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## Data Article

# Data set of smallholder farm households in banana-coffee-based farming systems containing data on farm households, agricultural production and use of organic farm waste



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## ABSTRACT

The data was collected in the Karagwe and Kyerwa districts of the Kagera region in north-west Tanzania. It encompasses 150 smallholder farming households, which were interviewed on the composition of their household, agricultural production and use of organic farm waste. The data covers the two previous rainy seasons and the associated vegetation periods between September 2016 and August 2017. The knowledge of experts from the following institutions was included in the discussion on the selection criteria: two local non-profit organisations, i.e., WOMEDA and the MAVUNO Project; the International Institute of Tropical Agriculture (IITA); and the National Land Use Planning Commission (NLUPC). Households were selected for inclusion if all of the following applied to them: 1) less than 10 acres of land (4.7 ha) registered in the village offices, 2) no agricultural training, and 3) decline in the fertility of their land since they started farming (self-reported). We selected 150 smallholder households out of a pool of 5,000 households known to WOMEDA in six divisions of the Kyerwa and Karagwe districts. The questionnaire contained 54 questions. The original language of the survey was Kiswahili. All interviews were audio recorded. The answers were digitalised and translated into English. The data set contains the raw data with 130 quantitative and qualitative variables. For quantitative variables, the only analysis that was made was the conversion of units, e.g., land area was converted from acres to hectares, harvest from buckets to kilograms and then to tons, and heads of livestock to Tropical Livestock Units (TLU). Qualitative variables were summarised into categories. All data has been anonymised. The data set includes geographical variables, household information, agricultural information, gender-specific responsibilities, economic data, farm waste management, and water, energy and food availability (Water-Energy-Food (WEF) Nexus). Variables are written in italics. The following geographical variables are part of the data set: *district, division, ward, village, hamlet, longitude, latitude, and altitude*. Household information includes *start of farming, household size, gender and age of household members*. Agricultural information includes *land size, size of homegarden, crops, livestock and livestock keeping, trees, and access to forest*. Gender-specific responsibilities includes *producing and exchanging seeds, weed control, terracing, distributing organic material to the fields, care of annual and perennial crops, harvesting of crops, decisions about the harvest and animal products, selling and buying products, working on their own farm and off-farm, cooking, storing food, collecting and caring for drinking water, washing, and toilet cleaning*. Economic data includes *distance to the market, journey time to market, transport methods, labourers employed by the household, working off-farm, and assets such as type of house*. Variables relevant to the WEF Nexus are *drinking water source and treatment, meals per day, months without food, cooking fuel, and type of toilet*. Variables on farm waste management are the *use of crop residues, food and kitchen waste, livestock manure, cooking*

ash, animal bones, and human urine and faeces. The data can be potentially reused and further developed for the purpose of agricultural production analysis, socio-economic analysis, comparison to other regions, conceptualisation of waste and nutrient management, establishment of land use concepts, and further analysis on food security and healthy diets.

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## Specifications Table

Subject	Agricultural and Biological Sciences (General)
Specific subject area	The subject area is related to agricultural sciences involving agroforestry and connected to Circular Economy and waste management. 90% of banana-coffee farming systems are operated by smallholder farmers in East Africa. These farming systems are based on agroforestry with integrated composting of organic waste. However, due to severe degradation of vegetation and soils, as in north-west Tanzania, these farming systems have lost diversity and fertility.
Type of data	Table in Excel
How data were acquired	Survey, audio recorded and hand-noted questionnaire answers in Kiswahili, digitalised in Microsoft Excel, and translated into English.
Data format	Raw
Parameters for data collection	We selected the data after discussion on the selection criteria and after consulting the relevant village officers. The following four institutions were involved in this discussion: two local non-profit organisations, i.e., WOMEDA (Women and Men for Destined Achievements, <a href="https://facebook.com/Womeda-285166848171570/">facebook.com/Womeda-285166848171570/</a> ) and the MAVUNO Project ( <a href="https://mavunoproject.or.tz/">mavunoproject.or.tz</a> ); the International Institute of Tropical Agriculture (IITA, <a href="https://iita.org/iita-countries/tanzania/">iita.org/iita-countries/tanzania/</a> ); and the National Land Use Planning Commission (NLUPC, <a href="https://nlupc.go.tz/">nlupc.go.tz</a> ). The criteria for smallholder farm households were the following: 1) less than 10 acres of land (4.7 ha) registered in the village offices, 2) no agricultural training, and 3) decline in the fertility of their land since they had started farming (self-reported).
Description of data collection	<p>The data contains geographical variables, household data, agricultural data, economic data, data on water, energy and food, and farm waste management.</p> <p>First, we agreed on the selection criteria (see parameters for data collection). We selected the data after discussion on the selection criteria and after consulting the relevant village officers. The following four institutions were involved in this discussion: two local non-profit organisations, i.e., WOMEDA (Women and Men for Destined Achievements, <a href="https://facebook.com/Womeda-285166848171570/">facebook.com/Womeda-285166848171570/</a>) and the MAVUNO Project (<a href="https://mavunoproject.or.tz/">mavunoproject.or.tz</a>); the International Institute of Tropical Agriculture (IITA, <a href="https://iita.org/iita-countries/tanzania/">iita.org/iita-countries/tanzania/</a>); and the National Land Use Planning Commission (NLUPC, <a href="https://nlupc.go.tz/">nlupc.go.tz</a>). We visited the offices of each village and asked for permission to conduct the survey. Then we tested the questionnaire in the field and made the final changes.</p> <p>When selecting the study area within the Kagera region, it was important that the climatic and geomorphological conditions did not change within the study area. Furthermore, the area had to be as 'unexplored' as possible. Therefore, the Bukoba district, for example, was not suitable (lower altitude and different source rock than in Karagwe, with higher rainfall; many scientific studies). Secondly, language barriers had to be tackled and the farmers had to have confidence in the research team and agree to the survey itself and its recording. Therefore, the local non-governmental organisation WOMEDA, which has been working with about 5,000 local farming households since the 2000s on issues such as malaria and AIDS prevention and disability, was involved in the data collection. It was also important that the survey area was not located in the divisions where the local Farmer Field School 'MAVUNO Project' has been active since the 1990s, in order to be able to subsequently compare the results of the survey with the success of the Farmer Field School's work. Therefore,</p>

(continued on next page)

the study area was reduced to 5000 households in six divisions within the Karagwe and Kyerwa districts in the Kagera region. During the visits to the village officers, we also received accurate information on the current population figures within the divisions. In order to derive a representative statement, the sample size had to be at least 5% of the population under investigation. Therefore, we chose a sample size of 150 households, which, depending on the division, represented 5% to 10% of the population under investigation.

Afterwards, we visited the selected families at home, either in their farmhouse or in the surrounding homegarden. We asked for permission to audio record the survey and to use the data for the purpose of research. We always used the same questionnaire. The surveying team conducted the survey in Kiswahili. If farmers answered in one of the local Kihaya languages, the answers were directly translated into Kiswahili and noted. The head of the household was interviewed in most cases; in 5% of the households the oldest son took his/her place. The answers given by the farmers were noted on the hard copy of the questionnaire and within a few days digitalised in MS Excel. All interviews were audio recorded. Finally, the answers were translated into English.

Data source location	Region: Kagera region District: Karagwe and Kyerwa Country: Tanzania, East Africa Latitude and longitude (and GPS coordinates) for surveyed farms: 30.7 and 31.5 E, and 1.2 and 1.8 S
Data accessibility	Repository name: PANGAEA Data identification number / Direct URL to data: <a href="https://doi.pangaea.de/10.1594/PANGAEA.914713">https://doi.pangaea.de/10.1594/PANGAEA.914713</a> [1]
Related research article	Reetsch, Anika; Feger, Karl-Heinz; Schwärzel, Kai; Dornack, Christina; Kapp, Gerald (2020): Organic farm waste management in degraded banana-coffee-based farming systems in north-west Tanzania. In <i>Agric. Syst.</i> 185, p. 102915. <a href="https://doi.org/10.1016/j.agsy.2020.102915">https://doi.org/10.1016/j.agsy.2020.102915</a> .

## Value of the Data

- The data is useful for agronomic analysis and to promote a deeper understanding of the agricultural production systems of smallholder farming families in the remote mountainous, sub-tropical Kagera region in north-west Tanzania, which has experienced long-term environmental degradation, refugee migration, and infection by HIV/AIDS.
- National and regional as well as non-governmental and governmental organisations and researchers can benefit from this data set. They can compare the region to other regions. Farmers indirectly benefit from the data, e.g., if governmental programmes use it to help frame land use policy or in farmer field schools to promote sustainable land use management.
- The data can be used to develop land use policies, to increase food security on a regional scale, to improve soil fertility farm waste management and thus nutrient management, to increase crop production, and to minimise environmental hazards in follow-up analyses.
- The data consists of gender-divided data, which is quite unique.
- The data set follows a holistic approach by combining the Water-Energy-Food Nexus, the Soil-Water-Waste Nexus, and other resource nexi.

## 1. Data Description

The data file is an Excel table with three sheets, metadata, legend, and data. The data covers the two previous rainy seasons and the associated vegetation periods between September 2016 and August 2017.

The following geographical variables are part of the data set: *questionnaire identity number, date, time, district, division, ward, village, hamlet, longitude, latitude, altitude*. Household data encompasses *the earliest start of farming, latest start of farming, duration of farming, household size,*

male household members, female household members, household members below 14 years, household members between 14 and 50 years, household members above 50 years, age of head of household, gender of head of household. Gender-divided responsibilities embrace the tasks of “producing own seeds”, “exchanging seeds”, “weed control by tillage”, “terracing”, “distributing organic material to the field”, “annual crops”, “perennial crops”, “harvest of crops”, “decisions on harvest”, “livestock-keeping”, “decisions on animal products”, “selling products”, “buying food”, “working on own farm”, “working off-farm”, “cooking”, “storing food”, “collecting and treating drinking water”, “washing”, and “toilet cleaning”.

Agricultural data refers to the total land size, size of the homegarden (in local language *kibanja*), size of new farmland (*kikamba*), size of grassland (*rwerya*), size of woodland (*kabira*); the annual production of coffee (*Coffea canephora* L. var. *robusta*), banana (*Musa* L. spp.), beans (*Phaseolus vulgaris* and other spp.), maize (*Zea mays* L. spp.), and cassava (*Manihot esculenta* Crantz spp.); the livestock owned at the moment of surveying including total Tropical Livestock Units (TLU) divided into Tropical Livestock Units kept on the farm and Total Tropical Livestock Units kept on grassland, heads of improved cattle (Friesian) divided into improved cattle kept on the farm and improved cattle kept on grassland, heads of indigenous cattle divided into indigenous cattle kept on the farm and indigenous cattle kept on grassland, heads of goats divided into goats kept on the farm and goats kept on grassland, heads of sheep divided into sheep kept on the farm and sheep kept on grassland, heads of pigs divided into pigs kept on the farm and pigs kept on grassland, heads of chicken divided into chicken kept on the farm and chicken kept on grassland.

Economic data includes distance to the market, journey time to the market, transport methods, labourers employed by the household, working off-farm, and assets such as type of house. Further data on water, energy and food were collected: water source, drinking water treatment, sanitation, energy source, and monthly food availability. Farm waste management involved the use of crop residues for composting, use of crop residues as fodder, use of food waste, use of kitchen waste, use of livestock manure, use of livestock urine, use of cooking ash, use of animal bones, use of human urine, and use of human faeces.

## 2. Experimental Design, Materials and Methods

We formulated a questionnaire following [2]. The sample design was prepared according to [3] and [4]. Accordingly, we combined 54 open and closed questions in the survey, intending to transfer the answers given by the farmers directly into qualitative and quantitative variables. The questionnaire was prepared in English and translated into Kiswahili by the research team. If farmers answered in one of the local Kihaya languages, the answers were directly translated into Kiswahili and noted. We tested the questionnaire with 10 farmers in the field and trained the surveying team in conducting the survey similarly. After the testing phase, final changes were made to the questionnaire concerning repetition of questions to double-check the answers given, length of questions, methods of asking, and correctness of translation from English to Kiswahili.

In the field, we visited and observed the study area and talked to farmers, experts, and village officers. We selected the data after discussion on the selection criteria and after consulting the relevant village officers. The criteria for smallholder farm households were the following: 1) less than 10 acres of land (4.7 ha) registered in the village offices, 2) no agricultural training, and 3) decline in the fertility of their land since they had started farming (self-reported). The following four institutions were involved in this discussion: two local non-profit organisations, i.e., WOMEDA (Women and Men for Destined Achievements, facebook.com/Womeda-285166848171570/) and the MAVUNO Project (mavunoproject.or.tz); the International Institute of Tropical Agriculture (IITA, iita.org/iita-countries/tanzania/); and the National Land Use Planning Commission (NLUPC, nlupc.go.tz).

We visited the offices of each village and asked for permission to conduct the survey and to agree on which farm households fulfilled the criteria. Households were selected out of a pool of 5,000 farm households that were known to WOMEDA and affected by the degradation of vegetation and soils. The households were located in the Bugene, Nyaishozi, and Kituntu divisions

of the Karagwe district and Kaisho, Mabira and Nkwenda divisions of the Kyerwa district. Of the 5,000 households meeting the criteria, we selected between 5% and 10% in each division. In total, we surveyed 12 villages in 6 divisions of the Kyerwa and Karagwe districts in the Kagera region of north-west Tanzania.

During the survey phase, we visited the selected farming families at home, either in their farmhouse or in the surrounding homegarden. We asked for permission to audio record the survey and to use the data for the purpose of research. We always used the same questionnaire. The surveying team conducted the survey in Swahili. The head of the household was interviewed in most cases; in 5% of the households the oldest son took his/her place. The answers given by the farmers were noted on the hard copy of the questionnaire and within a few days digitalised in MS Excel. All interviews were audio recorded. Finally, the answers were translated into English. Units of quantitative variables were harmonised, e.g., from acres to hectares, buckets to tons, and livestock to tropical livestock units according to [5]. Qualitative answers were shortened and, if needed, categorised following the method of qualitative content analysis after [6]. Different interpretations of the same response were avoided and checked. For example, the variable *food waste* derived from the question: “During the last year, what have you done with food waste?” Answers like “we do not have food waste” or “no food waste” or “we don’t have any” were transformed into “*not available*” to make similar answers comparable with other answers and ready for statistical analysis. The survey answers are saved in the data set as raw data.

## Ethics Statement

All data is treated anonymously. In advance, all participating farmers agreed to the survey and the use of the data for non-profit research purposes. The farmers participated in the survey voluntarily. All participants have agreed in writing to the anonymised publication of the survey data.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

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