Agriculture and the Rural-Urban Continuum – GIS-based Analysis of Urban and Periurban Agriculture in Moshi, Tanzania

Johannes Schlesinger[1]; Axel W. Drescher[1]
[1]Department of Physical Geography, University of Freiburg, Germany
Email: Johannes.Schlesinger@Geographie.Uni-Freiburg.de

Why this research?

Urban and periurban agriculture (UPA) plays a crucial role in providing nutrition for the **rapidly growing population of cities** in developing countries in general and in African cities in particular. Even though the research on this topic has significantly grown within the last years, there is a notable bias on capital cities and the main economic centres and there is a **lack of research on medium-sized cities** in Africa. Therefore, the understanding of the character of the rural-urban continuum is limited. This leads to the formulation of inappropriate land use policies. This case study of Moshi, Tanzania is based on a **transect approach** and aims at developing a tool to comprehensively **analyse spatial patterns along the rural-urban continuum**.

Research Questions

- How can **land use data and household survey data** be successfully **integrated** in a Geographic Information System (GIS)?
- How should a **replicable toolset** be shaped that helps analysing and visualising the character of the rural-urban continuum?
- What kind of **spatial patterns** in land use and the households' agricultural activities can be identified **along the rural-urban continuum**?

Methods – working along the transect

The transect approach

The data collection and analysis process is based on a transect approach.

The four identified transects:

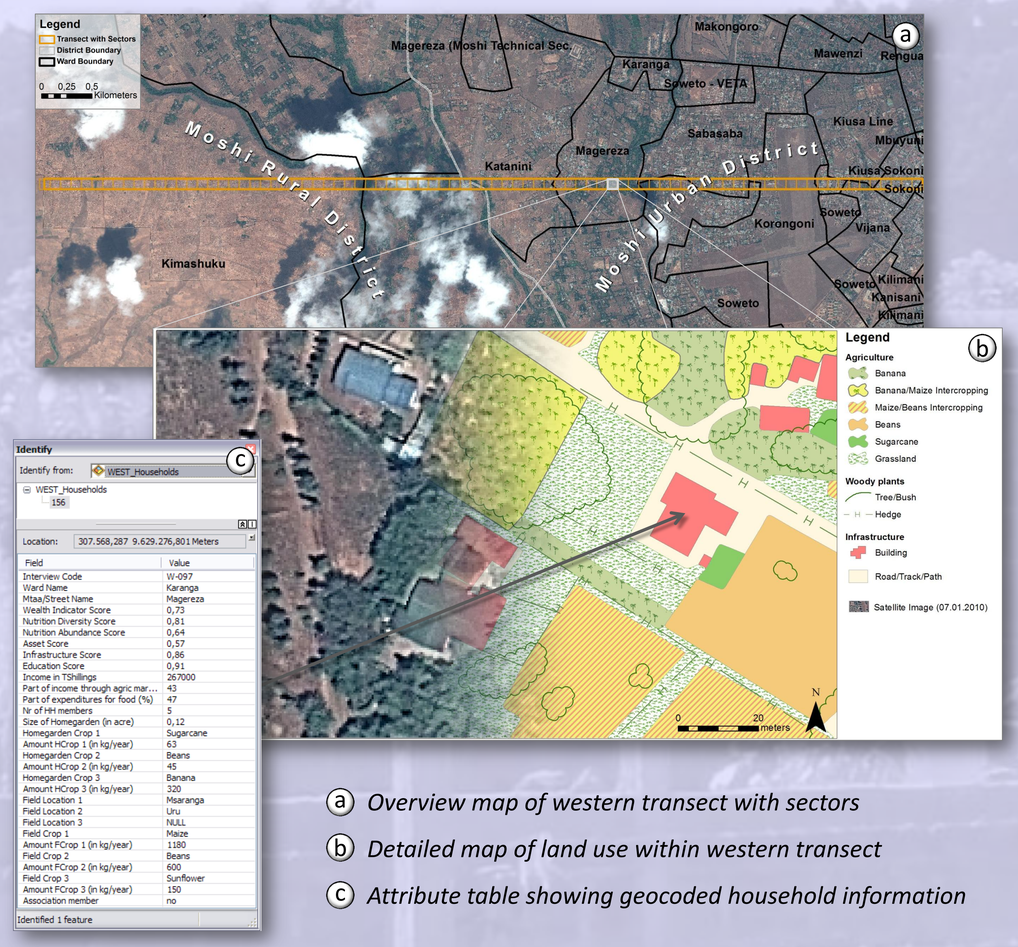
- originate at the city centre (in this case the central market)
- are oriented towards north, south, east and west respectively
- are up to 8 km long and 100 m wide each
- are divided into up to 84 sectors each that form the geographic basis for data analysis (see ⓐ)

To analyse spatial patterns of UPA along the transects a two-fold research approach is being applied:

- **Mapping of agricultural land use along the four transects** (see ⓑ)
  - In situ mapping of all agricultural areas within the transect rectangles (recent satellite images and cadastral maps as base maps)
  - Digitisation of analogue mapping data
  - GIS-based processing (e.g. assign attributes, calculate areas) and analysis of digital data of agricultural land use
- **Household survey within the four transects**
  - GIS-based random sampling of survey households (n = 404)
  - Elaboration and pre-testing of standardised questionnaire covering different aspects of agricultural activities (e.g. yearly production, inputs used, marketing, income generation)
  - Geocoding of interview data (see ⓒ) and analysis of spatial patterns

Additionally, data is being collected through:

- Qualitative interviews with experts on the national, municipal and ward level
- Acquisition of aerial photos, cadastral maps and agricultural statistics



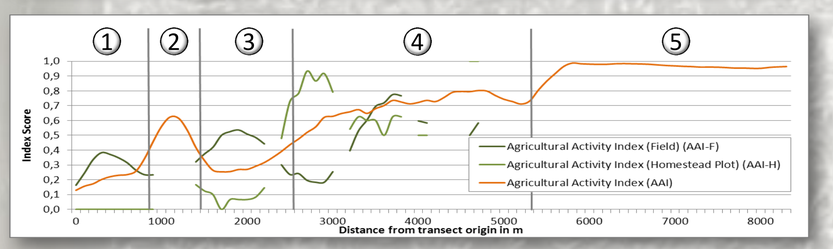
Field	Value
Interview Code	W-097
Ward Name	Karanga
Mtaa/Street Name	Magereza
Wealth Indicator Score	0,73
Nutrition Diversity Score	0,81
Nutrition Abundance Score	0,64
Asset Score	0,57
Infrastructure Score	0,86
Education Score	0,91
Income in TShillings	267000
Part of income through agric mar…	43
Part of expenditures for food (%)	47
Nr of HH members	5
Size of Homegarden (in acre)	0,12
Homegarden Crop 1	Sugarcane
Amount HCrop 1 (in kg/year)	63
Homegarden Crop 2	Beans
Amount HCrop 2 (in kg/year)	45
Homegarden Crop 3	Banana
Amount HCrop 3 (in kg/year)	320
Field Location 1	Msaranga
Field Location 2	Uru
Field Location 3	NULL
Field Crop 1	Maize
Amount FCrop 1 (in kg/year)	1180
Field Crop 2	Beans
Amount FCrop 2 (in kg/year)	600
Field Crop 3	Sunflower
Amount FCrop 3 (in kg/year)	150
Association member	no

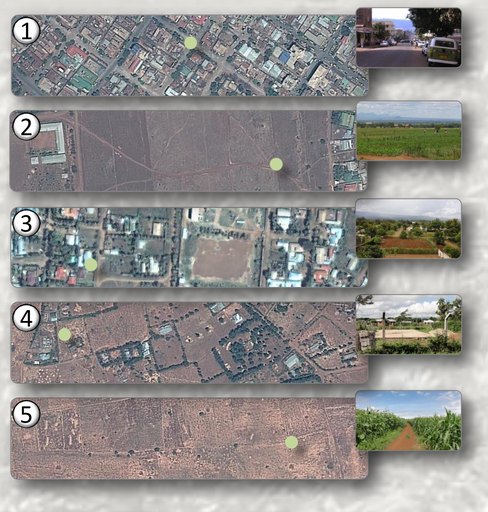
ⓐ *Overview map of western transect with sectors*

ⓑ *Detailed map of land use within western transect*

ⓒ *Attribute table showing geocoded household information*

Results – the comprehensive Agricultural Activity Index (AAI)





Area	Building density	Construction activity	Agricultural land use	Agricultural activity on homestead plot	Agricultural activity on field	Agricultural Activity Index (AAI)	Description
①	++	-	--	--	-	-	City centre, very high building and population density, jobs mainly in the tertiary sector, hardly any agricultural activity
②	--	--	+	n/a	n/a	+	Part of the Moshi airfield, currently not used as runway, intra-urban open space close to residential areas, utilised urban agricultural area
③	0	0	-	+	0	0	Planned residential area with good infrastructure, mix of government employees and businessmen, medium/high-income, mainly lawn
④	-	++	+	++	++	+	Mix of long-standing farm plots and new residents, heterogeneous land use and social structure, very dynamic
⑤	--	--	++	n/a	n/a	++	Vast area of smallholder fields, subsistence- as well as market-oriented cultivation of staple foods (maize, beans)

-- very low - low 0 medium + high ++ very high

In this research, the transect approach has been developed and improved as a tool that can help to collect, process, analyse and visualise data. Some results are:

- Convenient **tool for data collection** (land use data as well as social data)
- Successful **integration of land use data and geocoded interview data**
- Elaboration of a **number of Indexes** for all relevant scale units
- Development of the **Agricultural Activity Index (AAI)** based on, inter alia, land use data and involvement of households in agricultural activities
- Coherent **analysis and visualisation of spatial patterns** along the rural-urban continuum (see ①-⑤)

Outlook

- Replication of methods in other medium-sized cities
- Scaling-up of methods (e.g. bigger cities, more transects)
- Inclusion of findings in appropriate land use policies

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Department of Physical Geography
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