USING MOBILE PHONES, GPS, AND THE CLOUD TO DELIVER FASTER, CHEAPER AND MORE TRANSPARENT LAND TITLES: THE CASE OF BURKINA FASO

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Abstract

Burkina Faso passed a groundbreaking law "On Rural Land Tenure" in 2009. This law gave the country's rural people the right to receive a document -- a Rural Land Possession Certificate (APFR) -- that recognizes their customary land rights. The law also established a new system of rural land administration to validate and register these rights.

Unfortunately, very few people across the country have received APFRs since 2009. At the operational level, this is due to the fact that villages are remote, information is limited, and the traditional method of processing APFR requests required extensive funding and expertise.

In response, in 2016-2017 USAID supported a pilot project to test a mobile technology platform for mapping land plots and capturing all data needed to prepare APFRs. This platform, the Mobile Application to Secure Tenure (MAST), was configured to follow the processes set forth in the laws of Burkina Faso, and then tested in Boudry Commune. Villagers with basic skills used MAST to map and enter data on 2,638 land plots in a matter of weeks. The information was then transferred by internet to the various government offices for approval. This work was done faster than prior efforts, and with comparable accuracy.

Key Words: Africa; customary ownership; land registration; law; technology

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ABBREVIATIONS and SPECIFIC TERMS

APFR	*Attestation de Possession Foncière Rurale* – Rural Land Possession Certificate. Defined by the Law No. 034-2009 (Article 44) as an administrative act having the same legal force as a title.
CCFV	*Commission de Conciliation Foncière Villageoise* – Village Land Dispute Resolution Commission. Defined by Law No. 034-2009 (Article 96), which stipulates: "Attempts to reconcile rural land disputes shall be ensured by the local authorities usually responsible for the management of land disputes."
CFV	*Commission Foncière Villageoise* – Village Land Commission. Defined by Law No. 034-2009 (article 81), a CFV is a specialized sub-committee responsible for land issues at the village level.
DMI	Data Management Infrastructure. MAST Data Management Web Infrastructure.
EC2	Elastic Compute Cloud (Amazon EC2)
GeoServer	Open-source web server that allows serving maps and data from a variety of formats, web standards or client offices to advanced GIS programs
GoBF	Government of Burkina Faso
GPS / GNSS	Global Positioning System / Global Navigation Satellite System
Law No. 034-2009	Law No. 034-2009 / AN "On Rural Land Tenure," adopted on 16 June 2009 by the National Assembly of Burkina Faso, is part of the ongoing land reform process and falls in line with the content of the Rural Land Governance National Policy (PNSFMR).
MAST	Mobile Application to Secure Tenure. Mobile land-use security system developed by USAID and targeted to communities around the world that want to improve land tenure security for their citizens.
MCA-BF	Millennium Challenge Account - Burkina Faso
OGC	Open Geospatial Consortium
ONF-BF	*Observatoire National du Foncier au Burkina Faso* – National Land Observatory of Burkina Faso. Established in 2014 at the end of the MCA Compact project, designed to contribute to improving land governance

	through the production and dissemination of land information
PNSFMR	*Politique National de Sécurisation Foncière en Milieu Rural* – Rural Land Governance National Policy initiated in 2007 and strengthened since 2009 with support from the Millennium Challenge Account Compact project between 2009 and 2014.
PV	*PV de Constatation Contradictoire de Possession Foncière Rurale* – Report on Open Determination of Rural Land Possession (PV Report). This report is defined by Law No. 034-2009 as the document drafted by a public officer during the field assessment of the recognition of the customary right to a parcel given by all the owners and neighbors of this parcel.
Regional Cadastral Department	Decentralized General Directorate of Taxes in charge of managing the cadastre in a region (e.g. *Plateau Central*), and which reviews APFR applications.
SFR	*Service Foncier Rural* – Rural Land Service. Defined by Law No. 034-2009 (Article 77) as the commune-level department responsible for all the management and formalization activities of private land, the territorial collectivity's land and the state land within the commune.
GIS	Geographic Information System
USAID	United States Agency for International Development
WMS, WFS and WPS	Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS) standards of the Open Geospatial Consortium (OGC) to use any web mapping engine compatible trade or OGC Open Source as GeoServer.

I. INTRODUCTION

1. Initiation of land registration in rural Burkina Faso

First Implementation of Law No. 034/2009

On 16 June 2009, Law No. 034-2009/AN "On Rural Land Tenure". It is a normative translation of the reforms enshrined in the 2007 Rural Land Governance National Policy (PNSFMR). This law defines the legal and institutional framework for managing and accessing land in rural communes and villages attached to urban communes.

After promulgation of Law No. 034/2009, a project was implemented by the GoBF with financial and technical assistance from the Millennium Challenge Corporation (a U.S. government agency). This land governance project supported 47 pilot municipalities (communes) in the implementation of the Law in order to create Rural Land Services (SFR)[1] within each commune. At the end of the land governance project in Burkina Faso in July 2014, the State and its partners were to help the remaining 304 communes implement the law. Unfortunately, after a few months functioning on their own, the SFRs encountered several difficulties.

The law stipulates that SFRs should have a staff that includes a land agent, a communications agent and a topographer. After a few years of operation, the situation varies greatly from one commune to another and is marked by the following points:

- A lack of staff, with too many activities, given the number of villages to cover;
- An absence of topographer in most SFRs;
- The instability of SFR agents in general;
- Inadequate means of transport for SFR agents to villages;
- Not enough training for most SFR agents who needed more time to understand and master the technology, including the use of the GPS device and the GIS software;
- Inadequate and general lack of financial resources for operations, including the maintenance or replacement of equipment (about USD 10,000 for GIS software and GPS of sub-meter accuracy); and

[1] *Service Foncier Rural* – Rural Land Service. Defined by Law No. 034/2009 (section 77) as the communal department responsible for all the management and securitization activities of the private land, the territorial collectivity's land and the state land within the commune.

- The lack of means for the verification and slow processing of files by the decentralized technical services such as the regional cadastral departments.

Village Land Commissions (CFV) are responsible for initiating requests for Rural Land Possession Certificates (APFRs)[2]. CFV performance is limited by:

- The illiteracy of most members;
- The poor mobilization of members due to lack of motivation;
- The lack of transport;
- The lack of archiving of land formalization documents;
- The complexity of doing an initial sketch map of a land plot, followed up by a formal survey.

In addition to the difficulties associated with land management bodies, it has been observed that certain difficulties are inherent in the activities of establishing land rights in rural areas, such as:

- Inadequate financial resources to support the transportation of agents in the field;
- The mobilization of neighboring land possessors and members of the CFV and Village Land Dispute Resolution Commission (CCFV);
- Difficulties in preparing the Reports on Open Determination of Rural Land Possession (PV Report);
- The high cost of acquiring the equipment necessary for the delineation and registration of rural land (GPS, computers, geo-processing software and means of transport SFR agents, etc.); and
- Non-mastery of the use of GPS/GNSS.

[2] *Attestation de Possession Foncière Rurale* – Rural Land Possession Certificate. Defined by Law No. 034/2009 (Article 44) as an administrative act having the same legal force as the title of as envisaged by the texts reorganizing agrarian and land in Burkina Faso.

Fig 1: Training with the sub-meter accurate GPS in 2012

Table 1. Results of production of APFR from January 2013 to December 2016 in 47 communes

Situation of APFR	Men	Women	Total
Requests received	**13,266**	**2,098**	**15 364**
Number of PV Reports prepared			**3706**
APFRs delivered with the support of sponsors (foreign donors)		**1200**	**1965**
APFRs delivered by SFR agents without sponsors	**741**	**24**	

These results fell short of expectations. From January 2013 to December 2016 only 1,965 APFRs were issued out of 15,364 requests made by the people.

2. Need to use simpler and less expensive tools; the choice for MAST

To bring an innovative solution to these difficulties, the National Land Observatory of Burkina Faso (ONF-BF)[3] carried out a pilot project to test the "Mobile Application to Secure Tenure" (MAST) in the rural commune of Boudry. This rural commune had already processed 4,200 APFR applications but was only able to issue 163 APFRs between January 2013 and December 2016. MAST promised to reduce processing time, reduce associate costs, and automate geo-processing tasks, and by doing so freeing state agents from the complexity of mapping tools so they could focus on the legal aspect of the validation of land tenure.

MAST is a mobile application aiming at improving the governance of rural lands. Technically, it is a web-based Data Management Infrastructure (DMI). MAST is used to collect geo-spatial data, demographic data and land status information in the field. MAST then stores this information in a cloud database, and trained agents who must verify the collected information and validate the rights under the law can easily access the information. The MAST methodology uses citizens to collect data. The MAST tool, coupled with a program of sensitization and capacity building within the villages, was been successfully piloted in rural Tanzania to map and record rural land rights in 2014-2016.

With the assistance of USAID, starting in September 2016 the ONF-BF began the process of adapting MAST to the Burkinabè context in order to contribute to the improvement of land governance in rural communes and villages attached to urban communes in Burkina Faso.

On the legal level, the MAST application had to be configured to meet the requirements of Law No. 034-2009 together with its implementing decrees. This application of the law required a technical review of the tool. The work consisted of the restructuring of the MAST data model, the modification of the source codes of the mobile application and the server application from what was developed in Tanzania, withdrawals of the modules not adapted, and addition of the modules required for Burkina Faso. Finally, the implementation of special mechanisms was necessary to ensure the 3-meter accuracy of the spatial data capture in rural areas (use of external GPS coupled with a smart phone, and use of satellite images).
Now the technology captures and manages the data needed to map, establish and document land rights according to Law No. 034-2009. At the methodological level, MAST now allows CFV agents in villages to digitally collect the spatial and biographical data required for APFR applications; data that were collected by SFR agents under the former system established in 2012.

[3] The National Land Observatory of Burkina Faso is a non-commercial organization dedicated to monitoring implementation of land policy, finding solutions to implementation problems, and doing public dissemination of land information. The Observatory was established in 2014 at the end of the MCA Compact project.

3. Choice of the pilot commune

The MAST pilot sought to adapt the existing technology to the context of Burkina Faso in order to better guarantee rural land rights and improve land governance. Thus, the mission was to test the technology, then map and prepare 2,000 APFRs in a rural commune. For the choice of the study area, two candidate communes were considered: the rural commune of Bama in the *Hauts Bassins* region, and the rural commune of Boudry in the *Plateau Central* region. Both of these communes exhibited strong demand for APFRs. Boudry Commune was ultimately selected for the MAST pilot, with field implementation being executed by the CFV and CCFV agents in four villages (Ouayalgui V1, V2, V3 and V4), along with the SFR agent of the commune. The *Plateau Central* Regional Cadastral Department, located in the town of Ziniaré, was also called upon to give its opinion on the applications in order to avoid overlaps with existing titles.

Fig. 2: MAST pilot study area in the *Plateau Central* Region, Ganzourgou Province, Boudry Commune, Ouayalgui Villages V1, V2, V3 and V4

II. CONFIGURATION OF THE MAST SYSTEM IN THE CONTEXT OF LAW NO. 034/2009

1. Conceptualization of the APFR Issuance Process

The MAST reconfiguration phase was based on the MAST experience in Tanzania and standardized according to the Social Tenure Domain Model (STDM). In order to standardize it according to the Land Administration Domain Model (LADM) and the context of Burkina Faso, it was first necessary to document the entire APFR application and issuance procedure. This below diagram was the base of MAST configuration to the Burkinabè context:

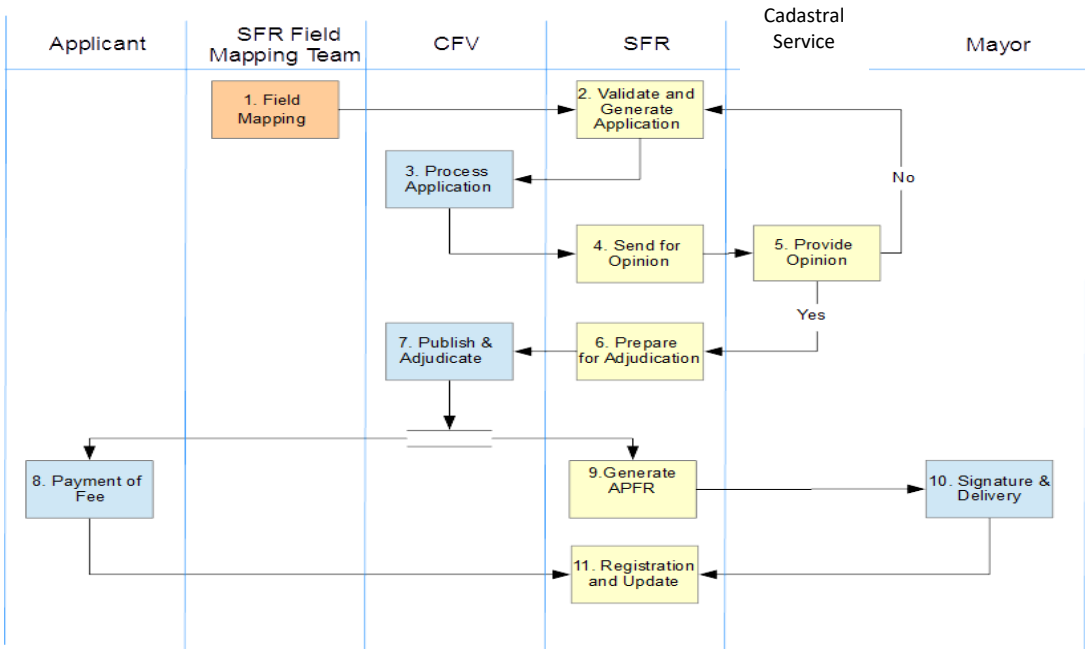


Fig. 3: The APFR registration process (MAST optimization)

In order to formalize his legal right to possess the land plot, the landowner must submit an application to the village government. For a family, the application must include authorization for the representative of the family to act on the family's behalf. The Village Land Commission then examines the application file and checks the accompanying documents. In principle, the CFV agent should draft a sketch map of the parcel which was very difficult and normally not done. If the application and file are in order, they are forwarded to the SFR office at the commune level. In principle, the SFR checks with the territorially competent technical services of the State to make sure that no other title has previously been established on the land subject to the application. If such a title is found to exist during the examination of the application file, the application is dismissed. But in reality, because there is no sketch map to locate the

parcel, the SFR officer and the topographer proceed to the PV Report and parcel mapping prior to sending any request to opinion to the technical services. This step is normally done after the 45 days of public notice.

If the application file is compliant, the CFV provided public notice of the application to the population. According to the law, this public notice period is forty-five (45) days from the posting date to collect any objections and possible claims. Once the forty-five (45) day period ends, the SFR, in consultation with the CFV and the customary authorities, calls a meeting of the applicant and his field neighbors to determine if there any objections to the application. In principle, the CFV then prepares a PV Report on a form provided by the commune that captures the results of the meeting. The PV Report is then transferred to the SFR. In reality, this step in realized by the SFR land officer and topographer before the 45 days as explained above. After formal checking of the file of application for registration of rural landholding and on the basis of the PV Report, the SFR land officer prepares: the request for payment to the applicant; and the APFR on behalf of the applicant for the signature of the mayor. The list of all those entitled to the family is attached as an annex to the APFR. The Mayor is required to sign the APFR within 30 days from the date of receipt.

This procedure has been optimized to save time by taking advantage of the database while still following the implementing decrees of Law No. 034/2009 (see Fig. 4). Documentation is maintained and a specification document has been written detailing the key points of the procedure and describing the data manipulated.

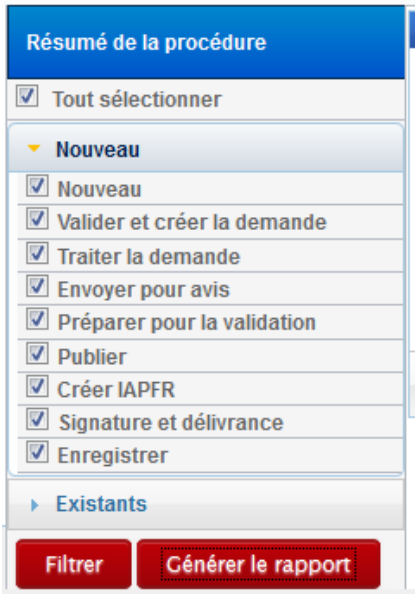
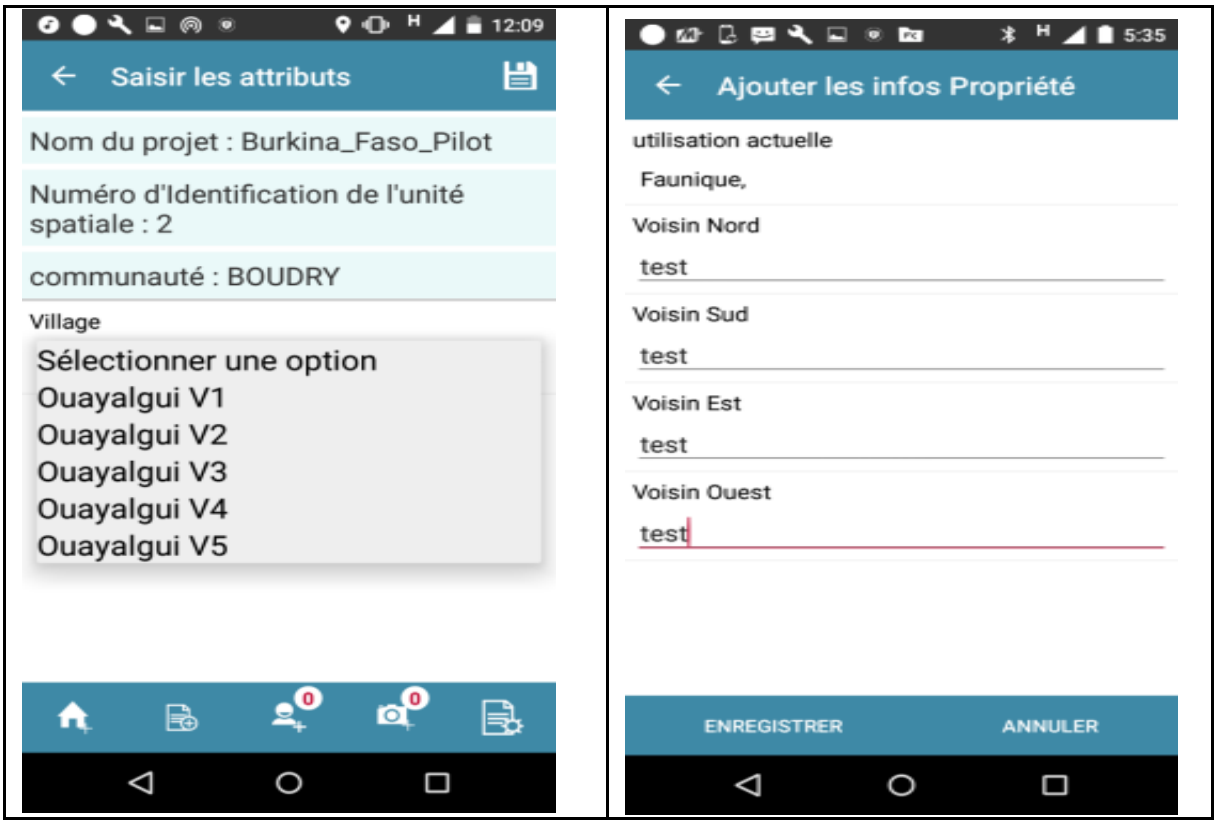


Fig. 4: APFR application, validation and delivery steps as configured in MAST

2. Development

RMSI, an information technology company based in India, developed the first MAST configuration in Tanzania. This company assisted the ONF-BF in understanding the MAST system and adapting it to the context of Burkina Faso. An important activity in the configuration was the translation of the software into French.

Fig. 5: Parcel mapping in the APFR procedure



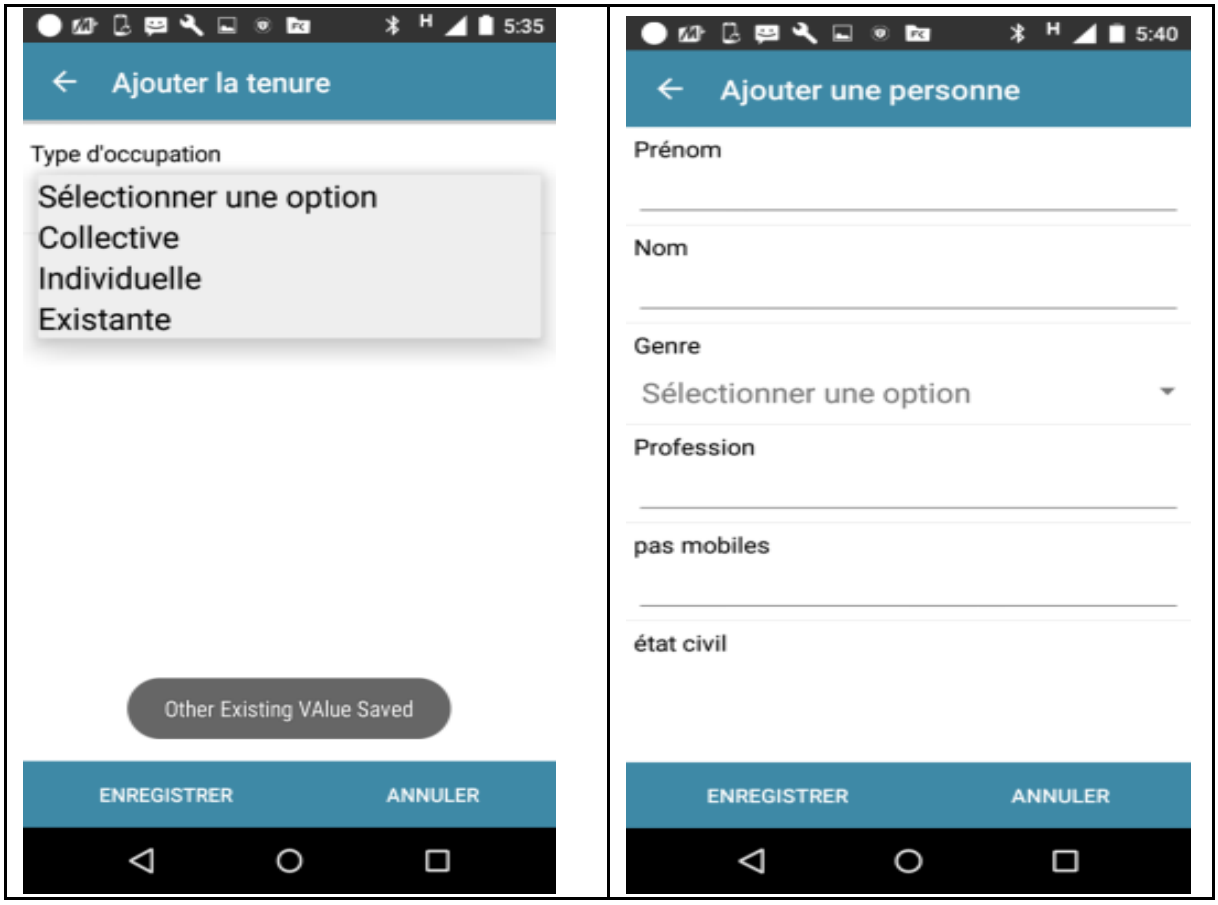


Fig. 6: MAST interface adapted in French to the context of Burkina Faso

The next step was development of the mobile application to load on the smart phone, and configuration of the DMI. The DMI takes advantage of the capabilities of cloud-computing technology. The SFR oversees and validates the land entitlement data captured by CFV and CCFV agents in the field. Mobile phones and Android tablets are used to capture data on land rights and data is stored on devices until there is enough 3G connection to synchronize the data with the DMI. The data are thus accessible by the SFR, also via the 3G internet connection, and are examined, modified and validated on the platform. The DMI is also accessible to other decentralized technical services, such as the Regional Cadastral Department, in order to collect their opinions on an application. The procedure includes the production of standard reports, such as APFR application forms, land registration forms, PV Reports and APFRs, all through the DMI.

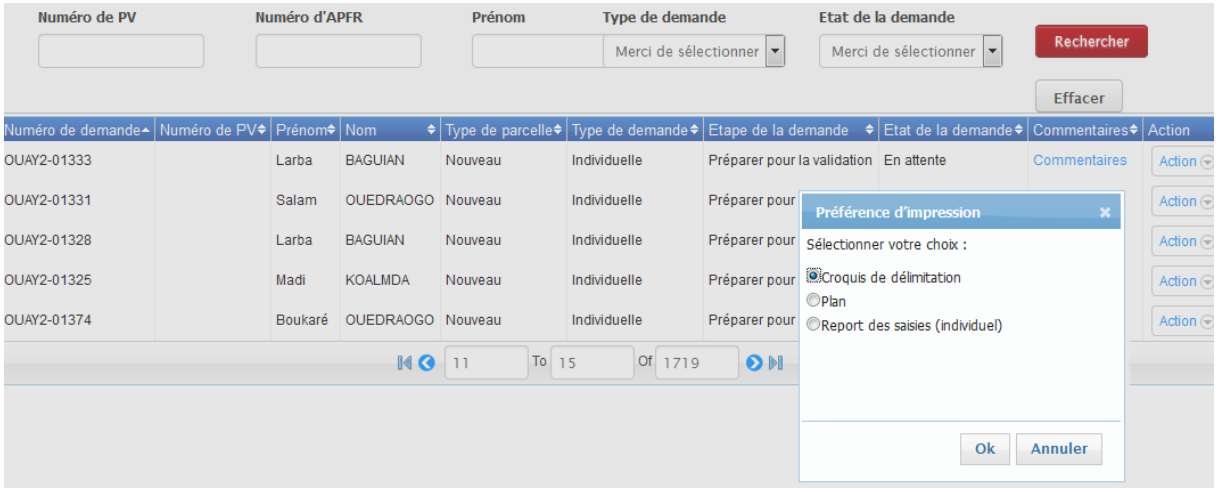


Fig. 7: MAST DMI land record dashboard

The DMI was built to integrate a register summarizing the APFRs issued by the commune, to share information with decentralized technical services and to allow exporting of various statistics.

3. Compliance with Law No. 034/2009: the Geographical Accuracy Requirement

In the context of land management in Burkina Faso, the 3-meter accuracy required for rural boundaries has led to the use of more accurate external GPS devices to connect to the smart phone via Bluetooth technology. The use of external GPS, the management of the Regional Cadastral Department's opinion on the platform and the taking into account of the notification of the cost of the APFR required additional spontaneous developments compared to the Tanzanian experience. The use of satellite imagery in the Mobile application (Fig. 3) and in the DMI (Fig. 8) made it possible to better manage the boundaries of the parcels in the delimitations and even in the validations.

4. Integration of existing titles

It is necessary to import the land parcels already registered either at the SFR or in other technical services. In Boudry Commune, the SFR had already registered 163 APFRs that needed to be integrated into MAST in order not to request a new APFR on or overlapping this parcel, which could create a land dispute. The Regional Cadastral Department expressed the fact that existing titles were present in Boudry but they were not able to provide a map of these titles.

5. Data hosting and information management

The DMI was developed as a GIS web platform to manage, view and analyze spatial data via a standard web browser. The DMI is purely based on OGC standards such as WMS, WFS and WPS and can use any commercial OGC or Open Source compatible OGC mapping engine such as GeoServer.

The data collected from the mobile device are synchronized with the primary server. The data can then be accessed, modified, and approved on the web application. This server uses two services (Web Application server and Relational Database service) all hosted on the Amazon Cloud environment in the same EC2 entity. It is a virtual machine that can be migrated to Burkina Faso installations. Contacts have already been made with the Ministry in charge of the digital economy in Burkina Faso on the feasibility of this approach.

The security subsystem uses a spring-loaded security frame to provide ready-to-use authentication and authorization on the credentials stored in the database, configurable without modification of the application code. Depending on the authorization information received (based on roles), the subsystem implicitly controls access to parts of the system by the user.

In addition to the plan display and spatial layer management capabilities for plot viewing and verification, the MAST application has tools that the user may use to adjust plot boundaries, access information on the cadastral plans, as well as modify the existing parcels.

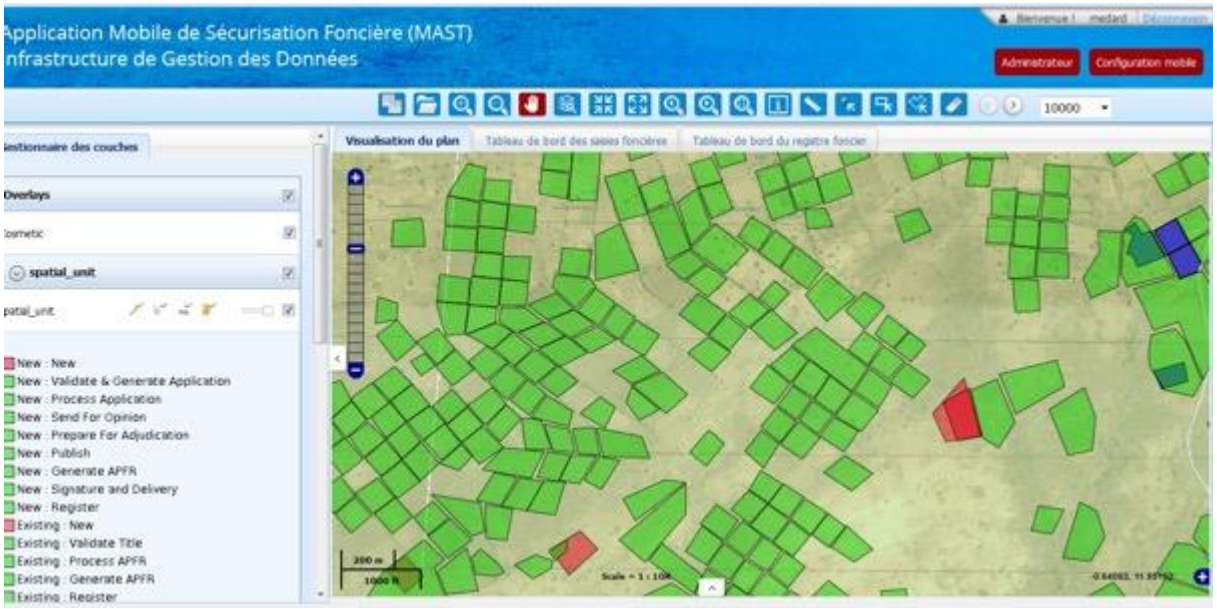


Fig. 8: MAST DMI map viewer
(Green = plots validated; Red = plots rejected;
Blue = plot already validated before MAST pilot)

5. Difficulties encountered and lessons learned

- **Delay in delivery of the platform**

The development of MAST for the Burkina context was delayed for two main reasons: the configuration of MAST with an external GPS so that mapping would be accurate within three meters as required by with Law No. 034/2009; and to follow the precise procedure for issuance of APFRs having been more important than expected. This led to a delay of roughly one month, though in the world of software manipulation this is not excessive. Also, it was necessary to solve some translation and configuration errors and bugs during the test period.

- **The acquisition of high resolution satellite images**

The acquisition of the high-resolution satellite images was also delayed. The first delivery of images did not cover all the pilot villages, and even those images that were delivered were not very good resolution because they did not allow the farmers to view their fields. Satellite images from a prior project were used during the validation process for better accuracy.

- **Translation of software and documents**

The translation of the software part required a careful review of the French / English terms to be used. Technical translation of software is always complicated because it does not necessarily have visibility to the translator who does not have direct access to the platform. For documents, it is essential to write simple sentences and avoid the future and conditional when translating so that the machine translation tools facilitate translation.

III. TRAINING

1. Training of CFV/CCFV and SFR Teams

Before MAST, the SFRs had a topographer to map the land parcels using a sub-metric GPS and then transferred into a GIS. The simplicity of the MAST tools allows access to the technology with a minimum of knowledge. Thus, twelve CFV and CCFV agents, who were literate and had some experience in the use of smart phones, were trained to use MAST to map land parcel boundaries and collect other information needed for APFR applications. The training also included four SFR officers and one Regional Cadastral Department officer in the use of the DMI in order to validate the fees requested.

Fig. 9: CFV/CCFV and SFR training in Boudry Commune in October 2016

2. Review of laws and information on the pilot with the population

In order to achieve the objectives of the pilot a preliminary, but very important, round of local awareness-raising took place with the local population and other stakeholders. This phase resulted in a renewed awareness of the local population on the provisions of the law on the recognition of the rights of people. The population had received information during prior efforts on the subject, thus this phase reinforced this already acquired legal knowledge with the population. It also made it possible to introduce the question of the need to have tools to go faster in the application of the Law No. 034/2009 and to realize the enthusiasm of the populations regarding the objectives fixed for the pilot: 2,000 applications to process in 4 months.

3. How MAST has already contributed to facilitating the procedure for issuing APFRs

MAST benefited from the MCA project to raise public awareness of Law No. 034/2009 and the construction of premises, technical equipment and training of rural land services in the commune of Boudry.

In addition, it was immediately observed that the CFV/CCFV agents were more appropriately involved in the land tenure formalization process, as were SFR officers and cadastral agents. This appropriation as well as the speed of operations reassured the population targeted by the pilot.

The training period allowed all actors in the land chain to see how the digitization and centralization of all records make it possible to develop various statistics and observe the progress of land registration in rural areas.

IV. IMPLEMENTATION OF THE PILOT

1. Registration of applications

In 25 days, 12 selected CFV and CCFV agents recorded a total of 2,708 plots, or 131.9% of the objective pursued by the MAST pilot. This occurred while villagers were engaged in agricultural activities, making the speed of completion even more impressive.

Table 2. Breakdown of land plot processing by village

Number of CFV/CCFV agents	Number of treated plots including training on test plots	Villages
3	696	Ouayalgui V1
3	661	Ouayalgui V2
3	615	Ouayalgui V3
3	736	Ouayalgui V4
Total	2708	

Fig. 10: CFV/CCFV agents collecting applications in the field

2. Validation of Data

- **Data management workflow using the MAST Data Management Interface (DMI)**

This data validation focused on validating parcel boundaries, overlaps and attribute corrections. Three SFR officers processed and validated 2,638 parcels. This effort started in late October 2016 and ended in December 2016. The officers grouped the verifications per location as stated in the public notice, and each verification effort took about 30 minutes.

- **Data workflow at the regional level**

The opinions of the Regional Cadastral Department were obtained on all the requests submitted to them directly on the DMI by means of an internet access. Prior to MAST, the traditional system required sending by mail each request for advice, which made for a very slow process (up to one year). By comparison, all 2,638 parcels were given an opinion by February 3, 2017, a period of about two months. Even this period could have been shortened, had the Regional Cadastral Department acted more promptly.

3. Public Notice

To date, the village of Ouayalgui V1 has completed the public notice period on February 20, 2017 for the 593 recorded plots. Applications in the other three villages are still under public notice. The mandated public notice period of 45 days will end for all applications in the four villages on March 20, 2017.

Fig. 11: List of APFR applications displayed during the public notice period

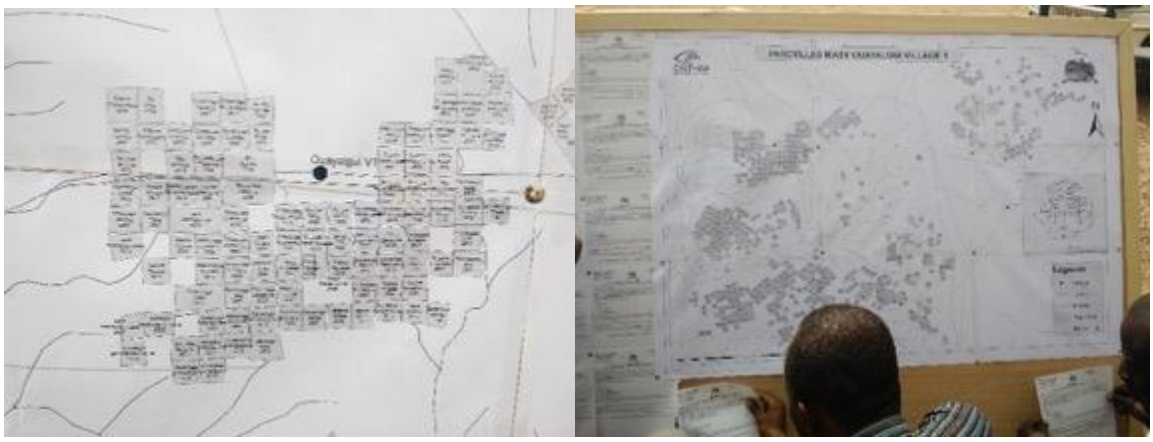


Fig. 12 – Maps of subject land plots displayed during the public notice period

4. Issuance of APFRs

- **Drafting of PV Reports**

On 20 February 2017, after the Regional Cadastral Office finally gave its opinion, the SFR began drafting the PV Reports for the village of Ouayalgui V1. These reports were submitted to all applicants, neighbors, and CFV agents of the concerned village, and no objections were raised. The PV Reports for the other three villages will also be prepared as soon as the public notice period finishes.

- **Notification of payment requirement**

Applicants for APFRs must pay a fee to receive their APFR. The fee is at least CFA 9,000 (USD 14.60) per application, but can increase depending on the area of the parcel. The payment notification took place in the village of Ouayalgui V1 during the drafting of the PV Reports. The amount of the fee is not automatically calculated in MAST, thus the SFR had to calculate and integrate it manually into the database. The APFR is only delivered after payment by the applicant to the cashier of the commune government.

- **APFR preparation and delivery to the applicants**

The SFR prepared the APFR documents and, once the applicants paid the requisite fee to the commune government cashier, physically gave them their new APFRs.

- **Results**

In four months, in spite of the difficulties encountered, the MAST tool was used to prepare 2,638 APFRs in the pilot villages of Boudry Commune. The first APFRs were issued at an official ceremony for the

issuance of APFRs on 23 February 2017 in the Boudry Commune meeting hall to 20 beneficiaries, including 12 women.

Fig. 13: First female beneficiary receiving 4 APFRs

5. Difficulties Encountered

- **Internet connectivity issues**

The MAST tool requires a 3G connection for data uploads; this is not always available on the territory of rural communes on a daily basis. As a result, some villages were delayed in the synchronization of applications because. Importantly, data can still be collected in the field using MAST in an offline mode and uploaded later, so an irregular connection is not a fatal flaw.

Connectivity outages also delayed issuance of DMI opinions by the Regional Cadastral Department.

Charging of the batteries for the smart phones was also an issue, mainly because of a lack of electricity in the villages. This was worsened by the Bluetooth connection of the external GPS, which uses energy and thus drains batteries faster. Also, out of the 16 smart phones made available to the ONF-BF, only four were new. The 12 used phones had major battery problems, which affected on the registration process.

The pilot project dealt with this charging issue by supplying external batteries. But electricity remained a challenge.

- **The slowness of the Regional Cadastral Department in providing opinions**

The Regional Cadastral Department slowed down implementation of the pilot project significantly. The department's agents had reservations about the use of the MAST tools, and thus required two levels of verification testing before giving their opinion about the viability and accuracy of the data collected. A first test was organized with these agents in the villages of Ouayalgui to ensure the accuracy of the GPS and the quality of the satellite images. A second test was organized with the central services of the cadastre, which also went to the villages of Ouayalgui to compare the coordinates between the telephone coupled to the GPS and the conventional GPS system alone.

- **Insufficient logistics for carrying out the public notice process in villages**

The villages were not equipped to handle such an event where large maps and hundreds of notifications are required. Thus, the project had to buy wood panels at the last minute in order to post the APFR applications for public review. This is likely to be a problem in almost villages in rural Burkina Faso.

6. How has MAST Really Contributed to Facilitating the Procedure for the Delivery of APFRs?

Table 3. Comparison of the Former System to the MAST Pilot System

APFR delivery in Burkina Faso (2013-2016)	APFR delivery in the MAST pilot (Oct. 2016 - Feb. 2017).
47 rural communes	**1 rural commune (4 villages)**
15,364 applications	2,638 applications (including 301 from women)
3,706 PV Reports prepared	2,638 PV Reports prepared
1,965 APFRs issued (including 1,200 sponsored and 24 non-sponsored APFRs belonging to women)	30 APFRs issued (including 16 for women, 1 woman having 4 APFRs), preparation of 2,608 APFRs nearing completion
Mapping carried out by SFR topographer	Mapping carried out by CFV/CCFV agents, supported by the SFR topographer

MAST demonstrated since the beginning of the pilot a great improvement at all levels of the procedure of issuance of the APFR. At the level of the SFR:

- Only the land officer and the communications officer are needed to process APFRs using MAST. This is very important because experience shows that SFR offices are unable to hire and keep topographers to do the mapping work. The topographer position is thus essentially worthless;
- Sufficient number of staff and reduction of activities by the SFR due to the village level CFV and CCFV agents being able to map property boundaries and collect application data using MAST;
- Stability of the SFR officers which will now focus primarily on law and not technology;
- Less need for SFR officers to travel to the villages for APFR processing activities. Reduced travel saves money for the commune;
- Easier trainings and mastering of software due to a lighter technology;
- Means of operation less expensive therefore more affordable for the communes, due to less travel and less technology costs;
- Better coordination with the decentralized technical services such as the Regional Cadastral Department, therefore increasing the speed and number of files that could be processed. This, in turn, represents an improvement the land rights formalization process.

At the CFV level, which is in charge of initiating APFR applications, their action has opened to:

- Young members mastering mobile technologies and thus acquiring knowledge of the land issues in their villages;
- Carrying out the boundary survey work previously performed by the SFR topographer;
- An increased engagement/motivation of CFV/CCFV agents;
- A facilitated transmission of information eliminating the movements between the SFR and the field due to the 3G telephone network; and
- The archiving of documents in digital format, thus overcoming the lack of space for storing paper files within the villages. Data security is likely also improved for this same reason.

V. FOLLOWING THE PILOT

1. Delivery of the MAST System in Boudry Commune

After only a few days experiencing the simplicity of MAST, Boudry Commune is not intending to return to the former system using complex tools. Boudry Commune is therefore becoming an integral part of maintaining MAST capacity in Burkina Faso. The commune's SFR should continue to use MAST, which

will not only provide a great example of success for the rest of the country, but will enable the SFR to train other communes on MAST as opportunities arise. Thus, the Boudry Commune SFR, along with the ONF-BF, are key players in maintaining MAST capacity over the medium term.

Already existing:

- Computer, printers, some office supplies

Potentially transferable resources provided by USAID to operate MAST during the pilot:

- Four (4) Motorola smart phones;
- Four (4) Bad Elf GPS Pro devices to ensure the three-meter accuracy required by law;
- Four (4) power banks.

Non-transferable resources provided by USAID to operate MAST during the pilot:

- USAID-licensed satellite imagery - 50 cm resolution, 10m positional accuracy. Google images are not appropriate or this work, for they are not accurate enough to be reliable and to not have any discrepancy between the GPS measurements and the shape of the land;
- Access to the cloud-based server: USD 200/month until a solution is found at the higher level to host the MAST data for all communes of Burkina Faso. This server will then be shared with other communes implementing MAST which will reduce the cost to USD 150/year/commune.

2. Resources Needed to Maintain the Whole System

Thinking beyond Boudry Commune, the following categories of resources are needed to maintain MAST functionality in the country:

- **The management of resources of the core infrastructure**

Based on Cloud-computing technology, the infrastructure must include a host virtual server, with a spatial extension database, open a map server and many tools and "Framework" manipulation of spatial and attribute data.

For now the infrastructure is hosted on Amazon server. These servers are secured and should not compromise data integrity. That said, it is necessary to consider another formula to accommodate the data belonging to the communes. One solution might include the creation of a virtual machine hosted by the Ministry in charge of the digital economy.

In the MAST management infrastructure, an entire module is dedicated to security management which is organized by level of clearance for each user, and a partitioning system of data and applications. For the generalization of MAST, the ONF-BF will go towards data access protocols that will define the openings needed to access the data. These protocols will be signed with the communes interested in deploying MAST, but also with the Ministry of Territorial Administration, Decentralization, and Internal Security, which assists the communes.

- **MAST deployment and management resources needed for each commune**

In addition to configuring the "project" in the data management infrastructure in MAST, it is important for each commune to have access to high resolution satellite images of the area to cover as well as all the map layers such as villages, roads, rivers, etc.

Furthermore, in terms of hardware equipment, the commune should have Android smart phones or tablets for the use of CFV/CCFV agents as well as the 2.5m-accurate Bad Elf Pro GPS to complete each unit. The number of equipment depends on the number of villages within the commune and the financial capacity of the commune. However, at least 02 units should be made available for the CFV/CCFV agents and 01 unit for the SFR. Add to this, a desktop computer for the SFR, a robust printer with office supplies for printing all required documents. The management of this equipment and the implementation of the MAST local technology require training of local actors. As for the regional cadastral departments, they will need to have access to the applications for giving their opinions.

- **The cost for a commune and budget to maintain the infrastructure**

For a town with an existing SFR having the prerequisites for administration management (computer, printer ....), the MAST deployment cost can be summarized to the costs of

- SFR and CFV/CCFV agents training;
- Acquisition of data capturing devices (smart phones or tablets and external GPS);
- Satellite images for the area of interest; and
- Participation of the commune in hosting and maintaining the database on the cloud-server.

The hosting cost for a cloud server is about USD 200 per month but the site can accommodate several projects which would make the cost affordable to rural communes (ideally 150 US per year). To this cost should be added the access cost to the 3G network.

In Burkina Faso, a smart phone 32GB and a type of external Bad Elf GPS Pro costs USD 720. The former system uses a GPS used by the topographer or SFR only and costs about USD 3,000. With four (4) data collection units, a SFR can deliver the 1,200 APFRs per year that are needed to make the SFR office financially sustainable. The units give enough capacity for even more APFR production if there is demand.

Communes can obtain free satellite images to provide a better view of the communal land and properties to register. The Boudry Commune SFR received a satellite image acquired by USAID, however the SFR was already using an image of high resolution provide by MCA-BF during the implementation of the former system.

- **Technical training on the MAST system**

While the training of the SFR topographer required weeks on the use of GPS and ArcGIS resulting in imperfect mastery during the former system, MAST technical training for 5 SFR officers, 2 Cadastral agents and 12 CFV/CCFV agents requires only a total of 5 mobilization days for the ONF-BF. MAST will help rural communes that have shut in production of APFRs due to the lack of maintenance of the SFR services.

3. Evolution of the MAST Tool

Managing the delivery of initial APFRs is an important and central activity in the activities of the SFRs. Beyond this activity, Law No. 034/2009 and its implementing regulations provide the SFR with the allocation of management of:

- The transactions made on the initial APFRs (transmission of the first order to second order following sale, donation or inheritance, as well as loans/rent and improvements of land),
- The rural land charters, and
- The maintenance of four land registries for APFRs, transactions, rural land charters and land conflicts.

The MAST data model has been designed to facilitate the integration of future needs such as adding complementary modules compliant with the Law No. 034/2009 for managing land transactions, rural land charts, loans and improvements.

During the launch of the MAST pilot, invited mayors coming from other rural communes have expressed their request to see MAST managing rural land charts prepared, validated and adopted in public. This is

possible and feasible on the basis that any resources converted into a point, line or polygon can be recorded and monitored through MAST through a configuration management screens.

For more efficiency and transparency in the local land governance while reducing the number of tools used in the local land management, it is appropriate that MAST may include these additional features.

4. How will MAST Contribute to Land Tenure Security in Rural Burkina Faso?

In light of the results achieved through this pilot in Boudry and all the experience gained in the preparation and implementation, we can say that MAST certainly contribute to securing land in Burkina Faso by its archiving, traceability and transparency capabilities as well as the speed in the process of issuing APFRs. It is already possible to see the initiation of a rural cadastre.

By recording all data on the DMI, MAST improves one of the major challenges of rural land information in Burkina Faso until now: the archiving of data, the transparency of information and the traceability of operations. It becomes now easy to trace the information several years back thus reduce conflicts related ambiguities and lack of land information.

By involving the CFV/CCFV agents in the application collection process, the initial phase of the land possession recognition becomes faster. Moreover, the SFR officer is discharged from its responsibility to proceed to delimitation and can focus on the land tenure verification and validation process, devoting more time to the land rights formalization and management. Regional technical services no longer expect to receive paper records through carriers from the communes; they connect directly to the DMI to give the required opinion with great efficiency and the ability to make data exports and sketches?

Through MAST, each APFR grant leads to the creation of geospatial data useful to build a communal land information system. With its potential future developments, MAST will contribute to building a rural cadastre, which does not yet exist in Burkina Faso.

In 2017, 15 communes in Burkina Faso will benefit from the establishment of MAST to stimulate the delivery of APFRs.

VI. CONCLUSION

The need for tools for recording land information is real in rural communes that are struggling to develop and equip rural land services in order to fulfill their missions of applying the Law No. 034/2009. The MAST pilot first demonstrated that the technology allows greater ownership of the registration process of APFRs by village bodies in charge of land, allowing SFR land officers to focus on the legal part and not the technology.

Despite some technical difficulties like the access to electricity and the 3G network, MAST is a real alternative for the rural communes of Burkina Faso for the registration of rural lands by rural land services. It offers the possibility to reduce the cost of equipment by four times and further enables automated geo-processing tasks that weigh heavily on rural land services. In other words, the overall financial burden of securing land shall be more tolerable for municipal budgets.

The application of Law No. 034/2009 accelerates. Regardless of the land registration, the MAST is also an excellent tool for the constitution of Land Information Systems in rural communes, something essential to the development of a future rural cadastre. MAST also helps the CFVs and SFRs find a solution to their archiving issues. Also this system could also serve as a basis for registration of other types of rights in rural areas: commons and public lands.

APPENDICES

LAND CONTEXT IN BURKINA FASO

In Burkina Faso, land tenure systems were initially established based on beliefs and/or traditional religions. However, other land management methods were introduced during the colonial and post-colonial times. The advent of the National Revolutionary Council has crossed a crucial step in to develop the law “Agrarian and Land Reorganization (RAF) in Burkina Faso”. Thus, Burkina Faso has experienced in its history traditional (customary) and regulatory (modern) land tenure systems, as well as the collective and private land tenure regimes since the pre-colonial period.

Since 1984, Burkina Faso has undertaken numerous actions to lay solid foundations of a sound and efficient management of land issues. These initiatives have resulted in an abundant and diversified production of policy documents, legislations and regulations in the field of land management.

Despite these texts, the calm and consensual land management remains relevant in the concerns of the authorities and the population at all territorial levels. While efforts are made to provide the country many regulations, their effectiveness in practice is still a battle to be won. Land insecurity continues to grow in Burkina Faso with the very strong demand for housing in cities, development of agribusiness, the "boom" mining and persistent degradation factors that result by shrinking over the years of useful land.

On June 16, 2009 was adopted Law No. 034-2009/AN on the rural land tenure. It is a normative translation of the reforms included in the national land tenure policy in rural areas (PNSFMR) of 2007. This law defined the legal and institutional framework for the management and access to land in rural communes and villages attached to urban municipalities.

The implementation of Law No. 034/2009 was supported by the MCA Compact project between 2009 and 2014. Thus, more than 8,700 local officials in 47 rural communes were trained on participatory land-use management, land service operations and conflict mediation in according with the new laws by the end of the compact. It incorporated 18,000 land parcels into the national registry, established more than 1,000 conflict mediation committees in the villages of 47 rural communes and secured land rights for 4,793 Households, businesses, and other entities. Although only 2,167 of the 6,000 targeted APFRs were approved by the end of the compact, 13,000 applications were still in the validation process.

NATIONAL LAND OBSERVATORY OF BURKINA FASO (ONF-BF)

Context

The creation of the ONF-BF is part of this special national context. The Government of Burkina Faso had committed to funding the land administration offices and supporting the delivery of post-compact certificates. In this regard, the establishment of the ONF-BF was essential to observe the land phenomena following the MCA Compact.

Internationally, the context was also marked by several initiatives such as the New Alliance for Food Security and Nutrition, transparency for improved land governance initiated by the G8 in June 2013, part of the governance analysis land of the World Bank (LGAF), the proposed establishment of regional observatories within UEMOA and ECOWAS, a statement of the African Union on issues and challenges and the land plan Nairobi Action on major land investments, not to mention the Voluntary Guidelines for Responsible Governance of Tenure for Land, Fisheries and Forests by the FAO in May 2012.

The ONF-BF was established at its first general assembly on July 3, 2014. It responds to the need felt by the actors of the land chain in Burkina Faso to develop an instrument of intelligence and inquiry on the issues land that the country faces. It also responds to the desire to create an independent and neutral body in the treatment of land information and formulation of land issues recommendations to decision-makers.

Operation

The ONF-BF is a non-profit organization, apolitical and non-denominational governed by Law No. 10/92/ADP of 15 December 1992 on freedom of association in Burkina Faso.

The ONF-BF is structured around the following elements:

- The general assembly first gathered on 03/07/2014 with 60 structures;
- The Board of Directors composed of 19 elected members and coming from four colleges of the national land chain actors:
  - The structures of the central government (Ministry of Economy and Finance, Ministry of Housing and Urban Development, Ministry of Agriculture, Ministry of Territorial Administration, Decentralization and Interior Security, Ministry of Justice);
  - The territorial collectivities (two regions and two municipalities);
  - The private sector (four representatives of the order of chartered surveyors, architects, notaries, design offices and the Chamber of Commerce); and

- Organizations of the civil society (four representatives of the customary chiefdom, farmer organizations and women lawyers).

- The Executive Secretary with 7 agents;
- The Scientific Council with 10 members including 3 from academia, the civil society, private consultants and technical services of the ONF-BF;
- Two Accounting/Statutory Auditors.

The observation program

The ONF-BF's main mission is to contribute to improving land governance through the production and dissemination of land information in order to make land, a factor of sustainable development in Burkina Faso (Article 3 of the Articles of ONF-BF).

To meet its mission, the ONF-BF has developed a five-year observation program aiming at analyzing land phenomena in Burkina Faso (PQO). The phenomena to document in the PQO are grouped into three (03) major fields of observation: rural land, urban land and climate change. A total of sixteen (16) land phenomena have been identified in both urban and rural areas in the specific field of climate change by the ONF-BF, in order to cover the maximum of observable phenomena and thus meet the diversity of actors in the land and members of the ONF-BF.

The challenges of the ONF-BF

- Develop the ability to mobilize the necessary resources to the implementation of its five-year obs. program;
- Create interpellation frameworks to decision-makers on the major findings of land phenomena;
- Benefit the status of association for public interest in order to ensure a continued support for annual grants from the State with a view of a sustainable structure;
- Preserve the independence of the ONF-BF in its role of vigilance and interpellation in land matters;
- Ensure the accessibility to right and current land information.

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TABLES

FIGURES