Cultivos Tropicales, 2021, vol. 42, no. 3, e13
ISSN impreso: 0258-5936
ISSN digital: 1819-4087

http://ediciones.inca.edu.cu

julio-septiembre
Ministerio de Educación Superior. Cuba
Instituto Nacional de Ciencias Agrícolas

Short communication

Area occupied by group and genetic types of soils in Cuba

Alberto Hernández-Jiménez[1*]

[1]Instituto Nacional de Ciencias Agrícolas (INCA), carretera San José-Tapaste, km 3½, Gaveta Postal 1, San José de las Lajas, Mayabeque, Cuba. CP 32 700

[*]Author for correspondence: ahj@inca.edu.cu

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´ 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^2 (6.21 %).

Key words: cartography, soil classification, productivity

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 Fersiallitic or Gleysol soils [9].

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^2), 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´ 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´ 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´ 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].

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^2)	Corelation with Soil Taxonmy	Corelation with WRB
Allitic Soils ($6717\ km^2$)	Low Activity Clay Red Allitic	1931	Rhodic Kandiustalf	Rhodic, Alumic Acrisol
	Low Activity Clay Yellowish Red Allitic	890	Rhodic-Xanthic Rhodustalf	Rhodic, Xanthic, Alumic Acrisol
	Low Activity Clay Yellow Allitic	380	Xanthic Rhodustalf	Xanthic, Alumic Acrisol
	High Activiy Clay Yellowish Red Allitic	3200	Typic Rhodudalf	Rhodic, Xanthic, Alumic Alisol
	High Activiy Clay Yellowish Allitic	316	Xanthic Rhodudalf	Xanthic, Alumic Alisol
Ferritic Soils ($1908\ km^2$)	Dark Red Ferritic	1875	Rhodic Eutrudox	Ferritic, Rhodic, Eutric Ferralsol
	Yellowih Ferritic	33	Xanthic Eutrudox	Ferritic, Xanthic, Eutric Ferralsol
Ferrallitic Soils ($6807\ km^2$)	Red Ferrallitic	5539	Rhodic Eutrustox	Ferralic, Rhodic, Eutric, Clayey Nitisol
	Red Lixiviated Ferrallític	716	Typic Rhodustalf	Ferralic, Rhodic, Lixic, Eutric Nitisol
	Yellowih Lixiviated Ferrallitic	552	Xanthic Rhodustalf	Ferralix, Xanthic, Lixic, Eutric Nitisol
Ferrallic Soils ($1650\ km^2$)	Red Ferrallic	1400	Oxic, Rhodic Haplustept	Ferralic, Rhodic, Eutric Cambisol
	Yellowish Ferrallic	250	Oxic, Xanthic Haplustept	Ferralic, Xanthic, Eutric Cambisol
Fersiallitic Soils ($2952\ km^2$)	Reddish Brown Fersiallitic	2300	Oxic Haplustept	Chromic, Eutric Cambisol
	Red Fersiallitic	652	Oxic Haplustept	Rhodic, Eutric Cambisol
Siallitic Brown Soils ($36068\ km^2$)	Brown	34548	Cambisol Typic Haplustept	Eutric Cambisol
	Grayish Brown	1520	Typic Dystrustept	Dystric Cambisol
Humic Siallitic Soils ($5744\ km^2$)	Calcimorphic Humic	2300	Typic Haplustoll	Calcaric, Clayey Feozem
	Rendzina	3444	Lithic Haplustoll	Rendzic, Calcaric Feozem

Group	Genetic Type	Area (km^2)	Corelation with Soil Taxonmy	Corelation with WRB
Vertisols	Pellic Vertisol	8200	Typic Haplustert	Pellic Vertisol
(9060 km^2)	Chromic Vertisol	860	Chromic Haplustert	Chromic Vertisol
Hallomorphic Soils	Saline	96	Salic Epiaquent	Gleyic, Clayey Solonchak
(216 km^2)	Sodic	120	Typic Halaquept	Stagnic Solonetz
Hydromorphic Soils	Vertic Gley	6800	Ustic Endoaquert	Eutric, VerticGleysol
(23380 km^2)	Humic Gley	6400	Typic Endoaquept	Eutric, Clayey, HumicGleysol
	Nodule Ferruginous Gley with 2 Subtypes:	10180	They are Plintaqualf with two Subgroup:	
	Typic	6254	Typic Plinthaqualf	Pisoplinthic Gleysol and
	Petroferric	3926	Petroferric Plinthaqualf	Petroferric Gleysol
Fluvisol	Fluvisol	375	Typic Ustifluvent	Eutric Fluvisol
(375 km^2)				
Histosols	Fibric Histosol	5200	Typic Haplofibrist	Fibric Histosol
(9062 km^2)	Mesic Histosol	3520	Typic Haplohemist	Mesic Histosol
	Sapric Histosol	342	Typic Haplosaprist	Sapric Histosol
Few Evolutionated Soils	Arenosol	1030	Typic Quartzisapmment	Eutric Arenosol
(3583 km^2)	Lithosol	753	Lithic Ustorthent	Lithic, Skeletic Lithosol
	Protorrendzina	1800	Lithic Ustorthent	Lithic, Rendzic Leptosol
Anthrosols	Saline Anthropic	2000	Dont have correlation	Salic Anthrosol
(2010 km^2)	Recultivated Anthropic	10	Dont have correlation	Hortic Anthrosol

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^2 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 siallic 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)].

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 Ferrallitic) have an area a little greater than 15,000 km^2.
- It is notable that Fluvisols and Lithososls are very little extensive.

BIBLIOGRAPHY

1. USDA. Claves para la Taxonomía de Suelos. Departamento de Agricultura de los Estados Unidos, Décima. 2014;399.
2. IUSS Working Group WRB. International soil classification system for naming soils and creating legends for soil maps. Vol. 106. Rome, Italy: World Soil Resources Reports (FAO). 2014. 181 p.

3. Vera-Macias L, Hernández-Jiménez A, Mesías-Gallo FW, Guzmán-Cedeño ÁM, Cedeño-Sacón ÁF. Manual para la cartografía de suelos y la descripción de perfiles de suelos. [Internet]. 1ra ed. Calceta, Manabí, Ecuador: Editorial Humus. Escuela Superior Politécnica Agropecuaria de Manabí; 2017. 76 p. Available from: https://isbn.cloud/9789942773081/manual-para-la-cartografia-de-suelos-y-la-descripcion-de-perfiles-de-suelos/
4. Vera-Macías LR, Mesías Gallo FW, Guzmán-Cedeño AM, Hernández-Jiménez A, Cedeño-Sacon AF, Zambrano-Pazmiño DE. Aportes al conocimiento edafológico para lograr la agricultura sostenible del sistema Carrizal - Chone. Calceta, Manabí, Ecuador: Editorial Humus. Escuela Superior Politécnica Agropecuaria de Manabí; 2017. 187 p.
5. Hernández-Jiménez A, Pérez-Jiménez JM, Bosch-Infante D, Castro- Speck N. Clasificación de los suelos de Cuba 2015. Instituto Nacional de Ciencias Agrícolas; 2015. 89 p.
6. Gonçalves-dos Santos H. Sistema brasileiro de classificação de solos. Brasília, DF: Embrapa; 2014.
7. Bernal A, Hernández A, Mesa M, Rodríguez O, González PJ, Reyes R. Características de los suelos y sus factores limitantes de la región de murgas, provincia La Habana. Cultivos Tropicales. 2015;36(2):30-40.
8. Carnero-Lazo G, Hernández-Jiménez A, Terry-Alfonso E, Bojórquez-Serrano I. ENP-P.08 Cambios de carbono orgánico del suelo bajo diferentes coberturas. En Vardero, Cuba: Ediciones INCA; 2018.
9. Bernal-Fundora A, Hernández-Jiménez A. Influencia de diferentes sistemas de uso del suelo sobre su estructura. Cultivos Tropicales. 2017;38(4):50-7.
10. Hernández-Jiménez A, Pérez-Jimenéz JM, Bosch-Infante D, Rivero-Ramos L. Nueva versión de la clasificación genética de los suelos de Cuba. La Habana, Cuba: Instituto de suelos; 1999. 64 p.
11. Hernández-Jimenez A, Morales-Díaz M, Borges Y, Vargas-Blandino D, Cabrera-Rodríguez JA, Ascanio MO, et al. Degradación de los suelos Ferralíticos Rojos Lixiviados de la Llanura Roja de la Habana por el cultivo continuado. Algunos resultados sobre su mejoramiento. Mayabeque, Cuba: Ediciones INCA; 2014. 158 p.
12. Hernández-Jiménez A, Vargas-Blandino D, Bojórquez-Serrano JI, García-Paredes JD, Madueño-Molina A, Morales-Díaz M. Carbon losses and soil property changes

in ferralic Nitisols from Cuba under different coverages. Scientia Agricola. 2017;74(4):311-6.

13. Academia de Ciencias de Cuba. Génesis y clasificación de los suelos de Cuba. Instituto de Suelos. La Habana, Cuba. 1973;315.
14. Trémols-González AJ, Hernández-Jiménez A, Rosario-González J, Morales-Díaz M, Cánepa-Ramos Y. Soils 500 000. GIS product for agriculture technical consulting, research work and especialized teaching. En Huatulco, Oaxaca, México; 2009. p. 16-20.
15. Hernández-Jimenez A, Cárdenas-García A, Obregón-Santoyo A, Marrero A, Bosch D. Estudio de los suelos de la región de Campo Florido. Serie Suelos. 1973;18:1-57.