A geospatial dataset of inland valleys in four zones in Benin, Sierra Leone and Mali

Justin F. Djagba a, Amadou M. Kouyaté b, Idriss Baggie c, Sander J. Zwart d,*

a Africa Rice Center (AfricaRice), Cotonou, Benin
b Centre Régional de la Recherche Agricole Sikasso, Institut d’Économie Rurale (IER), Sikasso, Mali
c Rokupr Agricultural Research Centre (RARC), Sierra Leone Agricultural Research Institute (SLARI), Rokupr, Sierra Leone
d International Water Management Institute (IWMI), Accra, Ghana

ARTICLE INFO
Article history:
Received 7 December 2018
Received in revised form 6 January 2019
Accepted 18 January 2019
Available online 22 January 2019

ABSTRACT
The dataset described in this data article represents four agricultural zones in West-Africa that are located in three countries: Benin, Mali and Sierra Leone. The dataset was created through a research collaboration between the Africa Rice Center (AfricaRice), Sierra Leone Agricultural Research Institute (SLARI) and the Institute for Rural Economy (IER). The dataset was compiled to investigate the potential for rice production in inland valleys of the three countries. The results of the investigation were published in Dossou-Yovo et al. (2017) and Djagba et al. (2018). The dataset describes the biophysical and socioeconomic conditions of 499 inland valleys in the four agricultural zones. In each inland valley data were collected through a focus group interview with a minimum of three farmers. In 499 interviews a total of 7496 farmers participated. The location of each inland valley was determined with handheld GPS devices. The geographic locations were used to extract additional parameters from digital maps on soils, elevation, population density, rainfall, flow accumulation, and distances to roads, market places, rice mills, chemical input stores, and settlements. The dataset contains 65 parameters in four themes (location, biophysical characteristics, socioeconomic characteristics, and inland valley land development and use). The GPS
coordinates indicate the location of an inland valley, but they do not lead to the location of individual fields of farmers that were interviewed. The dataset is publicly shared as Supplementary data to this data article.

© 2019 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Specifications table

| Subject area                        | Agriculture, Geography, Sociology, Economics |
|-------------------------------------|---------------------------------------------|
| More specific subject area          | Africa, rural development, food security    |
| Type of data                        | Table (Excel format)                        |
| How data were acquired              | Face-to-face farmer groups interviews using a structured questionnaire; geographic locations obtained with handheld GPS devices; ancillary data extracted from maps using geographic coordinates |
| Data format                         | Raw,                                        |
| Experimental factors                | Data set was cleaned from duplications, data entry errors, incomplete responses, and wrongly GPS recorded coordinates |
| Experimental features               | Inland valleys in four zones were randomly selected. A group of minimally 3 farmers from the selected inland valley was interviewed. |
| Data source location                | Data are available for four regions (see also Fig. 1): 1. Mono and Couffo departments (Benin) 2. Ouémé River upper catchment (Benin) 3. Sikasso and Kadiolo circles (Mali) 4. Bo and Kenema districts (Sierra Leone) |
| Data accessibility                  | The latitude and longitude coordinates of each inland valley are included in the dataset. |
| Related research article            | Dataset is available with this article as Supplementary data |
|                                    | Djagba, JF, LO Sintondji, AM Kouyaté, I Baggie, G Agbahungba, SJ Zwart, 2018. Predictors determining the potential of inland valleys for rice production in West-Africa. Applied Geography 96, pp. 86–97. |

Value of the data

- A large multidisciplinary dataset comprising 499 inland valleys in three countries in West-Africa that cover location, biophysical characteristics, socioeconomic characteristics and inland valley exploitation.
- The dataset can be deployed to analyze the potential for agricultural development, to characterize diverse inland valley landscapes, to perform environment impact assessments, to classify land use from satellite imagery, etc.
- The dataset contributes to food security research and assessments in West-Africa and leads to further understanding of the diversity of agricultural systems and their potential to contribute to food production and income generation for the rural population.
- The dataset was deployed to assess the diversity and importance of inland valley agricultural systems to a regional scale in Sierra Leone [1].
- To expand regional coverage the data can be linked to similar surveys conducted in inland valleys in Niger state (Nigeria), entire Burkina Faso and southern Mali [3,4].
1. Data

The dataset contains biophysical and socioeconomic information on 499 inland valleys in four zones in Benin, Mali and Sierra Leone (see Fig. 1). The inland valleys are geolocated with latitude/longitude coordinates. The parameters (Table 2), grouped in four themes (Table 1), were obtained from farmers’ responses during focus group interviews conducted in each of the 499 inland valleys between 2013 and 2014. Additional parameters were extracted from digital maps using the location of the inland valleys. Table 2 outlines the variables collected, and their source whether from the interviews or secondary spatial data sources.

The dataset is provided in Microsoft Excel format and contains seven sheets. The first sheet (source) provides citation information and refers to this data article. The second sheet (variable explanation) outlines the variables. After that the sheet location provides the unique identifier of each surveyed inland valleys and the geographic coordinates expressed in longitude/latitude. The unique identifier can be linked to the variables stored in four sheets, one for each of the four zones, called Mali, Sierra Leone, Benin_Ouémé supérieur and Benin_Mono-Couffo (Fig. 1).

2. Experimental design, materials and methods

This section provides a summary of the steps taken to develop the geospatial dataset. [2] provides a full description of the methodology that was followed.

Data collection was implemented in two phases. In the first phase, 499 inland valleys were identified in four zones in Mali, Benin and Sierra Leone. These were 100, 149, 100 and 150 inland valleys in Mono and Couffo departments (Benin), Upper Ouémé catchment (Benin), Sikasso and

Fig. 1. Location of the four zones in West-Africa.
### Table 1
Themes, subject and total number of parameters in the inland valley dataset.

| Theme                              | Subjects                                                                 | # of parameters |
|------------------------------------|--------------------------------------------------------------------------|-----------------|
| 1. Location                        | Coordinates (Lat/Lon)                                                    | 1               |
| 2. Biophysical characteristics     | Shape, width, soil type, surface water, groundwater, drainage           | 24              |
| 3. Socioeconomic characteristics   | Farmers, ethnicity, farmer organization, markets, accessibility, land    | 21              |
| 4. IV development and use          | IV area, agriculture area, varieties, inputs, water supply, infrastructure| 19              |

### Table 2
Summary of the parameters included in the inland valley (IV) dataset.

| Subjects        | Variable | Description                                      | Unit          | Type            | Source                        |
|-----------------|----------|---------------------------------------------------|---------------|-----------------|-------------------------------|
| Hydrological data | Floodurf | Flooding duration in inland valley (IV) fringe    | Week          | Quantitative    | Field survey                  |
|                 | Floodurb | Flooding duration in IV bottom                    | Week          | Quantitative    | Field survey                  |
|                 | Flowacc  | Flow accumulation (maximum)                       | Index         | Quantitative    | DEM/STRM (30 m)              |
|                 | Watersou | Water flow source                                 | Qualitative   | Field survey    |                               |
|                 | Waterdur | Water flow duration                               | Qualitative   | Field survey    |                               |
|                 | Watflodur| Water flow duration if temporary                  | Qualitative   | Field survey    |                               |
|                 | wtablemb | Emerging water table IV bottom duration           | Month         | Quantitative    | Field survey                  |
|                 | wtablemf | Emerging water table IV fringe duration           | Month         | Quantitative    | Field survey                  |
|                 | Wtablshb | Shallow water table IV bottom duration            | Month         | Quantitative    | Field survey                  |
|                 | Wtablshf | Shallow water table IV fringe duration            | Month         | Quantitative    | Field survey                  |
|                 | Drainage | IV drainage                                       | Qualitative   | Field survey    |                               |
| Topographical and climatic data   | Shape    | Transversal entrenchment shape                    | Qualitative   | Field survey    |                               |
| Topographical and climatic data   | Elevation| Elevation (mean)                                  | Meter         | Quantitative    | DEM/STRM (30m)              |
| Topographical and climatic data   | Widthest | Estimated average width                           | Meter         | Quantitative    | Field survey                  |
| Topographical and climatic data   | Rainfall | Annual average rainfall                           | Millimeter    | Quantitative    | ARC2 for FEWS                  |
| Soil data                    | OC       | Soil organic carbon content                       | g kg\(^{-1}\)  | Quantitative    | AfSoilGrids250m               |
| Soil data                    | Ntot     | Total nitrogen                                    | g kg\(^{-1}\)  | Quantitative    | AfSoilGrids250m               |
| Soil data                    | Exchbas  | Exchangeable bases                                | Cmolc kg\(^{-1}\) | Quantitative    | AfSoilGrids250m               |
| Soil data                    | Sand     | Sand fraction at 30 cm depth                      | Percent       | Quantitative    | AfSoilGrids250m               |
| Soil data                    | Clay     | Clay fraction at 30 cm depth                      | Percent       | Quantitative    | AfSoilGrids250m               |
| Soil data                    | pH       | Soil pH in H\(_2\)O                               | Index         | Quantitative    | AfSoilGrids250m               |
| Soil data                    | Soilbot  | Soil IV bottom                                    | Qualitative   | Field survey    |                               |
| Soil data                    | Soilfring| Soil IV fringe                                    | Qualitative   | Field survey    |                               |
| Soil data                    | Soilupslop| Soil upper slope                                  | Qualitative   | Field survey    |                               |
| Socio-economic and accessibility environment | Pavedrd | Nearest distance from IV to paved road            | Meter         | Quantitative    | OSM & GoogleEarth             |
| Socio-economic and accessibility environment | Othroad | Nearest distance from IV to other road            | Meter         | Quantitative    | OSM & GoogleEarth             |
| Socio-economic and accessibility environment | DistRd  | Distance from IV to road                          | km            | Quantitative    | Field survey                  |
| Socio-economic and accessibility environment | Settlement| Nearest distance from IV to a settlement         | Meter         | Quantitative    | OSM & GoogleEarth             |
| Socio-economic and accessibility environment | Market  | Nearest distance from IV to a market place        | Meter         | Quantitative    | GPS location                  |
Table 2 (continued)

| Subjects | Variable | Description | Unit | Type | Source |
|----------|----------|-------------|------|------|--------|
|          | Ricemill | Nearest distance from IV to a rice mill | Meter | Quantitative | GPS location |
|          | Store    | Nearest distance from IV to a store of inputs | Meter | Quantitative | GPS location |
|          | IVmarket | Road type between IV and market | Qualitative | Field survey |
|          | Vilgmarket | Road type between village and market | Qualitative | Field survey |
|          | IVmarketdis | Distance between IV and Market | km | Quantitative | Field survey |
|          | Vilgmarketdis | Distance between village and market distance | km | Quantitative | Field survey |
|          | Popden | Population density | Person/km$^2$ | Quantitative | GPWV4$^a$ |
|          | Landowner | Land ownership | Qualitative | Field survey |
|          | Men | Number of male farmers in the IV | Person | Quantitative | Field survey |
|          | Women | Number of female farmers in the IV | Person | Quantitative | Field survey |
|          | Ethnig | Major ethnic groups | Qualitative | Field survey |
|          | Migranpred | Predominance of the migrants in the use of IV | Qualitative | Field survey |
|          | Landaccess | Access to land | Qualitative | Field survey |
|          | Access | Accessibility of the IV | Qualitative | Field survey |
|          | Seeds | Source of seeds | Qualitative | Field survey |
|          | Otherinput | Source of other inputs | Qualitative | Field survey |

Farm management practices data

|          | Othcrop | Other crops cultivated in IV | Qualitative | Field survey |
|          | Vegetable | Vegetable cultivation in IV | Qualitative | Field survey |
|          | IVarea | Total area of the IV | Hectare | Quantitative | GPS data/GoogleEarth |
|          | Exploitation | Mode of exploitation | Qualitative | Field survey |
|          | Objective | Production objective | Qualitative | Field survey |
|          | Agrisupport | Presence of agricultural support structure | Qualitative | Field survey |
|          | Ivorganizat | Existence of IV farmers’ organization | Qualitative | Field survey |
|          | Organizatyp | If yes, type of organization and if no, none | Qualitative | Field survey |
|          | Dvlopd | IV development status | Qualitative | Field survey |
|          | Soilmgnt | Soil fertility management | Qualitative | Field survey |
|          | Watersupply | Water supply | Qualitative | Field survey |
|          | Irrigation | Irrigation water resource | Qualitative | Field survey |
|          | Fields | Field development | Qualitative | Field survey |
|          | Drainagpr | Drainage practices | Qualitative | Field survey |
|          | Irrigationpr | Irrigation practices | Qualitative | Field survey |
|          | Rsvegarea | Wet season vegetable cultivation area | Hectare | Quantitative | Field survey |
|          | Dsvegarea | Dry season vegetable cultivation area | Hectare | Quantitative | Field survey |
|          | Rsocroarea | Wet season other crops cultivation area | Hectare | Quantitative | Field survey |
|          | Dsocroarea | Dry season other crops cultivation area | Hectare | Quantitative | Field survey |

---

$^a$ Digital Elevation Model/Worldwide High-resolution Shuttle Radar Topography Mission (SRTM 30 m), URL: http://srtm.csi.org. Data derivation were done in ArcGIS.

$^b$ African Rainfall Climatology Version 2 for Famine Early Warning Systems available at ftp.cpc.ncep.noaa.gov/fews/fewsdata/africa/arc2.

$^c$ Soil properties of African at 250 m, Soil Grids available at www.isric.org/data/AfSoilGrids250m.

$^d$ Open Street Map or digitizing from Google Earth. Layers derivation were done in ArcGIS.

$^e$ Gridded Population of the World (GPW) Version 4 in 2015, Center for International Earth Science Information Network (CIESIN).
Kadiolo districts (Mali) and Bo and Kenema districts (Sierra Leone), respectively. These sites were visited by teams of trained surveyors equipped with a questionnaire and a GPS. Focus group interviews with at least three farmers operating in the inland valley were held and their responses were recorded. Focus groups existed of maximum 7496 farmers and on average 15 farmers participated in the focus group interviews. With the use of handheld GPS devices, the coordinates of the inland valleys were obtained.

In a second phase, the locations of the inland valleys were imported into a Geographic Information System and their quality was checked. Spatial information available in the public domain were downloaded and imported in a GIS. These included maps of soil parameters, topology, rainfall, settlements, roads, population density, etc. Information for each inland valley was extracted using the location information of the sites and the values were added to the dataset of questionnaire responses and observations.

Table 2 provides an overview of the 65 parameters in the dataset and their source (whether from the field surveys or public domain sources).

Acknowledgements

The data collection was supported by the European Commission through the International Fund for Agricultural Development (IFAD) [grant number C-ECG-65-WARDA]; and the Global Rice Science Partnership (GRiSP). The authors are grateful to the many agents of Sierra Leone Agricultural Research Institute, Institut d’Économie Rurale of Mali, and Ministry of Agriculture of Benin for conducting field data collection.

Transparency document. Supporting information

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.103699.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.103699.

Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.103699. This contains a kmz-file that can be used to display the locations of the 499 surveyed inland valleys in Google Earth.

References

[1] E.R. Dossou-Yovo, I. Baggie, J.F. Djagba, S.J. Zwart, Diversity of inland valleys and opportunities for agricultural development in Sierra Leone, PLoS ONE 12 (6) (2017) e0180059. https://doi.org/10.1371/journal.pone.0180059.
[2] J.F. Djagba, L.O. Sintondji, A.M. Kouyaté, I. Baggie, G. Agbahungba, S.J. Zwart, Predictors determining the potential of inland valleys for rice production in West-Africa, Appl. Geogr. 96 (2018) 86–97. https://doi.org/10.1016/j.apgeog.2018.05.003.
[3] E.R. Dossou-Yovo, S.J. Zwart, A. Kouyaté, T. Sawadogo, I. Ouédraogo, O.S. Bakare, A geospatial database of drought occurrence in inland valleys in Mali, Burkina Faso and Nigeria, Data Brief 19 (2018) 2008–2014. https://doi.org/10.1016/j.dib.2018.06.105.
[4] E.R. Dossou-Yovo, S.J. Zwart, A. Kouyaté, T. Sawadogo, I. Ouédraogo, O.S. Bakare. Predictors of drought in inland valley landscapes and enabling factors for rice farmers’ mitigation measures in the Sahel zone, Sustainability 11 (2019) 79. https://doi.org/10.3390/su11010079.