

Documentation of ILRI/JIRCAS/ICRISAT Fakara data sets

JIRCAS Commissioned Research

By Bruno Gerard, Pierre Sibiry Traore, Adamou Laouali, Binta Ndiaye, Dougbedji Fatondji
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1. Background

From the early 1990s, the Fakara region, located 60 km east of Niamey, has been a privileged area for a series of studies at the landscape scale. Earlier work has been initiated by an ILRI team lead by Pierre Hiernaux and Matthew Turner with the general objective of studying livestock mediated nutrient cycling in typical South-Saharan crop-livestock systems.

The approach followed by ILRI scientists was holistic and led to intensive data collection from 1994 to 2001. Characterisation performed over an area of 500 km² has been very detailed and included bio-physical and socio-economic data, some of them spatially explicit and encoded in a GIS.

In the early 2000's some ICRISAT scientists, willing to capitalize on the characterization work and research outcome of ILRI's research, implemented and monitored a series of on-farm demonstrations (2000-2002) in collaboration with FAO Project Intrans with the objectives of understanding better the response of pearl millet to improve fertility management (organic and inorganic) under a range of bio-physical and climatic conditions. Since then a network of more than 60 rain gauges have monitored the spatial and temporal distribution of rainfall, accompanied by an automated weather station recording important agro-climatic parameter on an hourly and daily basis. The demonstrations have been followed by a large multi-location three-year experiment aiming at understanding site-specificities and complex interaction between water and nutrients.

Aware of the benefit of having access to and capitalizing on a large spatial data set, several special research projects have, in the recent years, selected the Fakara as one of their benchmark research site (JIRCAS-ICRISAT collaborative project, ICRISAT DGDC, DMP, ICRISAT-Agrhymet Climate Change) and have contributed to the enrichment of the database.

In addition of the data collected by the three partners¹ (JIRCAS, ILRI, ICRISAT) several other actors were or are still involved in specific researches over the Fakara. Major secondary data sets belong to the IRD/CNES/CESBIO lead HAPEX-Sahel project (Hydrological and Atmospheric Pilot Experiment in the Sahel; see <http://www.ird.fr/hapex/>) that collected data between 1990-1992 and the on going AMMA project² African Monsoon Multidisciplinary Analysis; see <http://amma-international.org/>).

¹ In this context, we will call Primary Data, data directly collected by JIRCAS, ILRI or ICRISAT and Secondary Data, data collected by other institutions.

² ICRISAT has recently signed a Data Agreement with AMMA/IRD allowing access to several data sets and satellite images collected within the AMMA project.

The Fakara data base thus constituted a unique opportunity for further systems research and better understanding of complex processes and dynamics at the village and landscape scale. In addition, very good interaction with development bodies and farmer groups coupled with a good understanding of bio-physical and socio-economic environments permits rationale upscaling/outscaling exercises.

The Fakara Data collected by the institutions, vary in their attributes and formats and have been partially accumulated in the different databases. Therefore, JIRCAS, ICRISAT and ILRI desire to document the Fakara Data and integrate them into a metadatabase with contents in order to facilitate the exchange and effective utilization of the Fakara Data collected and stored by the three institutions. To achieve this JIRCAS has contracted ICRISAT for a commissioned research.

2. Objectives of the commissioned research

The objective of this commissioned research was to document Fakara Data collected in the Fakara area by ILRI, ICRISAT and JIRCAS, according to recognized standards with the use of the ArcCatalog software for spatial data and other appropriate tools.

3. Calendar of activities

3.1 Preparatory work

Preparatory work was initiated by early September to review/evaluate existing metadata tools/software and elaborate the program of a workshop.

3.2 Niamey workshop

The workshop was organized at the ICRISAT Sahelian Center from 20 to 25 September 2006. Twenty-two participants from ICRISAT, JIRCAS, Kyoto University, ILRI, INRAN, IRD, and AGRHYMET attended the sessions. It had the following specific objectives:

- Complete the inventory of bio-physical, socio-economic data sets (spatially explicit or not) collected over the Fakara region by the three institutions (JIRCAS, ICRISAT, ILRI)
- Refine guidelines for metadatabase creation and data sharing (procedure, tools, sharing rules)
- Share past on going research objectives protocols and results and future research plans for better integration of research of the three institutions and future data requirements
- Establish clear protocols between ICRISAT staff responsible for metadata encoding and data owners (scientists) to facilitate metadata collection/encoding during the period October-November 2006.

It was initially decided to use ArcCatalog as the main metadata encoding software. An alternate solution using another interface was identified and discussed during the Niamey workshop. M3Cat open-source metadata editor was evaluated and we decided to use it at the data entry interface for involved scientists. M3Cat was installed on the Sadoré LAN and is since available online on the ICRISAT website for secure access from all locations through the Internet (<http://icrisatsc.cgiar.org/m3cat/>).

This tool facilitated interactions between scientists/data holders and metadata encoders and paved the way for .XML metadata record posting on a GeoNetwork node

3.3 Metadata encoding

More than 90 datasets were identified as part of the exercise, and prioritized for metadata encoding (see table 1).

During the period October-December, encoding of metadata was performed jointly by the scientists and Laouali Amadou (contracted for the task).

The entire process has been summarized in a flowchart (Figure 1).

During the Bamako meeting in January 2007, final data encoding was performed and validation procedures were defined. Since all the metadata have been validated online on the USGS web site (<http://geo-nsdi.er.usgs.gov/validate.php>)

4. Products delivered at the end of the contracted research

The following products are delivered to JIRCAS at the end of the project period (mid-February 2007):

- The present report in an electronic form (pdf) sent as mail attachment to Dr. Satoshi Tobita (JIRCAS) and copied to Drs. Keiichi Hayashi, Ryoichi Matsunaga (JIRCAS), Saidou Koala, Dyno Keatinge, Steve Twomlow (ICRISAT)
- Four hard copies of the present report sent to Dr. Satoshi Tobita at the following address: JIRCAS Ohwashi, Tsukuba, 305-8686, Japan
- Four copies of a DVD, sent with the hard copies of the report to Dr. Satoshi Tobita, containing:
 - the metadata in MS Access format (M3Cat compatible format);
 - M3Cat installation file;
 - several datasets which were considered as public domain with no access/use restrictions;
 - Power presentations prepared for the Niamey;
 - Series of MS and PhD theses related to research work in the Fakara;
 - Various background documents on metadata.

5. What's next (future activities)

The end of this contracted research is far from being the end of our joint documentation efforts. JIRCAS financial support allowed an initial boost to the task but metadata as data in general are dynamic so continuous efforts are needed to upgrade and update them. This exercise being also very important for ICRISAT we update the product delivered to JIRCAS on a regular basis within the next year. For that matter ICRISAT has decided to extend the contract of Laouali Amadou until the end of December under DGDC/ICRISAT funds.

Because of the dynamic nature of metadata, we envisage continuing using M3Cat as an online tool to access, search, update and validate our metadata according to the

process developed (see flowchart) during this contracted research. However it is highly desirable to find an alternate host to Sadore server, JIRCAS or ICRISAT India being considered to host the database in the near future. The documentation of ICRISAT other datasets (outside of the Fakara) will also follow the same procedure.

Within the next few months, publication of the metadata and selected datasets on a geoportal will need require further consideration and should be done with the approval of the three institutions involved.

A follow-up report will be delivered to JIRCAS by the end of 2007.

6. ICRISAT human resources contribution

Bruno Gerard: Coordinator, supervision

Pierre Sibiry Traore: Technical backstopping, development/identification of appropriate tools, quality control.

Binta Ndiaye: Metadata expertise, quality control

Laouali Abdou: Contracted agent for metadata collect and encoding

Harou Rabe: IT support for on-line availability of M3Cat interface.

The coordination wish to thank all the JIRCAS scientists involved for their availability and their very positive and productive attitude during the first phase of this contracted research.

7. Access to the online Fakara metadata

Current version of the metadata can be access online in browsing mode only using M3Cat interface (see guide in Annexe 1) at the following web address:

<http://icrisatsc.cgiar.org/m3cat/>

With the following login:

Username : user

Password: user

Table 1. Datasets identified for documentation during the Niamey workshop

Dataset documented	Scientists custodian
1-Answers of individual interviewed farmers to selections of the questions 2-Answers of individual interviewed farmers to the questions about cropping pattern system 3-Answers of individual interviewed farmers to the questions about the reasons for cowpea cultivation 4-Narrative answers of individual interviewed farmers to the questions 5-On farm survey on the cowpea cultivation	Ryoichi Matsunaga (JIRCAS)
1- Actual situation of land use for Jerma household 2- Agricultural production and soil fertility status in differently managed farms in fakara 3- Estimation of nutrient removal through crop production of three villages in Fakara 4- Indigenous Knowledge description of sampling of Area 5- Quantity and quality of materials used for recycling system of three villages in Fakara 6- Questionnaire 7- Soil Color of Indigenous Knowledge Soil in Fakara 8- Soil Fertility (Corg TN brayP) of Indigenous Knowledge Soil 9- Effect of corralling on millet production 10- Optimal timing for the application of fertilizer and its optimal timing of application in corralling 11- Survey on corralling activities	Keiichi Hayashi (JIRCAS)
1- Household characteristics in fakara_expense 2- Household Characteristics in Fakara_identification 3- Household characteristics in fakara_income 4- Household characteristics in fakara_livestock 5- Household characteristics in fakara_number of persons	Tahirou Abdoulaye (JIRCAS)
1- Area_cropped by sedentary Fulani (HS) 2- Transhumance and corralling by sedentary Fulani 3- Monitoring grazing route by sedentary Fulnai	Hitoshi Shinjo (JIRCAS)
1-Household risk management in Fakara	Uru Tanaka (JIRCAS)
1- Daily rainfall measurements at landscape scale with a network of rain gauges in 2004 2- Daily rainfall measurements at landscape scale with a network of rain gauges in 2005 3- Daily rainfall measurements at landscape scale with a network of raingauges in 2000 4- Daily rainfall measurements at landscape scale with a network of raingauges in 2001 5- Daily rainfall measurements at landscape scale with a network of raingauges in 2002 6- Daily rainfall measurements at landscape scale with a network of raingauges in 2003 7- Layout of the multilocational multifactorial (genotype, mineral fertilizer, manure) experiment conducted in 2003, 2004, 2005 8- Position of neutron probe access tubes placed in 2003 in the fakara	Bruno Gérard ICRISAT

<p>multilocation experiment</p> <p>9- Land use cover in 2004 obtained from segmentation of spot 5 image</p> <p>10 – Satellite-image map of the Fakara A (Banizoumbou)</p> <p>11- Satellite-image map of the Fakara B (Tigo)</p> <p>12- Satellite-image map of the Fakara C (Baboussay)</p> <p>13- Satellite-image map of the Fakara D (Dantiandou)</p> <p>14- Satellite-image map of the Fakara E (Kodey)</p> <p>15- Pan-sharpened false color IR Landsat 7 image</p> <p>16- Pan-sharpened true color Landsat 7 image</p> <p>17- Multispectral Spot 5 Imagery of the Fakara taken on 28 September 2004 Level 1B Imagery .TIF</p>	
<ol style="list-style-type: none"> 1- Fakara Geomorphology map 2- Land use in the Fakara in the year 1950 3- Land use in the Fakara in the year 1965 4- Land use in the Fakara in the year 1975 5- Land use in the Fakara in the year 1992 6- Land use in the Fakara in the year 1994 7- Land use in the Fakara in the year 1995 8- Land use in the Fakara in the year 1996 	<p>Pierre Hiernaux (ILRI)</p> <p>Documented by Bruno Gerard</p>
<ol style="list-style-type: none"> 1- Katanga AWS weather data 2000 Daily Output 2- Katanga AWS weather data 2000 Hourly Output 3- Katanga AWS weather data 2001 Daily Output 4- Katanga AWS weather data 2001 Hourly Output 5- Katanga AWS weather data 2001 Rainfall 6- Katanga AWS weather data 2001 Wind Speed 7- Katanga AWS weather data 2002 Daily Output 8- Katanga AWS weather data 2002 Hourly Output 9- Katanga AWS weather data 2002 Rainfall 10- Katanga AWS weather data 2002 Wind Speed 11- Katanga AWS weather data 2003 Wind Speed 12- Katanga AWS weather data 2003 Rainfall 13- Katanga AWS weather data 2003 Hourly Output 14- Katanga AWS weather data 2003 Daily Output 15- Katanga AWS weather data 2004 Daily Output 16- Katanga AWS weather data 2004 Hourly Output 17- Katanga AWS weather data 2004 Rainfall 18- Katanga AWS weather data 2004 Wind Speed 19- Katanga AWS weather data 2005 Daily Output 20- Katanga AWS weather data 2005 Hourly Output 21- Katanga AWS weather data 2005 Rainfall 22- Katanga AWS weather data 2005 Wind Speed 	<p>Fatondji Dougbedji (ICRISAT)</p>
<p>1-Ethno-botanical_survey</p>	<p>Augustine Ayantunde (ILRI)</p>

Flowchart: procedure followed for Fakara metadatabase creation

scientist input
 no scientist input

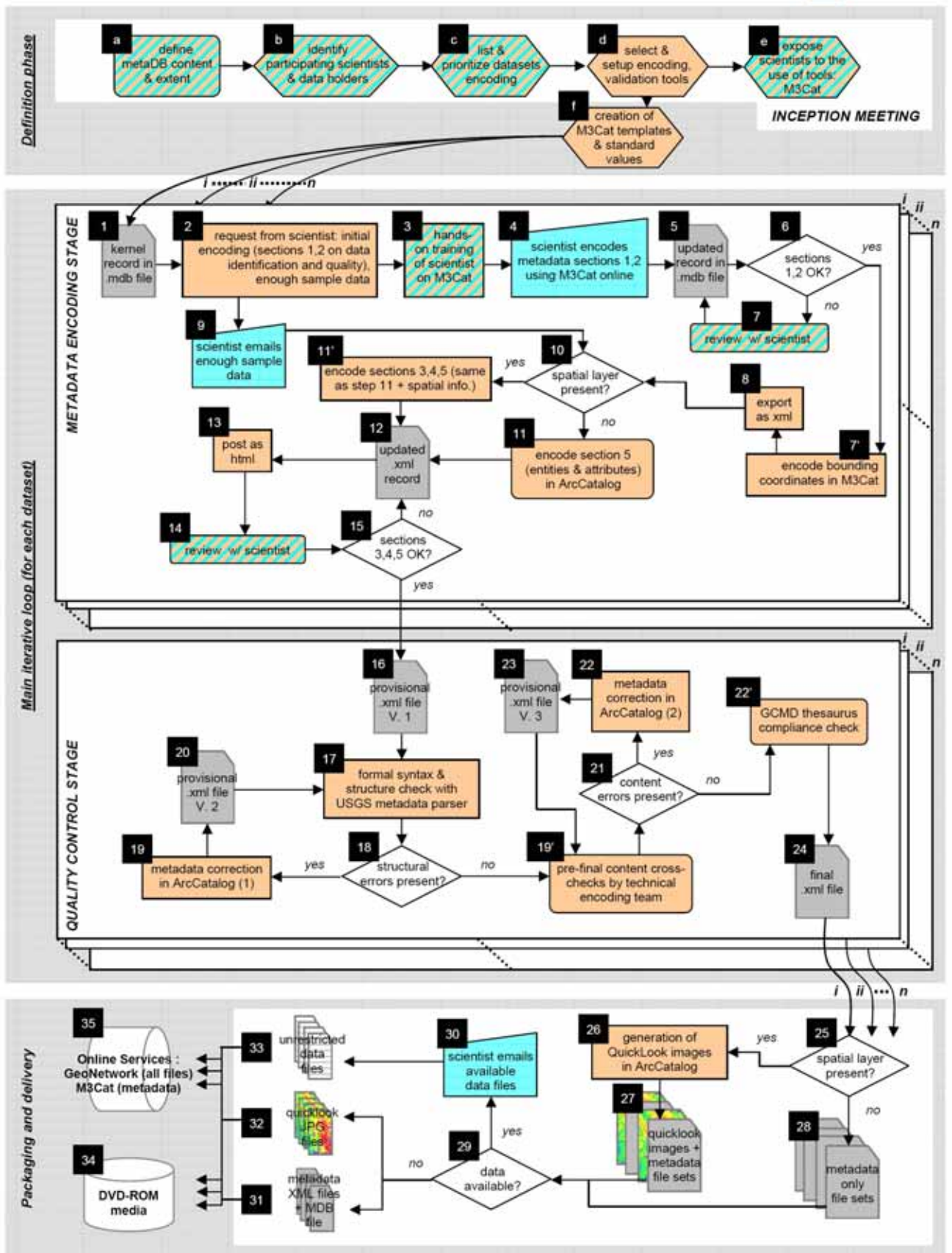


Figure 1: Fowchart for the documentation process of the Fakara database.

Flowchart legend

Definition phase

- a. In the Fakara metadatabase case, data included a variety of formats, sources, topics and disciplines. Metadata creation was not restricted to geospatial data and included references for datasets that were not georeferenced *a priori*. Geographical extent was bound by the limits of the Fakara region.
- b. c. See Table 1.
- d. Priority was given to encoding tools that helped simplify interactions with participating scientists (free, customizable, network-based) and met the wide-spread Content Standard for Digital Geospatial Metadata (CSDGM): M3Cat v. 1.5. For higher-level editing, ArcCatalog v. 9.0 was used. Links to other popular choices are at: http://www.csi.cgiar.org/metadata/Metadata_Tools.asp. With help from IT department, M3Cat was installed on the Sadoré local area network and made visible from the internet at: <http://icrisatssc.cgiar.org/M3Cat>. Appropriate security restrictions were applied for each of xx individual users.
- e. Participating scientists received initial exposure to the CSDGM metadata file structure during the introductory M3Cat software demonstration session.
- f. The creation of templates and standard values by the technical team allowed for automatic filling of repetitive metadata (e.g., data holder contact information) and masking out inappropriate levels of detail to facilitate inputs by scientists and accelerate metadata encoding.

Main iterative loop

1. The kernel record includes the title of the dataset (as provided during the inception meeting), and repetitive details such as scientific (data holder) and technical (metadata encoder) contact information.
2. Initial request sent by personal email.
3. The encoding technician visited Sadoré-based scientists in their offices to train them in the use of M3Cat online.
4. Using M3Cat online, individual scientists / data holders encoded CSDGM sections on...
5. Upon completion of scientist input, all M3Cat edits are stored in an online, password-protected Microsoft Access .MDB database containing individual metadata records.
7. Encoding technician visited the scientist to jointly review metadata sections 1,2 using M3Cat online tool.
- 7'. Bounding coordinates for the Fakara region, see a/ above.
14. Encoding technician visited the scientist to jointly review metadata sections 3,4,5 using M3Cat online tool.
17. A description of the USGS metadata parser, error reporting and online version are available at: <http://geology.usgs.gov/tools/metadata/tools/doc/mp.html>.
- 19'. This step involved individual verification of metadata record printouts for content discrepancies and errors.

Packaging and delivery

26. Color quicklook images were generated in ArcGIS9.0.