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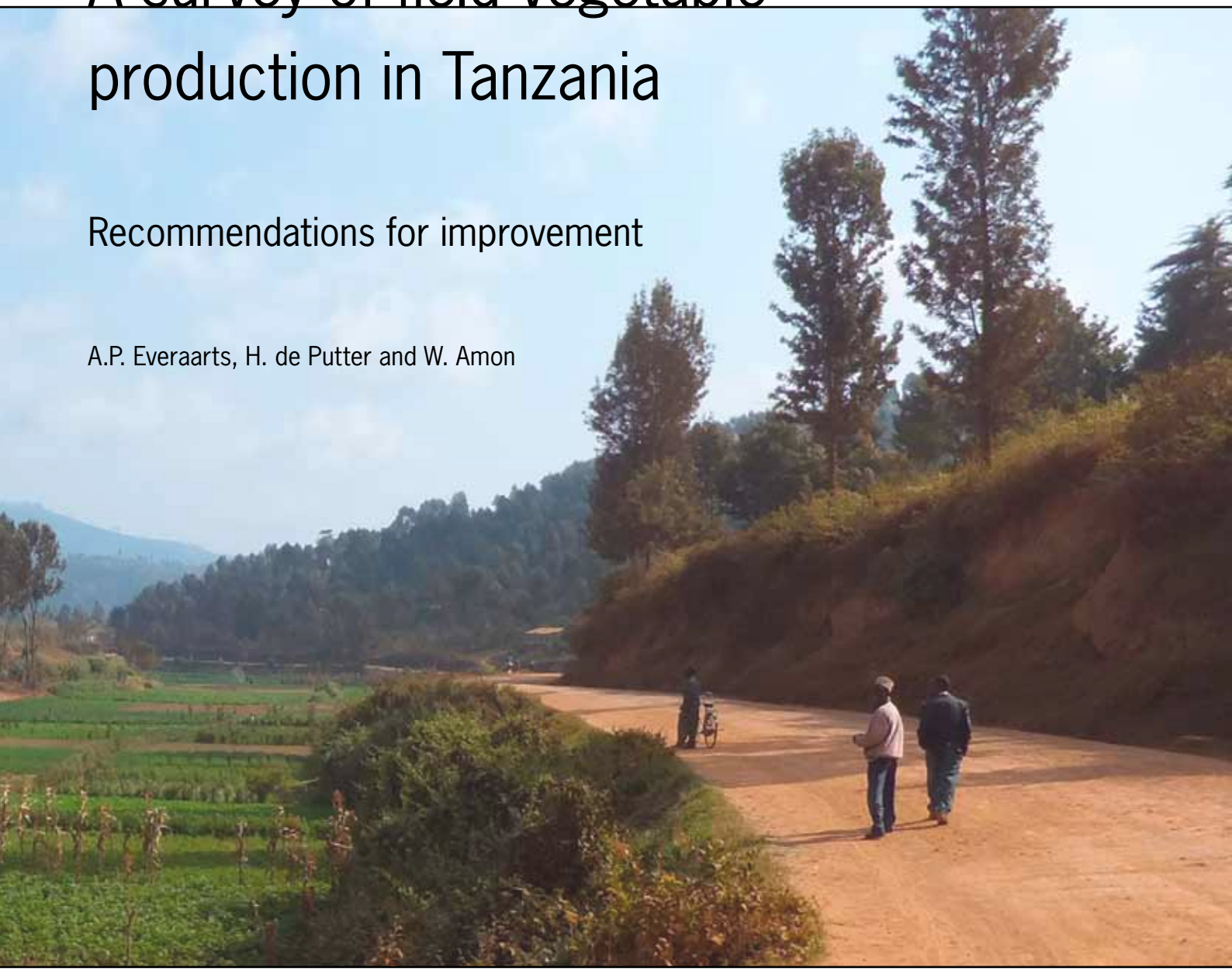

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Photo cover: Lukosi, vegetable fields in the valley bottom.

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A survey of field vegetable production in Tanzania
Recommendations for improvement

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Contents

Figure 1. Red cabbage.

1 Summary

In July 2011 a survey was carried out in five field vegetable producing areas in Tanzania. The areas visited were Lukosi, Lushoto district, Hembeti, Mvomero district, Ulaya, Kilosa district, Ruhembe, Kilombero district and Mgela, Iringa district. The aim of the survey was to learn about the conditions for field vegetable production in these areas and to learn about production methods and marketing.

All vegetable production takes place in areas, where at least for part of the area there is year-round access to water. All areas have more or less close access to rough roads, with connection to major tarmac roads. At field level, however, access sometimes was found to be limited to narrow paths. All major field vegetables were found to be cultivated. Especially in Lukosi many different crops are produced. Main planting seasons depend on rainfall. However, planting is year-round with year-round water availability. In general growers appeared to be well experienced in vegetable production. Access to water was mentioned as a major limiting factor for expansion of vegetable production. Pest and disease control appeared to be appropriate. Due to packing in bulk, bags, baskets and crates, post-harvest losses may be high. Marketing is mostly through middlemen and is largely focused on Dar es Salaam.

It is recommended to initiate a nationwide programme for (i), the demonstration of modern, water saving, production methods, such as the use of drip irrigation and mulch, (ii) the introduction of new varieties, and (iii) to stimulate the use of new, protective packing material.

Figure 2. Transport of tomatoes.

2 Recommendations

- Field vegetable production could benefit from identification of suitable new varieties, by nationwide testing of potentially suitable varieties presently already available outside Tanzania.
- Field vegetable production could be increased by the introduction of modern, water saving, cultivation methods, such as the use of drip irrigation and mulch.
- Efficiency of transplant production could be increased by producing transplants in trays in nurseries.
- Post-harvest losses could be reduced by the introduction of new, protective packing material.
- A nationwide programme could be organised for the demonstration of these modern production methods, new varieties and new, protective packing material in the major production areas.
- In connection with such a programme, pilots should be carried out in these areas to set up producer organisations.
- On a national scale, forest conservation and soil and water management in vegetable production areas need attention, to retain production capacity in the future.

Figure 3. Watering of young plants.

3 Introduction

A survey has been made of a number of concentrated field vegetable production areas in Tanzania. The aim of the survey was to learn about the conditions for field vegetable production in these areas and about present production methods of field vegetables and the marketing of the products.

In each area visited, semi-structured interviews were held with one or more informers, with the aid of a checklist.

It appeared that it proved difficult to get detailed information on all aspects of the vegetable production. Often the information was not available or the length of the interview time increased such that the effectiveness of the questioning and accuracy of the answers tended to decrease and the interview was ended. Interviews were mostly conducted in Swahili and translated on the spot by an interpreter to English.

Nevertheless it appeared that in general a good first impression of the vegetable production and marketing in each area was obtained and the information could be amply supplemented and supported by the photos made in each area visited.

The result of the survey is a qualitative description of the field vegetable production and marketing methods in the areas visited, based on the data collected during the visits. The description has been supplemented with information from the 2002/2003 National Sample Census of Agriculture[1] on agricultural production in each region (Appendix 2). Given the years passed since the census, the data on areas now are likely to give mainly a relative indication of importance between areas.

In the discussion section of the report the information collected is discussed and, together with the observations, is placed in more general perspective. Based on the conclusions, recommendations for improvements are formulated.

[1] *Published by the National Bureau of Statistics, Ministry of Agriculture and Food security, Ministry of Water and Livestock Development, Ministry of Cooperatives and Marketing, Presidents office, Regional Administration and Local Government, December 2007.*

Figure 4. Map of Tanzania with the areas visited.

4 Tanzania

Tanzania is situated in East Africa at the Indian Ocean in the southern hemisphere (1 – 12° S). Tanzania is bordered by Kenya and Uganda in the north, Ruanda, Burundi and Congo in the west and Malawi and Mozambique in the south. The surface of the country is 947,000 km^2. In 2009 the population was estimated at 44 million. Tanzania is divided in 22 regions (or Mkoa) which are sub-divided in districts.

The areas visited were (Figure 4):
1. ***Lukosi***, Lushoto district, Tanga region.
2. ***Hembeti***, Mvomero district, Morogoro region.
3. ***Ulaya***, Kilosa district, Morogoro region.
4. ***Ruhembe***, Kilombero district, Morogoro region.
5. ***Mgela***, Iringa district, Iringa region.

See Appendix 1 for a travel itinerary.

Figure 5. Lukosi, vegetable fields in the valley bottom.

5 Areas visited

5.1 *Lukosi*, Lushoto district

Informants

Mr. Yuma Kambaga, local farmer and farmer's group treasurer. Local farmers group.

Area characteristics

The altitude of the area is around 1780-1850 m.a.s.l.. The season with heavy rains is from March to May. The short rainy season runs from October to December. The Lukosi area is characterized by moderate to rather steep sloping hills and flat valley bottoms. Usually there is a small stream in the valley bottoms, providing water for crop cultivation. Vegetable crop cultivation mainly takes place on fields located in the valley bottoms and on terraces immediately adjoining the valley bottom. Maize is the predominant crop on the hill slopes, whether the fields are terraced or not (Figures 5, 6 and 7). The average farm size is said to be five acres. Fields on which vegetables are cultivated generally are rectangular in shape and may vary in size from 200 to 1000 m^2. Actual plots generally are small, because direct orders for products (see Marketing) involve relatively small quantities and also bewcause farmers prefer to spread the risk in production by cultivating a variety of crops.

Figure 6. Lukosi, water availability near the fields is essential.

Figure 7. Lukosi, vegetable fields.

Figure 9. Lukosi, harvesting carrots.

Figure 10. Lukosi, soil tillage for planting.

Figure 8. Lukosi, potatoes.

Figure 11. Lukosi, watering with a hose.

Figure 12. Lukosi, spraying potatoes.

Figure 13. Lukosi, curled leaf lettuce.

Crops

Major: Potato, tomato, carrot, white cabbage, sweet pepper.

Minor: Broccoli, various types of lettuce, leeks, beetroot, red cabbage, artichoke, fennel, garlic, zucchini.

Planting seasons

The major crops, especially potato and carrots, are cultivated from May to August, because these crops need the lower temperatures in this period (Figures 8 and 9). Tomato is planted in the warmer period from October to December. The minor crops are mostly cultivated throughout the year, provided water is available.

Cultivation

The soil in the Lukosi area is a rather loamy sandy soil, with a high organic matter content. Length of crop growth periods varies from 45 days for crops like zucchini and cucumber to three months for crops like potato.

No artificial fertilisers are used, mainly because of the high price. Farm yard manure is used at a rate of approximately 40 t/ha. Farm yard manure is worked into the soil at the time of planting. All soil preparation is done by hand using a hoe. Depth of soil preparation is about 0.2 m (Figure 10).

When water is available, fields are cultivated year-round. Fields are surface irrigated with water directly from the water stream, arriving at the production field through a ditch. For fields

Figure 14. Lukosi, transport of cabbage from field to truck.

located further away from the stream, or on higher grounds, water is pumped up and crops are watered using a hose (Figure 11).
In general the crops in the field looked good and well maintained (Figure 12 and 13). The level of craftsmanship of the growers in this area appears to be quite high.

Pests, diseases and weeds
Insecticides are not used, although white fly and cutworms were mentioned as serious problems. Fungicides, e.g. Ridomil and Ebony, are used for disease control.
Weed control is by hand using a hoe. For directly sown crops mulching with organic material may be used to prevent weed growth. Organic mulch is also used to enhance germination of direct sown crops. Weed pressure did not seem to be particularly high because of the high frequency of crop cultivation.

Marketing
Dar es Salaam is the main market for the vegetables of the Lukosi area.
As a result of a previous GTZ project, Mr. Kambaga is the head of a regional farmers group of around 45 farmers that organize their own marketing of products directly to customers in Dar es Salaam. The farmers group is also operating in other areas than Lukosi as well. Customers include an airlines caterer and the Mövenpick Hotel in Dar es Salaam. When an order is received, the leader of the group discusses with the members of the

Figure 15. Lukosi, packing shed.

group who has what crop available for harvesting and delivery. Also, orders for crops may be received more than three months in advance, which gives the farmers sufficient time to plant the required crops.
Besides the 45 registered members of the regional group, there are about 60 associated members, both coming from Lukosi and other areas in the Lushoto district. These associated members may profit from the direct marketing system in case there is a need for their products. Members of the group pay an initial entrance membership fee and after that a yearly contribution. For coverage of the operational costs of the marketing 5% of the sales is taken. The leader of the group is financially rewarded for his time and efforts spend.
Alternatively, middlemen come from Dar es Salaam to buy the product from the farmers.

Packaging and transport

Transport of product from the production field to the nearest road where the truck for road transport is waiting, is by walking, carrying the product in bags on the back or head (Figure 14). In the truck, product may be bulk transported, as in the case of cabbage, or packed in bags. The farmers group said to use plastic crates for transport of lettuce for instance, but no observation on this could be made. The farmers group has its own small collecting and packing house in Lukosi (Figure 15).
There is a well maintained rough road from Lukosi to Lushoto. Lushoto has a tarmac road connection to the main road to Arusha and Dar es Salaam. The drive from Lushoto to Dar es Salaam takes about 8 hours. Transport of perishable vegetable products is mainly done in the evening and night since no refrigerated transport is available. Risks during the night are accidents due to poor illumination of the roads and other traffic and to hold ups by gangs.

Varieties and seed source

Vegetable varieties mentioned: Tomato: Tanya, Cal.-J., Rio Grande; Carrots: Nantes; Sweet pepper: Yolo wonder. Seed potatoes are bought from a local source or grown by the farmer himself before he starts a crop for consumption purposes.
Seeds are bought locally or in seeds shops in Lushoto. Most of the major vegetable seed brands are said to be available giving the farmers ample possibilities for buying seeds. Seed brands mentioned: East West Seeds, Kibo, Mkulima, PopVriend, Royal Sluis, Seminis, Topharvest.

Figure 16. Hembeti, African eggplant field.

5.2 *Hembeti,* Mvomero district

Informant
Mr. Milliack Tillya, chairman of local farmer's group.

Area characteristics
The fields visited were near a village called Hembeti. The area is located at approximately 400 m.a.s.l., at the foot of the Nguru mountains. The heavy rains fall from March to June. The short rains occur from October to December.

The area is a rather large, flat area where rice and vegetables are cultivated (Figures 16, 17, 18 and 19). Vegetable production fields may vary in size from 200 to 5000 m^2. There are narrow rough roads in the area and the area is connected by a well maintained rough road, which is being upgraded to a tarmac road, to the main road to Morogoro and on to Dar es Salaam.

Farmers complained that the weather is changing. Since around 2000 they can no longer rely on the timing of the start of the rainy seasons.

Figure 17. Hembeti, cabbage field.

Figure 18. Hembeti, small plots with various ve

Crops

Major: Tomato, cucumber, white cabbage, onion, water melon, sweet pepper.
Minor: African eggplant, okra.

Planting seasons

Minor crops may be planted the whole year around depending on water availability. Other crops are mainly planted in March, April and May. Crops planted after rice are mainly planted in March.

Cultivation

The choice of crops to grow depends on the expected market demand. All crops are grown in monocultures. Soil tillage is with a tractor mounted disc plough, done by a farmer/owner of the tractor on contract basis. Other soil preparation by the farmer is by hand, using a hoe.
Rice is cultivated on low lying, waterlogged fields. There, however, is no standing water on the rice fields. Rice may be cultivated in sequential monoculture or in rotation with vegetable crops. When in rotation with rice, the vegetables may fully be grown on the water present in the soil after the rice cultivation, without any additional irrigation. Other vegetable crops are grown on fields in rotation with field crops such as maize.
The ground water table is relatively high. After digging a hole, the water accumulates permanently in the hole, close to the soil surface (Figure 20). Irrigation may be by pumping water from the reservoir into small basins (plots surrounded by

egetables.

Figure 19. Hembeti, rice field.

ridges) in the field. Using a pump, however, did not seem to be common. Otherwise, water is taken from the hole by a watering can and plants are watered individually by hand. Fully rainfall dependent crops are grown on ridges.
Some farmers strongly argued that using a pump makes watering the crops much easier and would enable them to enlarge their area of operation. They, however, lack the funds, and access to credit, to buy a pump.
For some crops, like cabbage, urea may be used, otherwise no fertilizer or farm yard manure is used.

Pests, diseases and weeds

White fly and cutworms were mentioned as major pests. Pests and diseases are controlled by pesticides applied with a knapsack sprayer. Thionex and Karate are used to control pests. Mancozeb and Ridomil are used to control fungal diseases. It seems that every 14 days routinely an application is carried out. Weed control is by hand, using a hoe.

Marketing

Vegetable production is predominantly for the Dar es Salaam market, with tomato also for the local markets, e.g. Morogoro. Middlemen from Dar es Salaam come to the area and buy the product that is available.

Packaging and transport

No observations could be made as no harvest was taking place during the visit.

Varieties and seed source

Seeds are bought in seeds shops in Mvomero and Morogoro. For tomatoes predominantly the determinate OP varieties Onyx, Tanya, Cal-J and Rio Grande are used. For the other crops also F1 hybrid varieties are used. Sweet pepper: Yolo wonder. Onion: Red Bombay. Cucumber: Tamu. Okra: Clemson.

Generally, seeds of many major vegetable seed companies were said to be available.

Figure 20. Hembeti, water hole with groundwater in Sweet pepp

er field.

Figure 21. Ulaya, field with African eggplant.

5.3 *Ulaya,* Kilosa district

Informants

Mr. Benedict Daniel, chairman of Ulaya village.
Mr. Abdallah Mnaga, farmer.

Area characteristics

Ulaya is located at around 550 - 600 m.a.s.l.. The heavy rains occur from March to June, the light rains form November to February. Ulaya is situated along the rough road from Mikumi to Kilosa. In Mikumi the rough road connects with the main tarmac road to Morogoro and further on to Dar es Salaam to the north east.

Vegetables are mainly cultivated on flat plots between slightly undulating hills, near the rough road, preferably near a source of water (Figures 21, 22, 23 and 24).

Figure 22. Ulaya, Chinese cabbage field.

Figure 23. Ulaya, small plots with various vege

Crops

Major: Tomato, onions, dry beans, African eggplant, hot pepper, sweet pepper, cabbage.
Minor: Chinese cabbage, Amaranthus, African nightshade.

Planting seasons

Direct sowing or transplanting is done during the rainy seasons from March to June and from November to February.

Cultivation

The choice and area of crops to cultivate is related to expected prices in the harvest periods.
Soil tillage is exclusively done by hand, using a hoe. Irrigation is by pumping water from the water source to the field and watering the plants with a hose. About 25% of the farmers depend exclusively on rainfall to cultivate crops, about 25% of farmers can irrigate all crops and 50% of the farmers grow crops either with only rainfall or irrigation.
Urea, Calcium Ammonium Nitrate and NPK fertilizers are used, but no farm yard manure. However, according to information given, the amounts of fertilizer used would appear to be rather limited.
Vegetables may be grown in rotation with rice. Rice is grown in the rainy seasons on fields with capillary water. Maize may also be part of the rotation in which vegetables are grown.
Farmers complained about the lack of credit facilities, for instance to buy a pump.

tables.

Figure 24. Ulaya, main road near vegetable fields.

Pests, diseases and weeds

Farmers receive information from the local government field officer about the identity of pests and diseases and what chemicals can be used for control. Pesticides can be bought in the agro-supply shops in Kilosa. Weeds are controlled by hand using a hoe.

Marketing

Dar es Salaam is the major market for the products. There are several methods of marketing the product.

i). The farmer does not know the prices at the Dar es Salaam market. The middleman comes to the field and offers a price. The farmer sells the product when the price is deemed attractive or sufficient.

ii). The farmer gets information from a contact in Dar es Salaam about the actual vegetable prices of the day. He then is in a better position to negotiate with the middleman that comes to his field. However, according to the farmers, the information from Dar es Salaam is not always reliable or outdated.

iii). The farmer himself goes to Dar es Salaam and enquires about the actual price of the product. If the price is attractive, he hires transport, brings the product to Dar es Salaam and sells the product himself. This is not often done as it involves a lot of organizing and the farmer is not always sure whether all additional costs of transport and packaging can be recovered.

The change of losing the product due to accidents was also considered a risk by the farmers. There also is the risk of a significant price decrease in the period while bringing the product to Dar es Salaam. Furthermore, if the price is attractive, many farmers in the country may be tempted to follow the same procedure, resulting in a price decrease

Packaging and transport

No observations could be made.

Varieties and seed source

For tomato the OP variety Onyx is used, as well as the varieties Rio Grande, Tanya and Cal-J. For other crops no variety names could be given. Seeds are bought in Kilosa in agricultural supply shops. Seeds of different seed companies were said to be available.

Figure 25. Loading of truck with cabbage.

Figure 26. Ruhembe, sugarcane on flat land with surrounding hills.

5.4 *Ruhembe,* Kilombero district

Informants
Mr. Ahmadi Sahidi, farmer.
Mr. Maulidi Libungi, farmer.

Area characteristics
The vegetable production fields are located at the outskirts of the large Kilombero sugarcane plantation (Figure 26). They are situated there where the flat terrain starts to transform to undulating hills.
The altitude of the area is 300 m.a.s.l.. The heavy rains season runs from March to May. The light rains season is from December to January.

The vegetable plots vary in size and shape, but mostly are small, around 200 m^2. Some are difficult to access and can only be reached along narrow foot paths across undulating terrain, sometimes passing steep slopes (Figures 27, 28, 29 and 30).

The general impression in this area was that vegetable fields either are difficult to access, or they are located at a considerable distance from the nearest major rough road.

Figure 27. Ruhembe, hot pepper field.

Figure 28. Ruhembe, small plots with various v

Crops

Major: Tomato, sweet and bitter African eggplant, eggplant, sweet pepper, okra, cabbage, water melon, cucumber.

Minor: Chinese cabbage.

Planting seasons

Sowing and transplanting of crops in the production field is mostly done from April to June.

Cultivation

Field preparation is by hand using a hoe. In this area multiple cropping was observed, e.g. okra between tomatoes (Figure 31). Rice, maize and tobacco, for local consumption and use, are grown in rotation with the vegetables. Rice is mainly grown on plots located on soils with capillary water. Vegetable crops may be irrigated only when water is available close to the production field. Water is pumped to the field and plants are watered with a hose. Average costs per season of irrigation are approximately 200,000 Tsh/acre. Taking into account a yield of 4000 kg/acre for tomato this results in a cost price of 50 Tsh/kg for irrigation. Market prices of tomato may vary between 125 and 500 Tsh/kg.

During the dry period vegetable crops are only cultivated on fields with the opportunity of irrigation or after rice, on the fields with capillary water. It was estimated, however, that only 10% of the vegetable crops are irrigated. Another 10% of the vegetable crops is grown on rice field soils with

vegetables.

Figure 29 Ruhembe, small path leading to and from vegetable fields.

capillary water, but 80% of the vegetable crops is grown exclusively depending on rainfall.
The chairman of the village was met later during the day. He explained that the farmers very much would like to expand their vegetable production operations. However, they were hindered by the dependency on rainfall for water and lacked the funds, or access to credit, to buy pumps for irrigation.
Urea may be used several times during one cultivation as a fertilizer. Amounts of application would seem to be quite low though. Foliar fertilizers are also used, but no accurate information on their use was obtained.

Pests, diseases and weeds

White fly, spider mite and cutworms were mentioned as major pests. Virus diseases in tomato are a serious problem. Thionex, Karate and Dume are used as insecticides. Ivory and Mancozeb were mentioned as fungicides. The village government field officer may provide farmers with information on pests and diseases and control methods.

Marketing

In this area all product is sold to middlemen, who sell the product in Morogoro or in Dar es Salaam. Depending on the accessibility of the vegetable production field, costs of transport of the product from the production field to a truck for further transport can be high. This makes farmers reluctant

to organize their own marketing. Farmers may get product price information from Dar es Salaam from acquaintances there. They share this information with other farmers, as to be able to better negotiate with the middlemen. Farmers may work together to accumulate enough product to completely fill one truck.

Packaging and transport

No observations could be made.

Varieties and seed source

Tomato varieties grown are Onyx, Tanya, Cal-J and Rio Grande. For eggplant Black Beauty was named. For sweet pepper the varieties Yolo Wonder and Ganga F1 were mentioned. Cabbage varieties: Copenhagen market and Glory of Enkhuizen.

According to the farmers, the seeds available in the local seed shop mostly come from one local Tanzanian company, Mkulima seeds. Seeds of other companies are only limitedly available.

Figure 30. Ruhembe, steep path leading to and from vegetable fields.

Figure 31. Ruhembe, multiple cropping of tomatoes and okra.

Figure 32. Mgela, irrigation scheme.

5.5 *Mgela,* Iringa district

Informants

Mr. Shadrake Nyamai, vegetable seeds sales representative.
Mr. Jamali Mkelemi, farmer.

Area characteristics

The Mgela vegetable production area concerns an irrigation scheme, that was recently, from 2005 – 2011, established by the local district government (Figures 32, 33 and 34). It lies at an altitude of approximately 1500 m.a.s.l. and covers an area of about 1000 hectares. The main rainy season runs from November to February. The minor rainy season is from February to April.
Primary canals have been constructed in the framework of the irrigation scheme, the secondary and tertiary canals leading up to the production fields are made by the farmers themselves, whether or not on a temporary basis. Watering is by letting the water flow across the surface of small, approximately 3 by 3 m, basins, in which the crops are grown.
About 1600 farmers participate in the irrigation scheme. Farmers may own the land or farmers hire the land from other farmers. Available land per farmer may vary from one to ten acres. All farmers pay Tsh 5000,- a year for the supply of water, independent of the area cultivated.

Figure 33. Mgela, secondary irrigation canals.

Figure 34. Mgela, small plots with beans.

Figure 36. Mgela, dry beans near harvest time.

Figure 37. Mgela, small plots of onions.

Figure 35. Mgela, tomatoes at harvesting stage.

Figure 38. Mgela, drying onions after harvest.

Figure 39. Mgela, main road to irrigation scheme.

Figure 40. Mgela, tomatoes in baskets, waiting

Because of water availability, cultivation of crops is year-round. All crops are only grown on rather large areas, as to accumulate enough product to be attractive for selling to middlemen. Crops with comparatively large areas are tomatoes and dry beans (Figures 35 and 36). Next to vegetables, maize and rice are cultivated on a considerable scale.
In general, judging from the type and condition of the houses in the area, the area made the impression of economically being a rather poorly developed area.

Crops
Major: Dry beans, onions, tomatoes, Sweet pepper, hot pepper, sweet and bitter African eggplant, cucumber, garlic, water melon, okra, carrot.

Planting seasons
Planting of crops is year-round.

Cultivation
The field is divided in small plots surrounded by ridges, 'basins', to facilitate irrigation (Figures 37 and 38).
Soil tillage is done with a collectively owned two-wheeled tractor or with an ox-drawn plough. Soil preparation for planting is done by hoe.

Pests, diseases and weeds
Aphids, cutworms, other caterpillars and White fly were mentioned as major pests. Late and early blight, leaf spot diseases and damping off disease were considered major disease problems. Mancozeb

g for transport.

Figure 41. Mgela, loading of small truck for transport of vegetables.

was used as a fungicide in tomatoes, beans and carrots. Spraying was said to be done mostly on a routine basis. No weed problems were encountered.

Marketing

All product is sold to middlemen. Informants mentioned that the daily price of vegetables in nearby Iringa nowadays is closely related to the price in Dar es Salaam, the major market for their products. They use the price information from Iringa in the negotiations with the middlemen. Products are mainly sold in Dar es Salaam, but also in nearby bigger cities like Iringa, Mbeya and Songea. Product may also be sold to Zambia and Malawi.

According to the informants, the inadequate small rough road leading to the irrigation scheme and the long distance to the major market, considerably negatively influences prices for the farmers, because of high transport costs (Figure 39).

Packaging and transport

Crops are harvested and packed in baskets (Figures 40 and 41).

Varieties and seed source

Varieties mentioned were Onyx for tomatoes, Red Bombay for onions, Orange for sweet pepper, Ashley for cucumber, Sugar Baby for water melon, Crimson for okra and Nantes for carrots. Seeds are bought in agro-supply shops in Iringa.

Figure 42. Iringa, local agro-shop.

5.6 Visit to seed shops in Iringa and Morogoro

Vegetable seeds shops were visited in Iringa and Morogoro. Many seed brands were available in these shops (Figures 42, 43, 44, 45, and 46). It appeared that most brands only give a packing date on the sachet or tin (Figure 47). Only few companies also give an expiry date (Figure 48).

Figure 43. Morogoro, local agro-shop.

Figure 44. Morogoro, local agro-shop.

Figure 46. Morogoro, advertising for vegetable seeds in agro-shop.

Figure 47. Morogoro, tomato seeds for sale wi

Figure 45. Morogoro, vegetable seeds for sale in agro-shop.

th packing date only.

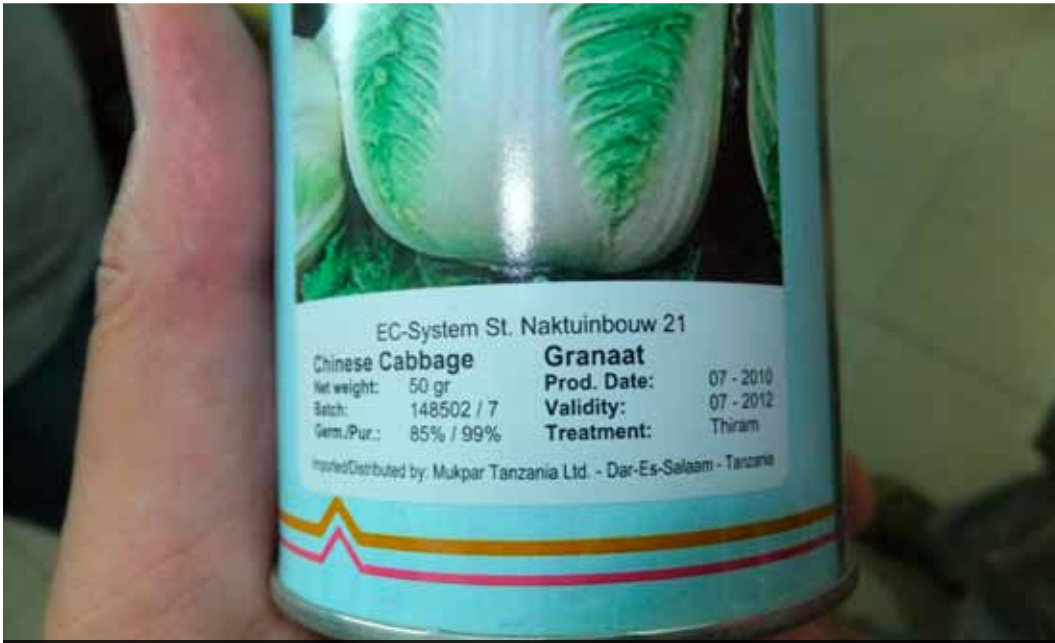

Figure 48. Morogoro, Chinese cabbage seeds for sale with production and validity date.

Figure 49. Bulk transport of cabbage.

6 Discussion

Area characteristics

Vegetable production areas are located in regions, where at least for part of the region, there is year-round access to water. Water either being available from (mountain) streams or water holes. Furthermore, there is more or less close road access to the fields. These two conditions, water for crop growth and road access for produce marketing, appear to be major determinants for the location of field vegetable production.

In other countries often the proximity to major cities, as concentrations of consumers, is another determinant. Given the great distances in Tanzania between cities, it appears that these distances, and transport costs, are taken as a given factor and do not play a decisive role in determining where vegetable production takes place.

Crops

All major field vegetable crops were found to be cultivated in the areas visited. Especially in Lukosi, a number of generally minor crops were cultivated on a larger scale as observed in the other areas.
No effort was made to establish crop yield levels, as no reliable data connecting areas and yield could be obtained. However, based on the information from the National census held in 2002/2003 average yield levels are not high (Appendix 2).

Planting seasons

Planting seasons depend on crop temperature requirements and rainfall. With year-round water availability, suitable crops may be cultivated year-round.

Cultivation

In general growers appear to be well experienced in vegetable production. Especially in the Lushoto district the level of craftsmanship is high.
No transplant production was observed. But it is common practice to produce transplants in field nurseries. Modern methods of transplant production in trays in plastic house nurseries have not yet been introduced.
From the limited amount of information that we could obtain on fertilization, we, however, conclude that most likely the amounts of fertilizer applied are too low. Farmers complained about high prices of fertilizers in relation to low yields and this may make them reluctant to apply fertilizers.

Water

A recurrent subject in the discussions with informants was the availability of water and the decreasing reliability of the start and the intensity of the rainy seasons. It was often stated that the area of vegetable production could be enlarged, if only water for irrigation could be made available on the field by pumping water from streams or water holes. Farmers complained that they lacked the funds, or had no access to credit, to buy pumps.
It appears that growers could be made less dependent on rainfall for crop growth by supplying them with affordable credit to buy and operate pumps. Watering crops with a hose is not efficient in terms of spatially equal distribution of water and may, as observed, outright physically damage the crop.
Modern irrigation and water conservation methods, such as using drip tape and mulch, should urgently be introduced in Tanzanian field vegetable production. At present no such methods were observed to be in use in the areas visited. These modern methods would increase the efficiency of water use, enabling a larger area of production with the same amount of water.

Credit facilities would enable producers to buy suitable pumps. Coupled with large storage drums and gravity driven drip irrigation, one pump could serve a number of growers and costs could be shared.

Marketing

The areas visited differed e.g. in altitude, physical characteristics, field size and access to water, influencing the choice of crops grown. But despite these differences, the one noticeable characteristic that emerged for all was the focus on marketing in Dar es Salaam.

Nationwide Dar es Salaam is the major focal point for marketing and price setting. Consequently farmers would benefit from a nationwide information system providing them with daily whole-sale market prices form Dar es Salaam, enabling them to better negotiate with middlemen. Some farmers did have, informal, access to this kind of information.

Although no data were collected on profitability of production, the general impression obtained was, that middlemen earn a disproportionally large part of the money involved in vegetable production, without taking any risk in production.

The producers group in Lukosi appeared to be functioning well, doing their own marketing. The next step in improving the marketing system and increasing the profitability for growers, thus could be to set-up producer groups, who organize their own marketing in direct contact with retailers.

Pests, diseases and weeds

White fly and spider mites were the most serious pests mentioned. Diseases were not considered serious limitations. As our first impression, despite the presence of major pest problems, pest and disease control appeared to receive appropriate attention.

Nevertheless efficiency of control can probably be improved by the introduction, testing and application of new insecticides and fungicides and by improvements in application methods. Such efforts may result in less pesticide use, saving growers money and resulting in better environmental, grower and consumer protection.

Weeds, or weed growth, were never mentioned, nor observed, as a problem.

Packaging and transport

The fact that during the ten days of the survey (see Itinerary) a distance of about 3000 kilometers was covered, in eight to twelve travelling and working hours per day, illustrates a major challenge for vegetable production development, i.e. the large distances to be covered in transport from the production fields to the major markets.

Figure 50. Transport of vegetables in bags.

Figure 51. Tomatoes packed in baskets.

Add to that, the often poor conditions of the mostly unpaved roads on the countryside, and it becomes clear that costs of transport of products and prevention of post-harvest losses during transport need to be a major points of attention in further development of vegetable production. Indeed, costs of transport, i.e. trucking hours and fuel, was said to a factor that considerably influenced profitability of production, as middlemen fully account transport costs to the growers.

What would be needed is to introduce simple collecting and packing sheds, where produce can be cleaned, graded, packed and cool stored, awaiting transport. During long distance transport to the whole-sale market, produce needs to be adequately packed and stored, to prevent bruising and crushing. Transport of product nowadays is in bulk , e.g. with cabbage, or, for most other crops the product is packed in nylon bags, baskets or wooden crates (Figures 50, 51, 52 and 53). Inevitably, this results in bruising and crushing, and as a result, loss of product. Not all bruised product needs to be lost, however. Slightly damaged product might still be sold.

Introduction of plastic packing crates could greatly help to reduce post-harvest losses during storage, long distance transport and transport to retailers. Standardization of plastic crates would ease handling of product, would increase efficiency in utilizing the space in trucks and might standardize costs of transport.

Figure 52. Tomatoes in baskets stored in truck.

Varieties and seed sources

In general most major vegetable seed companies were said, or found, to be present with their products in the seed shops. It did, however, not became clear whether the varieties offered for sale had been tested under the local conditions. Most varieties are imported from Europe or the United States and have originally been developed for those areas. There appears to be no nationwide vegetable variety testing scheme in operation. It is our conviction that farmers could likely greatly benefit from systematic testing and comparing of worldwide available, possibly suitable, vegetable varieties. Such testing schemes would also offer the opportunity to screen for pest and diseases resistance, delivering valuable information for local breeding activities.

Watershed management

In all areas visited at the end of the day people were seen going home with loads of fire wood (Figure 54). Along roadsides everywhere charcoal is offered for sale (Figure 55) or waiting in larger quantities for transport (Figure 56) . It is evident that the nation wide-scale use of wood and charcoal for cooking is resulting in a slow, gradual but persistent depletion of trees, and eventually forests, around the country.

Especially in the mountain areas, the often obvious degrading and disappearance of the forest vegetation, affects the water conservation capacity of the areas. This results in run-off and erosion in periods of heavy rainfall and in limited water availability during dry periods, because of lack of

Figure 53. Tomatoes packed in crates.

Figure 54. Returning home with fire wood.

Figure 56. Large quantity of charcoal waiting for transport.

Figure 57. Clearing of forest for vegetable culti

vation near Lukosi.

Figure 55. Charcoal for sale at roadside.

Figure 58. Steep hillsides are used for cultivation near Lushoto.

Figure 59. Virtually denuded areas near Lushoto.

Figure 60. Arumeru area, Arusha, vegetable fie

retention of water in the forest vegetation and soils. Furthermore, it was evident that continuing efforts are made to cut mountain forests, to make place for vegetable cultivation (Figures 57). After clearing, crops may be cultivated on too steep soils, without soil conservation measures (Figure 58).

Much likely as a result of this continuous removal of wood, outright clearing of forest vegetation and because of cultivation without soil conservation efforts, some areas in the Lushoto district have now become almost bare of soil and are no longer protected by soil conservation measures or covered by vegetation (Figure 59).

To prevent further loss of vegetation and soil, and thereby loss of vegetable production capacity, landscape conservation measures and soil and water management programs are urgently needed in the mountain areas.

Alternatives for cooking fuel need to be introduced in order to maintain production areas for vegetable crops.

The future

Growing demand because of ongoing urbanization in Tanzania and sustainable use of water, energy and other resources, puts pressure on growers to intensify production.

In the Lushoto district a comparatively high level of production has already been achieved. The same applies to the Arusha district (not covered in this survey but visited multiple times personally), where field vegetable production is more advanced as

elds.

Figure 61. Arumeru area, Arusha, vegetable fields.

compared to the areas visited during the survey (Lushoto excepted) (Figures 60 and 61). The present level of sophistication of field vegetable production as observed in Lushoto and Arusha, may well offer the starting point to initiate similar developments as have been taking place during the last twenty to thirty years in SE Asia, i.e. the introduction of new hybrid varieties, transplant production in trays in specialised nurseries and the introduction of modern cultivation techniques, such as the use of mulch and drip irrigation.

The introduction of new varieties, coupled with the use of modern production techniques, may now come at the right time to connect to market developments and bring African field vegetable production to a higher level.

Figure 62. Tengeru area, Arusha, roadside nursery.

7 Conclusions

In terms of crop performance, in this survey the Lushoto district showed the highest level of sophistication in field vegetable production.

Modern field vegetable production methods, such as the use of mulch and drip irrigation, use of hybrid varieties and transplants raised in trays in nurseries, were not yet observed.

Pest and disease control generally were observed to be adequate.

Growers would be able to expand their operations with better access to water and improved efficiency of water use.

In view of the present packing methods, post-harvest losses most likely are high.

Producers largely depend on middlemen for the marketing of their products.

Prevention of environmental degradation and soil and water conservation management needs attention on a national scale.

Figure 63. Selling of onions along main road near Iringa.

8 Acknowledgements

We thank our informants and the other people we met during this survey, who helped us to get a good first impression of field vegetable production in the areas visited. We gratefully acknowledge the assistence of Multiflower Ltd. in the preparation of this survey.

Figure 64. Kilombero market, Arusha.

9 List of Figures

10 Appendices

10.1 *Appendix 1.* Itinerary

July 2011		Production areas visited in **bold**.
Wedn.	6	Arusha - Lushoto
Thurs.	7	Lushoto – **Lukosi** - Kegogwe
Frid.	8	Kegogwe - Morogoro
Sat.	9	Morogoro – **Hembeti** - Morogoro
Sun.	10	Visit to Uluguru mountains
Mond.	11	Morogoro – **Ulaya** - Morogoro
Tue.	12	Morogoro – **Ruhembe** - Kilombero
Wedn.	13	Kilombero – **Mgela** - Iringa
Thurs.	14	Iringa - Morogoro
Frid.	15	Morogoro - Arusha

10.2 *Appendix 2.* National Census data 2002/2003

Acreage and production of vegetable crops in Iringa.

Crop	ha	production	t/ha
maize	253874	265945	1.05
Irish potato	18178	72865	4.01
beans	59661	23479	0.39
tomatoes	3274	18991	5.8
cabbage	1380	9098	6.6
onions	386	1371	3.6
chillies	196	101	0.5
spinach	154	254	1.6
pumpkins	111	83	0.7
amaranthus	86	145	1.7
okra	21	10	0.5
carrot	3	6	2.0
watermellon	2	1	0.5
eggplant	1	11	11

Area and yield of tomato, cabbage and onion per district in Iringa.

	Tomato		Cabbage		Onion	
District	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)
Ludewa	71	5.5	76	4.6	14	
Makete	19	5.1	36	2.4		
Njombe	931	7.3	1137	6.9	94	
Mufindi	182	8.0	131	2.9		
Kilolo	171	3.9	0	-	273	
Iringa rural	343	10.0	0	-	5	
Iringa urban	17	9.3	0	-		

Acreage and production of vegetable crops in Morogo.

Crop	ha	production	t/ha
maize	19509	115570	0.6
Irish potato	2950	4883	1.7
beans	20407	8617	0.4
tomatoes	6159	21747	3.5
cabbage	1889	10374	5.5
onions	965	4687	4.9
chillies	533	973	1.8
spinach	184	347	1.9
pumpkins	947	1877	2.0
amaranthus	457	849	1.9
okra	164	99	0.6
carrot	478	525	1.1
watermellon	151	92	0.6
eggplant	154	153	1.0
bitter eggplant	93	145	1.6
cucumber	152	312	2.1
cauliflower	74	48	0.7

Area and yield of tomato, cabbage and carrot per district in Morogoro.

	Tomato		Cabbage		Carrots	
District	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)
Morogoro urban	95	2.9	38		5	
Morogoro rural	1214	3.7	133		74	
Mvomero	3154	3.5	1371		398	
Kilosa	1278	3.2	237		0	
Kilombero	271	4.3	19		0	
Ulanga	147	5.1	91		0	

Acreage and production of vegetable crops in Tanga.

Crop	ha	production	t/ha
maize	287476	173602	0.6
Irish potato	15402	20736	1.3
beans	63028	24023	0.4
tomatoes	2569	10852	4.2
cabbage	846	3472	4.1
onions	119	364	3.1
chillies	721	1973	2.7
spinach	30	8	0.3
pumpkins	78	265	3.4
amaranthus	131	199	1.5
okra	35	29	0.8
carrot	194	328	1.7
watermellon	215	781	3.6
eggplant	32	31	1.0
bitter eggplant	194	512	2.6
raddish	194	512	2.6
cucumber	90	668	7.4

Area and yield of tomato, cabbage and chilli per district in Tanga.

	Tomato		Cabbage		Chillies	
District	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)
Kilindi	120	6.4	17	2.7	2	7
Handeni	49	1.9	32	1.3	-	-
Pangani	92	1.7	0	-	2	0.4
Korogwe	456	1.8	35	0	237	2.9
Lushoto	1680	5.2	751	4.8	438	2.7
Muheza	108	1.7	9	2.1	18	3.9
Tanga	63	2.2	2	1.7	23	1.2

Acreage and production of vegetable crops in Kilimanjaro.

Crop	ha	production	t/ha
maize	96593	105222	2.1
Irish potato	3016	15591	1.3
beans	44283	17622	4.0
tomatoes	1363	11221	8.2
cabbage	417	1425	3.4
onions	344	2751	8.0
chillies	352	1181	3.4
spinach	283	481	1.7
pumpkins	28	10	0.4
amaranthus	480	1581	3.3
okra	14	57	4.1
carrot	383	2275	5.9
watermellon	146	229	1.6
eggplant	18	83	4.6
bitter eggplant	4	2	0.5
cucumber	80	440	5.5

Area and yield of tomato, cabbage and chilli per district in Kilimanjaro.

	Tomato		Cabbage		Chillies	
District	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)
Same	308	6.8	48		84	
Mwanga	149	3.2	55		6	
Moshi rural	402	7	250		154	
Moshi urban	0	-	0		0	
Rombo	0	-	2		0	
Hai	504	11.6	63		107	

Acreage and production of vegetable crops in Arusha.

Crop	ha	production	t/ha
maize	99986	92118	0.9
Irish potato	1277	2715	2.1
beans	51481	22200	0.4
tomatoes	1504	7340	4.9
cabbage	710	2813	4.0
onions	2558	10656	4.2
chillies	187	1391	7.4
spinach	207	811	3.9
pumpkins	0		
amaranthus	353	1528	4.3
okra	63	198	3.1
carrot	31	120	3.9
watermellon	0		
eggplant	0		
bitter eggplant	0		
cucumber	0		

Area and yield of tomato, cabbage and chilli per district in Arusha.

	Tomato		Cabbage		Chillies	
District	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)	Acreage (ha)	Yield (t/ha)
Monduli	0	-	0	-	0	-
Arumeru	1452	5.0	688	4.0	187	7.4
Arusha	0	-	0	-	0	--
Karatu	0	-	0	-	0	--
Ngorongoro	52	2.7	22	1.3	0	-