Diálogos Geográficos N°3

LADM COL

Land Administration Model

Vol. 4:

Initial conceptualization of the core model LADM-COL

IGAC
INSTITUTO GEOGRÁFICO AGUSTÍN CODAZZI

Dirección de
INVESTIGACIÓN
y prospectiva

ISBN: 978-958-5494-55-8
ISBN en línea: 978-958-5494-42-8

Land Administration Model – Colombia
Volume 4

Initial conceptualization of the core model LADM-COL

IGAC
INSTITUTO GEOGRÁFICO AGUSTÍN CODAZZI

Dirección de
INVESTIGACIÓN
y prospectiva

Land Administration Model - Colombia Volume 4
Initial conceptualization of the core model LADM-COL
First Edition Bogotá / May 2024
ISBN 978-958-5494-55-8
Online ISBN 978-958-5494-42-8

Agustin Codazzi Geographic Institute
Research and Prospective Directorate

Johan Andrés Avendaño Arias
Technical Director, Research and Prospective Directorate

Diego Fernando Sánchez
Elkin Dario Pérez
Erick Nicolas Sarmiento Linares
Héctor Andres Castro
Ivan Daniel Torres Beltrán
Juan Carlos Ramírez Caicedo
Mónica Vanessa Paternina Riaño
Paola Vanesa Navarrete Prada
Sebastián Sierra Bernal
Sebastián David García Guzmán
Researchers

Oswaldo Ibarra
Alexander Páez
Content Review

Gloria Yulier Cadena-Montero
Managing Editor

Angela Marcela Ortiz
Sofia Alejandra Estrada Cely
Gian López
Translation

Sofia Alejandra Estrada Cely
Angela Marcela Ortiz
Copy Editing

Gabriela Amaya Vásquez
Jose Castro Garnica
Sofia Alejandra Estrada Cely
Design and Layout

Table of Contents

Introduction **4**

Analysis and Characterization of Initial Variables of the Core Model LADM-COL **6**

Administrative Package. Rights, Restrictions, and Responsibilities **8**

Party Package **10**

Document Package **13**

Spatial Unit Package **14**

Structure Tables **17**

Conclusions **18**

Table of Figures

Figure 1. Reading Guide for Documents Related to LADM Conceptualization in Colombia **3**

Figure 2. LADM-COL Core Model Version 2.2.0 **7**

Figure 3. Classes LA_RRR and LA_BAUnit of the Administrative Package in the Core Model LADM-COL Version 2.2 **9**

Figure 4. LA_BAUnitType Domain of the Administrative Package in the Core Model LADM-COL Version 2.2 **9**

Figure 5. Party Package Classes in the LADM-COL Core Model Version 2.2 **10**

Figure 6. Party Package Domains in the LADM-COL Core Model Version 2.2 **11**

Figure 7. Party Package Domains in the LADM-COL Core Model Version 2.2 **12**

Figure 8. Document Package Classes in the LADM-COL Core Model Version 2.2 **14**

Figure 9. Spatial Unit Package Classes in the Core Model LADM-COL Version 2.2 **15**

Figure 10. Surveying and Representation Subpackage Classes in the LADM-COL Core Model Version 2.2. **16**

Figure 11 Classes Related to the Structures of the LADM-COL Core Model Version 2.2 **17**

Preliminary Considerations

The Instituto Geográfico Agustín Codazzi (Agustin Codazzi Geographic Institute —IGAC by its acronym in Spanish—), in its exercise as the maximum cadastral authority, gives the following linear and progressive documents, with the present one being the first. These documents are the result of a research process emphasized in bibliographical review and the generation of documents that could be used as input for the comprehension, development, and promotion of the Land Administration Domain Model (LADM) and the adoption of this one to the Colombian profile, denominated as LADM-COL.

Throughout the document review, it will be possible to encounter diverse technical and methodological analyses of the process, history, changes, and behavior that the LADM-COL Extended Model Cadastral-Registration, and the various application models that surged in the framework of Multipurpose Cadastre, thus seeking to make the cadastral approach the center of these writings so that the various actors of the cadastre and the community in general have within reach a purified and synthetic version of the processes, lessons and current state of the adoption of the models, based on official documentation from the IGAC as the governing body.

Regarding the documentation of these models, it has been observed that if the official information, issued by different national organizations, is contrasted over time, since the conception of the standard's inclusion in Colombia, it may present some ambiguities or appear to be inconsistent in terms of the terminology associated with designated them and the competencies related to them. This corresponds to the institutional development, evolution, and understanding of the implementation of the Land Administration Model in Colombia, oriented towards cadastral management with a multipurpose emphasis.

In the ensuing part is a conceptual map displaying the name of each document, a brief description, and the position that it occupies within the sequence, to delimit its scope and provide the reader with a general overview that allows them to navigate its contents more easily (Figure 1).

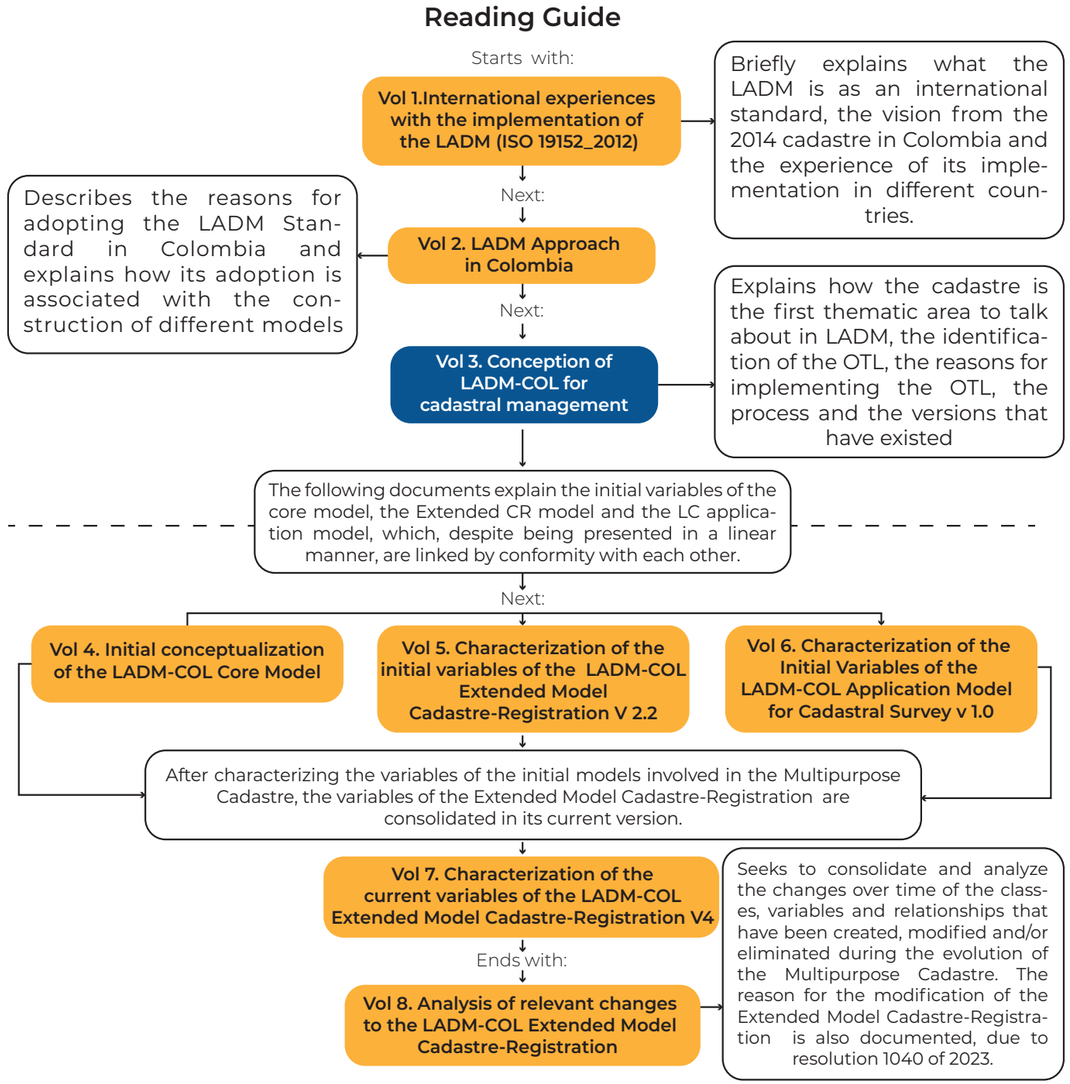

Figure 1. Reading Guide for Documents Related to LADM Conceptualization in Colombia.

Introduction

The process of adopting the ISO 19152:2012 Land Administration Domain Model (LADM) standard as an international norm seeks a semantic standardization of territorial information through data models that allow the governance, exchange, and interoperability of information on territorial information (ICDE, 2022). According to the Colombian Spatial Data Infrastructure (ICDE by its acronym in Spanish, 2022), for a country to adopt this standard, it is necessary to build a specific profile that suits the needs of its territory. For Colombia, this was achieved for the first time in the profile known as the LADM-COL Core Model, so the main adjustments include the following:

- Adaptation of prefixes of the main classes of the model.
- Definition of particular classes for the Colombian context.
- Elimination of some cyclic relationships.
- Design and inclusion of modeling definitions for land objects to be included in the model ecosystem.

Considering the above, the Colombian profile was defined with the definition of a LADM-COL data model called the Core Model, which is the basis for describing the territorial objects that will be part of the land administration (ICDE, 2022). As mentioned, this series of primers will consider the conceptualization of the first officialized version of the LADM Model for the Colombian territory, available in the web repositories as LADM_COL_Nucleo version 2.2. A preliminary analysis suggests the existence of preliminary versions prior to this one, since otherwise, this would be version 1.0, however, the versions before these were not official.

In this context, an analysis of the documentation related to the subject was carried out. Previous records were also examined, some of which were unpublished, such as minutes, reports, technical memories, and interviews generated

in the framework of the joint work between the IGAC, the Superintendence of Notaries and Registry (Superintendencia de Notariado y Registro or SNR by its acronym in Spanish) and technical experts, as an integral part of the land modernization project in Colombia. This process was developed in close collaboration with the international cooperation project with the Swiss government. It should be noted that the previously identified version is the first to be located and is considered the main focus of study in this paper. For the analysis of the variables of the first official version of the LADM-COL Model, we start from the conceptualization documented in the ICDE, which refers to the LADM-COL core model as the first level of conformity. This model establishes the ontological and semantic basis of land administration in Colombia and defines a common language for the use of its different entities responsible for land information management responsible for land information management (ICDE, 2022).

The legal support that supports the adoption of the Colombian profile of the LADM is specified in the Joint Resolution IGAC 642 SNR 5731 of 2018. Although this will not be the object of study in this document, it is mentioned as an integral part of the analysis and characterization of the initial variables, as it will be considered in detail in a specific document to narrate the history of the LADM-COL Model.

This document analyzes and characterizes the initial variables of the LADM-COL Core Model, since as a conceptual model it defines the classes, attributes, and relationships of the scope of land administration and defines the guidelines for the identification of land objects, through the implementation of standard packages, subpackages, and other necessary complements to establish the interoperability of alphanumeric information among the different entities that interact in it, balancing the technological offer with the demand for services.

The LADM-COL core model must have at least the following classes, with the assigned colors (Table 1):

LADM ISO 19152:2012	LADM COL	COLOR CORE	
Party	Party Package	#ccffcc RGB (204, 255, 204)	
BA_Unit (administrative purpose)	Administrative Package	#ffffcc RGB (255, 255, 204)	
RRR (Rights, Restriccions and Responsabilities)	RRR (Rights, Restrictions, Responsibilities)	#ccffff RGB (204, 255, 255)	
SpatialUnit (space object)	Spatial Unit Package	#ffcccc RGB (255, 204, 204)	
Surveying and Representation Subpackage	Surveying and Representation Subpackage	#d9d9d9 RGB (217, 217, 217)	
Source	Structure Types	#FFFFFF RGB (255,255,255)	

Table 1. Classes of the LADM-COL Core

Analysis and Characterization of Initial Variables of the Core Model LADM-COL

In order to understand the variables of the core model, it is essential to understand its composition, i.e., its structure. This model is divided into three general packages, a subpackage, a transversal documentary support component, and a set of structural tables (Figure 2). These elements are as follows:

- Administrative Package: Integrates the aspects of Rights, Restrictions, and Responsibilities, it is identified in yellow color.
- Documentary Support Component: Recognized by its gray color, this component plays an essential role in documentary support.

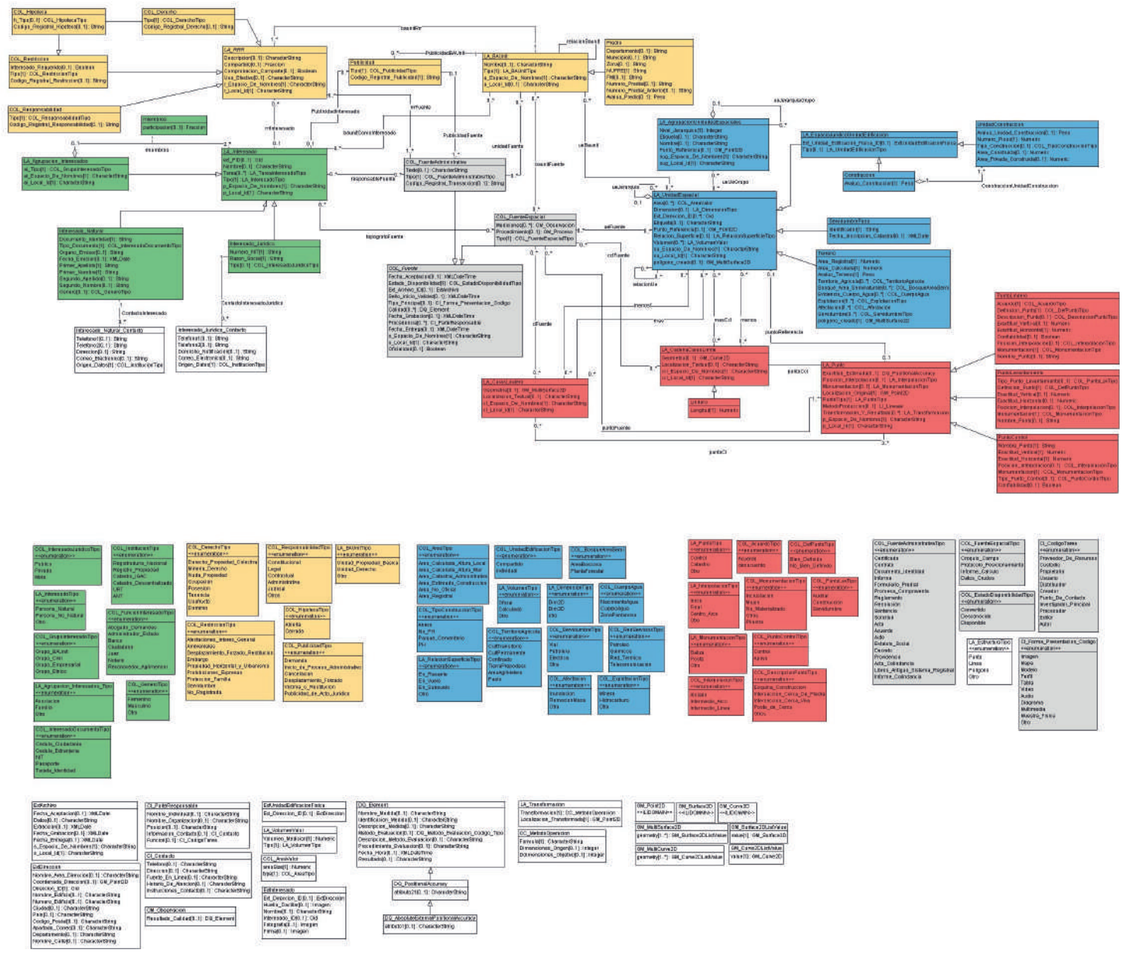

Figure 2. MLADM-COL Core Model Version 2.2.0. **Source:** IGAC & SNR (2018).

» Party Package: Identified by green, this package focuses on parties and their implications.
» Spatial Unit Package: identified by blue color, this package considers aspects related to the spatial dimension of the model.
» Surveying and Representation Subpackage: highlighted in red, this subpackage specializes in topography and graphical representation.
» -Structure Classes: identified in white, these classes are a fundamental element in the organization and representation of the model.

To consider the characterization of the initial attributes, it will be done by packages as presented below:

Administrative Package, Rights, Restrictions, and Responsibilities:

It is important to note that the names of the classes in this package always begin with the prefix LA, following the convention established in ISO 19152 of 2012 for the identification of packages; however, it is necessary to highlight that in the previous image, the administrative package is presented, made up of the basic administrative unit and the rights, restrictions, and responsibilities. There is a direct relationship between these two elements, evidenced through a relational table called baunitRrr, as shown in Figure 2.

It is established that a record of class LA_BAUnit must have at least one linked record of class LA_RRR. It should be noted that this relationship may be plural, allowing more than one linkage. On the contrary, it is indicated that a record of class LA_RRR can only have a single linked record of class LA_BAUnit, this nuance in the relationships between classes is fundamental to understand the structure and restrictions of the model (Figure 3).

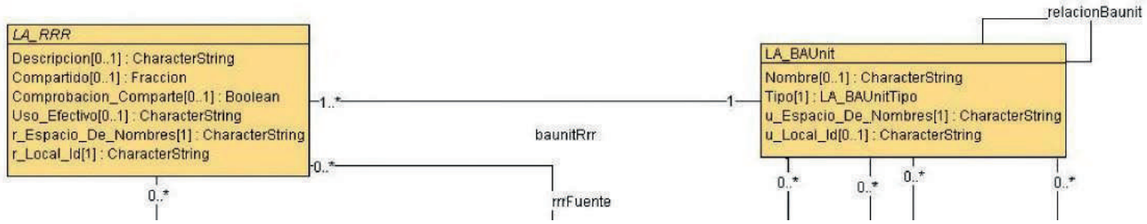

Figure 3. Classes LA_RRR and LA_BAUnit of the Administrative Package in the LADM-COL Core Model Version 2.2. **Source:** IGAC & SNR (2018).

Concerning the attributes, it is observed that within the LA_BAUnit class, the type and the namespace are determined as mandatory attributes, finding a domain within this type attribute (Figure 4).

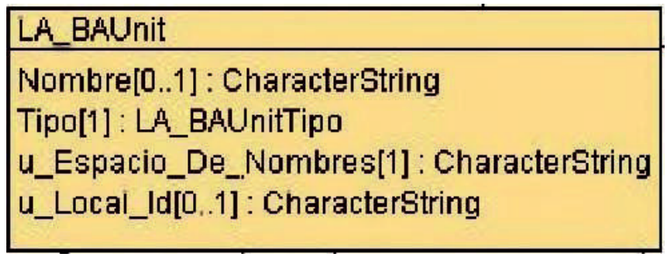

Figure 4. LA_BAUnitType Domain of the Administrative Package in the LADM-COL Core Model Version 2.2. **Source:** IGAC & SNR (2018).

The class LA_RRR has only one mandatory attribute which is the namespace and, as a general explanation for all classes that have this attribute, it refers to the name of the entity, class, element, or table from which the source data comes from.

Party Package

In this package there is a concept of class inheritance linked to the class LA_Interesado, which is the parent class of this package and which seeks to characterize each of the parties that may exist in relation to a part of the territory, for this reason, it is important to see how una tarea, un tipo, el espacio de nombre y un local id (a name, a task, a type, the namespace, and a local id in English respectively) are defined (Figure 5 and 6).

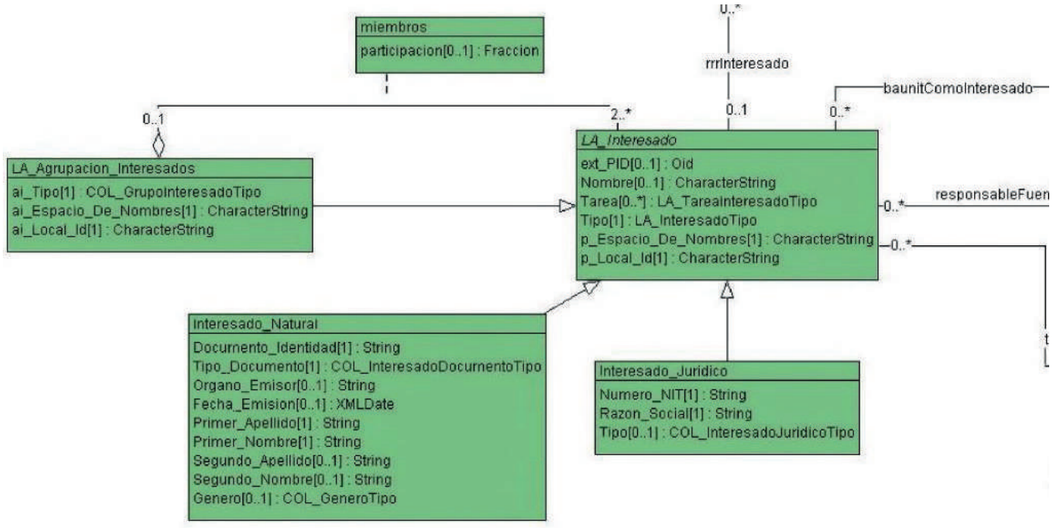

Figure 5. Party Package Classes in the LADM-COL Core Model Version 2.2.
Source: IGAC & SNR (2018).

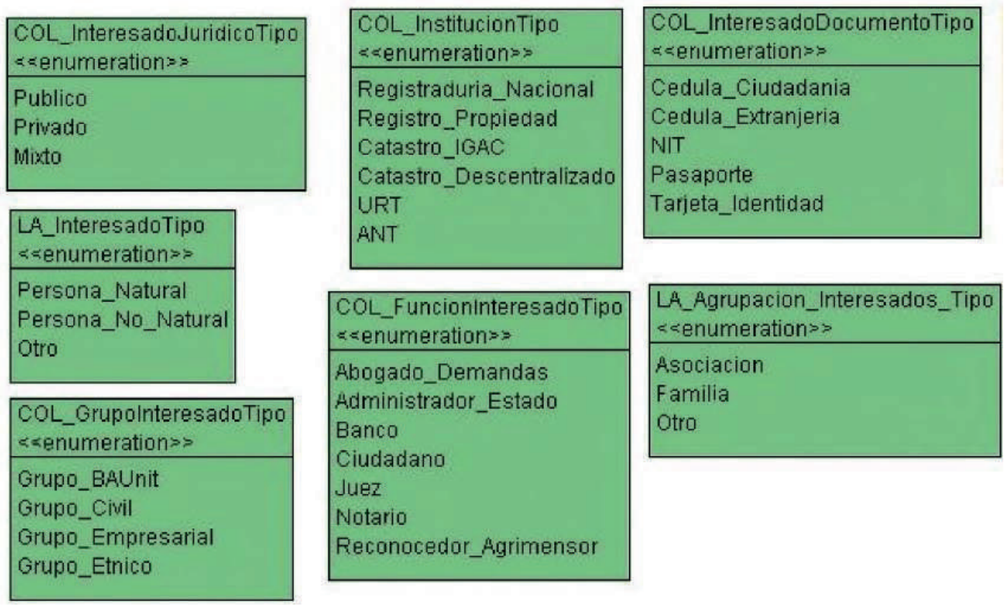

Figure 6. Party Package Domains in the LADM-COL Core Model Version 2.2
Source: IGAC & SNR (2018).

A fundamental aspect lies in the derivation of three additional classes from the main class, two of these classes are directly linked to the class LA_InteresadoTipo, while the third one represents a grouping of parties, especially when there is more than one party per basic administrative unit or Legal Land Object.

The attributes of these classes are designed to characterize both natural and legal persons, considering aspects such as names, company names, and identification, among others. In addition, multiple domains describe a set of values that can be taken by the variables that seek to characterize the interested party, for example, the domain Col_InteresadoDocumentoTipo that allows establishing the

type of identification of the interested party, which can be its Cedula_Ciudadania, Cedula_Extranjeria, NIT, Pasaporte or Tarjeta_Identidad. This approach helps to establish a more detailed structure for the characterization of parties, comprehensively considering the diversity of information relevant to individuals and legal entities. In general, this domain concept is replicated in the other packages.

Party Package is formed by the following seven domains (Figure 7):

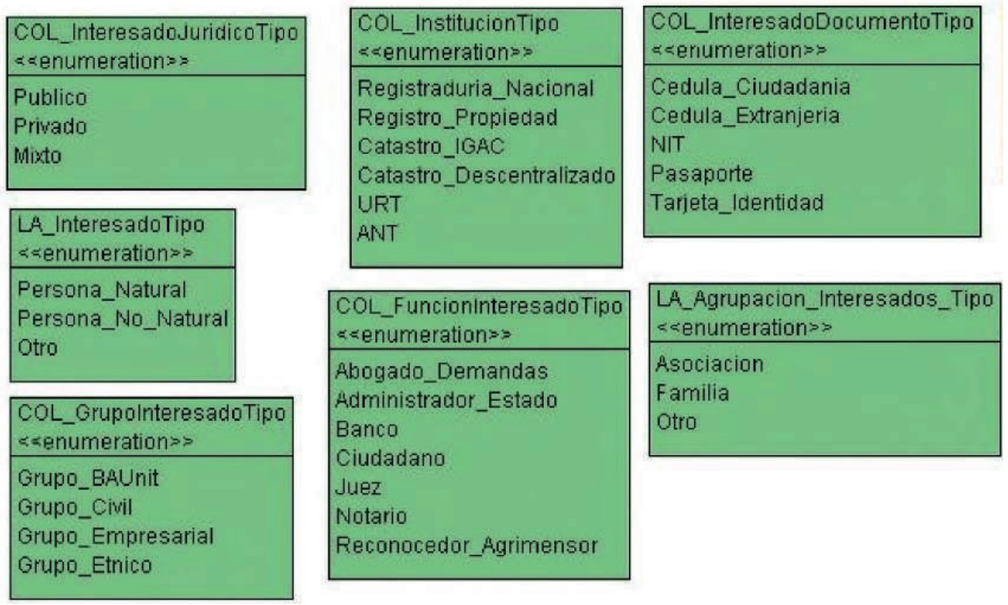

Figure 7. Party Package Domains in the LADM-COL Core Model Version 2.2.
Source: IGAC & SNR (2018).

Document Package

The purpose of this package is to store the information that supports the records of each of the classes. It is essential to highlight that, in the field of land administration, it is crucial to have documents that facilitate the linkage of rights, restrictions, and responsibilities associated with different areas of the territory, this is done with the objective of having a clear understanding of their specific legal situation, in addition, it allows contrasting the information recorded in the data model in relation to the other packages that make it up.

In the Document Package, there is a main table called COL_Fuente, with two secondary classes called COL_FuenteEspacial and COL_FuenteAdministrativa, these classes have different attributes, but they share the function of storing general data, such as the date of acceptance of the source, the availability status, the link to the source file, the start-of-validity stamp, the main type of document (map, image, video, audio, etc.), the quality of the source, the date of recording in the source, the provenance, the date of delivery, as well as general fields applicable to all tables, such as the namespace for the source of origin and the original identification of the data in its original base; this approach allows for the effective consolidation and organization of relevant information in the context of the source (Figure 8).

The unique attributes for the spatial source are the measurements taken, the procedure, and the type of spatial source, and for the administrative source are the text it contains, the type, and the transactional registry code. The latter can be understood as if we were thinking of an application for the Superintendence of Notaries and Registry since it is their own data, but this should not be the case.

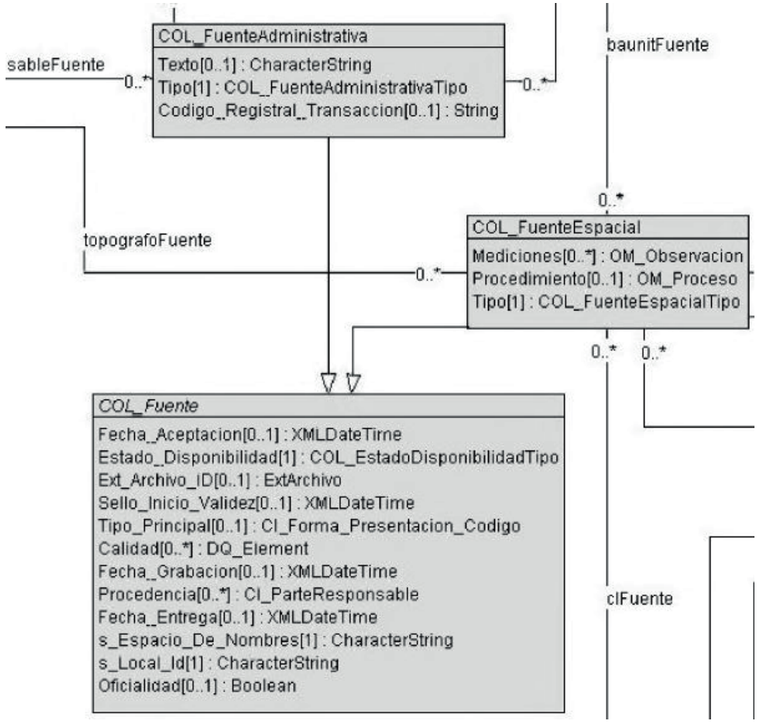

Figure 8. CDocument Package Classes in the LADM-COL Core Model Version 2.2.
Source: IGAC & SNR (2018).

Spatial Unit Package

Within this package, we have the spatial representation that each unit could have depending on the thematic, finding a parent class COL_UnidadEspacial, two inherited classes LA_EspacioJuridicoUnidadEdificacion, LA_EspacioJuridicoRedServicio, and a class linked to the main one that can be understood as a grouping of spatial units. This means that there can be one spatial unit, or a grouping of spatial units if it is the case, allowing not only one spatial record to be stored but more than one, respecting the hierarchy, the legal space per service network, and one legal space per building unit (Figure 9).

The attributes that were designed for the identification of these classes are an area that can be alphanumeric or geographic, a hierarchical level, a text that allows labeling the representation, a reference point for the location of the representation, a volume, an area ratio, the name of the representation in some cases, the state in which they are located, among others.

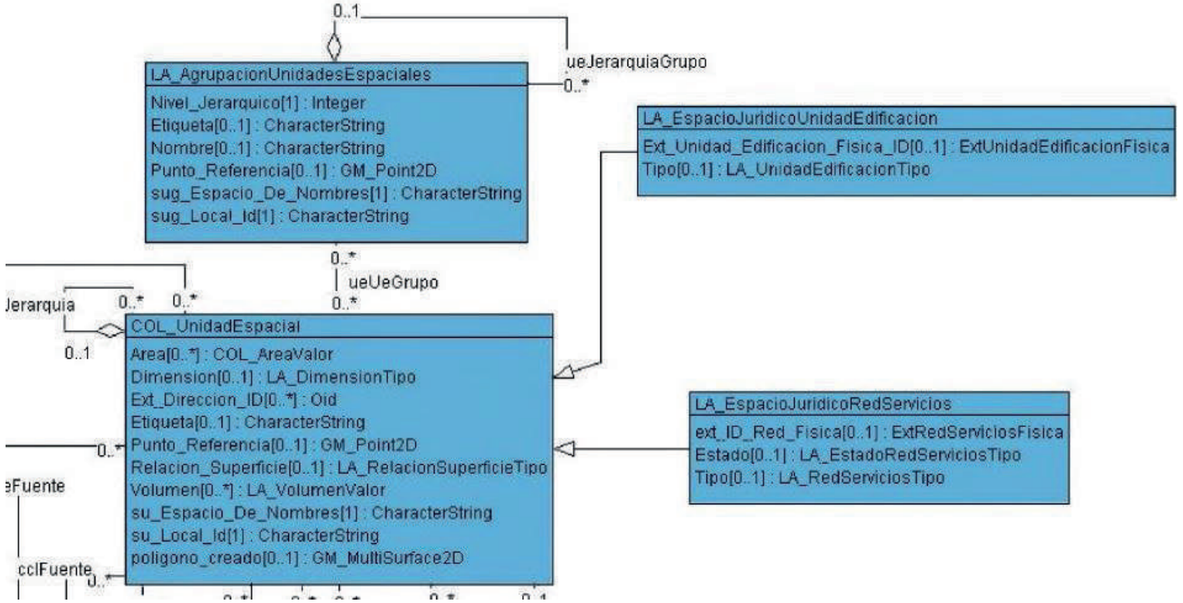

Figure 9. Spatial Unit Package Classes in the Core Model LADM-COL Version 2.2.
Source: IGAC & SNR (2018).

Surveying and Representation Subpackage: To understand the use of this subpackage it is important to say that it is born from the Spatial Unit Package, i.e., it has a geometric representation and must be located for its characterization (Figure 10).

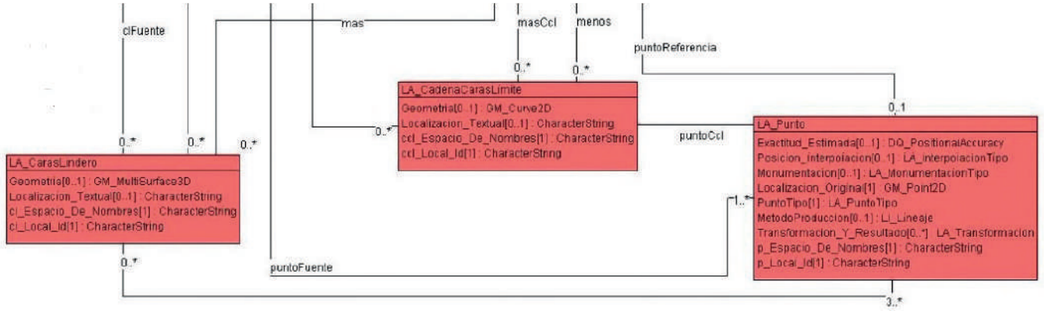

Figure 10. Surveying and Representation Subpackage Classes in the LADM-COL Core Model Version 2.2. **Source:** IGAC & SNR (2018).

In this subpackage, there are three classes: LA_CarasLindero, LA_CadenaCarasLimite, and LA_Punto, all with equal importance and linked to each other. Their relationship indicates that a boundary face must have a mandatory minimum of 3 points (it allows more), and yet a point can exist without needing to be associated with a boundary face. For the Chain of boundary faces, it is established that they are directly linked to the points since the cardinality that they present is not defined, so we can speak of a one-to-one associative relationship.

The attributes of these classes respond to the exact location of what is to be characterized, such as points and borders. What is sought is that they are determined based on topographic exercises that prove the veracity of the information that will be available there. In the same way, a textual location, the location of the interpolation, the type of point being characterized, and some other attributes that will make sense when implemented in the respective extended models are allowed to be written.

Structure Tables

The purpose of this group of structure classes is to define database topics that are specific to the database itself, i.e. when it is instanced in the respective extended models, it must comply with certain parameters, such as the acceptance of a multipart geometry in 2D and 3D, whether there are curved surfaces or not, the transformation that was performed between reference systems, a method of operation, the structure of the table that will store the files that support the documentary sources, the addresses that identify the location of the basic administrative unit, data of the person in charge, the contact of the person in charge, the type of volume that can be taken, some observations that exist, among others (Figure 11).

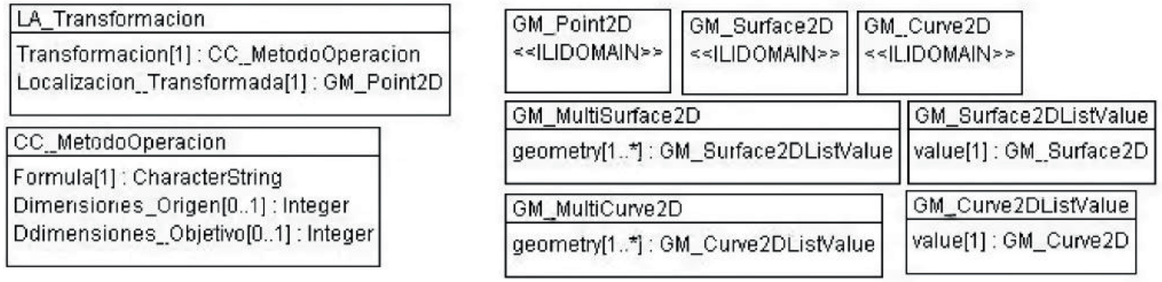

Figure 11. Classes Related to the Structures of the LADM-COL Core Model Version 2.2. **Source:** IGAC & SNR (2018).

Conclusions

This document is able to determine the purpose for which the different classes were created, which will allow characterizing and interoperating the information that enters the Land Administration System (LAS), likewise, it is sought that from the LADM-COL Core Model adapted from the ISO 19152:2012 standard, extended models are developed and adapted to the specific needs of each entity at the national level regarding the characterization of their legal land objects.

It is crucial to highlight that, in some cases, attention is diverted from the characterization of specific elements, since they are not aligned with a centralized need in the LAS; rather, their focus is directed towards particular topics, such as the multipurpose cadastre. Therefore, it can be recognized that the LADM-COL Core Model will undergo adjustments that will result in the current version (3.1) since its relationships, groupings, and cardinalities transcend the essential information and characterization needed in the context of the LAS.

The Core Model that is the subject of this text, in its version 2.2, is the basis of the LADM-COL Extended Model Cadastre-Registration that will be considered and studied in the following volume.

References

Colombian Spatial Data Infrastructure. (2022). Gobernanza del Modelo Núcleo LADM-COL y sus modelos extendidos. IAGC – ICDE. https://www.icde.gov.co/sites/default/files/archivos/ICDE_GED_GUI_GobernanzaModelosLADM_V20220706.pdf

Agustin Codazzi Geographic Institute. (2023). Modelos Núcleo LADM-COL. https://igac.gov.co/catastro-multiproposito/ladmcol

Agustin Codazzi Geographic Institute and Superintendency of Notaries and Registries (2018). Resolución Conjunta IGAC 642 SNR 5731. Por la cual se adopta el modelo común de intercambio LADM_COL. May 1, 2018. https://antiguo.igac.gov.co/es/contenido/resolucion-conjunta-snr-5731-igac-642-2018

This document was prepared by the Geomatics research group, affiliated with the Ministry of Science, Technology and Innovation (Minciencias by its acronym in Spanish), at the Agustin Codazzi Geographic Institute (IGAC). The project was promoted by the Research and Prospective Directorate, as part of the project *Conceptualization of LADM and development of applications for interoperability in land administration information.*