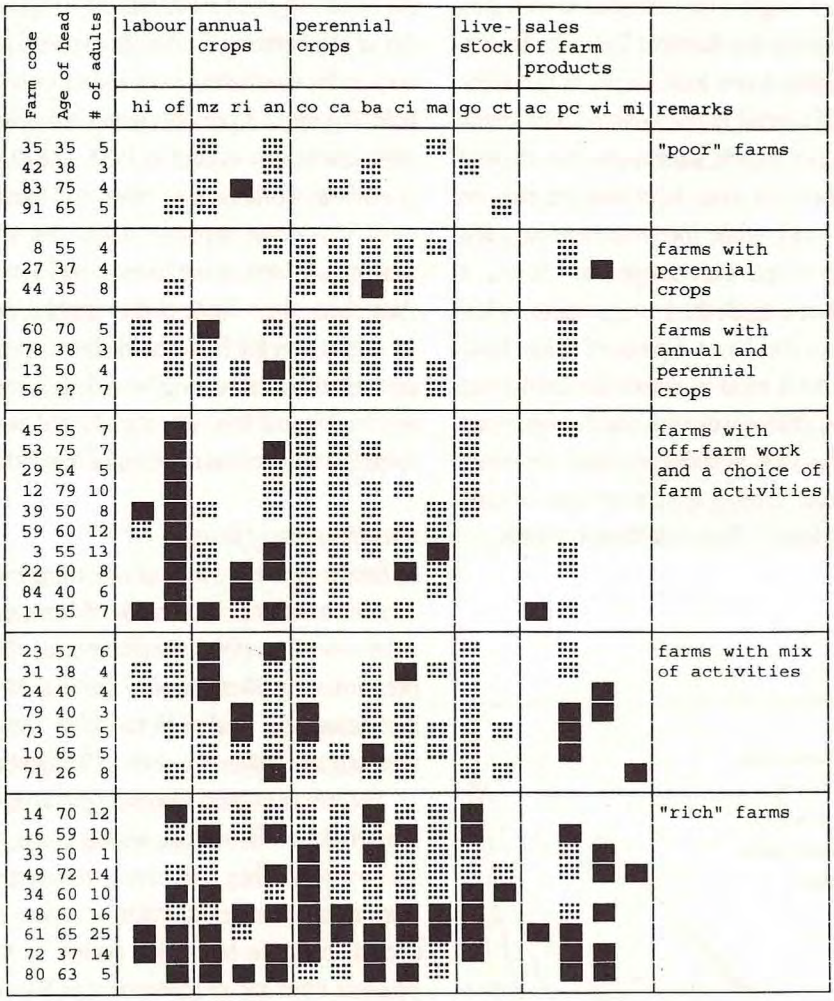
As farmers can have little of one thing but more of another, a realistic classification of farms should consider several variables simultaneously. Figure 5 presents a classification of 37 farms in Mbuyuni village based on a total of 16 variables. Details on the methods and results are given in Waaijenberg 1994.

The variables used represent the activities of the household: off-farm work, annual crops, tree crops and livestock. They refer also to resources: off-farm work means ready cash, maize or annual cash crops access to fertile land, rice access to wet lands, whereas trees are an investment in future production and animals can be seen as wealth in themselves. They moreover indicate the orientation of the household: in the employment of labour and the sale of labour, palm wine, milk and other products the market orientation is explicit. The variables also determine the household income: more activities and in larger amounts usually imply more produce for use and sale, and with less variation. Most of them refer to relatively permanent characteristics of the farm, such as the numbers of coconut palms and other trees, but others to more changeable features, such as the number of off-farm workers or the sale of milk. After dividing the values of the variables in two (no/yes) or three (none/ some/much) classes, the farms were grouped using a tabulation method borrowed from vegetation science. This method was conceptually simple, could if necessary be done by hand and resulted in an illustrative two-dimensional picture of a multi-dimensional reality (Figure 5).

The classes of farms that are distinguished and their descriptions are not final. The number of classes, their boundaries and the positions of individual farms are open to discussion. Nevertheless, some conclusions can be drawn. Most farms were similar in that they had a wide range of activities. Yet, there was a differentiation between several farms that scored low on most variables and some with high scores for many activities. Apart from many intermediate ones, there were ‘poor’ and ‘rich’ farms. There was also a tendency towards specialisation in, for example, perennial crops or off-farm work.

Less than one third of the variance between farms was determined by household size, which in turn was related to the age of the head of the household. Farmers of middle age tended to have larger households and more resources or activities. However, most of the variation between farms was not related to the life cycle or size of the household. Therefore, it appears that indeed not all farms were equal, but different in amount of resources or choice of activities. Several factors contribute to the differences between farms. These include access to specific types of land, distances to roads, markets or school, availability of family labour and investment in land, crops, livestock or education. However, the most important is the factor management, the way the farmer and his/her family use their resources to improve on the conditions they find themselves in. A number of real-life stories that illustrate this quite clearly are given in Waaijenberg (1994).

Figure 5 Tentative classification* of a random sample of 37 farms in Mbuyuni village, Kaloleni (Waaijenberg 1994).



* The method of analysis consisted of the reiterative ordering of the rows and columns of a species-by-sites matrix in such a way that sites with a similar species composition and species with a similar distribution over sites were brought together (Digby & Kempton 1987). By replacing 'sites' with 'farms' and 'species' with 'variables', the method was used for grouping similar farms and related variables into the equivalents of 'communities' and 'associations', respectively.

Flow variables refer to the whole year 1981, state variables to December 1981. All were divided into three classes: none or little (blank), some (grey squares) and much (black squares) of a resource or activity. The variables were :

(hi) money sent on hired labour, (of) number of off-farm workers;
(mz) maize consumption from own harvest, (ri) amount of rice grown, (an) number of other annual crops;
(co-ca-ba-ci-ma) number of coconut palms, cashew trees, banana plants, citrus trees and mango trees;
(go-ct) numbers of goats+sheep and cattle;
(ac-pc-wi-mi) sale of annual crop, perennial crop, palm wine and milk products.

CONCLUSION: RURAL DEVELOPMENT PROSPECTS

The agricultural potential of Coast Province in general is limited. Most of the land is rather flat, dry, of low agricultural potential and thinly populated. Only some relatively small areas, favoured by nearness to the coast, altitude or large rivers, receive more water, are of medium to high potential and support large numbers of farmers. However, low agricultural potential or high population density both make it difficult to get a living out of farming. The hardships farmers suffer are made worse by the climatic risks (drought) and unhealthy conditions (malaria) of Coast Province.

However, in several ways agriculture at the Kenya Coast is not poorly developed. The farmers cleverly exploit the diversity of their difficult environments. In the areas described farmers opt for diversification. Most have several plots of different land and grow perennial crops that provide some stability and annual crops that give flexibility. The Pokomo farmers make use of the minimal variation in altitude, drainage and risk of flooding. The Mijikenda plant crops in several land use zones or change their crop mixes along the catenas. The Taita combine different altitudes and rainfed land with swampy or irrigated land.

A particular proof of farmers' management abilities are the genetic materials they have selected and maintained. Examples are the rice cultivars of the Lower Tana River and the maize cultivars in the Kaloleni area that so far have withstood replacement with 'improved cultivars'. In other areas, no doubt, many more valuable materials adapted to the harsh conditions of Coast Province can be found. This genetic resource is being undermined by the frequent food shortages, when farmers have to eat their seeds and to replace them later with materials from shops, markets, nurseries and multiplication sites (Kenya 1993). There is a real danger of irreversible genetic erosion, especially in rice and pulses.

In spite of farmers' inventiveness most areas of Coast Province now have a food deficit so that staple food (maize meal) has to be imported. In the past the harvests of crops were supplemented with livestock products, hunting or fishing and trade. Today off-farm work is the major supplier of additional income and stability. There is evidence that non-farm income contributes to improved nutrition and provides resources to buy land or farm inputs. However, in general the relation between off-farm work and farm development is little understood. There is no quantitative information on how the seasonal or permanent lack of labour affects the productivity of crop and livestock enterprises, and on how much off-farm income is left after essential consumption to compensate for the loss of labour and management.

At present the farmers of Coast Province face a difficult period: productive land and well-paid jobs are becoming scarce and there are no easy ways out. However, their impressive record of historical changes gives hope for the future of rural development (Waaijenberg 1991). A central condition for progress is that their farming systems are allowed to maintain their flexibility. Often institutions, projects and programmes, sometimes without knowing it, reduced the freedom of farmers to run their farms in the way they know best. For example, obligations in irrigation schemes made it difficult to exploit a favourable flood year in the Lower Tana River (Budelman & Eisses 1983). Mijikenda

farmers were at times forbidden to cut down overage cashew nut trees to make place for more productive land use (Waaijenberg 1994). Taita farmers were not allowed to intercrop their coffee with beans – and improve nutrition and income – although the practice would not have affected the national coffee harvest at all (Fleuret & Fleuret 1991).

Other important limitations are lack of capital and skills or technology. Many actions by the colonial and independent government, such as the confiscation of livestock, high hut and poll taxes, prohibition of palm wine tapping, monopolies of copra or cashew marketing and other restrictive measures have limited the build-up of local capital. The poor formal education of most farmers hampers the adoption and application of complicated technology. On the other hand, in spite of a long record or research and extension rather little improved agricultural technology has been generated or transferred, especially for the major perennial crops such as coconut and cashew (Waaijenberg 1994).

Often land tenure problems – absentee Arab landlords who do not work their land and Bantu tenants without security – are mentioned as a cause of the poor development of agriculture at the Kenya Coast. However, these problems are restricted to specific parts of the coastal strip and are not relevant for most of Coast Province. They certainly need to be solved, but meanwhile should not be used as an excuse to cover other problems or to avoid action in other fields. Land tenure aspects of agriculture in Kilifi and Kwale are reviewed in Waaijenberg (1993). An analysis of the effects of land tenure reform in Taita Taveta is given by Mkangi (1983).

Probably, the major challenge for improving agriculture is not at the farm or production level. Households have proven over the centuries that they can manage to survive under the most difficult conditions. The main problem is how to organise and serve a widely dispersed population. In the first place there are physical obstacles to overcome; the road from Vanga to Kiunga is more than 400 km and crosses numerous rivers and creeks. The organisational bottlenecks especially in marketing may be even more difficult to solve as shown by the tortuous history of the Mariakani Milk Scheme. Whereas Taita and Kilifi farmers have a moderately successful record, elsewhere prospering cooperatives are a rare phenomenon. However, as most farms are too small to stand on themselves, associations for political support, input supply, production technology and marketing of produce may be essential for the development of agriculture and rural prosperity.

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Appendix 1 Names of plants*

Aubergine	*Solanum melongena*	Introduced fruit vegetable
Amaranth	*Amaranthus* spp.	Wild and cultivated species
Bambara nut	*Vigna subterranea*	Drought resistant pulse, underground pods
Banana	*Musa* AA and AAA	Dessert bananas, consumed ripe
Bean	*Phaseolus vulgaris*	Most of bush type
Bixa	*Bixa orellana*	Source of anatto (colourant)
Black nightshade	*Solanum nigrum*	Farmers distinguish several types
Cabbage	*Brassica oleracea* var. *capitata*	Grown at high altitudes
Cashew	*Anacardium occidentale*	Cultivated or abandoned
Cassava	*Manihot esculenta*	Some cultivars are interspecific hybrids
Chillies	*Capsicum* spp.	Small, hot peppers
Citrus	*Citrus* spp.	Mostly orange and mandarin
Coconut	*Cocos nucifera*	Nearly all of East African Tall type
Coffee	*Coffea arabica, C. canephora*	Mostly Arabica, very little Robusta coffee
Cotton	*Gossypium* spp.	Grown in mixed cropping and pure stand
Cowpea	*Vigna unguiculata*	Bush and creeping types, for leaves and seeds
Eggplant	*Solanum macrocarpon*	Local; diverse fruit colours and shapes
Green gram	*Vigna radiata*	Pulse with small green seeds
Gum copal	*Hymenaea verrucosum*	Exudate from forest tree (18th and 19th century)
Irish potato	*Solanum tuberosum*	Grown in high and cool areas
Kale	*Brassica oleracea* var. *acephala*	Cheap and named *sukuma wiki* (push the week)
Lablab bean	*Lablab purpureus*	Grown in Lamu District and known as *fiwi*
Maize	*Zea mays*	Cross pollinator: cultivars get mixed up
Mango	*Mangifera indica*	Numerous old and new cultivars
Millets	*Eleusine coracana*	Finger millet, highly valued
	Pennisetum americanum	Pearl millet, less appreciated
Mutsunga(Giriama)	*Launaea cornuta*	Popular wild leaf vegetable (Asteraceae family)
Okra	*Abelmoschus esculentus*	Fruit vegetable
Onion	*Allium cepa*	Grown at high altitudes
Peppers	*Capsicum* spp.	Sweet and large, hot and small types
Pigeon pea	*Cajanus cajan*	Pulse crop (shrub)
Pineapple	*Ananas comosus*	Commercial production in Malindi hinterland
Plantain	*Musa* AAB (false horn type)	Consumed after boiling or frying
Pyrethrum	*Chrysanthemum cinerariifolium*	Insecticide, grown at high altitudes (up-country)
Rice	*Oryza sativa*	Grown in Tana River delta and in small valleys
Rubber	*Landolfia* spp.	Wild rubber, collected during 19th century
	Manihot glaziovii	Ceara rubber, plantation crop early 20th century
Simsim	*Sesamum indicum*	Correct english name is sesame
Sisal	*Agave sisalana* (or an interspecific hybrid)	Produced in large scale plantations in Kilifi and Taita-Taveta Districts
Sorghum	*Sorghum bicolor*	Tall local cultivars and short recent introductions
Sugar cane	*Saccharum officinarum*	In Coast Province mainly for home consumption
Sunflower	*Helianthus annuus*	Rarely grown in Coast Province
Sweet potato	*Ipomoea batatas*	Root crop with creeping vines
Tannia	*Xanthosoma sagittifolium*	Tuber crop with arrow shaped leaves
Taro	*Colocasia esculenta*	Tuber crop with heart shaped leaves
Tea	*Camellia sinensis*	Grown at high altitudes (up-country)
Tobacco	*Nicotiana tabacum*	Mostly grown for home consumption
Tomato	*Lycopersicon esculentum*	Important commercial vegetable
Water melon	*Citrullus lanatus*	Of minor importance
Wheat	*Triticum aestivum*	Grown at high altitudes (up-country)

* The scientific names of the collected and cultivated plants mentioned in this review are given, with some observations about their origin, growth or use.

Appendix 2

Areas, yields, productions and values of major food and cash crops in Coast Province , 1992*

	Mombasa		Taita-Taveta		Kwale		Kilifi	
	ha	t/ha	ha	t/ha	ha	t/ha	ha	t/ha
Maize	443	1.0	8146	1.2	12848	1.9	32476	1.0
Rice	71	1.0	6	0.8	1012	1.5	1429	1.0
Sorghum	5	1.1	264	1.3	155	0.8	59	0.5
Millets	3	1.1	272	0.6	69	1.0	3	0.2
Cereal Crops	522	-	8688	-	14084	-	33967	-
Cowpea	213	0.2	620	0.8	2145	0.5	5352	0.6
Common bean	0	-	2648	1.2	736	0.6	326	0.6
Green gram	24	0.2	267	0.7	557	0.6	905	0.6
Pigeon pea	0	-	192	0.6	106	0.5	0	-
Lablab bean	0	-	0	-	0	-	0	-
Pulse crops	237	-	3727	-	3544	-	6583	-
Cassava	207	7.8	371	22.6	8526	4.3	7164	10.0
Sweet potato	10	7.4	76	0.8?	260	3.8	190	0.1?
Root crops	217	-	447	-	8786	-	7354	-
Tomato	78	7.0	407	20.0	371	9.0	279	8.0
Peppers	25	2.7	58	14.8	89	5.0	69	5.0
Eggplant	55	8.0	32	15.0	128	3.0	87	8.0
Kale	4	6.0	149	15.0	104	5.0	104	8.0
Cabbage	0	-	155	20.0	49	9.0	28	3.8
Amaranth	127	18.0	0	-	78	5.0	34	5.0
Okra	33	7.0	19	8.0	18	5.0	41	5.0
Onion	1	6.0	88	16.0	25	5.0	9	5.0
Vegetable crops	323	-	908	-	862	-	651	-
Citrus	118	6.6	184	9.7	4657	7.7	2460	6.5
Mango	179	7.7	125	4.8	2587	4.0	2533	8.3
Banana	207	8.8	1348	22.0	2396	6.8	320	10.3
Pineapple	0	-	0	-	141	6.0	943	11.5
Water melon	3	9.0	3	8.0	63	7.0	40	8.0
Fruit crops	507	-	1660	-	9844	-	6296	-
Coconut	785	0.7	82	0.9	18109	1.0	21795	1.4
Cashew	318	0.4	46	7.6	11732	0.5	18481	0.2
Bixa	0	-	0	-	3083	0.5	0	-
Coffee	0	-	267	0.7?	15	0.7	5	0.2
Cotton	11	0.1	911	0.2	65	0.1	425	0.2
Simsim	13	0.4	7	0.6	628	0.8	1091	0.6
Industrial crops	1127	-	1313	-	33632	-	41797	-
Sisal	0	-	11863	0.7	2400	0.5	4117	0.9
Area (ha)	2933	-	28606	-	73152	-	100765	-
Value (10^6 Ksh)	63	-	592	-	850	-	1083	-

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Appendix 2, continued

Areas, yields, productions and values of major food and cash crops*

	Tana River		Lamu		Coast Province			
	ha	t/ha	ha	t/ha	ha	t/ha	t	10^6 Ksh
Maize	1352	0.9	3174	0.8	58439	1.2	70865	481
Rice	234	1.2	23	0.6	2775	1.2	3317	10
Sorghum	3	0.2	169	0.8	655	1.0	636	5
Millets	0	-	75	0.5	422	0.6	273	3
Cereal Crops	1589	-	3441	-	62291	-	75091	499
Cowpea	154	0.7	753	0.6	9237	0.6	5425	28
Common bean	79	0.9	0	-	3789	1.0	3875	68
Green gram	263	0.6	172	0.6	2188	0.6	1321	9
Pigeon pea	0	-	68	0.6	366	0.6	214	3
Lablab bean	0	-	204	0.7	204	0.7	143	1
Pulse crops	496	-	1197	-	15784	-	10978	109
Cassava	40	10.6	161	11.0	16469	7.3	120079	564
Sweet potato	19	9.8	48	3.0	603	2.4	1456	13
Root crops	59	-	209	-	17072	-	121535	577
Tomato	111	16.0	42	1.5	1288	12.5	16096	129
Peppers	0	-	23	1.0	264	6.6	1736	15
Eggplant	0	-	11	1.0	313	2.0	1058	16
Kale	130	8.0	41	2.0	532	8.9	4733	29
Cabbage	0	-	0	-	232	16.2	3765	34
Amaranth	0	-	0	-	239	11.9	2676	20
Okra	0	-	4	1.0	115	5.9	682	4
Onion	14	15.0	2	1.5	139	12.9	1797	20
Vegetable crops	255	-	123	-	3122	-	32543	267
Citrus	22	4.3	258	2.0	7699	7.1	54815	219
Mango	793	11.0	866	7.1	7083	6.8	48207	289
Banana	934	9.1	946	4.7	6151	10.4	64134	321
Pineapple	0	-	0	-	1084	10.7	11646	35
Water melon	3	8.0	6	4.0	118	7.3	860	6
Fruit crops	1752	-	2076	-	22135	-	179662	870
Coconut	54	7.7?	1605	1.9	42430	12.5	52983	262
Cashew	20	0.5	1454	0.6	32051	0.3	10363	114
Bixa	0	-	702	0.9	3785	0.6	2142	11
Coffee	0	-	0	-	287	0.7	200	1
Cotton	219	4.5	1380	1.4	3011	1.0	3142	36
Simsim	4	0.3	293	0.5	2036	0.6	1323	9
Industrial crops	297	-	5434	-	83600	-	-	433
Sisal	0	-	0	-	18380	0.8	13955	159
Area (ha)	4448	-	12480	-	222384	-	-	-
Value (10^6 Ksh)	145	-	161	-	-	-	-	2890

* Several minor crops were not included. The value of the production was probably based on estimated farm gate prices of air-dry grains and pulses; fresh roots, leaves, bulbs and fruits; dehusked coconuts, air-dry cashew nuts, bixa seeds, coffee berries, seed cotton, simsim seeds and sisal fibre.

Source: Kenya 1993.

REVIEW DETAILS

Source
Waaijenberg H. (2000). Agriculture. In Hoorweg J., Foeken D. & Obudho R. eds. *Kenya Coast Handbook:Culture, resources and development in the East African littoral.* (pp. 175-195). Hamburg: LIT Verlag