

TECHNICAL NOTE: LAND TENURE MAP OF BRAZIL

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Abstract

The land tenure map of Brazil is the result of a collaborative effort between Imaflora, ESALQ/USP's GeoLab, the Royal Institute of Technology (KTH, Sweden), and the São Paulo Federal Institute for Education, Science and Technology. This georeferenced database covers the entire Brazilian territory, providing an open and public picture of all public and private land holdings in Brazil. This land tenure map is an update on previous studies conducted by Professor Gerd Sparovek's team - ESALQ/USP's GeoLab - (Freitas et al., 2017a, 2017b, 2016, Sparovek et al., 2015, 2012, 2010) and it includes new functionalities and the coding of a routine that allows for this database to be updated on an ongoing basis.

Improvements offered by v.1812

- Compilation of the databases in vector format
- Implementation of an algorithm with sophisticated rules for cleaning overlaps between private properties, mainly in the CAR database
- Change in the hierarchy of priorities to clean overlaps between layers
- Updating of most land tenure databases that were used for building the previous land tenure map

KNOWN LAND TENURE FRAMEWORK

The land tenure map uses several public government databases (Table 1), including, for example, the database of national and state-level protected areas, INCRA's database of rural properties and settlements, and CAR's (Environmental Rural Registry) land polygons, which together cover 82.6% of the country.

Table 1 - Categories, layers, and data sources making up the land tenure map of Brazil.

Category	Layer	Scale	Year	Source
Transportation	State roads	Not available	2016	DNIT ⁽¹⁾
	National Roads	Not available	2016	DNIT ⁽¹⁾
	National railways	Not available	2016	DNIT ⁽¹⁾
	Mapped roads	1 : 250,000	2017	IBGE ⁽²⁾
	Mapped railways	1 : 250,000	2017	IBGE ⁽²⁾
Urban area	Urban areas	1 : 250,000	2017	IBGE ⁽²⁾
Hydrography	Water bodies	1 : 250,000	2017	IBGE ⁽²⁾
	Rivers and streams	1 : 250,000	2017	IBGE ⁽²⁾
Land tenure	Federal public forests	Not available	2017	SFB ⁽³⁾
	Indigenous Land Areas	Not available	2017	FUNAI ⁽⁴⁾
	Conservation Units	Not available	2017	MMA ⁽⁵⁾
	<i>Terra Legal</i> (Legal Land) Program	Not available	2015	INCRA ⁽⁶⁾
	Rural settlements	Not available	2018	INCRA ⁽⁶⁾
	Registered private properties	Not available	2018	INCRA ⁽⁶⁾
	Registered public properties	Not available	2018	INCRA ⁽⁶⁾
	Quilombola Land Areas	Not available	2018	INCRA ⁽⁶⁾
	Military Areas	1 : 1,000,000	2014	IBGE ⁽²⁾
	Environmental Rural Registry (CAR) ⁽⁷⁾	Non-applicable	2018	SFB ⁽³⁾

Notes: ⁽¹⁾ DNIT - DNIT - National Transportation Infrastructure Department; ⁽²⁾ IBGE - Brazilian Institute for Geography and Statistics; ⁽³⁾ SFB - Brazilian Forest Service; ⁽⁴⁾ FUNAI - National Foundation for Indigenous People; ⁽⁵⁾ MMA - Ministry of Environment; ⁽⁶⁾ INCRA - National Institute for Colonization and Agrarian Reform; ⁽⁷⁾ the CAR database used here is for rural properties registered until June 09, 2018.

Most land tenure layers described in the table above were fully incorporated in the process of building the land tenure map, except for layers of indigenous land areas, conservation units, federal public forests, and transportation, which were pre-processed as described below:

- Indigenous Land Areas: features were segmented into homologated and non-homologated indigenous land areas. For Homologated Indigenous Land Areas, features were considered in the following phases of the demarcation procedure: Declared, Homologated, and Regularized indigenous land areas. For non-homologated land areas, features classified in the following phases were considered: Under study and Delimited areas.

- Conservation Units: the features of Environmental Protection Areas (APAs) were removed and the remaining areas were divided into Fully Protected Conservation Units and Conservation Units for Sustainable Use.
- Federal public forests: the so-called "Type B" federal public forests were fully incorporated into the land tenure map, while those referred to as "Type A" federal public forests were partially incorporated, and only the Community Territories of that database were selected, which consist in federal and state settlements of the following categories: Agroextractive Settlement Project (PAE), Forest Sustainable Project (PAF), Sustainable Development Project (PDS), State-Level Agroextractive Settlement Project (PEAX), State-Level Sustainable Settlement Project (PEAS), State-Level Rural Settlement Project (PARE), and Rubber Plantation.
- Transportation: the original features of roads were segmented into unpaved roads, one-lane paved roads, and two-paved roads, to which 15-meter, 30-meter, and 60-meter buffers were applied, respectively, turning linear features into polygonal ones. In the case of railways, a 30-meter buffer was applied to the features of this database, turning them into polygonal features as well. All features classified as planned were excluded from the database.

METHODOLOGY FOR GENERATING THE KNOWN LAND TENURE FRAMEWORK

The known land tenure framework was built in six main steps:

- A) Cleaning and analysis of overlaps in properties certified by INCRA
- B) Analysis of overlaps in the INCRA and CAR databases
- C) Cleaning and analysis of overlaps in the CAR database
- D) Regrouping of the decharacterized CAR database
- E) Aggregation of databases of different land tenure layers
- F) Final cleaning

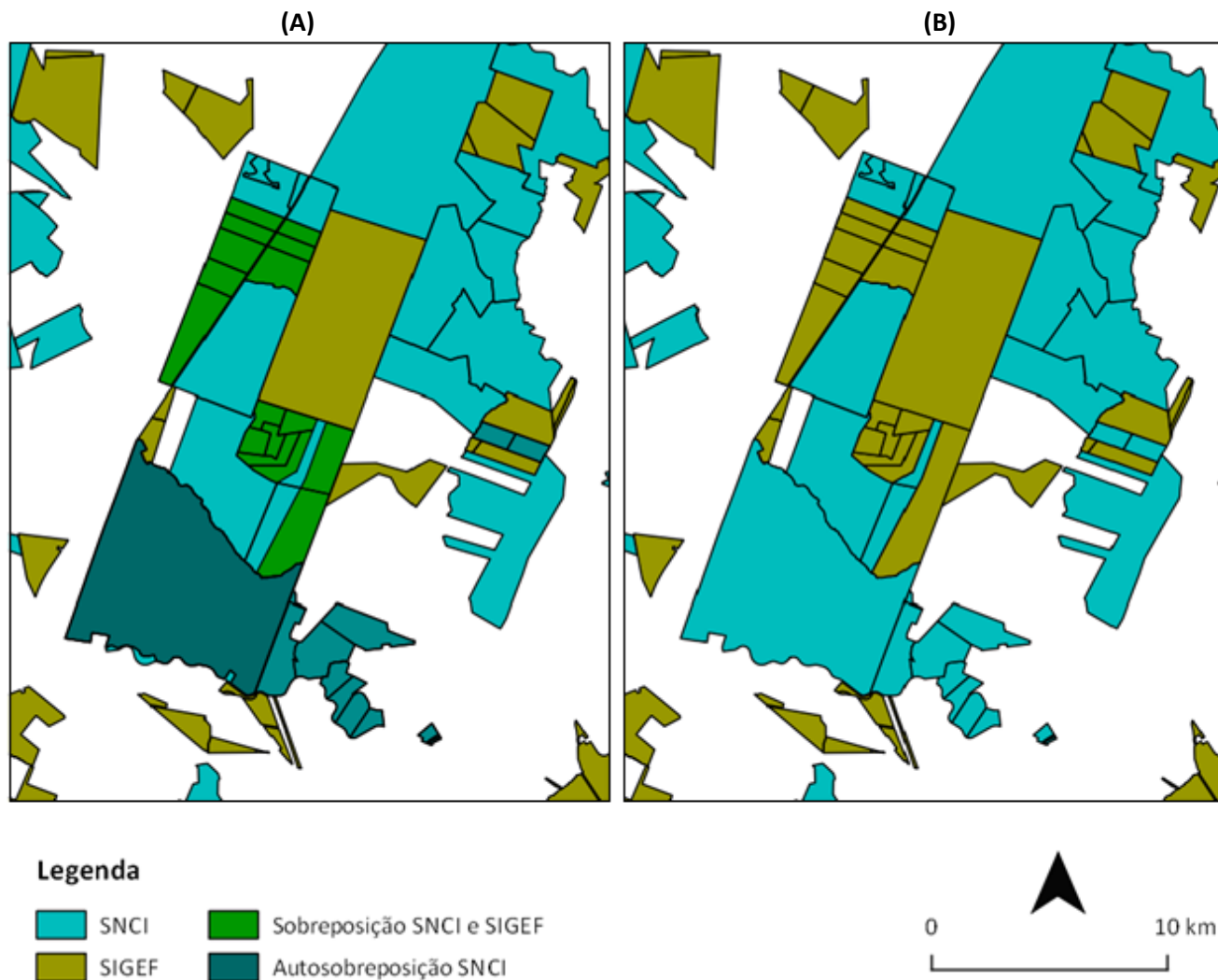
A) Cleaning and analysis of overlaps in properties certified by INCRA

Data for properties certified by INCRA are available in two separate files, one for properties registered in the Land Management System (SIGEF) and another one for properties registered in the National Rural Property Certification System (SNCI). We observed that a small percentage of properties in both databases had internal overlaps and that overlaps between the databases were recurrent. We also noticed that they had duplicate polygons with the same geometry. To correct these problems, the following operations were performed:

- Cleaning of duplicate polygons;
- Cleaning of self-overlaps for each layer, giving priority to records with the most recent approval date;
- Cleaning of overlaps between the SIGEF and SNCI systems, giving priority to records with the most recent approval date (mainly properties registered in the SIGEF system);
- Removal of decharacterized properties (i.e. those that lost more than 50% of their area after overlaps were cleaned).

Once the analysis was over, we had a SIGEF/SNCI database cleaned of overlaps, as shown in **Legendas em inglês da figura não editável: Caption; SNCI; Overlaps between the SNCI and SIGEF systems; SIGEF; Self-overlapping in the SNCI system**

Figure 1.



Legendas em inglês da figura não editável: Caption; SNCI; Overlaps between the SNCI and SIGEF systems; SIGEF; Self-overlapping in the SNCI system

Figure 1. Example of analysis of INCRA databases, showing the situation before processing (A) and after processing (B). In Figure A, the layers are shown in transparency, so that the overlaps can be identified by different compositions of turquoise blue (properties registered in the SNCI system) and brown (properties registered in the SIGEF system). For example, overlaps between the SIGEF and SNCI systems result in a light green color, while self-overlapping in the SNCI database is shown in darker green. In Figure B, intersections are resolved by giving priority to properties with the most recent date of certification approval.

During the overlap cleaning operation, some properties lose much of their original area, becoming decharacterized. Decharacterized properties are those that lost more than 50% of their original area as a result of later processing stages.

B) Analysis of overlaps between the INCRA and CAR databases

For cleaning up overlaps between the INCRA and CAR databases, we prioritized the INCRA database, since the properties registered in that database were evaluated and certified by INCRA technical experts, while the data in the CAR database is self-declared data that has not been validated yet for the most part. In this stage, a priority property (SIGEF) simply incorporates an overlapping area within its bounds, erasing that area from properties with a lower priority level (CAR). Again, decharacterized properties (i.e. those that lost more than 50% of their original area) were excluded from further processing.

C) Cleaning and analysis of overlaps in the CAR database

We saw that the CAR database has several overlaps between the registered polygons, including duplicate polygons and CAR numbers and several polygons with invalid topology.

To correct the problems found in the CAR database, the following procedures were performed:

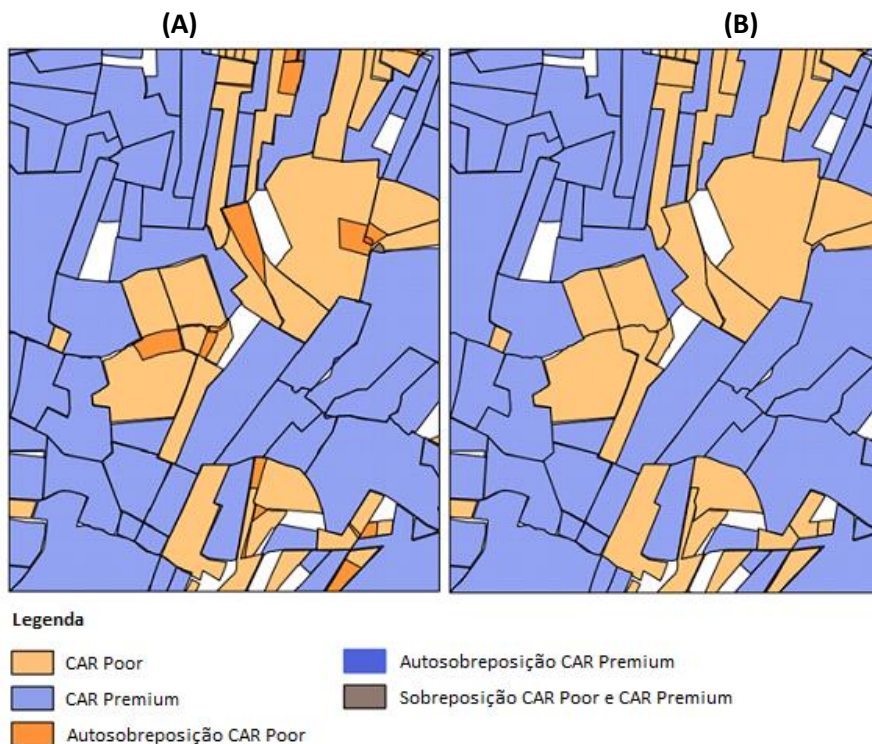
1. Validation of the geometry, making it valid;
2. Removal of duplicate geometries;
3. Removal of geometries with the same CAR number, giving priority to the one with the largest polygon. We emphasize that this decision is based on observed cases of editing of polygons of rural properties to remove areas with irregular activities such as deforestation in the Amazon region;
4. Removal of features outside Brazil's borders;
5. Separation of the analysis into CAR Premium and CAR Poor categories based on the amount of self-overlaps and/or overlaps with the INCRA database described in the Item *Analysis of overlaps Analysis of overlaps in the INCRA and CAR databases databases*:
 - i. CAR Premium: overlapping area greater than or equal to 5% of the total area of the property.
 - ii. Car Poor: overlapping area greater than 5% of the total area of the property.
6. Cleaning of self-overlaps in the CAR Poor and CAR Premium categories separately with different priorities (small, large, or random) to create three scenarios that will be preserved until the end of the processing. These three scenarios have major implications and can interfere directly with later modeling, such as with the calculation of liabilities of the Brazilian Forest Code:
 - i. Prioritization of large properties: may overestimate the calculation of liabilities of the Forest Code;
 - ii. Prioritization of small properties: may underestimate the calculation of liabilities of the Forest Code;
 - iii. Random: creates a normal distribution of errors and generates an intermediate result between the prioritization of large and small properties.
7. Analysis of overlaps between the CAR Poor and CAR Premium categories, giving priority to CAR Premium.
8. Removal of sliver polygons originated in the above-described overlap cleaning steps:

- i. For cleaning sliver polygons, all polygons with a circularity index (CI) of less than 0.12 were excluded. This value was determined after a series of analyses of the CIs of rural properties included in the CAR database were carried out and it corresponds to the minimum value found for parcels of rural settlements with extremely elongated geometries;
- ii. The CI calculates how similar a polygon is to the shape of a circle. This index behaves independently of the size of a polygon, unlike the simple form index (area-perimeter ratio);
- iii. The CI ranges from 0 to 1, with 1 being the exact shape of a circle. The index is calculated by the following formula (Nascimento et al., 2006):

Equation Erro! Indicador não definido.. **Formula for calculating the circularity index.**

$$IC = \frac{2\sqrt{\pi A}}{P}$$

where CI is the Circularity Index; A is the Area; and P is the perimeter



Legendas em inglês da figura não editável: Caption; CAR Poor; Self-overlapping in CAR Premium; CAR Premium; Overlapping between CAR Poor and CAR Premium; Self-overlapping in CAR Poor

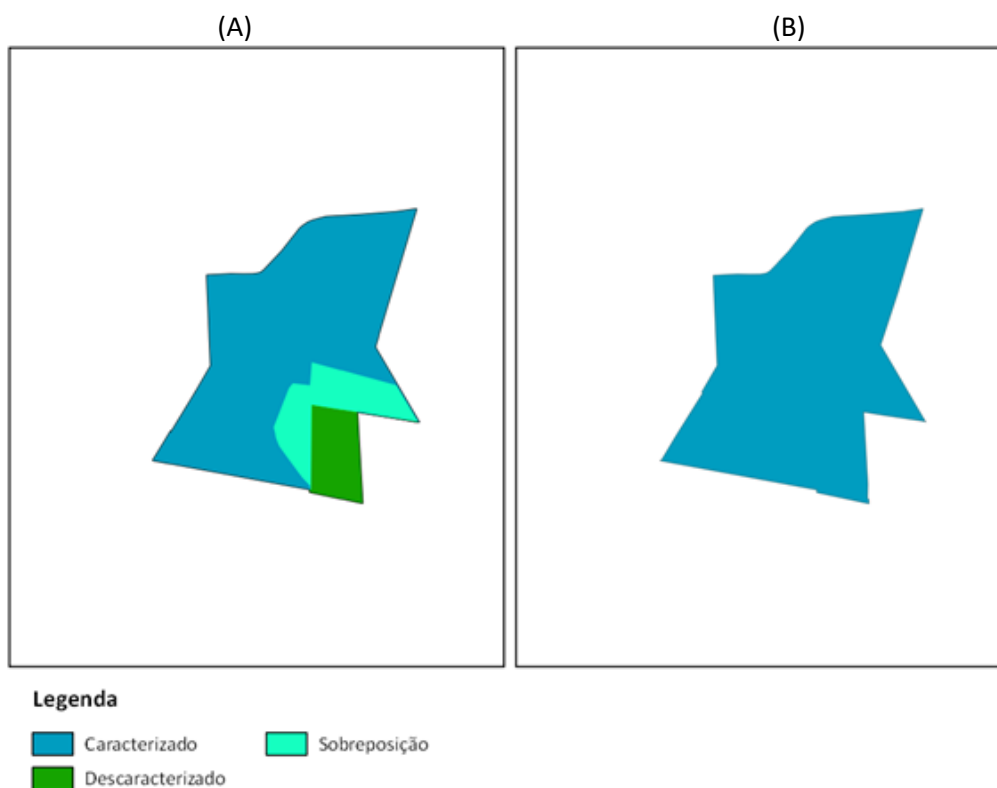
Figure 2. Example of steps 6-8 for cleaning the CAR database, separating properties into CAR Poor (orange - overlapping > 5% of the area) and CAR Premium (purple - overlapping <= 5% of the area). Figure 2A shows a transparent picture for overlaps to be identified by the different compositions of purple (CAR Premium) and orange (CAR Poor), which result in darker shades of these colors. In the

example provided in Figure 2B, overlaps are treated by prioritizing CAR Premium and properties within the same CAR class (Premium or Poor) randomly.

Using this processing method, it was possible to analyze overlaps between properties registered in the CAR database, generating numbers that can quantitatively represent consistency as well as possible overlapping conflicts between properties. This analysis made it possible to see that most properties have little overlaps and were classified as falling under the CAR Premium category, since less than 5% of their area overlaps with others. Of a total of 4,213,785 properties registered in the CAR database, approximately 70% (or 2,979,816 properties) were classified as Premium.

D) Regrouping of the decharacterized CAR database

At this stage, properties of the CAR Poor group that lost more than 50% of their original area were aggregated into neighboring properties that kept at least 50% of their area. An example of the result of this analysis can be seen in **Legendas em inglês da figura não editável: Caption; Characterized; Overlap; Decharacterized** Figure 3 below.



Legendas em inglês da figura não editável: Caption; Characterized; Overlap; Decharacterized

Figure 3. Aggregation of decharacterized CAR Poor properties (which lost more than 50% of their original area) into CAR Poor properties of the "Characterized" class (which preserved more than 50% of their original area).

At this stage, different thresholds were tested to determine whether a property would be decharacterized or not, and, as a result, we observed that 1,233,69 properties lost more than 5% of their original area, 617,513 properties

lost more than 25% of their area, 425,981 lost more than 50% of their original area, 339,631 properties lost more than 75% of their area, and 256,557 properties lost more than 95% of their original area. After seeing that there was little difference between the number of properties that lost part of their original area between the thresholds of 25% and 95%, we opted for the threshold of 50%.

E) Aggregation of the databases

While internal inconsistencies in features of the CAR and SIGEF systems were treated in previous steps, overlaps in other layers used for building the land tenure map were treated based on a hierarchy of priorities. In this approach, higher-priority layers incorporate overlapping areas from lower-priority layers, resulting in a single vector base free of overlaps. The hierarchical order used in this version of the land tenure map is different from the one used in the previous version and it corresponds to the result of a study commissioned to the Land Governance Group of the University of Campinas - UNICAMP (GGT/UNICAMP), which is coordinated by Professor Bastiaan Philip Reydon. The criteria and hierarchy of overlaps were discussed with representatives of important agencies dealing with land tenure issues, such as the National Institute for Colonization and Agrarian Reform (INCRA), the Federal Assets Secretariat (SPU), the Brazilian Rural Society (SRB), companies operating in the agricultural sector, NGOs, among others, and were agreed upon between the parties. The full report drawn up by GGT/UNICAMP can be downloaded [here](#). The main points of that report will be highlighted below.

First, it should be noted that the hierarchy of priorities among the layers is not a proposal for priorities ranked in order of environmental importance or based on land-related rights. It is a hierarchical order based on the reliability of the available information, considering recognized rights and tenure over land and the possibility of future changes in how it is occupied currently. This hierarchical order guides the prevalence of one layer over another one when areas registered in different systems overlap. The criteria proposed for the analysis were the following ones: legal certainty, accuracy of geospatial information, possibility of overlapping, and possibility of changes in tenure. Based on these criteria, the different land tenure databases were classified in relation to the quality of the available information, namely: "High", "Medium" and "Low". Considering the different evaluations based on the 4 criteria, the databases were organized into a hierarchy where a position of greater advantage over the others should have high legal certainty, highly precise geospatial information, low possibility of overlapping, and low possibility of changes in tenure.

For evaluating the different databases of land registers in light of the "Legal Certainty" criterion, different relevant laws were considered which can interfere in the priority attached to the use and occupation of a certain part of the territory (i.e. the original right of indigenous peoples, as provided for in paragraph 4, Article 231, of the Brazilian Federal Constitution), but land titling and allocation procedures were also considered, especially based on the land tenure databases of agencies in charge of regularizing legitimate land tenure in public areas (INCRA and *Terra Legal* Program). In addition, historical and legal antecedents in settling conflicts related to overlaps were considered, as well as the specific positions assumed by each agency on this aspect. Thus, land was ranked as having "High" priority when the rights associated with its tenant were clear, recognized, and guaranteed by a competent institution, as well as based on the legal certainty of the tenure in relation to any overlapping of rights.

For evaluating the different databases of land registers in light of the "Accuracy of Geospatial Information" criterion, the technical procedures adopted by each agency in charge of the specific register and its specific

features were considered, as well as the type of responsibility of each one of them for organizing information on the relevant territory (i.e.: the process adopted by INCRA for certifying rural properties requires the involvement of an engineer accredited by the agency to conduct a georeferenced survey of the perimeter of the property), ensuring the high accuracy and reliability of the information available/submitted. In this case, the reliability of the available information is classified as "High," since the quality of the survey carried out by the agency in charge to obtain such information is recognized and it is also known that the information made available is updated as required.

For evaluating the different databases of land registers in light of the "Possibility of overlapping" criterion, overlaps detected in a first experience of the Atlas in crossing the information were considered, as can be seen in Figure 2. Based on the results of this experience and on specific knowledge of recurrent overlaps (i.e. for old rural settlements registered as Community Land where overlaps with the database of Rural Settlements are recurrent, as surveys are being updated). The occurrence of overlaps does not necessarily constitute a land tenure conflict, but in many cases they indicate situations that the public agencies in charge are aware of and which are given priority in the process of allocating public land. Thus, for areas likely to be regularized encroaching on public areas and/or for properties that were not properly demarcated the possibility of overlapping was classified as "High".

For evaluating the different databases of land registers in light of the "Possibility of change in tenure" criterion, special consideration was given to overlapping of properties located in undesigned public areas or of properties marked by fragile (uncertified) rights conflicting with areas already designated with high legal certainty. A representative example is that of areas set apart by the *Terra Legal* Program that have not yet been titled, as changes in tenure in those areas are highly likely since the program is intended to regularize legitimate tenure in public areas under the Land Regularization Law (Law 13,465 of 2017). For this reason, processes for allocating public land were also considered, as overlaps in these areas were recurrently identified.

After the databases of land registers were duly analyzed according to the methodology proposed in this report, the following hierarchical relationship between the land tenure databases was defined (Table 2):

Table 2 - Hierarchy of Land Tenure Databases available in Brazil

Databases of Land Registers / Criteria	Legal Certainty	Accuracy of Geospatial Information	Possibility of overlapping	Possibility of change in tenure	Overlapping priority
Private properties registered in the SIGEF/SNCI systems	H	H	L	L	1
Titled land from the Terra Legal Program	H	H	L	L	2
Quilombola Land	H	H	L	L	3
Homologated Indigenous Land	H	M	M	L	4
Fully Protected Conservation Unit	H	M	M	M	5
Conservation Unit for Sustainable Use	H	M	M	M	6

Military area	H	H	L	L	7
Rural settlement	H	M	H	H	8
Community Territory	L	M	H	H	9
Non-Homologated Indigenous Land	L	M	H	H	10
CAR	L	M	H	M	11
Untitled land from the Terra Legal Program	L	H	H	H	12
Public properties registered in the SIGEF/SNCI systems	L	H	H	H	13
Type B Forest	L	M	H	H	14

Captions: H: High, M: Medium, B: Low

We emphasize that the layers providing information about urban areas, water bodies, and the transportation network (after applying the buffers described in the item *Known Land Tenure Framework*) were given the highest overlapping priority, deleting areas overlapping with the other layers. This decision was made because the features of those layers represented immutable physical aspects of the territory, limiting their occupation by people.

DESCRIPTION OF CATEGORICAL ATTRIBUTES

In this version, the land tenure map is available in vector format (SQL and shapefile) and includes a table of attributes providing the following descriptive fields or categorical variables for each rural property (Table 3).

Table 3 - Information fields available in the land tenure map

FIELD	DESCRIPTION										
id_imovel	Primary Key (4 519 223 Ids)										
fonte	Source of rural property geometry										
classe	<p>Classifies the rural property as private or public</p> <table> <tr> <th>Acronym</th><th>Caption</th></tr> <tr> <td>Public land</td><td>Public land areas</td></tr> <tr> <td>Private land</td><td>Private land areas</td></tr> <tr> <td>Urban, water, and transportation</td><td>Urban areas, water bodies, and transportation network</td></tr> <tr> <td></td><td></td></tr> </table>	Acronym	Caption	Public land	Public land areas	Private land	Private land areas	Urban, water, and transportation	Urban areas, water bodies, and transportation network		
Acronym	Caption										
Public land	Public land areas										
Private land	Private land areas										
Urban, water, and transportation	Urban areas, water bodies, and transportation network										
subclasse	<p>Classifies the property according to the data source</p> <table> <tr> <th>Acronym</th><th>Caption</th></tr> <tr> <td>Water</td><td>Water bodies</td></tr> </table>	Acronym	Caption	Water	Water bodies						
Acronym	Caption										
Water	Water bodies										

		Military area	Military areas
		Rural settlement	Rural settlements
		CAR poor	CAR properties with more than 5% of areas overlapping with neighboring areas
		CAR premium	CAR properties with less than 5% of areas overlapping with neighboring areas
		Type B Forests	Undesignated public forests
		SIGEF/SNCI	Private properties registered in INCRA'S SIGEF/SNCI systems Private properties registered in INCRA'S SIGEF/SNCI systems
		Public SIGEF/SNCI	Public Properties registered in INCRA's SIGEF/SNCI systems Public Properties registered in INCRA's SIGEF/SNCI systems
		Homologated Indigenous Land	Homologated Indigenous Land Areas
		Non-homologated Indigenous Land	Non-homologated Indigenous Land Areas
		Untitled land from the Terra Legal Program	Undesignated land areas from the <i>Terra Legal</i> Program
		Titled land from the Terra Legal Program	Private properties from the <i>Terra Legal</i> Program
		Quilombola land	Quilombola land areas
		Community territory	Community land areas
		Transportation	Transportation network
		Fully Protected CU	Fully Protected Conservation Unit
		CU for Sustainable Use	Conservation Unit for Sustainable Use
		Urban	Urban areas
area_orig	Polygon original area		
area_final	Polygon final area after resolution of overlapping areas		
cd_mun	IBGE Municipality key / 5 570 IDs		
nm_mun	Municipality name / 5 570 IDs		
nm_micro	Microregion name / 558 IDs		

nm_meso	Mesoregion name / 137 IDs										
nm_regiao	Region name / 5 IDs										
nm_bioma	Name of the most representative biome where the rural property is located										
tamanho	Size of the rural properties <table border="1"> <thead> <tr> <th>Acronym</th><th>Legend</th></tr> </thead> <tbody> <tr> <td>Small</td><td>Small rural property (≤ 4 fiscal modules)</td></tr> <tr> <td>Medium-sized</td><td>Medium-sized rural property (area of 4-15 fiscal modules)</td></tr> <tr> <td>Large</td><td>Large rural property (> 15 fiscal modules)</td></tr> <tr> <td>NA</td><td>Public and non-designated land</td></tr> </tbody> </table>	Acronym	Legend	Small	Small rural property (≤ 4 fiscal modules)	Medium-sized	Medium-sized rural property (area of 4-15 fiscal modules)	Large	Large rural property (> 15 fiscal modules)	NA	Public and non-designated land
Acronym	Legend										
Small	Small rural property (≤ 4 fiscal modules)										
Medium-sized	Medium-sized rural property (area of 4-15 fiscal modules)										
Large	Large rural property (> 15 fiscal modules)										
NA	Public and non-designated land										
nome	Field with the name of the polygon according to the data source										

RESULTS

Based on the methodology proposed for compiling the different land tenure databases, it was possible to recover 82.6% of the Brazilian territory with 4,519,223 different properties (Table 4).

Table 4 - Summary of areas and number of properties included in the land tenure map of Brazil for each land category

Land Categories	Area (ha)	Area (%)	Number of properties
CAR	167 262 326	19.7%	3 740 983
Small	78 923 346	9.3%	3 544 798
Medium-sized	40 358 936	4.7%	162 508
Large	47 980 045	5.6%	33 677
SIGEF/SNCI	188 782 115	22.2%	379 577
Small	12 700 160	1.5%	206 070
Medium-sized	41 552 188	4.9%	110 831
Large	134 529 768	15.8%	62 676
Rural settlement	41 731 597	4.9%	7 522
Quilombola Land	3 117 946	0.4%	362
Community Territory	1 779 320	0.2%	765
Untitled land from the Terra Legal Program	19 650 558	2.3%	1 399
Titled land from the Terra Legal Program	9 830 603	1.2%	116 493
Indigenous Land	112 412 053	13.2%	599

Fully Protected Conservation Unit	41 401 730	4.9%	570
Conservation Unit for Sustainable Use	51 043 800	6.0%	698
Military Area	3 006 816	0.4%	97
Type B Forests	30 479 536	3.6%	1 570
Public properties registered in the SIGEF/SNCI systems	5 192 146	0.6%	8 291
Urban, water, and transportation	26 269 954	3.1%	260 297
Land tenure map	701 960 498	82.6%	4 519 223
Brazil	850 278 031	100.0%	

It should be recalled that the areas described in the table above are free of overlaps as a result of their cleaning within and among layers described in the methodology. For each land tenure category, the original areas recorded in the databases and the areas lost as a result of the cleaning steps are described, as can be seen in the table below (Table 5).

Table 5 - Detailing of the original areas of each land category and their respective loss of areas resulting from the cleaning of overlaps

Land Tenure Categories	Original area	Lost area	Final area
Untitled land from the Terra Legal Program	123 568 045	103 917 487	19 650 558
Public properties registered in the SIGEF/SNCI systems	86 489 336	81 297 190	5 192 146
CAR Premium	167 124 280	42 818 007	124 306 273
CAR Poor	78 143 195	35 187 142	42 956 053
Type B Forests	61 096 172	30 616 622	30 479 549
Community Territory	15 476 142	13 696 822	1 779 320
Fully Protected Conservation Unit	52 302 640	10 900 911	41 401 730
Conservation Unit for Sustainable Use	55 610 025	4 566 224	51 043 800
Non-homologated Indigenous Land	6 533 273	4 177 401	2 355 872
Military Area	7 034 924	4 028 108	3 006 816
Rural settlements	44 776 253	3 044 655	41 731 597
Homologated Indigenous Land	110 791 597	735 415	110 056 181
Titled land from the Terra Legal Program	10 435 711	605 109	9 830 603
Quilombola Land	3 294 746	176 800	3 117 946

Urban area	3 138 410	0	3 138 410
Private properties registered in the SIGEF/SNCI systems	188 782 115	0	188 782 115
Transportation network	5 195 853	0	5 195 853
Water bodies	17 935 691	0	17 935 691
Total	1 037 728 405	335 767 894	701 960 511

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