

LADM - A Tool for Land Administration in Post-Conflict Colombia

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Key words: Interoperability Standards, LADM, Land Administration, NSDI, Post-Conflict.

SUMMARY

Colombia's internal armed conflict has lasted more than 50 years and is the oldest in the western hemisphere. After four years of negotiations, Peace Agreement between the FARC and the Government of Colombia was signed on November 24, 2016. The consequences of the conflict have been severe, including forced displacements usually in rural areas, with 87% of the total of victims coming from those areas (Centro Nacional de Memoria Historica, 2015). Concerning the amount of abandoned or dispossessed land the most agreed upon estimation suggests that about 6.5 million hectares may have been affected by some displacement process (González, 2013). Main difficulties for making more accurate estimations stem from a structural problem regarding the country's land tenure information, which is provided by two individual systems; on the one hand the cartography-based cadaster and, on the other hand an immovable property registry (UNHCR ACNUR, 2012).

The Colombian Government started addressing the problem by making a request to combine the two independent information systems, indicated in a recent national policy document (Departamento Nacional de Planeación, 2016). The document describes the need for a new integrated system, fed by both, Cadaster and Immovable Property Registry, based on principles of interoperability and legal independence. Moreover the system shall support a more reliable data management that also ensures accurate storage and collection of data.

The Colombian profile of the Land Administration Data Model (LADM-COL) conceptualizes both, semantic interoperability and legal requirements in order to support a full integration between the existing Cadastral and Property Registry information complying with the ISO19152:2012 norm. The profile is the outcome of a team composed of specialists from several National Agencies supported by a project of the Swiss Cooperation and led by the National Geographic Institute Agustin Codazzi (IGAC) and the Notary and Register Superintendence (SNR). The LADM-COL defines the required set of principles to ensure, on one hand, a proper land administration as well as all post-conflict related processes like land tenure regularization and formalization or land restitution.

The defined LADM-COL covers legal concerns about data quality, access restriction and role-defined tasks. Thus, all agencies responsible for tracing and solving land tenure issues during the conflict will have a framework at their disposal that supports data management during post-conflict. Although the profile represents an important achievement for Colombia, at the same time it also represents new challenges and commitments for the involved institutions.

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1. A STABLE AND LASTING PEACE IN COLOMBIA

1.1 General Information on Colombia

Colombia is a decentralized republic located in the northwestern corner of South America with a territory of 1,141,748 km² and 49 million inhabitants. In 1991 a new Constitution founded on the respect of human dignity stated that Colombia is a social state of law, democratic, participatory and pluralist. The Constitution assumes that state actions must be aimed at abolishing social inequality and thus guaranteeing human dignity. However, throughout Colombian history, social inequality has been reality, reflected in the great disagreements related to the exploitation, usurpation, appropriation or improper invasions of the land and the consequent concentration of property.

1.2 Short History of the Conflict in Colombia

Colombia has lived through a long history of conflict whose first expressions already appeared in the decade of the 1920s due to disputes in the forms of hiring and accessing land. At the beginning of the 1930s, the country presented a serious problem related to the lack of legitimacy on property, which resulted in the monopolization of lands and disorder in form of appropriation of public lands, called vacant lots in Colombia (Fajardo, 2014).

The internal armed conflict, as we know it today, began in 1948 for different reasons, however, the main ones are related to land issues. For many years there has been exclusion in access to land, concentration of property, persecution of agrarian organizations, over-exploitation of labor and drug trafficking, presented by the abandonment of the State in marginal areas, facilitating the cultivation of illicit crops. At a late stage of the conflict, control of land corridors for drug and arms delivery were constantly fought by different war actors.

The traces of the conflict left more than 220,000 deceased, close to 5 million displaced, more than 25 thousand missing, and about 6.500 recruited children and adolescents, among other victims (Grupo de Memoria Historica, 2013).

1.3 Process to Peace

There have been 10 peace process attempts with the different armed groups, 4 of them with the largest guerrilla group, the Revolutionary Armed Forces of Colombia (FARC), who initiated their activities in 1948 with a fight for an agrarian reform. Today the group consists of 5,700 members compared to 20,000 during the 90s.

The latest attempt to achieve peace began with the government of Juan Manuel Santos, with an agenda of six topics. In 2013 the first topic related to land and rural development was accomplished and on November 24, 2016, after four years of negotiations, the Peace Agreement between the FARC and the Government of Colombia was signed.

1.4 Integral Rural Reform

The Peace Accords determine that integral rural development is crucial to reduce the gap between the countryside and the cities (Acuerdo Final, 2016), reduce poverty of the rural population, and boost the integration of the regions and the social and economic development of the country. The structural transformation of the countryside implies the proper use of land, stimulating tenure formalization, restitution and equitable distribution of land.

The main commitments related to the integral rural reform (IRR) are to stimulate access and use of land by creating a 3 million hectares land fund for landless peasants and to carry out a massive tenure formalization plan for those who own or occupy the land but do not have registered titles. Ambitious goals were defined in order to formalize 7 million hectares within 10 years. The agreement recognizes the importance of the environmental richness of the country and guarantees conservation of the protected areas under constant pressure by displaced or landless communities. It additionally declares the need to ensure that land use is consistent with its vocation. The main instrument to achieve these goals will be the updating and modernizing of the cadastre in rural areas, which shall be accomplished within 7 years from now, including the establishment of an agrarian jurisdiction.

The implementation of the development programs including the land reform activities, shall be carried out in a systematic way, giving priority to the regions most affected by the conflict with high levels of poverty, less state presence and illegal economic activity. The multi-sectorial efforts to be achieved will be structured in Rural Reform Plans that foresee a reduction of 50% of poverty within the next 15 years. The plan promotes public goods and services in infrastructure and land adaptation. The rights of peasants shall be guaranteed, in particular the access to housing and drinking water, education, health and social security for rural workers. To insure agrarian productivity, food safety and marketing of farmers' products, technical assistance, technology, research and better access to credits shall be ensured as well.

1.5 Current regulatory Framework

According to FAO, the Peace Accords are required to expedite the approval of all the laws needed to implement the agreements, in order to achieve the ambitious goals of the IRR (FAO, 2005). Among other, those legal framework reforms will concern cadaster and land tenure.

Aware that the debt with the rural sector cannot be postponed, the Government has given priority to design policies and strengthen institutions which shall help to overcome the obstacles associated with land tenure and the recognition of victims of forced abandonment and dispossession. The Victims' and Land Restitution Law of 2011 stipulates that all the victims that have been dispossessed of their land or have been forced to abandon it have the right to its restitution. The

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Restitution Law also states that the pertinent institutions must provide the required information in peremptory terms to carry out sound research for each victim case.

On December 2015, the National Government, in compliance with the provisions of the National Development Plan 2014-2018 (Ley 1753, 2015), restructured the agrarian institutions, creating, among others, the National Land Agency (ANT). Article 104 of the same Law establishes that the Government must promote the implementation of a cadastre with a multipurpose approach, "[...] understood as the one that has Property information to contribute to the legal certainty of the right of immovable property, the strengthening of local tax authorities, spatial, social and economic planning".

Likewise, concerning the operational aspects, the National Development Plan states that the National Geographic Institute Agustín Codazzi (IGAC) with the support of the decentralized cadastre agencies, shall carry out the necessary activities for the cadastre in a gradual and integral way through systematic and massive land surveys.

The public policy document CONPES 3859 of 2016 "Policy for the adoption and implementation of a Multi-Purpose Rural-Urban Cadastre" (Departamento Nacional de Planeación, 2016) allows the participation of numerous actors in cadastral operation through the delegation of powers, and/or decentralization of operations to cadastre agencies. Additionally, the establishment and maintenance of a modern, complete and reliable cadastre is stipulated, requested to be fully consistent with the property rights registry and integrated with other systems used for land administration.

The Victims' and Land Restitution Law, the National Development Plan, several Decrees and CONPES 3859 formulate long-term strategies and emphasize an articulated work, interoperability and accessibility of data as well as the mentioned new forms for the operation of the cadaster. They also formulate the need to establish a Land Administration System based upon full interoperable information systems among the different agencies that are involved, all of this within the framework of a National Spatial Data Infrastructure.

2. CURRENT ISSUES CONCERNING LAND ADMINISTRATION IN COLOMBIA

2.1 Cadastre and Property Registry Information

In Colombia, the Cadastre and the Registry is led and operated by two separate institutions, the IGAC and the National Property Registry (SNR). Both institutions have always operated in function of their missionary objectives, which handicapped a seamless articulation of the Cadastre – Registry information, and thus affected legal security of registered property rights. The problem has been identified for some time and several interoperability projects have been proposed so far to remedy this disarticulation. However, none of these projects succeed in establishing a complete integration of cadastre and immovable property registry.

Within the current vision for a solid land management policy, the modernization of the cadastre – registry component is elemental as well as the “institutionalization of the paradigm of land administration” (Williamson, Enemark, Wallace, & Rajabifard, 2009). At present the paradigm is

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finally broadly accepted, however cadaster and registry institutions are not yet completely ready to face it. One of the main problems that must be coped with is that the status of the available information does not meet the needs for ensuring interoperability of data and for serving as a basis for a future national land administration information system.

As shown in the national policy document (Departamento Nacional de Planeación, 2016), the regulations for the cadaster have focused so far on the fiscal component, leaving the physical component of the legal system disjointed. One reason for this is that it is assumed that the legal aspect does not create enough economic benefits for the municipalities or for the state, and therefore it is not worth to consider it. Another, is that there was not a strong requirement for the cadaster from a legal perspective, given the fact that within the property titles a textual parcel description was used instead to rely on cadastral plans.

The CONPES 3859 includes statistical indicators on the outdated cadastral information, especially in areas that have been historically affected by the armed conflict as shown in Figure 1. It is estimated that about 28% of the national territory has no cadastre at all and in almost 64% of the territory where a cadastre exists, there is no updated information.

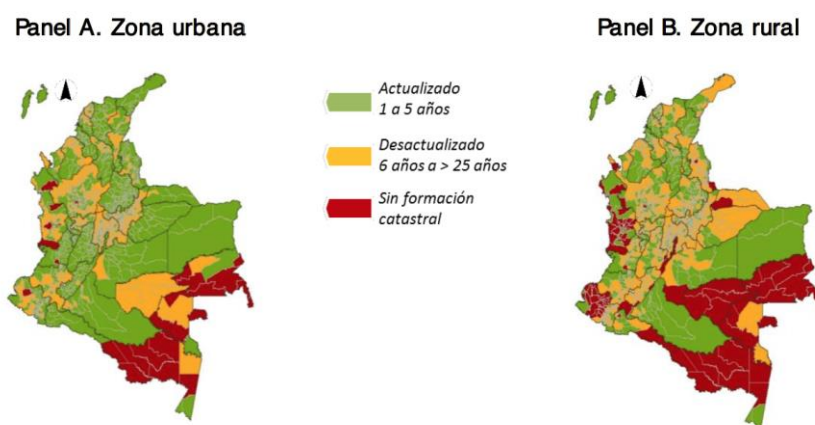


Figure 1. Status of cadastral formation by zone. Source DNP based on IGAC information queried on January 2015 (CONPES 3859, 2016)

The described situation has a serious impact on state processes for recognition of land rights, land assignation and land restitution. And very important: It implies high transaction costs for the users that have parcels with differences between the certified cadastral data and the textual description of the property included in the title.

2.2 Lack of Data Interoperability

Another problem with the current cadastral information is the lack of standardization to interoperate with other systems and to serve as a source for the entities that require reliable cadastral information for their missional needs. This has led to the situation where the institutions use outdated data or redundantly store the same data, un-accomplishing the principle of legal independence as stated in Cadastre 2014 (Kaufmann & Steudler, 1998).

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The CONPES 3859 states that “*Colombia has not defined and adopted all applicable international standards because of the limitations of IGAC's institutional capacity and resources*” (Departamento Nacional de Planeación, 2016). Another reason for the lack of adequate existing standards might be found in the fact that the IGAC was responsible almost exclusively for the cadastre, from definition regulations and often methods to be used, to the field survey and even the supervision.

Whatever the reason is, the lack of robust standardization has led to the fact that today information cannot be exchanged in an agile and efficient way. One direct consequence of this situation, as an example, is that the elaboration of official statistics and annual reports is a very complex and costly undertaking, where information from various sources, systems and at different levels has to be gathered and manually integrated. And even if the reports could finally be completed, due to inconsistencies and outdated information, they often cannot be used for supporting high-level decision making processes.

A cadastre demands up-to-date information, and it is because of the current deficiencies that it is necessary to think about real decentralization of the related processes. However, such an operational scheme also requires well defined standards and technical product specifications, giving the cadastral authority a means for proper validation of the delivered information.

Standards that increase data interoperability are therefore fundamental, enabling seamless exchange of cadastral information, which in turn supports effective land administration, meeting as well the multiple purpose of the cadastre.

3. THE LADM AS A TOOL FOR ADDRESSING THE ISSUES

The ISO 19152:2012 norm, known as the Land Administration Domain Model (LADM), takes into account patterns of land administration systems of many different countries, for managing e.g. legal land information, information of interested parties, information of spatial units, or even the surveying data required for defining the geometric part of a spatial land unit (Lemmen C., 2012).

Therefore, it is important to understand the LADM as a conceptual model and not as a data product specification (Lemmen, Oosterom, & Bennett, 2015). UML diagrams are normally used to describe the LADM, which allows users to see – and to discuss - the relationships between the administrative land objects (the BAUnits) and its structural components such as the parties, the rights, restrictions or responsibilities that a party might have over an administrative object, and finally the spatial representation that an object can have. Thus the LADM provides a descriptive standard based on the semantic structuring of land administration (Lemmen, et al, 2015).

3.1 Adoption of the ISO 19152 Norm in Colombia

In accordance with the new institutional policies and the strategic vision of the National Government, where the characterization of land and land administration is so important to fulfill the objectives of the IRR and therefore the Peace Accords, it is necessary to adopt international standards, contextualized to the country's needs.

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Regarding the ISO 19152:2012, the public policy document CONPES 3859 requests its adoption in the way that "all the entities that will be part of the land administration system should adopt the LADM standard. IGAC, SNR, ANT and DNP, must guarantee the incorporation of the LADM in their processes and while implementing the multipurpose cadastre" (Departamento Nacional de Planeación, 2016).

In this sense, the adopted LADM standard should also serve as a means for interoperability and integration of the cadastre with other systems that participate in land administration, fulfilling the objective of a multipurpose cadastre (Williamson et al, 2009), in addition to aligning all institutions with the principle of Legal Independence (Kaufmann & Steudler, 1998).

On the other hand, it is expected that the adoption of the LADM, will improve access to public information through the provision of appropriate information technologies and infrastructures based on standards that allow the seamless integration of information from the different public entities (Departamento Nacional de Planeación, 2016).

Regarding the last point, the implementation of the LADM in Colombia is particularly challenged by a complex institutional setting, with numerous institutions that are involved in land administration and regularization processes and the management of the related information. Introducing a new standard in such a complex environment implies also a certain risk potential, even if the advantages of the LADM regarding interoperability and opportunities to speed up the processes of land policy implementation are well recognized. By including all the relevant Colombian land administration entities in the modelling process, providing different forms of introductory trainings and showing a clear roadmap for the implementation of the norm, the initial skepticism vis-a-vis the norm could be turned into a positive attitude, especially among the specialists of the involved institutions who broadly supported the modelling process.

3.2 Colombian Profile LADM-COL

3.2.1 Process of Developing the Profile

The adoption of the LADM standard at the country level, requires the generation of a National profile (ISO/TC 211 Geographic information, 2012), in which the standard must be brought into accordance with National legislation and requirements.

The Colombian profile of ISO 19152:2012 – named LADM-COL, is the result of an interinstitutional work that began in September 2015 with the support of the Swiss Cooperation Project “Modernizing Land Administration in Colombia”, with financial support of the State Secretary for Economic Affairs (SECO). During several workshops, the project’s experts in the standard moderated the modeling sessions, where the specialists of the involved institutions such as IGAC, SNR, Decentralized Cadastre, Land Agency (ANT, former INCODER), Land Restitution Unit (URT), among others, were the protagonists.

The model was developed in several stages as shown in figure 2. In stage 0, an introduction to the standard and the model-driven approach has been made. This introduction allows the participants to

assimilate the used terminology in an early stage. It is important that the thematic specialists who participated in this stage, will also be involved in the rest of the stages.

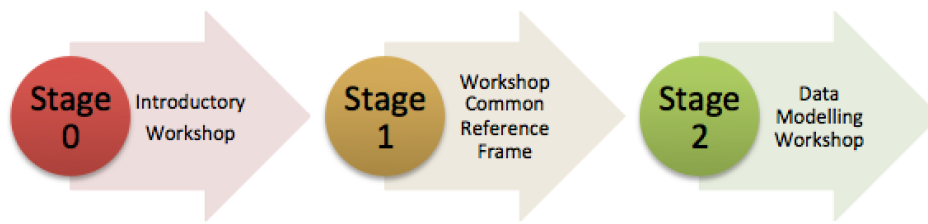


Figure 2: Process and Methodology for defining the conceptual Colombian LADM Profile. Source: Authors

In stage 1, Initial Definitions and Agreements regarding the possible modeling approaches were established for the main BAUnit and SpatialUnit classes, Rights, Restrictions and Responsibilities, as well as for the management of geometries. At this stage thematic specialists for cadaster and registry made a business model diagram which helped (also for the moderating experts) to understand, the particularities and the terminology used in Colombia. Based on the definitions and agreements a first test draft of the model was created.

During stage 2, the first stable version of the conceptual model was developed and, validated regarding its classes, attributes, domain types and relations. By applying the naming conventions defined in stage 1, a clear distinction between the classes and attributes that are part of the ISO norm and those defined for the national profile was possible. Stage 2 is also an iterative process, where the model has to be tested against all institutional needs, and where several adjustment steps are necessary in order to generate a new version of the profile.

The conceptual model which resulted from the process can be seen in figure 3.

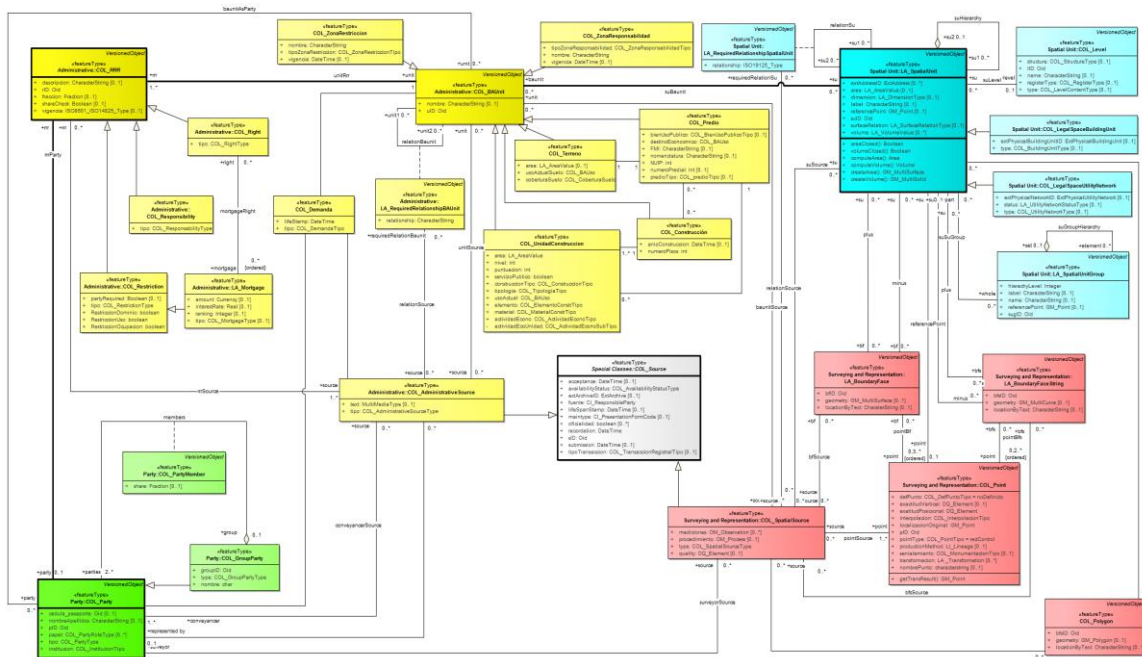


Figure 3: UML of the LADM-COL Profile. Source: Project

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The particular adaptations in the Colombian LADM profile in each package are specified below.

3.2.2 Party Package

In the party package, several specialized classes of the class LA_Party were included. This allows to define detailed and differentiated information of the interested stakeholders, which in turn will be of great importance during data exchange between the different entities.

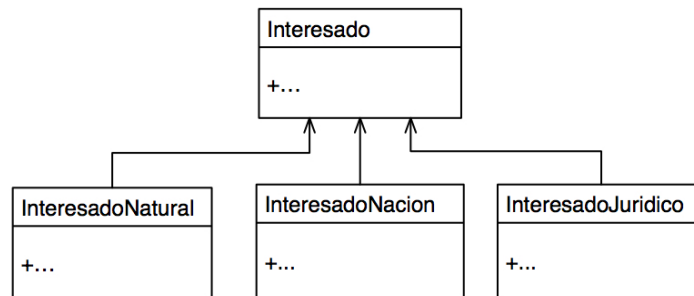


Figure 4: UML of the specialized LA_Party class.
Source: Authors

3.2.3 Administrative Package

The main characteristics of the administrative package in the national profile are:

- Variety of specialized classes of LA_BAUnit, see figure 5.
 - “Predio” (legal parcel) and “Terreno” (lot), whose existence is interdependent, means they must co-exist, because the cadastral regulation indicates that a parcel exists on an existing lot.
 - “Construccion”, a class where instances must not exist if there is not a “UnidadConstruccion” (Construction Unit), which in turn can only exist depending on a “Construccion” class. Both classes however, are specialized classes of LA_BAUnit.
 - COL_BAUnit is the generalized class of the basic administrative units of the LADM-COL cadastre model. Some of its attributes were modified for the Colombian profile.
- The class “Alerta” is meant to manage alerts and lawsuits concerning requests for Land Formalization or Restitution processes, on a BAUnit. “Alerta” is a class outside of the LADM, created according to the specific needs of the Colombian legislation (figure 6).
- Several new domains were created and existing ones adapted, for the specific context of Land Administration in Colombia.
- The class “COL_ZonaAfectacion” indicates the extension of the core model with specialized models to be developed for Restrictions and Responsibilities. These models share other classes of the core model.

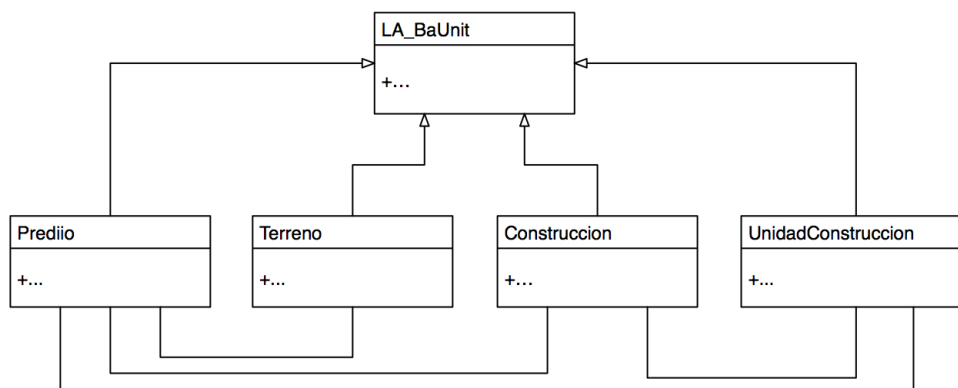


Figure 5: UML of the specialized LA_BAUnit class.

Source: Authors

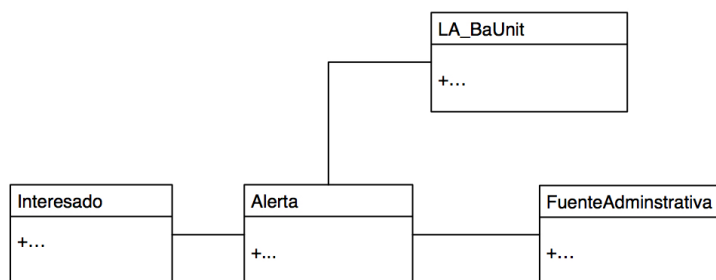


Figure 6: UML of the LADM-COL with "Alert" class.

Source: Project "Authors"

3.2.4 SpatialUnit and Subpackage Surveying and Representation

In the sub-package Survey and Representation specialized classes ("PuntoLevantamiento", "PuntoLindero" and "PuntoControl") and attributes of the LA_Point class were defined to be used for quality assurance of field measurements. A new class "Lindero" (boundary) was created as a specialization of the class LA_BoundaryFaceString. "PuntoLindero" (boundary point) has a relation to the "Lindero" class and allows the storage of data related to the agreement between parcel owners.

4. LADM-COL AS A SUPPORTING TOOL FOR LAND ADMINISTRATION IN POST-CONFLICT COLOMBIA – CONCLUSIONS

The land management paradigm focuses on providing tools to decision makers with the goal of sustainable development. This development, and especially rural development in the areas which have been affected the most by the armed conflict, is one of the pillars of the post-conflict in Colombia. And updated cadastral information managed through a unique semantic model is the basis for an integrated spatial planning and rural development.

Colombia's Government is committed to this paradigm and in the process to achieve sustainable rural development and poverty alleviation, the first step will be to undertake projects with a systematic approach to ensure access to land for the landless peasants and to respond to the huge demand on land tenure formalization and land titling of National vacant land, without disregarding environmentally strategic areas. As a top priority, the requests of the land dispossessed victims have to be attended.

The following points outline the use of the LADM and in particular of the Colombian profile of the standard, in supporting effective Land Administration in post-conflict Colombia:

- The LADM-COL is compliant with the ISO norm in that it clearly informs about the legal status of land rights. In particular, it permits to register if a parcel has an associated formal or informal right and in the latter case, whether it is a possession (private land) or occupation (National vacant land).
- Land use conflicts, that is overexploitation of soils and agricultural activities in environmentally sensitive or restricted areas, are highly relevant issues on the Government agenda for sustainable rural development. There, the LADM-COL will allow to manage restrictions of public interest (and legislation) such as environmental reserves, natural disaster risk- and other spatial planning zones. These restriction-zones have to be considered in every recognition-process of land rights, land assignments or land restitution requests.
- The current LADM-COL model includes so-called “alerts” (a special object class) regarding land restitution requests, land protection annotations, and other administrative or juridical procedures or lawsuits. It thus provides adequate information to the registry authority to prevent transactions on involved parcels. Additionally, specialized models are currently developed to guarantee collective land rights of indigenous and afro-Colombian communities. Other models include focus-zones of the restitution process, concentration areas of the FARC and other special territories with relevance to the post-conflict process.
- In any effective Land Administration System, the integration of the physical description of a property with the legal information in its different types of tenure seems to be elementary. In Colombia however, all initiatives for harmonizing cadastral and registry data have failed so far. The discussions on the LADM-COL provided an excellent platform among the involved institutions, for agreeing far-reaching definitions and setting the bases for interoperability between cadaster and registry, contributing thus to legal security on all registered land rights.
- Dissemination of information needed to support decision-making in land tenure regularization and restitution processes throughout the country can be easily realized by developing web services based on the common LADM data model. An example for this is the implementation of the first LADM compliant web service, which provides information on restituted land parcels to the cadastral authority.

The consolidation of effective land administration requires full data interoperability to meet the objective of articulating and disposing updated land information to the different users (Williamson, et al, 2009). Efficient interoperability is also required if the principle of Legal Independence shall

be fulfilled, where each institution assumes the responsibility for the management of its own legal land objects (Kaufmann et al, 1998).

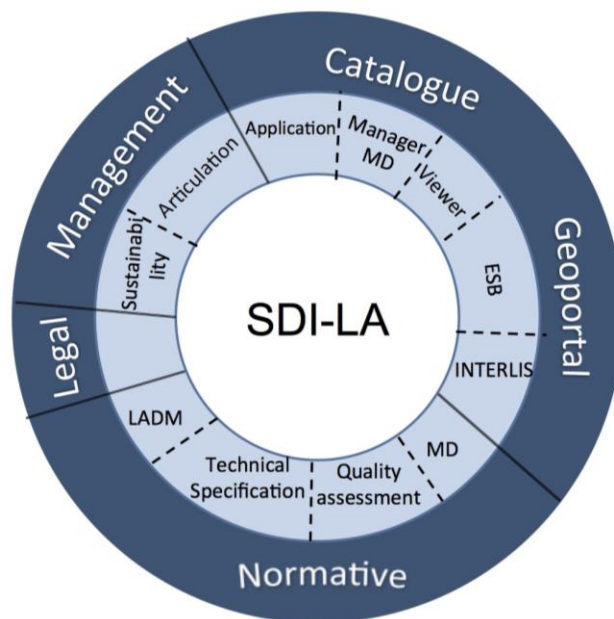


Figure 7: Conceptual framework of the SDI for Land Administration
 Source: Project “Modernization of the Land Administration in Colombia”

The huge task that the National Land Agency, the Land Restitution Unit, notaries, judges and other involved authorities will face in the above-mentioned land policy processes needs a seamless data interoperability and the fulfillment of the principal of Legal Independence.

The National Spatial Data Infrastructure (NSDI) provides the required normative framework where the LADM-COL is a crucial element.

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BIOGRAPHICAL NOTES

Andrés P. Guarín López is a cadastral engineer and geodesist, with a master in information sciences and communications from the Universidad Distrital Francisco Jose de Caldas. During his professional occupation, he has been the technical leader for implementing several GIS projects, from analysis, design, and development to the implementation stage. He was engaged in drafting the conceptual design of the new Multipurpose Cadastre of Colombia and is currently working for the National Land Agency as a consultant for the institution's Land Information Management.

Lina Baron studied law at the Santo Tomas University in Bogota and has postgraduate diploma in administrative law from the National University of Colombia and another in Tax Law at the Pontificia Universidad Javeriana. She has worked in several public and private entities related to agrarian, environmental, and real estate law. Currently, she works for the Superintendence of Notaries and Registry (the National Registry) in the implementation of the new multipurpose cadastre and in the development of the new registry information system.

Silvia Salamanca studied civil engineering at the Colombian School of Engineering and has a master's degree in mapping and geographic information management of Twente University (ITC). She has experience in management and execution of land tenure regularization, cadastre and GIS projects, working with the National Geographic Institute IGAC, IBM, Ministry of Agriculture and Rural Development and the Presidency of the Republic of Colombia. She co-initiated the National Land Titling Project and the National Rural Tenure Formalization Program. Silvia has been a land tenure and GIS consultant for the IDB in several Latin American countries and is currently working for the Swiss Government (SECO) financed Project "Modernization of Land Administration in Colombia".

Lorenz Jenni studied surveying and geomatics at the University of Applied Sciences in Basel and has a master's degree in GIS of the Universitat Politècnica de Catalunya. The last 15 years he has been working as a consultant in cooperation projects related to land administration and land information management, with Swiss Government, KfW, European Union, IDB and the World Bank, in Latin America, Caribbean and South-East Europe. Currently he is the technical team leader of the project "Modernization of Land Administration in Colombia".

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