



## Area occupied by group and genetic types of soils in Cuba

### Área que ocupan los agrupamientos y tipos genéticos de los suelos en Cuba

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**ABSTRACT:** This work presents the area occupied by the different soils of Cuba at the level of Grouping and Genetic Type of soil, according to the 1999 version of the Cuban Soil Classification. The work was carried out taking into account the data from the genetic map planimetry of Cuba's soils 1: 250,000 and the digital map SOILS 500,000, in which the 1999 soil classification is applied. It is shown that the Siallitic Brown soils are the most extensive (32.9 % of the country) and in that order are followed by Hydromorphic soils (Gleysols) (21.34 %), Histosols (8.27 %) and Vertisols (8.27 %). The soils of the Ferrallitic Group occupy the fifth place with an area of 6,717 km<sup>2</sup> (6.21 %).

**Key words:** cartography, soil classification, productivity.

**RESUMEN:** En este trabajo se presenta el área que ocupan los diferentes suelos de Cuba a nivel de Agrupamiento y Tipo Genético de suelo, según la versión de Clasificación de los Suelos de Cuba de 1999. El trabajo se realizó teniendo en cuenta los datos de la planimetría del mapa genético de suelos de Cuba 1:250 000 y del mapa digital SUELOS 500 000, en el cual se aplica la clasificación de suelos de 1999. Se demuestra que los suelos Pardos Sialíticos son los más extensivos (32,9 % del país) y en ese orden le siguen los suelos Hidromórficos (Gleysoles) (21,34 %), Histosoles (8,27 %) y Vertisoles (8,27 %). Los suelos del Agrupamiento Ferralítico ocupan el quinto lugar con un área de 6717 km<sup>2</sup> (6,21 %).

**Palabras clave:** cartografía, clasificación de suelos, productividad.

## INTRODUCTION

One of the most important premises of a country is to develop efficient agriculture, for which it is necessary to know what types and subtypes of soils there are, their properties and, above all, the area occupied by each type and subtype of soil. In this way, it will be possible to know the quality of the agricultural fund that is available and to know what limitations a sustained agricultural production will have.

In the world, the most developed countries such as the United States, Canada and European countries, have been able to carry out this research and have two types of classifications that have global relevance, such as the North American Soil Taxonomy classification (1) and the World Reference classification Base (2). However, underdeveloped countries have not yet reached that level.

In Latin America, there is no such development, many of the studies are carried out in isolated regions and most of the time there is no complete map of soils of the country on

a medium or large scale. In general, the studies are governed on the North American Soil Taxonomy system basis, although Mexico follows the World Reference Base system as a continuation of FAO Classification. In countries such as Ecuador, the World Reference Base system begins to be implemented; as for example, the results of the cartography and classification of soils to know their productivity of the Carrizal-Chone System in Manabí (3,4).

It should also be noted that in Latin America there are only two countries that have their own soil classification system, such as Cuba and Brazil, with recent versions (5,6).

A classification of soils, elaborated under the genetic-geographical principles, is essential to achieve an adequate mapping of the soils and thus know the agricultural potential that is available. In addition, it is essential to know the territory that each type of soil occupies, especially for applied edaphological work; thus, for example, to know the area of Ferrallitic soils, for the improvement works of its either structure (7); carbon capture and sequestration (8) or in case of application of mycorrhizal amendments in Ferrallitic or Gleysol soils (9).

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In Cuba, soil genesis and cartography studies had considerable support since the beginning of the Triumph of the Revolution and currently there are soil maps at different scales, which has given the possibility of knowing their distribution and the area that each occupies type and grouping of soils. However, for the 1999 version of soil classification this result has not been given, which is the objective of this work.

## MATERIALS AND METHODS

The area occupied by the soils of Cuba is presented in Groupings and Genetic Types of soils (expressed in km<sup>2</sup>), taking into account the "New Version of Genetic Classification of the Soils of Cuba" (10). Unfortunately, this version of soil classification does not take into account the separation of soils at the subtype level due to the influence of continued cultivation, since currently there are results obtained in recent years (11,12) and expressed as a subtype of soils agrogenic in the most recent version (5).

The calculation was made based on the results of the Soil Map of Cuba 1: 250,000 planimetry and published in the book "Genesis and Classification of Cuba's Soils" (13). Also, in the calculation of the areas of the work SOILS 500 000, prepared according to the New Version of the Genetic Classification of Cuba's Soils and presented at the International Soil Geography: New Horizons Conference in Huatulco, Mexico (14). In addition, the correlation of soil types with the world classifications Soil Taxonomy (1) and the WRB Classification of soils is presented (2).

The results should be taken in an approximate way, both for the correlations with other classifications, such as the area that each soil occupies.

## RESULTS

Table 1 shows the area in square kilometers occupied by each Genetic Group and Type of Cuba's Soils. As can be seen,

in the first place, the most extensive are the Brown Siallitic soils that occupy 32.9 % of the total territory, because of the formation in mountains of the ancient Arches of Islands and the pediplanation process that has occurred. It is due to the washing of the Miocene limestones and the outcrop of the oldest igneous rocks, with the formation of younger soils, as is well explained in the formation of the soils of the Campo Florido region (15).

Secondly, there are the Hydromorphic soils (Gleysols), affected by the gleyization process, which is due to the formation of soils in conditions of cumulative plain with poor drainage (21.34 % of the total). In this case, it should be noted that the territory of Cuba, largely, is made up of plains (4/5 of the territory), which is corroborated with other soil formations in cumulative plains, such as Histosols (8.27 % of the total) and Vertisols. It is followed in extension by the Ferrallitic soils, formed largely of Miocene limestone in the plains, due to the peniplanation process that began at the end of the Neogene (6.21 % of the total).

The representative soils of tropical weathering (Allitics, Ferritics and Ferrallitics), as a whole, occupy a territory of 15,442 km<sup>2</sup> and their presence is due to the formation over time, in stable reliefs such as plains, plateaus and surfaces stable in mountainous regions. The least extensive soils are Fluvisols and Lithosols. In the case of Fluvisols, it is because there are no mighty rivers in Cuba, Cauto River in the plains is confined to several meters deep, and due to neotectonic movements in the Quaternary and in the terraces closest to the river there are soils Brown, formed from ancient alluvial sediments. Lithosols refer mainly to the so-called "Diente de Perro", which occurs in the most recent quaternary terraces. In the case of rocky outcrops that occurred in the past due to tropical weathering, they rapidly transform into the B siallitic horizon (B cambic), giving lead to the formation of Brown soils that are correlated with Cambisols in the World Reference Base classification of soils (2) or Inceptisols by the Soil Taxonomy classification of soils (1).

**Table 1.** Groupings and Genetic Types of Soils of Cuba, approximate area they occupy and their correlation with the Soil Taxonomy and WRB classifications.

Group	Genetic Type	Area (km <sup>2</sup> )	Corelation with Soil Taxonomy	Corelation with WRB
Allitic Soils (6717 km <sup>2</sup> )	Low Activity Clay Red Allitic	1931	Rhodic Kandustalf	Rhodic, Alomic Acrisol
	Low Activity Clay Yellowish Red Allitic	890	Rhodic-Xanthic Rhodustalf	Rhodic, Xanthic, Alomic Acrisol
	Low Activity Clay Yellow Allitic	380	Xanthic Rhodustalf	Xanthic, Alomic Acrisol
	High Activiy Clay Yellowish Red Allitic	3200	Typic Rhodudalf	Rhodic, Xanthic, Alomic Alisol
	High Activiy Clay Yellowish Allitic	316	Xanthic Rhodudalf	Xanthic, Alomic Alisol
Ferritic Soils (1908 km <sup>2</sup> )	Dark Red Ferritic	1875	Rhodic Eutradox	Ferritic, Rhodic, Eutric Ferralsol
	Yellowish Ferritic	33	Xanthic Eutradox	Ferritic, Xanthic, Eutric Ferralsol
Ferrallitic Soils (6807 km <sup>2</sup> )	Red Ferrallitic	5539	Rhodic Eustrtox	Ferralic, Rhodic, Eutric, Clayey Nitisol
	Red Lixivated Ferrallitic	716	Typic Rhodustalf	Ferralic, Rhodic, Lixic, Eutric Nitisol
	Yellowish Lixivated Ferrallitic	552	Xanthic Rhodustalf	Ferralix, Xanthic, Lixic, Eutric Nitisol

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Group	Genetic Type	Area (km <sup>2</sup> )	Corelation with Soil Taxonomy	Corelation with WRB
Ferrallic Soils (1650 km <sup>2</sup> )	Red Ferrallic	1400	Oxic-Rhodic Haplustept	Ferralic, Rhodic, Eutric Cambisol
	Yellowish Ferrallic	250	Oxic-Xanthic Haplustept	Ferralic, Xanthic, Eutric Cambisol
Fersiallitic Soils (2952 km <sup>2</sup> )	Reddish Brown Fersiallitic	2300	Oxic Haplustept	Chromic, Eutric Cambisol
	Red Fersiallitic	652	Oxic Haplustept	Rhodic, Eutric Cambisol
Siallitic Brown Soils (36068 km <sup>2</sup> )	Brown	34548	Typic Haplustept	Eutric Cambisol
	Grayish Brown	1520	Typic Dystrupest	Dystric Cambisol
Humic Siallitic Soils (5744 km <sup>2</sup> )	Calcimorphic Humic	2300	Typic Haplustoll	Calcaric, Clayey Feozem
	Rendzina	3444	Lithic Haplustoll	Rendzic, Calcaric Feozem
Vertisols (9060 km <sup>2</sup> )	Pellic Vertisol	8200	Typic Hasplustert	PellicVertisol
	Chromic Vertisol	860	Chromic Haplustert	Chromic Vertisol
Hallomorphic Soils (216 km <sup>2</sup> )	Saline	96	Salic Epiaquent	Gleyic, Clayey Solonchak
	Sodic	120	Typic Halaquept	Stagnic Solonetz
Hydromorphic Soils (23380 km <sup>2</sup> )	Vertic Gley	6800	Ustic Endoaquet	Eutric, VerticGleysol
	Humic Gley	6400	Typic Endoaquet	Eutric, Clayey, HumicGleysol
	Nodule Ferruginous Gley with 2 Subtypes:	10180	They are Plintaqualf with two Subgroup:	Pisoplinthic Gleysol y Petroferric Gleysol
	Typic	6254	Typic Plinthaqualf	
	Petroferric	3926	Petroferric Plinthaqualf	
Fluvisol (375 km <sup>2</sup> )	Fluvisol	375	Typic Ustifluent	Eutric Fluvisol
Histosols (9062 km <sup>2</sup> )	Fibric Histosol	5200	Typic Haplofibrist	Fibric Histosol
	Mesic Histosol	3520	Typic Haplohemist	Mesic Histosol
	Sapric Histosol	342	Typic Haplosaprist	Sapric Histosol
Few Evolutionated Soils (3583 km <sup>2</sup> )	Arenosol	1030	Typic Quartzisapmmment	Eutric Arenosol
	Lithosol	753	Lithic Ustorthent	Lithic, Skeletic Lithosol
	Protorendzina	1800	Lithic Ustorthent	Lithic, Rendzic Leptosol
Anthrosols (2010 km <sup>2</sup> )	Saline Anthropic	2000	Dont have correlation	Salic Anthrosol
	Recultivated Anthropic	10	Dont have correlation (1)	Hortic Anthrosol

## CONCLUSIONS

- The area occupied by the Genetic Groupings and Types of Cuba´ soils is shown, based on the planimetric calculation of the 1: 250,000 scale soil map. Their extension responds to the conditions of soil formation, mainly due to the processes pedinplanation, hydromorphy and the presence of old stable surfaces.
- The most extensive soils are soils of the Brown genetic Type, following in that order the Gelysols, Vertisols and Histosols.
- The soils that are typical formation of the tropical regions (Allitic, Ferritic and Ferralitic) have an area a little greater than 15,000 km<sup>2</sup>.
- It is notable that Fluvisols and Lithosols are very little extensive.

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