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**Urban Vegetable Production in Dar es Salaam (Tanzania) –  
GIS-supported Analysis of Spatial Changes from 1992 to 1999**

Dongus, Stefan

University of Freiburg, Institute of Physical Geography, Section on Applied Physiogeography of the  
Tropics and Subtropics, Werderring 4, 79085 Freiburg, Germany. Email: dongus@gmx.de

**Abstract**

Like most of the cities of developing countries, Dar es Salaam, the largest city of Tanzania, is struck by the consequences of fast urban growth. Urban agriculture is one of the informal activities chosen by a large number of residents to generate income and achieve food security. By aerial photograph's analysis, field work and the use of Geographical Information Systems (GIS), an inventory of all open spaces used for vegetable production in Dar es Salaam was created for 1992 and 1999, showing the prevalence and the dynamics of this sometimes illegal land-use. A full inventory of agricultural open spaces including location and size is now available for planning purposes. The survey revealed that 650 ha of the urban area of Dar es Salaam are currently used for vegetable production on open spaces, which is equivalent to 4% of the whole surveyed area, offering employment for over 4000 farmers. Caused by growing pressure on the land through increasing population, the general tendency is a reduction of the area used for open space production. Over 200 ha of agricultural open spaces vanished during the last seven years. But despite this pressure, 120 ha newly emerged. This shows the viability of urban agriculture as one of the survival strategies for the urban poor and is an indication for the importance and function of open space production in the urban area of Dar es Salaam.

**Introduction**

The growth of cities can be observed all over the world, but particularly in almost all cities of developing countries, where the increase of population proceeds extremely fast. Cities are growing because of rural-urban migration coupled with natural population growth. As a result, these cities are facing enormous problems like unemployment, growing poverty, lack of basic services and deterioration of the environment. In ten years, for the first time in human history, more than half of the world's population will live in urban environments, and according to the World Resource Institute (WRI), about 56% of the developing world's absolute poor will be living in urban areas. The urban poor belong to the most vulnerable group in times of crisis. Reasons can be found in the limited access to food, land and water<sup>1</sup>. Growth in urban poverty, food insecurity,

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<sup>1</sup> DRESCHER & MÄCKEL 2000

malnutrition and a shift in their concentration from rural to urban areas will accompany urbanisation.

Today in Tanzania 20% of all inhabitants live in urban areas<sup>2</sup>. Estimations foresee that already in 2010 half of the Tanzanian population will live in urban areas with Dar es Salaam being by far the most important centre of all. Dar es Salaam shows a growth rate of 8% per year; its population is estimated at 3 million people in 1999 by the Dar es Salaam City Commission and has doubled in the last ten years.

Involvement in the informal economy has become a strategy of survival for the unemployed, the low wage earners and for women without sufficient skills to get well paid jobs. The creation of new jobs in the modern sector in Dar es Salaam can not keep up with the urbanisation. Mass unemployment and employment in the informal sector is characteristic for this development. More than half of the urban population is absorbed by the informal sector. For urban households, food production in the city has become an important strategy to cope with the demands of daily life, as urban agriculture generates income as well as food supply.

### **Urban agriculture world-wide and in Dar es Salaam**

Urban agriculture as defined by MOUGEOT<sup>3</sup> is “an industry located within or on the fringe of a town, a city or a metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area”. Urban agriculture includes horticulture, floriculture, forestry, aquaculture, and livestock production. The United Nations Development Programme (UNDP) estimates that 800 million people are engaged in urban agriculture world-wide. Regarding the current discussion on sustainable development on the global as well as the local level, there is an increasing awareness about the importance of urban agriculture, which is expressed by the involvement of various institutions and governments, for example the Food and Agriculture Organisation of the United Nations (FAO) and the German Ministry for Development Co-operation (BMZ).

By 1988, one in five people of working age in Dar es Salaam were involved in some form of urban agriculture<sup>4</sup>. The two major production systems for vegetable production in the urban parts of Dar es Salaam are the open space system and the homegarden system. Homegarden production or backyard farming is in terms of the number of households involved by far the most important urban production system in Dar es Salaam and practised throughout the whole city area, among all income groups. In contrast to open space production, homegardening is commonly done by women. The cultivation of the land is legal, as the right to use it is linked with the tenure of the house or the permission of the landlord<sup>5</sup>. The major part of vegetables grown in homegardens is consumed by the gardeners themselves, their relatives and neighbours, and is a very important source of vitamins, whereas only few of these vegetables are sold. Thus homegardening is mainly subsistence oriented.

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<sup>2</sup> UNITED REPUBLIC OF TANZANIA 1996

<sup>3</sup> MOUGEOT 2000

<sup>4</sup> SMIT ET AL. 1996

<sup>5</sup> JACOBI ET AL. 2000

## **Vegetable Production on Open Spaces and its importance**

Market production of vegetables in Dar es Salaam is taking place on open spaces all around the city, very often it is the only source of income for the farmers involved.

Open spaces as referred to in this article have the following characteristics in common:

- Open spaces are **intra-urban production areas** that are surrounded by residential, industrial or institutional areas.
- Open spaces are cultivated by **more than one farmer**, not necessarily working together as a group.
- Farming on open spaces is generally done by **men**.
- Production is **market oriented**.
- Production takes place on **public land** (e.g. hazardous land not suitable for construction, road and railway reserves, areas under main power lines, available land for community use) as well as **private land** (residential, industrial or institutional plots under-utilised or awaiting development).
- While public land is often farmed **without official permission** and is currently just tolerated by the authorities, use of private land depends on a **formal or informal agreement** with the owner.
- The dominating crops on all open spaces are **vegetables**.

It is estimated that at least half of the leafy vegetables appearing on the city's markets originate from open space production<sup>6</sup>, which emphasises the importance of this type of agriculture in Dar es Salaam's urban areas. A large number of farmers of open spaces obtained their plots during the economic crisis in the first half of the 1970s (with a severe famine in 1974). During this period, the Tanzanian government encouraged people in the city to cultivate every available piece of land. After a decrease in farming in the late 1970s, it has increased again in recent years.

Regarding ecological aspects in a metropolis like Dar es Salaam, the importance of vegetable production on open spaces can also be seen in the new potential that urban agriculture offers for recycling urban wastes. Especially composting of organic waste material would be a useful and economic way of reducing the amount of waste and at the same improving the quality of the soils. It should also be mentioned that vegetable production in the city contributes to the improvement of the urban microclimate and the beautification of the city (urban greening), and prevents new illegal dump-sites as well as squatting.

### **Objectives of the survey**

The main aim of this research project is to elaborate an inventory of the currently existing open spaces used for vegetable production in Dar es Salaam, but also of the open spaces used for vegetable production in 1992, including their different sizes and locations. The results will close the information gap concerning the actual area under vegetable production, and the dynamic development in the last decade. Thus conclusions may be drawn about the importance of this type of urban food production and its role in regard to urban food security.

Furthermore, the results will contribute to a knowledge base, which can be used by town planners, city officials and politicians to make future decisions concerning the place of

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<sup>6</sup> JACOBI ET AL. 2000

urban agriculture – especially vegetable production – in the city’s development. The inventory will also make it easier for support organisations to come into contact with urban farmers.

Another main aim of the research project is to raise public awareness for vegetable production within the urban area of Dar es Salaam. It was intended to incorporate already existing material on Dar es Salaam’s agricultural land-use (Dar es Salaam City Commission, University of Dar es Salaam, Mapping Department). The idea of the project is to make it possible for urban farmers to get more support from various stakeholders concerning the question of land tenure, water supply, infrastructure, extension services and training.

The medium to present the results of the survey is a map in digital and paper form that comes with additional tabular data showing further information, created with GIS Software. This allows to visualise the spatial distribution of vegetable production on open spaces in Dar es Salaam, but also to do further analysis like calculation of sizes. Other advantages of the digital map are that it can be combined with already existing digital data (map overlays), updated in the future, and extended to a greater range of topics by other researchers.

## **Methodology**

The methodology was a combination of drawing from experiences of agricultural staff and other involved institutions, analysing aerial photographs, empirical field work and finally using Geographical Information Systems (GIS) to visualise and analyse the results. The preparation for the project took place in Germany and comprised the study of all available publications of UVPP as well as Internet research on the topic of urban agriculture (in local as well as world-wide context). The available period of four months for the research in Dar es Salaam was divided in five main phases:

### *Phase I: Familiarisation with the topic and the ongoing research concerning vegetable production on open spaces in Dar es Salaam (2 weeks)*

This included field visits of several open spaces used for vegetable production, discussions with UVPP staff, meetings with different parties involved, such as the University of Dar es Salaam (Department of Geography), the Sustainable Dar es Salaam Programme (SDP), the University College of Lands and Architectural Studies (UCLAS), the Mapping Department and also a private consultancy for GIS (InfoBridge). One aim of this working phase was to get an overview of all research activities which had already taken place in this field, and to find out whether there was any existing information on the topic which might be useful for the project. Another intention was to discuss possible methodologies for the planned project to avoid mistakes resulting from lack of knowledge of the local context.

### *Phase II: Analysis of aerial photographs (3 weeks)*

The analysis was based on the most up-to-date available set of aerial photographs of the Dar es Salaam Region (black and white; scale 1:12500), taken in July 1992. The photographs were used in combination with a stereoscope in order to identify all open spaces used for vegetable production by the time the photographs were taken. The borders of the identified locations were transferred to the set of cadastral maps (scale 1:2500) of the Dar es Salaam Region. The high resolution of the aerial photographs and the large scale of the paper maps made it possible to obtain high accuracy regarding the position of boundary lines. Some locations were immediately visited to verify or clarify the situation. For general ground control, several accompanying field visits were done to avoid mistakes during this working phase.

### *Phase III: Field work (4 weeks)*

The fact that the most recent available complete set of aerial photographs available for the Dar es Salaam region was originating from 1992, and the lack of satellite imagery with an adequately high resolution for this area made it necessary to check the situation for 1999 exclusively by field work. The short period of time available for this part of the survey made it necessary to find a reasonable way to cover as much area as possible. With a motorcycle used as means of transport, and sometimes by walking in areas of difficult accessibility, all areas identified as productive open spaces during the aerial photograph's analysis were visited by the author and his Tanzanian counterpart from the Ministry of Agriculture. Sites which turned out not to be accessible for checking were some institutional areas such as army land, or private land like some industrial areas, which were fenced by high walls. Nevertheless, even in these cases it was often possible to have a glance at the area of interest from outside, which was enough to verify that the production was still going on or to find out the opposite. In more than 98% of all cases it was possible to check the sites. The usual procedure was to find one or several farmers working on the site and ask for a short informal interview. Finally, the extent of the site was compared to the one of 1992. In a lot of cases, this was possible only by observation and working with the cadastral maps. In case of changes, the new situation was marked in the map. In some cases, Differential GPS technique was used to measure significant changes or newly emerged productive open spaces in unintelligible areas.

### *Phase IV: Digitising of results / creation of map (3 weeks)*

Finally, the results of the aerial photograph's analysis and the field work were digitised. This was done by the use of MapInfo, which is a common Geographical Information System (GIS) Software that allows visualisation and analysis of spatial data, for example the calculation of the sizes of all digitised areas. In cases where the borders of the open spaces were marked in the cadastral maps, they were digitised by the use of a digitising tablet. In cases where the areas were measured by GPS, the downloaded coordinates were read by the GIS software and manually connected to polygons. A digital base map of Dar es Salaam (including roads and railway lines) was already available. The rivers and the coastline of the Indian Ocean had to be digitised from paper maps. Additional data like the information gained in short interviews with farmers was also added to the digital map (in terms of attributes to objects), visible in tables. This database can be used by town planners for further analysis and planning purposes. There was no compatible data available yet to create map overlays, but the Dar es

Salaam City Commission (DCC) has already started to adapt its existing GIS database to MapInfo/ArcView format. The final output of this working phase is the map “Vegetable Production on Open Spaces in Dar es Salaam – Spatial Changes from 1992 to 1999” attached to this article.

*Phase V: Data analysis and writing of interim report (4 weeks)*

As the last working step in Tanzania, an interim report was written. This was done in Dar es Salaam, to guarantee quick access to all necessary background information. Some of the main results were presented and discussed at a meeting in Dar es Salaam in February 2000 (organised by the GTZ), where all parties involved in the implementation process of the survey were invited (e.g. Sustainable Dar es Salaam Programme, University of Dar es Salaam (Department of Geography), Urban Vegetable Promotion Project, Dar es Salaam Department of Surveys and Mapping, agricultural extensionists). The interim reports were distributed to all stakeholders mentioned above.

The whole survey was sponsored by and carried out in cooperation with the Urban Vegetable Promotion Project (UVPP) in Dar es Salaam and UVPP’s various local network partners in the city (e.g. agricultural district staff, respective units in the Dar es Salaam City Commission (Sustainable Dar es Salaam Project (SDP)) from September 1999 to January 2000. The idea for the survey was brought up by the UVPP, which was launched in 1993 as a bilateral project of the Tanzanian Ministry of Agriculture and Co-operatives (MAC) and the German Technical Co-operation (GTZ). The UVPP is financed by the German Ministry of Economic Co-operation (BMZ).

### **Results of the survey**

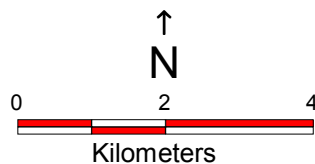
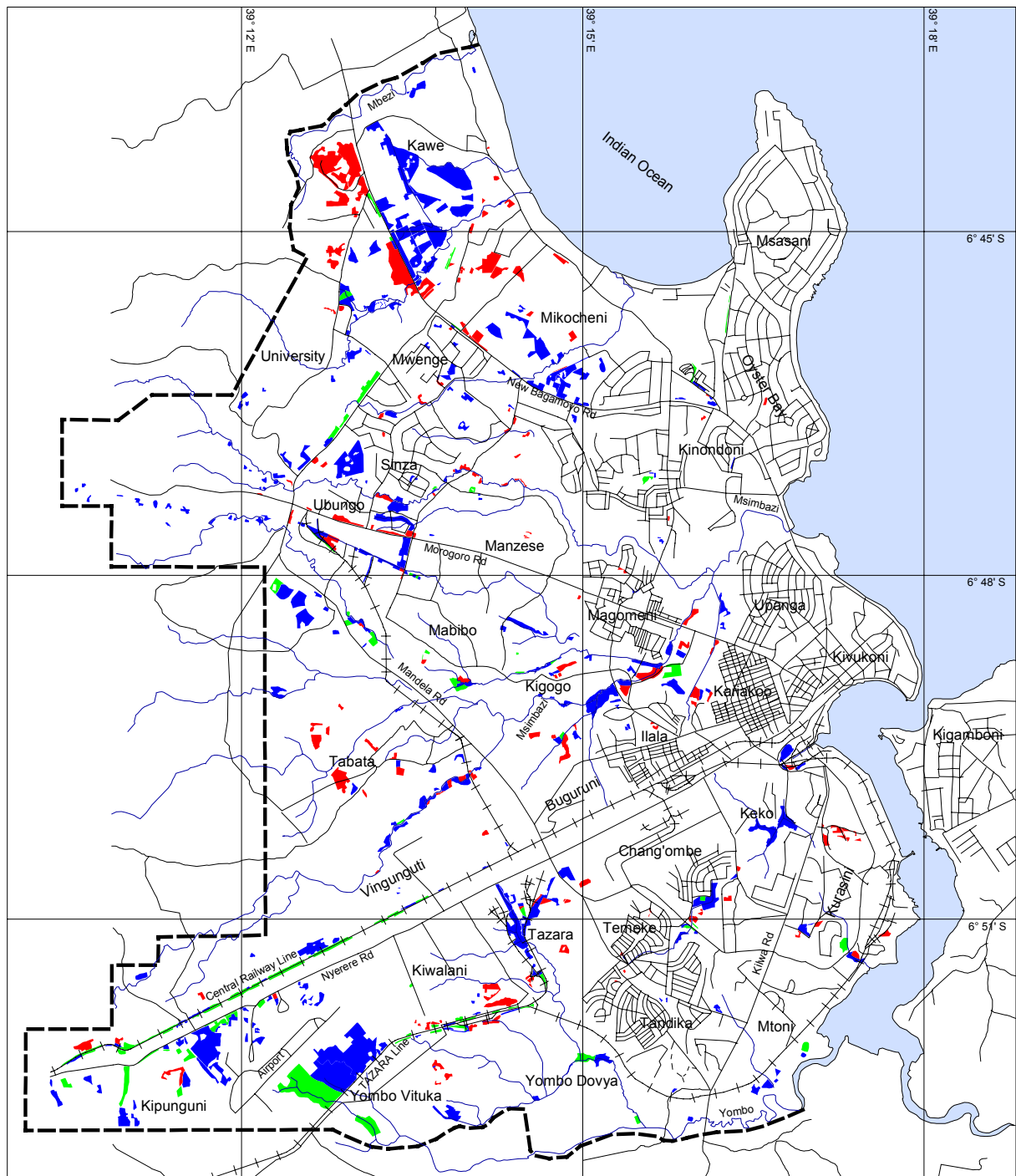
Besides a map showing the locations, sizes and dynamic changes of agricultural open spaces in Dar es Salaam (see below), the results of the project are mainly of statistical nature<sup>7</sup>:

Almost 650 ha of the urban area of Dar es Salaam are currently used for vegetable production on open spaces, which is equivalent to 4% of the whole surveyed area, offering employment for over 4000 farmers. 12% of these 650 ha are privately owned land, 48% are institutionally and 40% publicly owned. Caused by growing pressure on the land through increasing population, the general tendency is a reduction of the area used for open space production. Over 200 ha of agricultural open spaces vanished during the last seven years. But despite this pressure, 120 ha newly emerged. This shows the viability of urban agriculture as one of the survival strategies for the urban poor and is an indication for the importance and function of open space production in the urban area of Dar es Salaam. Regarding the fact that the extent of production in homegardens is many times over the area used for open space production, the importance of urban agriculture for the city’s food security becomes even more obvious.

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<sup>7</sup> More results, e.g. concerning water problems, land tenure, pests and diseases can be found in the Internet: <[www.cityfarmer.org/daressalaam.html](http://www.cityfarmer.org/daressalaam.html)>.

# VEGETABLE PRODUCTION ON OPEN SPACES IN DAR ES SALAAM - SPATIAL CHANGES FROM 1992 TO 1999



Base map:  
Dar es Salaam City Map 1:20000  
(United Republic of Tanzania 1995)

Data source:  
Aerial Photographs 1:12500 taken in July 1992  
(Surveys & Mapping Division, Tanzania)  
Own survey carried out in November 1999

Author:  
Stefan Dongus (University of Freiburg/Germany,  
Institute of Physical Geography)  
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## VEGETABLE PRODUCTION ON OPEN SPACES IN DAR ES SALAAM - SPATIAL CHANGES FROM 1992 TO 1999

### LEGEND

- Vegetable Production in 1992 and 1999
- Vegetable Production in 1999 (but not in 1992)
- Vegetable Production in 1992 (but not in 1999)
- Road
- +— Railway
- River
- - - Border of Area of Interest

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