



Food security in rural Zambia

The FOSEZA project

STEVEN GRONAU • JOHANNES HADERSDORFER • BEATRICE NÖLDEKE • NELE PETRUSJANZ • HARTMUT STÜTZEL • ETTI WINTER



Photo: © Johannes Hadersdorfer/TUM

As the hotspots of hunger are in Sub-Saharan Africa, poverty and malnutrition also severely affect Zambia's rural population. To promote food security in the country, foreign organisations, alongside the Zambian government, carry out development and research projects.

Besides chronic undernourishment, essential nutrients are lacking in the daily diets. Hidden hunger affects rural areas in particular. Related deficiency symptoms have irreversible consequences, especially for the mental and physical development of children under the age of five. Inadequate nutrition often causes growth disorders (Biesalski 2013).

The list of challenges for Zambia's rural regions is long. Due to a lack of qualification, lack of mechanization and inputs being scarcely available and of low quality only, the agricultural cultivation systems' productivity level is extremely low. Maize and manioc monocultures dominate while people tend to grow fruits and vegetables in their home gardens. Fish has traditionally been a valuable source of protein and micronutrients for Zambia's rural population. Today, however, many lakes and rivers are considered



Photo: © Steven Gronau

The research region Mantapala in northern Luapula Province, Zambia.

The majority of Zambians live below the poverty line and earn less than US\$1.90 a day (United Nations 2017). Maize and in particular manioc (cassava), cultivated by the majority of farmers, constitute the basis of people's daily diet. The national dish Nshima traditionally consists of maize flour boiled with water. The texture can range from being a rather dry cake to creamy porridge. Depending on the availability, Nshima is also made from manioc. Manioc tubers accumulate hydrocyanic acid and are toxic when raw. They are therefore dried, ground into flour and washed with boiling water, fermented or heated to destroy the toxins. Carbohydrate-rich dishes made from maize and manioc are the basis of almost every meal.

highly overfished. Deforestation affects forests that host wild fruits and edible insects.

The project region

Mantapala is located in the Congo Basin and is part of the Nchelenge District in the Luapula Province. This District has hardly any infrastructure (e.g. electricity, water, roads, trade, and financial services). The region Mantapala, located very remotely in an extensive swamp and forest area, is only accessible via one gravel road. As that becomes impassable in parts during the rainy season, Mantapala is temporarily cut off from the outside world.

The project region comprises 250 households from eight villages. Of the approximately 1,500 people, the majority live in traditional huts without electricity or running water. In Luapula Province, eight out of ten people are classified as poor (UN 2017). This Province also has the highest proportion of underweight children under the age of

five. The level of education is extremely low; more than half of Luapula's population has not completed primary school (CS 2016; IAPRI 2016; UNDP 2013).

Smallholder cultivation of maize and manioc, collecting firewood, and charcoal production account for almost 90 percent of economic activity (Gronau et al. 2018). On average, a household cultivates about one to three hectares of land. In addition to maize and manioc, small quantities of peanuts, beans, sweet potatoes, rice and millet are cultivated.

Shifting cultivation is the region's traditional and characteristic feature. Farmers slash and burn forests to use the land for agricultural production. After a few years, farmers need to clear new forests. Most families keep chickens, ducks, goats and/or pigs. Some also fish in nearby streams and rivers.

Area records show that the forest area in the project region has declined significantly since 1990 (Gronau et al. 2018). A similar trend applies to the resource fish (Bwalya et al. 2015; Verelst 2013).

The FOSEZA Project

The project started in November 2016. The integration of traditional fruit trees and vegetable plants in maize and manioc monocultures aims to make food production more diverse and to improve the food situation. Strategies are being developed and tested to increase villagers' acceptance of fruits and vegetables. Social networks and local business models play a central role in this context. For instance, FOSEZA supports the development of a tree nursery for traditional local fruit species. In addition to the positive effects on nutrition, the awareness of the value of the forest and its associated ecosystem services shall increase. Integrating fishponds into the production system is another central concern. In demonstration fields, new diversified cultivation systems are tested while participatory processes intend to increase participants' competencies sustainably. An external research station analyses demonstration fields' crop yields in view of their contribution to nutrition. Another central research aspect is the distribution of food within a household considering gender-specific aspects.

The project team consists of around 20 employees, six of whom are doctoral students. In addition, there are several bachelor and master students.

Examples from everyday project work

Data collection

During the initial project phase, detailed household surveys were carried out for a status quo analysis. These included general household data such as socio-demographic characteristics and economic activities, sources of income, consumption and expenditure, exploitation of fish and forest resources, livestock breeding and agricultural production. In addition, soil and plant samples were taken and comprehensive GPS measurements were carried out. Besides quantitative data, the project staff collected qualitative data through personal interviews and focus group discussions.

Description	
Food Security in rural Zambia (FOSEZA): Integrating Traditional Fruit and Vegetable Crops in Smallholder Agroforestry Systems	
Project goals	<p>The FOSEZA project aims to diversify agroforestry systems. This is to be achieved by integrating traditional fruit trees and vegetable plants into agricultural cultivation systems:</p> <ul style="list-style-type: none"> • Diversification of agricultural production systems to promote a balanced diet • Combination of agroforestry and aquaculture • Investigation of the nutritional situation and development of sustainable diets • Establishment of agricultural demonstration fields and a tree nursery • Introduction of participatory approaches to knowledge transfer and improvement of food distribution within households • Capacity building: summer schools, training courses, workshops, bachelor, master and doctoral theses and provision of scientific laboratory and agricultural equipment
Implementing organisations and partners	<ul style="list-style-type: none"> • Leibniz University Hannover (Coordinator) • Technical University Munich (TUM) • Zambia Agricultural Research Institute (ZARI) • Ministry of Agriculture, Ministry of Fisheries and Livestock (Zambia) • University of Zambia (UNZA) • Copperbelt University (CBU)
Project team	The team consists of around 20 employees, six of whom are doctoral students. Several bachelor and master students are also involved.
Project location	Zambia (Mantapala in the Luapula Province and ZARI Research Station in Mansa)
Duration and project budget	Almost one million euro over three years
Funding Agency	Federal Ministry of Food and Agriculture (BMEL); project executing agency: Federal Office for Agriculture and Food (BLE).
For further information	www.foseza.uni-hannover.de

INTERVIEW

Interview with Beauty Choobe, doctoral student at the Technical University of Munich (TUM) and Robert Chungu, member of the Nature Conservation Group of Mantapala Region

Photos: © Johannes Hadersdorfer/TUM



Beauty Choobe



Robert Chungu

How important are wild fruits for the villagers of Mantapala and their food security?

Beauty: Due to a lack of income and because the market is too far away, people in the region can hardly afford to buy fruits. Therefore, wild fruits are vital for people. As they are one of the few sources of vitamins, they have a decisive influence on food security.

Robert: Wild fruits are especially important for the children who collect fruits during school breaks because their parents have no money to buy food. Adults also eat wild fruits as small meals while they work on their fields.

What are the advantages and disadvantages of wild fruit consumption?

Beauty: Wild fruits' main advantages are their ingredients. They are rich in vitamins and antioxidants. A disadvantage or danger lies in the fact that many fruits are eaten unripe and some seeds can be harmful to human health.

Robert: Wild fruits can contribute to a balanced diet. Some plants are also said to have a medicinal effect, against stomach pain, for instance. Wild fruits are particularly important for the poorest because they have no money to buy or to grow food. Selling wild fruits can be a source of income. A big problem connected with collecting them are snakebites and the long distances to the places where they are collected.

How has wild fruit consumption changed in recent years?

Beauty: The per capita consumption of wild fruits in rural areas has decreased. This is probably the result of the constant population growth and the decline of fruit tree populations.

Robert: The consumption of wild fruits has declined because more and more people are cutting down more and more trees. This leads to a loss of wild fruits.

How to promote the cultivation of wild fruits?

Beauty: There is simply a lack of knowledge about cultivation techniques for wild fruit trees. The villagers do not know how to treat seedlings or how to domesticate wild fruits. In addition, there is a widespread ignorance of processing practices such as the fruit juice production or fruit storage. There is also no structure for marketing wild fruits. Villagers must be educated accordingly. Scientific analyses and publications are also lacking.

Robert: There is little knowledge about wild fruit cultivation practices or about pest control and plant diseases. Farmers lack knowledge about the ideal soil conditions that promote plant growth. Extensive training could help here. By growing new fruit trees, we can try to stop deforestation.

Poverty and food situation

Preliminary analyses confirmed that households in the project region are considered poor according to the internationally recognised definition. Analyses of food security indicators (e.g. food consumption score, household food insecurity access scale) showed that, for the majority of households, the food situation is unacceptable. At present, anthropometric measurements are being prepared in order to be able to provide information on the nutritional status of children under the age of five. Activities together with the village community on food processing, preparation and storage, hygiene and nutrition are planned for 2019.

Social Networks

Experience has shown that research projects often have no lasting effect because new knowledge and important skills are not disseminated within the village community and are not sufficiently practiced either. Initial data analyses revealed that social networks in the project region are extre-



Farmers present one of their banana plants.

mely weak. A farmer has on average only one to three trusted people with whom he would discuss, for example, cultivation techniques. Within the framework of agent-based modelling (<https://ccl.northwestern.edu/netlogo/>) will be investigated how new knowledge and innovations are disseminated in the village community and which measures or persons could optimise this transfer.

Banana seedlings and cultivation training

In an economic experiment (“reverse auction”), smallholders’ individual willingness to cultivate, maintain and take care of bananas for one year was tested. Currently, banana cultivation is almost unknown in Mantapala. The “auction” helped to identify more than 30 farmers who were willing to take care of five banana seedlings each and to complete a related training. Other farmers made extremely high bids as they apparently did not consider banana growing worthwhile.

Reverse auction

The principle is opposed to a ‘normal’ auction where the highest bidder wins. Here, the bidder who places the lowest (secret) bid wins the auction, being the person who shows the highest motivation for the task and asks least.

First results showed that the banana plants are in a very good condition and almost all farmers apply the knowledge they acquired during the training. Winners of the “auction” also showed that they were significantly more risk-seeking than the other participants. This suggests an increased willingness to make investments and an openness to innovation. These people could be “pioneers” and actively support new agricultural systems.

Demonstration fields and fishponds

Together with the villagers, demonstration fields were set up on an area of about two hectares. Local farmers cultivate various agricultural products such as soybeans, sweet potatoes, peanuts, modern manioc varieties and



Manioc (front) and maize cultivation (background) in Mantapala.



Afromomum, fruit



Masuku, fruit

pumpkin on 42 plots. Local fruit trees are planted between the individual plots. This is supposed to enrich the soil and the harvest through indirect fertilisation, soil loosening and less drying out of the soil. The farmers receive ample support via trainings, seeds, fertiliser and suitable equipment. Currently, a storage house for the harvest and a stable for oxen are being built to ease the cultivation of the fields. The demonstration fields represent a diversified agroforestry system. These aim to inspire farmers to transfer a similar system to their own fields. At the same time, new fishponds are being created. Required inputs and specific training are provided through the project.

Wild fruits

Indigenous wild fruits play a vital role in people’s daily diets. However, at times, places where to find and gather fruits and berries are kilometres away from the villages. The plants grow in the wild and uncontrolled, while yields fluctuate strongly. In addition, paths might lead through swamps and are dangerous, not least due to poisonous snakes. According to data analysed to date, masuku (*Uapaca kirkiana*), intungulu (*Afromomum africanum*), impundu (*Parinari curatellifolia*) and imfungo (*Anisophylla boehimii*) were the most frequently gathered fruits. Currently, extensive research regarding their nutritional value is carried out in laboratories at the

University of Zambia (UNZA) and at the Technical University of Munich (TUM). At present, work is being done together with the local population to deepen the knowledge of indigenous plants. At the same time, the first successes in the cultivation of wild fruits are visible. The objectives are to increase both food security and income (Choobe et al. 2018).

ZARI Research Station

At the ZARI research station in Mansa, comprehensive analyses of field crops are carried out in order to test their productivity (e.g. growth under various cultivation and fertilisation measures, yields, integration of new crops such as legumes) and quality (e.g. nutritional values). Via trainings and the provision of appropriate seeds, the station also supports progress on the demonstration fields.

For example, it was examined to what extent the harvesting of leaves from growing crops for consumption as vegetables – a common practice in Zambia – results in yield losses. Results showed that the removal of 75 percent of the leaves from six-week-old bean stands does not entail yield losses. There are no results yet available for manioc due to the forthcoming harvest.

Tree nurseries and reforestation

A nature conservation group in the Mantapala area dedicates its efforts to reforestation and biodiversity conservation and, with the support of the FOSEZA project, has successfully set up a tree nursery where collected seeds are cultivated and where farmers can purchase seedlings to plant them in the fields. The experiences of the nature conservation group contributed significantly towards the creation of a social network.

Outlook

In addition to the current activities, the FOSEZA project plans to carry out further scientific nutrient analyses of local food plants and to provide nutrition education programmes for the population. People in Mantapala are open-minded and motivated to learn about and test new production approaches to improve their own nutritional situation sustainably. In the course of time, a friendly co-



Group picture with the villagers.

Photo: © Steven Gronau

operation developed between the project team and the village community.

The FOSEZA approaches are long-term; some fruit trees in the demonstration fields will not bear fruits until years after the project will have ended. Establishing social networks should contribute to the successful continuation of innovations even after the end of the project. ■

Literature

Biesalski HK: Der verborgene Hunger. Satt sein ist nicht genug. Springer Spektrum, Berlin, Heidelberg (2013)

Bwalya M, Chaunga C, Deka B, Mwila BS, Mtawali M: Effective Management of Fisheries in Zambia. Research Report, Lusaka, Zambia (2015)

Choobe B, Syampungani S, Hadersdorfer J: Nutritional analysis of indigenous fruits and vegetables of Nchelenge District of Zambia. Poster presented at Technical University of Munich (TUM), 150 Years Culture of Excellence, 13.10.2018, Freising (2018)

CSO: 2015 Living Conditions Monitoring Survey Report. Republic of Zambia. Central Statistical Office, Lusaka, Zambia (2016)

FAO: World Food Summit. Rome Declaration on World Food Security. Rome, Italy (1996)

Gronau S, Winter E, Grote U: Papyrus, Forest Resources and Rural Livelihoods: A Village Computable General Equilibrium Analysis from Northern Zambia. Natural Resources 9, 268–296 (2018)

IAPRI: Rural Agricultural Livelihood Survey. 2015 Survey Report. Indaba Agricultural Policy Research Institute, Lusaka, Zambia (2016)

Report of the Auditor General: Report of the Auditor General on Sustainable Forest Management. Republic of Zambia (2017)

UNDP: Millennium Development Goals (MDGs). Provincial Profile/Luapula Province/2013. United Nations Development Programme, Lusaka, Zambia (2013)

United Nations World Food Programme: Food consumption analysis. Calculation and use of the food consumption score and food security analysis. Rome, Italy (2008)

USAID: Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide (v. 3). Washington, DC, Food and Nutrition Technical Assistance Project, Academy for Educational Development, August (2007)

Vereinte Nationen: Ziele für nachhaltige Entwicklung. Bericht 2017. New York (2017)

Verelst B: Managing inequality: the political ecology of a small-scale fishery, Mweru-Luapula, Zambia. Journal of Political Ecology 20, 14–36 (2013)

World Health Organization Nutrition: Landscape Information System (NLIS). Country Profile Indicators. Interpretation Guide. Geneva, Switzerland (2010)

>> German version of the article available in the magazine "Ernährung im Fokus" 02 2019 <<



FOR THE TEAM OF AUTHORS

Dr. Steven Gronau (Studies [BSc, MSc] and Ph.D. in Economics at Leibniz University of Hannover) has been working at the University of Hannover's Institute for Environmental Economics and World Trade since 2013. Within the project, he is involved in coordination and budget planning.

Dr. Steven Gronau
Leibniz University Hannover
Institute for Environmental Economics und World Trade
Königsworther Platz 1, 30167 Hannover
gronau@iue.uni-hannover.de