A geospatial database of drought occurrence in inland valleys in Mali, Burkina Faso and Nigeria

Elliott R. Dossou-Yovo, Amadou M. Kouyaté, Tasséré Sawadogo, Ibrahima Ouédraogo, Oladele S. Bakare, Sander J. Zwart

African Rice Center (AfricaRice), BFJ BFJ613609
Institut d’Economie Rurale (IER), Sikasso, Mali
Ministère de l’Agriculture et de la Sécurité Alimentaire (MASA), Ouagadougou, Burkina Faso
Institut de l’Environnement et Recherches Agricoles (INERA), Bobo Dioulasso, Burkina Faso
National Cereals Research Institute (NCRI), Bida, Niger State, Nigeria
Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Netherlands

ARTICLE INFO

Article history:
Received 27 April 2018
Received in revised form 18 June 2018
Accepted 27 June 2018
Available online 30 June 2018

Keywords:
Drought
Inland valleys
Rice
Africa

ABSTRACT

The data described in this article are related to drought occurrence in inland valleys and farmers adaptation strategies. The data were collected in 300 inland valleys distributed in 14 regions of West Africa. The data were collected in two phases. In the first phase, 300 inland valleys were identified in 14 regions and their locations were determined with handheld GPS devices. Questionnaires and informal interviews were administered to inland valleys users to collect data on physical and socio-economic characteristics, hydrology, farmers experience with drought affecting rice production in inland valleys and adaptation strategies. In the second phase, the locations of the inland valleys were imported in a GIS environment and were used to extract additional parameters on soil characteristics and water demand from the Shuttle Radar Topography Mission (SRTM), Africa Soil Information Service (africasoils.net) and POWER database (http://...
power.larc.nasa.gov). In total, the dataset contains 41 variables divided into seven themes: farmers’ experience with drought, adaptive management of rice farmers to drought, physical characteristics, hydrology, management practices, socio-economic characteristics and weather data of inland valleys.

© 2018 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                      | Environmental Sciences, Social Sciences |
|----------------------------------|----------------------------------------|
| More specific subject area       | Climate, Food security, Agriculture    |
| Type of data                     | Table (Excel format)                    |
| How data were acquired           | Face-to-face farmer surveys using questionnaires and informal interviews, geographic locations obtained with handheld GPS devices, secondary data extracted from maps using geographic coordinates (polygon shape files). |
| Data format                      | Raw, cleaned                           |
| Experimental factors             | Not applicable                         |
| Experimental features            | Not applicable                         |
| Data source location             | The data were collected in 14 administrative zones in 3 countries, see also Fig. 1. Mali, 1 region: 1. Sikasso Nigeria, 2 states: 2. Niger state 3. Kaduna state Burkina Faso, 11 regions 4. Boucle du Mouhoun 5. Cascades 6. Centre 7. Centre Est 8. Centre Nord 9. Centre Ouest 10. Centre Sud 11. Est 12. Hauts Bassins 13. Plateau Central 14. Sud-Ouest (Burkina Faso) The geographic coordinates of each inland valley are included in the data base. |
| Data accessibility               | Data are provided with this article     |
Value of the data

- Large multidisciplinary dataset comprising 300 inland valleys in 14 regions distributed in 3 countries in West-Africa, covering location, physical characteristics, socioeconomic characteristics, hydrology, weather data, farmers management practices, farmers experience with drought affecting rice production in inland valleys and adaptation strategies.
- The dataset can be deployed to assess the impacts of drought on rice production, to classify farmers management approaches to mitigate drought in inland valleys, to characterize the diversity of inland valleys based on biophysical and socio-economic characteristics, to analyze suitability of inland valleys for rice-based production systems, etc.
- The data can be linked to similar surveys conducted in Benin, Liberia and Sierra Leone [1–3] to analyze the determinants of farmers decision-making with respect to agricultural use of inland valleys in West Africa.
- The dataset contributes to spatial assessment of agricultural drought and to food security research in West Africa.

1. Data

Inland valley ecosystems are estimated to cover 190 Mha in Africa. Inland valleys are defined as the upper parts of river drainage systems, comprising the whole upland lowland continuum, from the rainfed uplands (pluvial) to rainfed, flooded and intensified lowlands in the valley bottom (fluxial), with the hydromorphic fringes (phreatic) as the (sloping) transition zone between them [4]. Given the high agricultural production potential, inland valleys provide opportunities to improve food and

![Fig. 1. Location of the study area in West Africa.](image-url)
Table 1
Summary of the variables included in the inland valley database grouped by theme.

| Variables | Scale type | Scale class | Source of data |
|-----------|------------|-------------|----------------|
| **Theme 1: Farmers’ experience with drought in the last 10 years** | | | |
| Occurrence of drought | Nominal | Yes, no | Survey |
| Frequency of drought events | Ordinal | Every year, every 2 or 3 years, every 4 or 5 years, more than every 5 years, never | Survey |
| Frequency of entire rice harvest loss | Ordinal | All years, in 1 to 2 years, in 3 to 6 years, in 7 to 9 years, never | Survey |
| Frequency of rice yield reduction | Ordinal | All years, in 1 to 2 years, in 3 to 6 years, in 7 to 9 years, never | Survey |
| **Theme 2: Adaptive management of rice farmers to drought** | | | |
| Use of drought resistant varieties | Nominal | Yes, no | Survey |
| Change in cultivation areas | Nominal | Yes, no | Survey |
| Investment in irrigation facilities | Nominal | Yes, no | Survey |
| Change in cropping seasons | Nominal | Yes, no | Survey |
| Others | Nominal | Bund, bund + compost + mulching, bund + early sowing, bund + early sowing + organic fertilizer, bund + organic manure, bund + organic manure + early sowing, bund + organic manure + irrigation, dry sowing + organic manure, early sowing, irrigation, irrigation + contour tillage, none, off-season cropping + irrigation, organic manure, tillage + organic manure, tree plantation, water conservation measures | Survey |
| **Theme 3: Physical characteristics** | | | |
| Inland valley size (ha) | Numeric | – | Digital elevation map |
| Average width (m) | Numeric | – | Digital elevation map |
| Cross-sectional shape | Nominal | Convex, concave, flat | Survey |
| Particle size distribution (%) | Numeric | – | AFIS \(^a\) |
| Soil organic carbon (%) | Numeric | – | AFIS |
| **Theme 4: Hydrology** | | | |
| Water source | Nominal | Spring, river, other | Survey |
| Flooding regime | Ordinal | Sporadic, seasonal, permanent | Survey |
| Duration of flooding (week) | Numeric | – | Survey |
| Duration of emerging water table (week) | Numeric | – | Survey |
| Duration of shallow water table (week) | Numeric | – | Survey |
| Drainage/irrigation infrastructure | Nominal | No drainage, canals for drainage and/or irrigation | SRTM \(^b\) |
| Flow accumulation | Numeric | – | SRTM |
| **Theme 5: Management practices** | | | |
| Rice varieties | Nominal | Only local, only improved, both local and improved | Survey |
| Soil fertility management | Nominal | No fertilizer, only mineral fertilizer, both mineral and organic fertilizers | Survey |
| Bunds | Nominal | No bunding, simple bunding, contour bunds | Survey |
| **Theme 6: Socio-economic characteristics** | | | |
| Distance to road and distance to market (km) | Numeric | – | Survey |
| Variables                                      | Scale type | Scale class                           | Source of data |
|-----------------------------------------------|------------|---------------------------------------|----------------|
| Quality of road to market                     | Nominal    | No road, path, dirt road, paved road  | Survey         |
| Land ownership                                | Nominal    | Individual, family, village, state    | Survey         |
| Origin of inland valley users                 | Nominal    | Native, migrant                       | Survey         |
| Percentage of women in the inland valleys    | Numeric    | –                                     | Survey         |
| (3)                                           | Nominal    | Individual, collective, both          | Survey         |
| Mode of exploitation                          | Ordinal    | In the village, at < 25 km, 25–50 km, 51–100 km, > 100 km | Survey |
| Source of seeds and other agricultural inputs | Nominal    | Yes, no                               | Survey         |
| Support from institution                      | Nominal    | Main activity, secondary major activity, marginal activity | Survey |
| Affiliation with farmers' organization        | Nominal    | Yes, no                               | Survey         |
| Role of rice farming in production system     | Nominal    | Main activity, secondary major activity, marginal activity | Survey |
| Theme 7: Weather data                         | Numeric    | –                                     | POWER database |
| Daily minimum temperature                     | Numeric    | –                                     | POWER database |
| Daily maximum temperature                     | Numeric    | –                                     | POWER database |
| Daily rainfall                                | Numeric    | –                                     | POWER database |

*a* Africa Soil Information Service (AfSIS)

*b* Shuttle Radar Topography Mission (SRTM), URL: [http://srtm.csi.org](http://srtm.csi.org)
nutrition security for smallholder farmer families in sub-Saharan Africa. Besides agricultural production, inland valleys provide local communities with forest, forage, hunting and fishing resources and recreational sites [1].

The database contains physical, hydrological, socioeconomic and weather data, as well as farmers experience of drought and adaptation strategies. The data were collected in 300 inland valleys distributed in 14 regions of three West African countries: Mali (98 inland valleys), Nigeria (106) and Burkina Faso (96) (see Fig. 1). The 14 regions are located in the Sudan-Sahel zone where average annual rainfall varies from 700 to 1300 mm. The inland valleys are geolocated with latitude/longitude coordinates. For each inland valley, 41 variables, grouped in seven themes (Table 1), were obtained from either farmers responses during community surveys in inland valleys conducted in 2013 or from digital maps using the location (polygon shape file) of the inland valleys. Table 1 provides a summary of the data base and the included variables.

The data base is in Microsoft Excel format and contains eight sheets. The first sheet (variable explanation) provides an explanation of the variables. The second sheet (location) provides the unique identifier of each surveyed inland valley and the geographic coordinates expressed in longitude/latitude. The unique identifier can be linked to the variables stored in three sheets, one for each of the three countries, called Mali, Nigeria and Burkina Faso. The sheets Mali-weather data, Nigeria-weather data and Burkina Faso-weather data provide daily rainfall and minimum and maximum air temperatures from 1995 to 2014 for each surveyed inland valley.

2. Experimental design, materials and methods

This section provides a summary of the approaches followed to develop the geospatial data base. We refer to Dossou-Yovo et al. [5] for a full description of the methodology that was followed. Data were collected in two phases. In the first phase, 300 inland valleys were identified in 14 regions distributed in three West African countries located in the Sudan-Sahel zone, viz. Burkina Faso, Mali and Nigeria. The location of each inland valley was determined with handheld GPS devices. Data on physical and socio-economic characteristics, hydrology, farmers experience with drought in rice-based production systems and adaptation strategies were collected from small groups of 5 to 20 farmers for each inland valley based on questionnaires and informal interviews. In the second phase, the geographic locations of the inland valleys were imported in a GIS environment and their quality was checked. Spatial information available in the public domain were downloaded and imported in GIS. These included soil parameters (particle size distribution and soil organic carbon), flow accumulation, daily rainfall and minimum and maximum air temperatures data. Digital elevation data from the Shuttle Radar Topography Mission (SRTM) at a spatial resolution of 30 m were used to derive flow accumulation. Maps of soil parameters in the first 30 cm of soil depth were obtained from the Africa Soil Information Service (AfSIS) project website (africasoils.net). Gridded daily rainfall and temperature data for the period 1995–2014 were obtained from the POWER database (http://power.larc.nasa.gov/). Table 2 provides an overview of the 41 variables in the data base and their source (whether from the field surveys or public domain sources).

Acknowledgements

The authors are grateful to field staff of the Institute of Rural Economy of Mali, the National Institute for the Environment and Agricultural Research of Burkina Faso and the National Crops Research Institute of Nigeria involved in the field surveys.
Funding sources

The data were collected in the framework of the project: ‘Improving rice productivity in lowland ecosystems of Burkina Faso, Mali and Nigeria through marker-assisted recurrent selection for drought tolerance and yield potential’ funded by the Global Challenge Programme (G7010.04.01).

Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.06.105.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.06.105.

References

[1] E.R. Dossou-Yovo, I. Baggio, J.F. Djagba, S.J. Zwart, Diversity of inland valleys and opportunities for agricultural development in Sierra Leone, PLoS One 12 (6) (2017) e0180059.
[2] J.F. Djagba, A.M. Kouyaté, I. Baggio, S.J. Zwart, A geospatial database of inland valley surveys in 4 zones in Benin, Sierra Leone and Liberia, Data Brief (2018) (In preparation).
[3] J.F. Djagba, L.O. Sintondji, A.M. Kouyaté, I. Baggio, G. Agbahungba, S.J. Zwart, Predictors determining the potential of inland valleys for rice production in West-Africa, Appl. Geogr. 96 (2018) 86–97.
[4] J. Rodenburg, S.J. Zwart, P. Kiepe, L.T. Narteh, W. Dogbe, M.C.S. Wopereis, Sustainable rice production in African inland valleys: seizing regional potentials through local approaches, Agr. Syst. 123 (2014) 1–11.
[5] 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 Sudan-Sahel Zone, Nat. Hazards (2018) (submitted for publication).