

Agricultural Biodiversity Assessments in Dryland Systems of Ghana, India, Malawi, Mali and Niger: An Overview of the Framework, Methods and Datasets

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Abstract

The Agricultural Biodiversity Assessment is a methodology that combines qualitative and quantitative approaches to assess the biodiversity of plant and animal species both domesticated and wild used for food by human populations in specific locations. In the context of the CGIAR Research Program on Dryland Production Systems and with its support, Bioversity International and partners carried out a series of Assessments in selected sites of Ghana, India, Malawi, Mali and Niger. As a result several datasets have been produced. This document provides a background and an overview of the data that have been collected. It offers the conceptual framework that guided its design, the context in which the Assessment was carried out, and a short description of the protocols and methods used, as well as a link to the documents and datasets.

Keywords: Agricultural biodiversity, diversification strategies, market participation, seed systems, risk preferences, foods consumed, dietary diversity, child and infant feeding practices, household food security

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Introduction

The biodiversity of plant and animal species both domesticated and wild used for food by humans (referred to here as agricultural biodiversity—ABD) is one of the most important assets for rural households, particularly for the poor in marginal areas such as the drylands of the developing world. Most agricultural research conventionally focuses on just a few major crops as entry points to improve the livelihoods of rural populations in these areas, inadvertently ignoring the great diversity of species from which rural populations derive their livelihoods and the foods they consume, and that underpin their food and nutritional security. Understanding and quantifying how this diversity is used as a source of income and food and its contribution to diets and nutrition, provides a systems-oriented basis to identify entry points where ABD could be used more effectively to reduce vulnerability or foster intensification of the agricultural and food systems of rural populations in marginal environments.

A contribution of Bioversity International to the CGIAR Research Program on Dryland Agricultural Production Systems (CRP) [<http://drylandsystems.cgiar.org/>] has been to document and examine systematically the diversity of plant and animal species used by rural population in CRP target sites in Ghana, India, Malawi, Mali and Niger. Bioversity and partners have carried out a set of Agricultural Biodiversity Assessments in these countries from 2013 to 2015. The ABD Assessment is a methodology that combines qualitative and quantitative approaches (e.g. focus group discussions and household surveys) to assess the biodiversity of plant and animal species both domesticated and wild used for food by human populations. Its objective is to identify and quantify all the useful plant, animal, and aquatic species utilized by rural households and communities in particular sites, as well as information on markets attended and general socioeconomic household characteristics. The Assessment aims at characterizing three dimensions of ABD: (1) the diversity of plant and animals species present on farm (including semi-domesticated species in home gardens and species collected from the wild), (2) the diversity of foods consumed in diets (included both local and exotic products, locally produced or imported, processed and industrialized); and (3) the diversity of plants and animal species and foods sold and purchased by households in markets. The data generated provide a basis for analyzing the roles of ABD in the lives and livelihoods of these rural populations in order to identify entry points for designing and implementing interventions that contribute to improve their well-being.

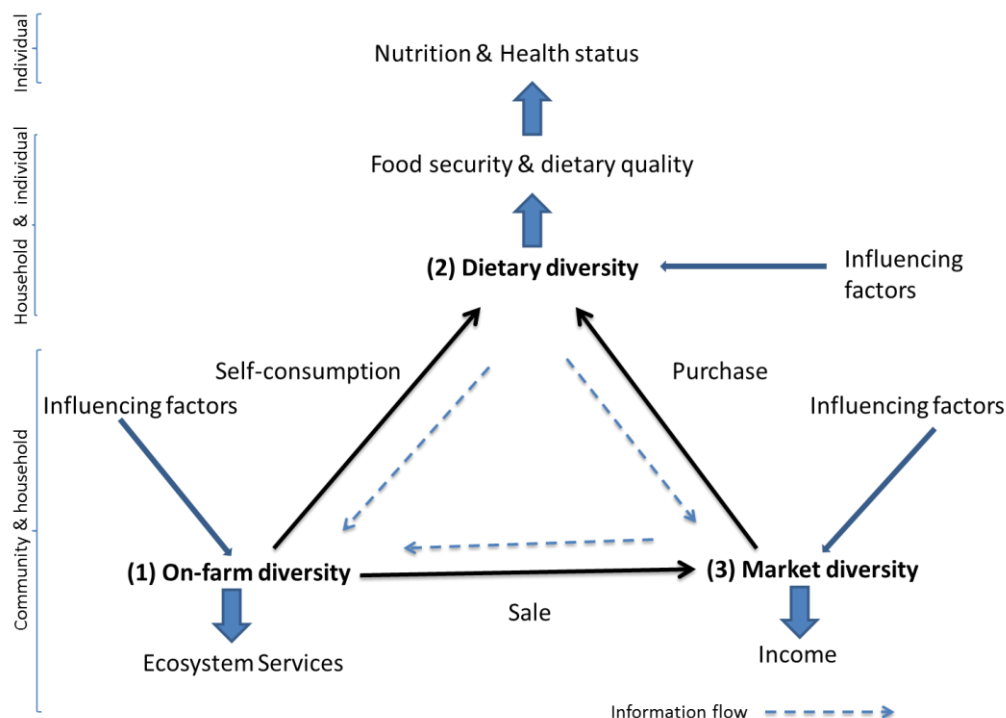
This document provides a background and an overview of the data that have been collected during the implementation of the ABD Assessments carried out in Ghana, India, Malawi, Mali and Niger. It offers the conceptual framework that guided its design, the context in which the Assessments were carried out, and a short description of the protocols and methods used, as well as a link to the documents and datasets.

Conceptual Framework

ABD, both within and among species, has been and continues to be the basis of the food supply and nutrition, and an important source of income for the rural poor in marginal areas. It can play multiple roles in their lives and livelihoods, addressing different needs and constraints, such as: (a) providing a variety of foods directly through self-production or by purchases from the market, and thus contributing to diverse diets and household food security; (b) providing opportunities to generate income by participating in markets through the sale of different products; (c) allowing land to be farmed in diverse environments; (d) coping with production and market risks; (d) avoiding or minimizing labor bottlenecks; and (e) fitting different budget constraints and seasonality. Most of the key roles played by ABD for the rural poor can be conceptualized as a set of relationships among three dimensions of diversity¹: (1) the diversity of plant and animals species present on farm (including semi-domesticated species in home gardens and species collected from the wild), (2) the diversity of foods consumed in diets (included both local and exotic products, locally produced or imported, processed and industrialized); and (3) the diversity of plants and animal species and foods sold and purchased by households in markets. Figure 1 depicts these relationships, showing physical flows connecting these three dimensions (black arrows), e.g. (1) and (2) through self-consumption, (1) and (3) through sale and (2) and (3) through purchase. These flows span three different scales from the community to the household and to the individual. There are also information flows (dash arrows) that create feedback loops (e.g. through demand, supply, prices, preferences, knowledge and tradition) across time and scales. Associated with each type of diversity, communities, households or individuals generate outcomes that are important for them and for society, such as food security and dietary quality, income, and ecosystem services. Each of these types of diversity is influenced by sets of exogenous factors, e.g. population density, links to different types of markets, availability of infrastructure, climatic variability, land quality and heterogeneity, land tenure, gender relationships, ethnicity, etc., within particular environmental, institutional and historic contexts. Some of these factors may influence all three dimensions of diversity, while others may be specific to a subset. The idea of the assessment is to generate information and data that characterize these three dimensions of ABD, the elements and relationships involved and the exogenous factors that influence them as the basis for analyzing the roles of ABD in the lives and livelihoods of rural populations and identifying entry points for designing and implementing interventions that contribute to improve their well-being.

¹ An explanation of this framework and an example of its application can be found in Bellon, M.R., Ntandou-Bouzitou, G. and Caracciolo, F. 2016. On-farm diversity and market participation are positively associated with dietary diversity of rural mothers in southern Benin, West Africa. PLoS ONE 11(9): e0162535 doi:10.1371/journal.pone.0162535

Figure 1. Conceptual model of the relationships among three dimensions of ABD



Source: Bellon, M.R., Ntandou-Bouzitou, G. and Caracciolo, F. 2016. On-farm diversity and market participation are positively associated with dietary diversity of rural mothers in southern Benin, West Africa. PLoS ONE 11(9): e0162535 doi:10.1371. <http://dx.doi.org/10.1371/journal.pone.0162535>

The Context

The ABD Assessment was implemented in the context of the Dryland Agricultural Production Systems CRP². This CRP targets improving the livelihoods of people in: (1) Marginal areas, with high vulnerability and low production potential, and (2) Higher production potential areas, and with scope for the sustainable intensification. Its goal is to identify and develop resilient, diversified and more productive combinations of crop, livestock, rangeland, aquatic and agroforestry systems that increase productivity, reduce hunger and malnutrition, and improve quality of life among the rural poor. The CRP has worked in five target regions: (1) West Africa Sahel and the Dry Savannas; (2) East and Southern Africa; (3) North Africa and West Asia; (4) Central Asia and the Caucasus and (5) South Asia. Within each of these regions specific Action Sites, i.e. specific locations—

² Information on the Dryland Production Systems CRP was taken from the document “CGIAR Research Program on Dryland Production Systems - New research approaches to improve drylands agriculture” available at <http://drylandsystems.cgiar.org/sites/default/files/New%20research%20approaches%20to%20improve%20drylands%20agriculture.pdf>.

usually villages in transects reflecting varying conditions—were chosen by consensus between the partners in the CRP based on a thorough characterization of climate, soil, land use, land degradation, water resources, farming systems, poverty, market linkages and institutional support³. The ABD assessments were carried out in only three of the five target regions: West Africa Sahel and the Dry Savannas; East and Southern Africa; and South Asia. The specific locations where the Assessments took place were selected by regional teams of the CRPs, where other activities were implemented as well. Biodiversity worked closely in many of these sites with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Methodology

The ABD Assessment consists of two parts:

- (1) A series of focus group discussions (FGDs) to elicit the local knowledge about the agricultural and wild biodiversity present in the study areas in order to generate: (a) an inventory (list) of all useful plant, and animal species used by local communities for human food, animal feed, medicine, fuel, housing, farming tools, etc. and their local names; (b) an inventory of all foods consumed; (c) an inventory of species and products bought and sold in markets that people in the village attend.⁴ In most cases, FGDs were held separately for men and women in order to collect gender disaggregated data. Effort were made to have different social categories of people in the study areas be represented in the FGDs.
- (a) A household survey with a representative random sample of between 30 and 60 households per village between three and up to eight villages in the Action Site. In most of the villages, other activities by other participating centers in the CRP also took place, though additional villages were included as well. The household survey is composed of two sections applied to different member of the household: (a) one that elicits information on the ABD used by the household; (b) another that elicits information on foods consumed by specific members of the household. In addition the survey also elicited information on household socioeconomic characteristics, an assessment of their food security and simple indicators of risk preferences.

³ The research site characterizations are presented in greater detail in the Dryland Systems Inception Report, available at:
https://apps.icarda.org/wsInternet/wsInternet.aspx/DownloadFileToLocal?filePath=Dryland_Systems/Dryland_Systems_Proposal.pdf&fileName=Dryland_Systems_Proposal.pdf

⁴ Markets are understood here in the widest sense, as the places where households purchase and sell items, thus this can happen in their own villages or even house with itinerant traders, etc. It is not restricted to village markets or specific locations.

Table 1 presents an overview of the ABD assessments that were done. A more detailed description of the methods used is presented below.

Table 1. Overview of the ABD assessments carried out by Bioversity and partners 2012-2015

Country	Region	No. Villages ¹	No. Households	No. Focus Groups
India	Rajasthan	8	240	4
	Karnataka	3	150	-
	<i>subtotal</i>		<i>490</i>	<i>4</i>
Mali	Koutiala	3	180	6
	<i>subtotal</i>		<i>180</i>	<i>6</i>
Ghana	Wa	3	180	6
	<i>subtotal</i>		<i>180</i>	<i>6</i>
Malawi	Ntcheu	4 ²	340	26
	<i>subtotal</i>		<i>340</i>	<i>26</i>
Niger	Maradi	3	-	6
	<i>subtotal</i>			<i>6</i>
	Total	24	1090	48

¹Names and coordinates of the specific locations presented in Annex 1

²Refer to Extension Planning Areas (EPAs)

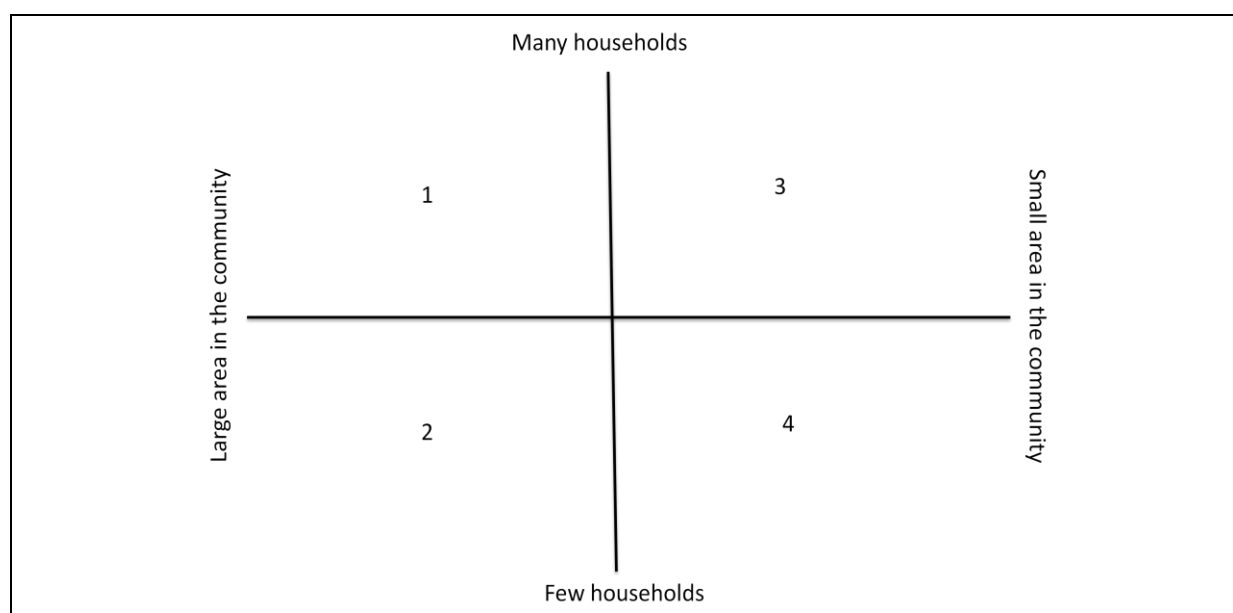
Focus Group Discussions

The FGD elicited information on (a) biological diversity in the production system – on the farm as well as harvested from forest and community land; (b) dietary diversity – consumed in house and also purchased from market; and (c) diversity of species and products sold and bought in markets. The FGD aims to capture the collective knowledge of the community, not of the specific participants in the group, as much diversity as possible, as well as gender differences. Two FGDs were usually organized in each site where the Assessment took place, one with males and another with females. There were between 10 and 16 participants in each group, who were selected with the help of local key informants to include a cross-section of individuals involved in agricultural production or at least collecting useful plants from

common lands and the wild, representing different levels of access to land (land owners, local land renters and migrant land renters), different ethnic groups present in the village and different age groups (special emphasis was placed to include younger farmers). Discussions were organized around a participatory methodology called the Four-Cell Analysis⁵. This methodology was originally developed for assessing the diversity of varieties within a crop, but here it was modified to assess the diversity among useful species, not just crops. The methodology is based on a free listing of useful species that participants are then asked to classify into one of four cells based on: (a) the number of households that grow or harvest the species and (b) its abundance in the community or landscape (e.g. area planted, number of trees, etc. depending on the type of species). The four cells are (see Figure 1):

- (1) Many households and large area in the community;
- (2) Few households and a large area in the community;
- (3) Many households and a small area in the community;
- (4) Few households and a small area in the community.

Figure 1. Diagram of the axes and resulting cells for the case of annual and biannual crops



The axes are modified according to the type of species being discussed or information on its marketing, e.g. the number of households that sell or purchase a species and how frequently

⁵ Sthapit B.R., P. Shrestha and M.P. Upadhyay (eds) 2006. Participatory Four-cell Analysis (FCA) for understanding local crop diversity on-farm management of agricultural biodiversity in Nepal: Good Practices. NARC/LI-BIRD/Bioversity International, Nepal, pp. 21-24.

they do. It should be emphasized that the meaning of “many” or “few” in one axis and of “large” or “small” area in the community in the other axis (or other categories used), are completely subjective and left ambiguous, trying to reflect the intuitive understanding that participants have about these categories. In the context used here, the Four-Cell Analysis method basically generates ordered lists of useful species that are cultivated or gathered and of products that are sold or purchased in specific locations. The order of the items in a list is based on a subjective assessment by a group of individuals of the abundance of the species or product along two dimensions: (a) the number of households, who cultivate/gather the species, sell or purchased the product; and (b) the area cultivated (ha) or number of individuals managed in the case of species (e.g. number of trees), or the frequency of sale or purchased in the case of a product. Thus any interpretation of these results should take this into account.

Specific details are provided in the particular protocols for each country. The FGD is organized around the following themes:

- Useful biological diversity in the production system, which is subdivided into:
 - Annual and biannual crop species;
 - Useful tree and shrub species in individual and common lands (perennial); These species include both cultivated (e.g. mango) and agro-forestry species. Many of these species are multi-purpose, e.g. providing fruits, leaves, wood, fodder, etc.;
 - Useful wild or semi-wild species used for food harvested from farms, forest areas or communal lands (annual or perennial);
 - Domesticated animals
 - Wild animals;
 - Fish or other aquatic species
- Market diversity, which is subdivided into:
 - Species sold;
 - Species and foods (e.g. salt, sugar, etc.) that are purchased.
- Dietary diversity
 - Parts of the species consumed (e.g. grains, flowers, leaves; rhizomes, etc.)
 - Cooking methods or methods of transformation used to prepare foods derived from that species;
 - Products are derived from the species through processing.

Household Survey

The household surveys were done with representative random samples of households in CRP Action Sites as explained above. Local authorities, heads of the participating households and women participating in the dietary section of the survey were informed of the purpose and procedures of the study. All participants explicitly agreed to participate in the study and were enrolled in the study on a voluntary basis. The survey consists of two sections applied to

different member of the household: (a) one that elicits information on the ABD used by the household; (b) another that elicits information on foods consumed by specific members of the household. In addition the survey also elicited information on household socioeconomic characteristics, an assessment of their food security and simple indicators of risk preferences.

The household survey aimed at identifying all species grown or harvested by a household in the two most recent crop production seasons (usually dry and wet seasons) relative to the date the survey took place, and for the same categories used in the FGD:

- Annual and biannual crop species (including those grown in home gardens);
- Useful tree and shrub species in individual and common lands (perennial);
These species include both cultivated (e.g. mango) and agro-forestry species. Many of these species are multi-purpose, e.g. providing fruits, leaves, wood, fodder, etc.;
- Useful wild or semi-wild species used for food harvested from farms, forest areas or communal lands (annual or perennial);
- Domesticated animals
- Wild animals;
- Fish or other aquatic species

For each species identified, the survey elicited information on: the objective for its production or collection (self-consumption, sale in the market, both); its different uses (food, medicine, animal feed, building material, processing, etc.); seasonality; the number of types, varieties and breeds recognized and used; key characteristics of its seed system (sources of seed, transactions and social relationships); and the water regime associated with its production (rainfed, irrigated, water harvest, etc.). Some of this information was not relevant for certain types of species (e.g. seed system for wild plant species, or for animals). The survey also collected household socioeconomic information that included: family size; land owned and cultivated; water resources; housing; ownership of consumer goods; sources of income; social networks; and participation in government and non-government programs. Specific information about the names of all the markets that the household attended in the previous fifteen days and for each market, the frequency of visits, means of transportation used, distance and travel time from the house, as well as whether the visit to the market was for purchasing or for selling by type of products (food, seed and planting material, other agricultural inputs, animals).

Qualitative 24 hour food recall⁶

There was a special section on diets that consisted in a qualitative 24h recall designed to collect information about all the different foods consumed during the day before the

⁶ This methodology was developed by Gervais D. Ntandou-Bouzitou, Gina Kennedy, and Celine Termote.

interview without measuring or estimating the quantities of the foods consumed. This questionnaire was applied to a woman and a child (if present) in the household being interviewed and selected as follows: (1) a mother in the household between 15-49 years old with a child aged between 6-59 months. If more than one member of the household has these characteristics then choose one randomly (see additional instructions for the dietary diversity section below). (2) If no mother in the household has a child of that age, choose a mother within the age group 15-49 years. If none is available, chose the woman who customarily prepares the food in the household irrespective of age. All foods consumed were recorded, as well as their ingredients and how they were obtained (self-produced, purchased, gifts, barter, food aid). In addition if a child was present, information on young and child feeding practices was also elicited. In addition the mother was asked about the household food security using the Household Food Insecurity Access Scale,⁷ as well as two questions on her risk attitudes.

Description of files with the protocols and data

The information available is organized in series of files (Word and Excel) that present the protocols that guided the implementation of the ABD Assessment in the field, as well as the resulting data. The files start with the name of the country, or state in the case of India, where the specific sections of the Assessment took place, follow by the type of information it contains.

Generic name of the file	Description
Country_ABD_Protocol.docx	Word document that describes the protocols that were used for the focus group discussions and the household surveys. It is written in the future tense because this document provided the instructions to the people that implemented the tools
Country_DD_Protocol.docx	Word document that describes the protocols that were used for the qualitative 24 hour food recall
Country_HH_Survey_Questionnaire.docx	Word document that contains the ABD household questionnaire
Country_DD&FS_Questionnaire.docx	Word document that contains the questionnaire used for the qualitative 24 hour food recall, the Food Insecurity Access Scale variables, as well as the questions on risk

⁷ Coates, J., Swindale, A., Bilinsky, P. 2007. Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3). Washington, D.C.: Food and Nutrition Technical Assistance Project, Academy for Educational Development.

	attitudes
Country_FGD_Data.xlsx	Excel file that contains the data collected during the focus group discussions. Different types of data are contained in each sheet and all data are presented by gender
Country_HH_Survey_Data.xlsx	Excel file that contains the data collected in the ABD household survey. Different types of data are contained in each sheet
Country_DD&FS_Data.xlsx	Excel file that contains the data collected during the qualitative 24 hour recall and the Household Food Insecurity Access Scale (HFIAS) data, as well as the responses to the questions on risk attitudes

Links to the Documents and Datasets

Ghana

Type	Name of file	Link
Focus Group Discussions		
Protocol	Ghana_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/KI92MG
Data	Ghana_FGD_Data.xlsx	http://dx.doi.org/10.7910/DVN/DKAS4Z
Household Survey		
Protocol	Ghana_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/KI92MG
Questionnaire	Ghana_HH_Survey_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/IXSOMM
Data	Ghana_HH_Survey_Data.xlsx	http://dx.doi.org/10.7910/DVN/IXSOMM
Qualitative 24-h food recall and HFIAS		
Protocol	Ghana_DD_Protocol.docx	http://dx.doi.org/10.7910/DVN/XWSNX8
Questionnaire	Ghana_DD&FS_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/XWSNX8
Data	Ghana_DD&FS_Data.xlsx	http://dx.doi.org/10.7910/DVN/XWSNX8

India-Karnataka

Type	Name of file	Link
Household Survey		
Protocol	Karnataka_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/JDC7QW
Questionnaire	Karnataka_HH_Survey_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/OZWE7N
Data	Karnataka_HH_Survey_Data.xlsx	http://dx.doi.org/10.7910/DVN/OZWE7N
Qualitative 24-h food recall and HFIAS		
Questionnaire	Karnataka_DD&FS_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/RLMYMR

Data	Karnataka_DD&FS_Data.xlsx	http://dx.doi.org/10.7910/DVN/RLMYMR
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India-Rajasthan

Type	Name of file	Link
Focus Group Discussions		
Protocol	Rajasthan_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/VGU2DW
Data	Rajasthan_FGD_Data.xlsx	http://dx.doi.org/10.7910/DVN/G6VP2L
Household Survey		
Protocol	Rajasthan_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/VGU2DW
Questionnaire	Rajasthan_HH_Survey_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/JDUSDR
Data	Rajasthan_HH_Survey_Data.xlsx	http://dx.doi.org/10.7910/DVN/JDUSDR
Qualitative 24-h food recall and HFIAS		
Questionnaire	Rajasthan_DD&FS_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/VGU2DW
Data	Rajasthan_DD&FS_Data.xlsx	http://dx.doi.org/10.7910/DVN/VGU2DW

Malawi

Type	Name of file	Link
Focus Group Discussions		
Protocol	Malawi_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/NDALXF
Data	Malawi_FGD_Data.xlsx	http://dx.doi.org/10.7910/DVN/SOHK1P
Household Survey		
Protocol	Malawi_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/NDALXF
Questionnaire	Malawi_HH_Survey_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/NDALXF
Data	Malawi_HH_Survey_Data.xlsx	http://dx.doi.org/10.7910/DVN/NDALXF

Qualitative 24-h food recall and HFIAS		
Questionnaire	Malawi_DD&FS_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/9GFLHO
Data	Malawi_DD&FS_Data.xlsx	http://dx.doi.org/10.7910/DVN/9GFLHO

Mali

Type	Name of file	Link
Focus Group Discussions		
Protocol	Mali_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/3QIG77
Data	Mali_FGD_Data.xlsx	http://dx.doi.org/10.7910/DVN/5SZUZA
Household Survey		
Protocol	Mali_ABD_Protocol.docx	http://dx.doi.org/10.7910/DVN/3QIG77
Questionnaire	Mali_HH_Survey_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/NEF7ZD
Data	Mali_HH_Survey_Data.xlsx	http://dx.doi.org/10.7910/DVN/NEF7ZD
Qualitative 24-h food recall and HFIAS		
Protocol	Mali_DD_Protocol.docx	http://dx.doi.org/10.7910/DVN/2DT22T
Questionnaire	Mali_DD&FS_Questionnaire.docx	http://dx.doi.org/10.7910/DVN/2DT22T
Data	Mali_DD&FS_Data.xlsx	http://dx.doi.org/10.7910/DVN/2DT22T

Niger

Type	Name of file	Link
Focus Group Discussions		
Protocol	Niger_FGD_Protocol.docx	http://dx.doi.org/10.7910/DVN/GTNSIL
Data	Niger_FGD_Data.xlsx	http://dx.doi.org/10.7910/DVN/GTNSIL

Annex 1. Coordinates of the locations where the ABD Assessments were carried out.

Village	Country	Admin unit	Lat	Lon
Bonpari	Ghana	Lawra	10.677032	-2.812473
Gbelinkaa	Ghana	Lawra	10.587412	-2.830384
Yagtuur	Ghana	Lawra	10.651602	-2.861302
Damodara	India	Rajasthan	26.900000	70.716667
Deda	India	Rajasthan	27.566667	70.716667
Dedhu	India	Rajasthan	27.333333	71.750000
Dhirasar	India	Rajasthan	25.450000	71.183333
Dhok	India	Rajasthan	25.483333	71.016667
Govindpura	India	Rajasthan	26.816667	73.083333
Mansagar	India	Rajasthan	26.750000	73.133333
Sankadiya	India	Rajasthan	27.483333	71.683333
Mannur	India	Karnataka, Bijapur	16.786000	76.115000
Nandyal	India	Karnataka, Bijapur	16.572586	75.501464
Balaganur	India	Karnataka, Bijapur	16.851000	76.337000
Fakoro	Mali	Sikasso	12.130740	-5.201560
Kani	Mali	Sikasso	12.150110	-5.108270
N'goutjina	Mali	Sikasso	12.179610	-5.283720
Champiti	Malawi	Netchu	-14.933333	34.750000
Ganya	Malawi	Netchu	-14.666667	34.833333
Kwataine	Malawi	Netchu	-14.833333	34.733333
Makwangwala	Malawi	Netchu	-14.916667	34.916667
Masasa	Malawi	Netchu	-14.466667	34.616667
Mpando	Malawi	Netchu	-16.350000	34.900000
Mphambala	Malawi	Netchu	-14.983333	34.733333
Phambala	Malawi	Netchu	-15.216667	34.666667
Tsikulamowa	Malawi	Netchu	-15.116667	34.866667
Milli	Niger	Aguié, Maradi	13.471656	7.878788
Gourjia	Niger	Aguié, Maradi	13.378331	8.009684
Dan-Saga	Niger	Aguié, Maradi	13.693036	7.737817

Geographic coordinate system: WGS 84 (World Geodetic System 84).

Latitude and Longitude are in decimal degrees.