



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



Implementation of the LADM_COL model for the reception and institutional data validation in Colombia. Project “Model of allocation and recognition of rights through massive land survey for multipurpose cadaster and formalization – Pilot Ovejas, Sucre”

ANDREA OLAYA ALVAREZ

Ministry of Agriculture and Rural Development, Colombia

andrea.olaya@minagricultura.gov.co

ANDRES GUARIN

Agencia de Implementación Proyecto Modernización de Administración de Tierras en Colombia, UT

BSF Swissphoto – INCIGE, Colombia

andresguarinlo@gmail.com

DANIEL CASSALPRIM

Agencia de Implementación Proyecto Modernización de Administración de Tierras en Colombia, UT

BSF Swissphoto – INCIGE, Colombia

daniel.casalprim@bsf-swissphoto.com

**Paper prepared for presentation at the
“2020 WORLD BANK CONFERENCE ON LAND AND POVERTY”
The World Bank - Washington DC, March 16-20, 2020**

Copyright 2020 by author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



ABSTRACT

According to the implementation of the Multipurpose Cadaster public policy that is being developed in Colombia, and based on the support provided by USAID through its Land and Rural Development Program LRDP, the “Model of allocation and recognition of rights through systematic cadaster survey for purposes of multipurpose cadaster and formalization” project was carried out in the municipality of Ovejas, department of Sucre, Colombia - The implementation of this project had, among its main objectives, the purpose to serve as a Land Formalization pilot and Multipurpose Cadaster in Ovejas municipality, testing the massive formalization process and its compliance with the technical product specifications defined by the Agustín Codazzi Geographic Institute - IGAC and the Superintendence of Notaries and Registry – SNR, including the implementation of LADM national profile (LADM-COL), supported by Land Administración Modernization in Colombia, implemented by SECO (Swiss Cooperation) The project is aligned with the national government vision of massive formalization strategy.

The National Land Agency - ANT is the highest land authority in Colombia and the entity responsible for carrying out activities for rights assignment and regularization of different land tenure situations in the rural sector. The ANT has been focusing significant efforts on the consolidation of a model of attention by institutional offer as a mechanism to intervene in the territory, this aligned with the strategy of multipurpose cadaster within the framework of the Systematic Land Survey (SLS), defined as a fundamental element in the identification of territorial reality and the characterization of the different land tenure present in the territory.

This new strategy of the ANT, requires a massive intervention in the territory, which represents an institutional challenge, not only in compliance with the specifications of cadastral products, which allow to clearly characterize the different tenure relationships that exist between the people and the properties, but also in the change of their internal processes, that moves from solving specific cases one by one to solving the processes in a massive way, changing also the municipal approach.

Key Words: cadaster, data quality control, LADM, land tenure formalization, systematic land survey.



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



INTRODUCTION

The implementation of the Final Agreement for the ending of the Conflict and the construction of a stable and lasting peace, signed in Colombia in November of 2016, demanded from the Colombian Government to make many changes (both in the legal framework and in the institutions with responsibilities in land administration) to comply with the agreement. Logically, the solutions to the conflicts with land had a principal and structural position in the agreement, and became the first point, called Comprehensive Rural Reform (CRR).

The goal of the multipurpose cadastral updating throughout the country and the access to the land and property formalization in 10 million rural hectares, included in the agreement, encouraged the development of new legal rules, changes in the way we attend our target population through the national land authority, and an adjustment in the technical specifications for cadastral surveys, which included the implementation of a common language to guarantee the interoperability of the data.

In order to guarantee solutions and procure a coordination between the involved institutions, the National Council of Economic Policy of the Colombian Government (Consejo Nacional de Política Económica y Social - CONPES) approved CONPES Document No. 3958 on March 26 2016, which mandates the implementation of the multipurpose cadaster strategy.

The four guiding principles of this policy is: (i) establishing technical capacity in the municipalities to enable the use of cadastral information (ii) Graduality: cadaster will be scaled up from 5% of the Colombian area updating to 100% of the country by 2025. (iii) Promote the use of cadastral information in different areas of public and private services and (iv) the Institutional strengthening for national level entities that include the ICT development and strengthening of the National Spatial Data Infrastructure. This last topic is the main aspect that will be developed in this paper.

A simple definition about Land Administration System (LAS) - provided by FIG - are an infrastructure which support and facilitate the implementation of land policies in a country. LAS are concerned with the social, legal, economic and technical framework within which land managers must operate. The core idea behind the LAS involves moving land administration beyond its functions of cadastral surveying and registering land. The idea for the Colombian Government is to increase the capacity of land institutions so that citizens have permanent access to affordable and accessible land administration services.



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



However, the institutional framework of the multipurpose cadaster strategy that is being implemented in Colombia is highly complex. Institutional mandates in land administration are distributed among various government institutions; thus, the coordination of different parties to achieve an agreement about definitions is needed to obtain new technical specifications, land intervention methods, and technological tools. Paradoxically, this is the same reason why it is essential to create the basis for a functioning land administration system in order to maintain land information as a productive asset. This is a significant challenge at coordination level

THE OBJECTIVE: MULTIPURPOSE CADASTER AND MASSIVE LAND TENURE FORMALIZATION

Traditional land administration models and land surveying methods are inadequate to meet the needs of a modern and sustainable society (Williamson, 2009). The paradigm of land management focuses on providing tools to decision makers with the objective of the sustainable development (Williamson, 2009), This is one of the pillars of the transformation processes and vision of territorial approach that seeks, among other objectives, the integrated rural development.

The implementation of the new multipurpose cadaster policy, implies major challenges for entities involved in territorial objects management. Among these challenges are, of course, the redefinition and adjustment of technological components, like software, hardware and communication networks of the information systems, to allow the interoperability and the data publication according the new strategic framework for land administration in Colombia, and guarantee available information to massive formalization process.

Create a parcel-based land information system that allows interoperability under the ISO international standard - Land Administration Domain Model (LADM) - ensuring that cadastral processes are integrated with land tenure formalization services means to develop a Social Tenure Domain Model, an extension from the core cadastral domain model for the land administration. The principal goal in Colombia, is to connect in the model, the owner, occupant or irregular holder (Who) and parcel (Where) concepts by a right relationship which is often generalized into triple-R for Right/Restriction/Responsibilities (How).



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



THE TOOL FOR LAND GOVERNANCE AND TENURE SECURITY: THE MUNICIPAL PROPERTY FORMALIZATION PLANS

Addressing the land issues at global, regional, country and city/municipal level is indeed one of the major challenges of our times, both in regard to addressing poverty issues as well as sustainability issues. Land related issues include unequal access to land and other natural resources, unsustainable land use, insecurity of tenure, weak institutions to resolve conflict, dysfunctional land markets and institutions and inefficient and inappropriate land administration systems (Palmer et al 2009 and Antonio 2009, 2010).

Colombia exhibits high levels of informal property rights; the most recently number estimated shows that the rural land tenure informality percentage is around 59%. Only 6% of municipalities has a percentage of formal land tenure between 75% and 100%. The rest of the country reported at lower percentages (UPRA 2014). Additionally, a large percentage of rural areas in Colombian doesn't have any cadastral information. An index the public lands, including its localization and its occupation status, is under construction. These problems have been studied and clearly characterized in different documents, as part of the land tenure formalization policy as a set of processes aimed at recognizing, clarifying, consolidating and protecting the rights of rural property (DNP-, 2015).

The main causes of this problem in the rural areas (DNP, 2015) revolves around the following axes:

- A complex institutional framework
- A parcel-based land information systems with duplicated, redundant, and fragmented data.
- The high rates of outdated cadaster
- The cadaster and registry information systems are not interoperable
- The weak implementation capacity of the entity responsible for managing the cadastre in 90% of the national territory (IGAC)

As a consequence, the multipurpose cadaster strategy included as principal actor, the cadastral administrators, a new roll in the legal framework of Colombian land administration. Being a cadastral administrator means being responsible for the cadastral update and maintenance process in an intervention unit; for example, a municipality, a group of municipalities or, and in some exceptional cases, by national entities in the rural area of the municipalities, only when the process is accompanied by a massive



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



formalization process. Both conditions, cadastral manager and land formalization manager, can be found in the National Land Authority - NLA.

That is the reason why the NLA has been focusing on the consolidation of a different attention model using its principal tool, the Plans of Social Use of Rural Land Property or massive land tenure regularization plans, developed through the implementation of a systematic cadaster survey (SCS): a land intervention methodology to identify the reality about parcels distribution and to characterize the land tenure typologies existing in territory. The systematic cadaster includes identifying informal land tenure rights on both private and public lands and the preparation of parcel files (expedientes) to be classified according to pre-established land tenure typologies. The NLA will subsequently use parcel files to carry out the corresponding formalization and registration of informal land tenure rights. The systematic cadaster will focus on women's land rights and include special procedures for indigenous and other ethnic communities in line with the existing legal framework. (The World Bank, 2019)

The definition developed by Ministry of Agriculture and Rural Development about Social Use of Rural Land Property is: *"It is a planning and management process to order the occupation and use of rural lands and administer the public lands, that promotes progressive access to property and other forms of tenure, equitable distribution of land, legal security of land tenure, planning, management and financing of rural land, and a transparent and monitored land market, in compliance with the social and ecological function of the property, in order to contribute to improving the quality of life of the rural population."* (MADR, 2017)

Under this premise, in order to respond the requirements and ensure territorial attention, the NLA proposes a redefinition of its institutional design for the attention of the land issue, incorporating into its traditional processes a scheme of attention that responds to the incorporation of the territorial approach in OSPR policy. This new approach proposes the allocation of rights in a massive way and in a planned way according to the specific conditions of each territory.

THE ROUTE FOR MASSIVE PROPERTY FORMALIZATION

The elaboration of massive property formalization plans and its implementation generate a great challenge at the institutional level. Therefore, was necessary identify and document relationships among the process activities and standardize the elements in a sequential and articulated route procuring an harmonization



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



between the territorial dimensions into the plan. To achieve this objective the ANT has built a route, which structures a series of tools that describe step-by-step the activities necessary for the generation of a POSPR.

The route becomes a tool (ANT, 2017), in which the procedures and actions that should be carried out in each municipality are described by the ANT in order to advance the formulation, implementation and maintenance of the rural formal land tenure.

The route has been structured from the strategic vision in three major elements. The upper level consists of the phases, which according to Resolution 740 of 2017 are defined in formulation, implementation and maintenance as shown in Figure 1. In turn, these phases are divided into stages of components. The structure of the route allows to obtain results based on the execution of the activities defined in each of the components according to the territorial intervention.



Figure 1. Phases of the route. Source. (ANT, 2017)

Below is a brief summary of the conceptualization of each phase and its main expected results.

THE COLOMBIAN LAND ADMINISTRATION DOMAIN MODEL - LADM COL

The domain model for land administration defined in the ISO 19152: 2012 LADM is a standard that seeks to represent the relationships between local objects and people from the rights, restrictions and responsibilities that exist in the territory at the conceptual level, and the spatial representation of these territorial objects. As defined by Lemmen C., (2012) the domain model for land administration describes the general standards for information management, considering the legal information, the interested parties, and the space units. It may also contain geometric information of each unit.

It is important to consider the LADM as a metamodel (conceptual model) and not as a product specification data (Lemmen, Oosterom, & Bennett, 2015). UML diagrams are commonly used to describe the LADM, which allows users to view and discuss the relationship between administrative objects existing on the earth (the BAUnits) and their structural components like parts, rights, restrictions or responsibilities that a party can have on an administrative object together with the spatial representation that this object can have.



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



Therefore, the LADM provides a standard based on the semantic structure of land administration (Lemmen, et al 2015).

An important factor to be considered in the LADM implementation in Colombia was the technology. An efficient land administration boosts information exchange based on the data interoperability. At architecture level, there are several solution schemes at general level for implementing a land administration model. All of them should seek to optimize data management by the entities with the vision to respect the institution's legal independence principle.

Modularity in land administration is essential to have proper information management and to respect the legal independence principle. As part of the conceptual model of the ISO 19152: 2012, some examples of how the core is the orchestrator of information between different subjects are shown. In the development of the national profile of the standard in Colombia, (LADM-COL), the national level entities have generated a version 3.0 of the core that adapts to the needing of the country, according to the model-based approach. This has been done with the support of the Land Administration Modernization in Colombia project, funded by SECO (Swiss Cooperation).

The figure 2 shows the concept of extended models in the implementation of the standard in Colombia.

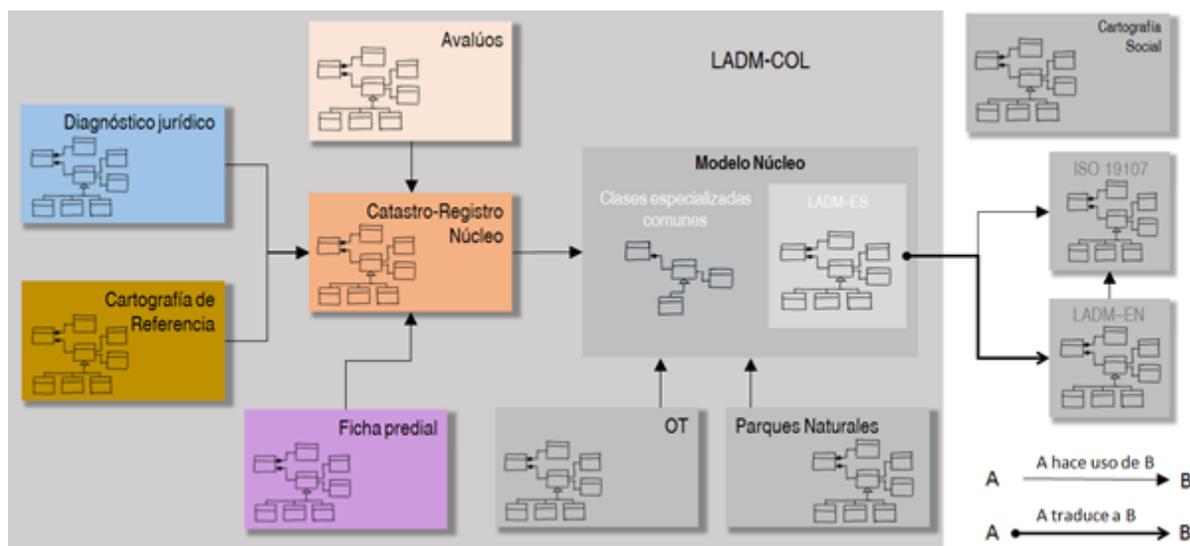


Figure 2. Model articulation in accordance with LADM_COL



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



In context of the multipurpose cadaster is necessary moving from conceptual level to an application level, and under this concept models have been developed as abstractions of different models that represent the necessary variables to define semantically particular contexts according the conceptual model definitions.

THE PILOT DEVELOPMENT BY LAND NATIONAL AGENCY AND USAID IN OVEJAS – SUCRE

Our testing project to start the implementation of allocation and recognition of rights process using the systematic cadaster survey methodology was Ovejas, Sucre, thanks to the collaboration from USAID through the Land and Rural Development Program LRDP.

Ovejas is a small municipality, sharply affected by the internal armed conflict, located in the north of Colombia, with a population of 21.700 people with a 71% of informality in the land tenure. The municipality has an approximate area of 457 km², 99.2% classified as rural land in its municipal Land Use Plan.

The Ovejas's pilot allowed to apply in the territory (in an operational level) the vision of national multipurpose cadaster policy, to test and to iterate the processes and activities in order to adjust the value chain at institutional level.

When those new elements were tested on the field under a massive approach, both the implementation tools and the unification of elements were considered to optimize the project's efficiency.

The pilot's results generated a learned lessons to apply in the development of the land tenure formalization route, and showed opportunities for improve the definitions for the product technical specifications according with the conceptualization document of the multipurpose cadaster. Also, the pilot showed the necessity to define in a simple form, but at detailed level, the current legal situations in Colombian land tenure.

The validation process to ensure the compliance of the technical specifications of the product, was transversal in the quality control processes for the validation of the other components information, doing that the data set validation process had several validation activities, as shown in Figure 3.



Institutions for Equity&Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020

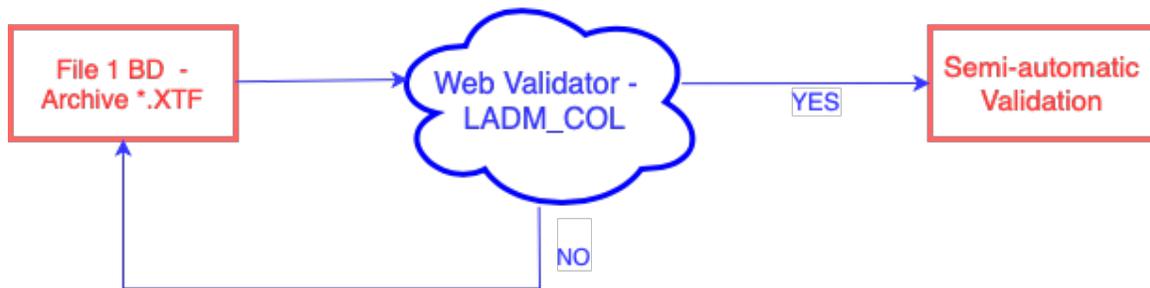


Figure 3. Validation Process

Three main processes were carried out: (i) consistency control process when the information is uploaded under the data structure and location requested. (ii) the web validator application on the data set, to verify the information consistency in relation to the LADM_COL model's semantic (some logical validators are applied in relation to variables codependency and consistency), and (iii) A semi-automatic validator to verify the topological rules on the data set of the intervention area and topological validations between the information deliveries.

As part of the validation process of the technological component, a folder called BD, was created to house the information delivered by the operator. At this point, the operator is both responsible to guarantee the quality information and database according the LAMD_COL model, and to upload the information under the exchange format defined for the XTF multipurpose cadaster pilot.

For information delivery, initially, a data migration from the operator data model to the ladm model was carried out. The reason was that the operator used its own model for the information capture. This activity was done using the plugin for QGIS version 3, LADM-COL Assistant. This tool allows to migrate massively data throughout intermediate structures (alphanumeric information), and throughout FileGDB (geographic information).

In the case of the intermediate structure, an excel file was used with all the information consolidated by the operator that contained the property, rights, administrative and interested data. This structure was previously defined to automate the process and it allowed to migrate the alphanumeric data automatically. On the other hand, the information was also migrated from postgresQL of the information collected in property records and appraisals. In the case of the information of the FileGDB, the tool ETL (Extract,



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



Transform and Load) was used to pass the information of points of parcel boundaries, buildings and construction units.

Once the two sets of data were migrated, the integration was made through the property codes generated by the operator. The results of the migration process were:

Class	Quantity
Parcel	6343
Property chips	6343
Land	6190
Constructions	9762
Constructions Unit	9762
Boundaries	20850
Boundary points	52686
Lifting points	20868
Rights	6343
Interested	5116
Groups of interested parties	387
Construction appraisals	8086

Table 1. Data Migration results

CONCLUSIONS

The Oveja's pilot results and the progress of the project for the modernization of land administration in Colombia showed the following lessons learned:

- Previous to the beginning of massive processes of cadastral updating and formalization of land tenure, it is required to ensure that the operational versions of both the LADM and STDM are approved. Achieve consensus on a set of common initial definitions and agreements, are essential for the successful massive operation.



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



- To Build-up adequate know-how when implementing LADM and STDM must be accompanied by expert courses and on-the-job training. There are not enough professionals in the national level entities for the implementation of the model For this reason, it is essential to develop training workshops, initially, in the national level entities, oriented to all professionals involved in the use of the model.
- It is essential that the information systems of the entities involved are compatible with the data structure of the model. If this does not happen, a transition system must be designed and developed to receive the information, to control its quality and to store the data, previous to the massive process.
- The support of Swiss Economic Cooperation and Development Program in Colombia in this modernization of land administration processes has been fundamental. The contribution of Swiss cooperation has been invaluable to attain the fundamental agreements that will allow the achievement of the multipurpose cadaster policy's goal. For them all the recognition and gratitude of the Colombian's Government.

REFERENCES

- Acuerdo Final. (24 de 11 de 2016). *Acuerdo final para la Terminación del Conflicto y la Construcción de una Paz estable y duradera*. Recuperado el 27 de 01 de 2017, de Mesa de Conversaciones <http://www.altocomisionadoparalapaz.gov.co/procesos-y-conversaciones/Paginas/Texto-completo-del-Acuerdo-Final-para-la-Terminacion-del-conflicto.aspx>
- Agencia Nacional de Tierras, Subdirección de Planeación Operativa. (2017). *Documento Conceptual de Planes de Ordenamiento Social de la Propiedad Rural*. Bogotá, Colombia.
- Decreto Ley 902 de 2017. (2017). *Medidas para facilitar la implementación de la Reforma Rural Integral, contemplada en el Acuerdo Final en materia de tierras, específicamente el procedimiento para el acceso y formalización y el Fondo de Tierras*. Bogotá, Colombia



Institutions for Equity & Resilience

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 16-20, 2020



- Departamento Nacional de Planeación. (2015). *Estrategia de Ordenamiento Social de la Propiedad Rural (CONPES 3859)*. Bogotá, Colombia: DNP.
- Departamento Nacional de Planeación. (2019). *Estrategia de implementación del Catastro Multipropósito (CONPES 3958)*. Bogotá, Colombia: DNP.
- The World Bank, Colombia Multipurpose Cadaster Project (P162594), Combined Project Information Documents / Integrated Safeguards Datasheet (PID/ISDS), 19-Nov-2018, Report No: PIDISDSA21443
- Unidad de Planificación Rural Agropecuaria UPRA. (2014). *Metodología para la formulación del Plan de Ordenamiento Social de la Propiedad Rural*, Bogotá D.C.
- Williamson, I., Enemark, S., Wallace, J., & Rajabifard, A. (2009). *Land Administration and Sustainable Development*. ESRI Press Academic.