Revision of the Classification of the Soils of Trinidad and Tobago

Based on Keys to Soil Taxonomy, 12th ed. 2014

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Table of Contents

Purpose

The purpose of this project is to update the classifications for the soil series of Trinidad and Tobago in accordance with the latest version of Keys to Soil Taxonomy (Soil Survey Staff, 2014b). The taxonomic classifications were originally assigned by Dr. Guy D. Smith, working with the University of the West Indies, as part of a larger project to classify the soils throughout the Caribbean region (Smith, 1983). Since then Soil Taxonomy has been revised numerous times and this has resulted in nearly all of these soils having obsolete classifications. This is now corrected. Tables 1 and 2 below present the old and new taxonomic names for the soil series.

This report can also be used to help in any planning for future updating of the soil survey of Trinidad and Tobago. The soil survey field work for the islands was completed in the 1960's. There have been many advances in soil survey technology and its application in the 50 plus years since this work was done. Some of the more important changes include the standards used for describing soil profiles, laboratory tests for documenting chemical and physical properties, cartographic procedures for making accurate maps, new kinds of soil interpretations to assist in land use management, and advances in soil classification. The section titled "Future Considerations" (below) details several issues involving the description of soils in the field and analysis of samples in the laboratory that would significantly improve the classification of the soils in any future work.

Changes to Soil Taxonomy

There have been many improvements to Soil Taxonomy. Four changes that most significantly impacted the classification of the soils of Trinidad and Tobago are described here.

Recognition of highly weathered, low activity clays. Many soils of semi-tropical and tropical areas are unique due to the nature of their highly weathered clay fraction as characterized by low cation exchange capacity, inherently low natural fertility, and the unique challenges they present to fertility management. These properties are now addressed through the recognition of the *kandic horizon* at the great group level (e.g. the Acono series – a *Kanhapludult*), or at the subgroup level (e.g. the Austin Road series – a *Kanhaplic* Haplustult). In addition, a new family level consideration, *cation exchange activity class* was introduced for use in many soils with mixed or siliceous mineralogy to provide insight into the inherent capacity of the soil to retain plant nutrients. For example, the Buenos Aires series has a *subactive* class while the La Retraite series has a *semiactive* class. Otherwise their classifications are identical. The different cation exchange activity classes reflect the lower nutrient supplying character of the Buenos Aires series compared to the La Retraite series (something noted in the original map unit descriptions). Together these changes help to better group soils based on the kind and nature of the clay minerals making up the soil.

Dropping the use of the *Trop* category throughout Soil Taxonomy. At the time that Dr. Smith first classified these soils, many (but not all) soils in tropical regions were placed in *Trop* suborders e.g. Piparo (Tropept), or great groups e.g. Acono (Tropudult), Barataria (Tropohemist), Montserrat (Tropudoll), or Couva (Tropaqualf). There are many examples shown under the "old classification" for Trinidad and Tobago soils. The *Trop* categories were intended to group soils that have both warm temperatures and little seasonal fluctuation in temperature (isomesic or warmer). Eventually the *Trop* classes were dropped for two major reasons. First, in practice it resulted in situations where some soils in tropical landscapes were classified in *trop* categories while their adjacent neighboring soils in the same landscape were not because other factors were deemed more important. Also, the use of *trop* categories at a high taxonomic level was redundant with the use of isohyperthermic temperature regimes at the family level. Both convey similar information so there was no real advantage to providing it at two categorical levels in the taxonomy.

Dropping the use of *Pell* and *Chrom* great groups in Vertisols. These great groups were originally intended to separate the mostly dark colored, wetter Vertisols on level to concave slopes from the somewhat lighter colored, better drained Vertisols on more sloping areas. In practice this was not particularly effective. New great groups based on the presence of important diagnostic horizons and features were established to replace the Pell and Chrom great groups. In addition, poorly drained Vertisols were better recognized with the introduction of the *Aquerts* suborder. Several Vertisols are recognized in Trinidad and Tobago. Examples include La Fortune, Marac, Milford, and Minister.

Recognizing both *fine* and *very-fine* particle-size classes in Ultisols.
At the time that Dr. Smith classified these soils, Ultisols with 35 to 100 percent clay in the subsoil were all placed in the *clayey* particle size class. These have since been separated into two classes, *fine* (35-59 percent) and *very-fine* (60% or more). This allows for better separations at the family level for Ultisols with high clay contents. A few examples include Anglais, Long Stretch, and Mon Pariel, all in Trinidad. No Ultisols were recognized in Tobago, primarily due to the prevalence of parent materials with inherently higher base status.

Procedure

In the introduction to his report, Dr. Smith pointed out several factors contributing to uncertainty about the classification of the soils (Smith, 1983). These included the minimal level of standards for describing the soils in the field, lack of some key laboratory data, and the challenge of applying a taxonomic system after the soil survey was completed rather than concurrently with the field work so that class limits and criteria could be tested and verified. These all continue to contribute to uncertainty of the proper classifications now. Despite these challenges, some key steps and considerations used to reclassify the soils included the following.

Acceptance of the previous work. Dr. Smith made many assumptions about likely soil moisture regimes (udic vs. ustic), and the presence or absence of key features such as argillic horizons, slickensides, plinthite, etc. that were not explicitly described in the original soil survey report. In addition, with no laboratory data available documenting the mineral makeup of the soils, he made informed estimations about likely mineralogy classes. These assumptions were generally accepted and carried forward for the new classifications.

It was necessary to evaluate the soils for the possible presence of a kandic horizon, a feature previously not recognized by Soil Taxonomy. Key laboratory data for clay content and cation exchange capacity was entered into a spreadsheet and calculations were made for *weighted average clay in the upper 7 inches* so that it could be compared to the layer below and for *apparent cation exchange capacity* (CEC/clay% * 100) in the subsoil layers. It should be noted that effective cation exchange capacity (ECEC) is also a criteria required by Soil Taxonomy, but these data were not available. It was assumed that if the calculated apparent CEC was low enough, the ECEC would also have been met (something generally accepted as true).

A few soils with high organic carbon in the upper part were placed in the Humults suborders (Maracas, Matelot, and Spring Hill). To confirm this classification requires values for organic carbon and bulk density to a depth of 1m so that the mass of organic carbon per square meter can be calculated. However, no bulk density data was reported and organic carbon was reported for just the upper several inches. In order to estimate this, bulk densities of 1.3, 1.4, and 1.5 were assumed for the surface layer, the next layer to 20 inches, and for the zone from 20 to 40 inches respectively. Organic carbon values as reported were used and (decreasing) values were assigned for the remaining depths having no reported carbon levels. If the result qualified for the suborder (i.e. 12.0 kg / m^2), then a class of Humult was assigned. This result seemed reasonable for the soils identified.

Mineralogy classes as estimated by Dr. Smith were generally accepted. In a few instances changes were made if clues in the descriptions suggested otherwise. Apparent CEC values provided some clues for clay mineralogy. In most cases these data simply were not available to make a determination with high confidence.

Several soils required assignments for cation exchange activity classes, which were not used in Soil Taxonomy when Dr. Smith classified the soils. Calculations for apparent CEC were calculated with the spreadsheet (as described previously) and cation exchange activity classes were assigned. Most soils were placed in either a *subactive* or *semiactive* class, several are *active*, and a few are *superactive* (Tables 1 and 2).

It should be noted that while the laboratory data for both Trinidad and Tobago soil surveys were incomplete by today's standards, these data for Tobago were particularly limited. Most significantly, there was no particle-size data, which made it impossible to evaluate family particle-size class. The only information available was the texture class from the field description. The assignments of particle-size made by Dr. Smith were accepted without change. Also, apparent cation exchange activity could not be calculated with the spreadsheet. In addition, in many instances the sampling was limited to sublayers of the horizons described in the field rather than each entire horizon.

Revised Classification of the Soils

Table 1 presents the updated classification for the soils of Trinidad. Table 2 presents the updated classification for the soils of Tobago.

Table 1. Classification of soil series from Trinidad updated from the 1983 report to the 12th edition Keys to Soil Taxonomy, 2014.

Series	Old Classification	New Classification
Acono	clayey, kaolinitic, isohyperthermic Orthoxic Tropudults	fine, kaolinitic, isohyperthermic Typic Kanhapludults
Anglais	clayey, kaolinitic, isohyperthermic Orthoxic Tropudults	fine, kaolinitic, isohyperthermic Aquic Hapludults
Antilles	clayey, mixed, isohyperthermic Typic Haplustults	fine, mixed, semiactive, isohyperthermic Typic Haplustults
Aranguez	fine, mixed, nonacid, isohyperthermic Tropic Fluvaquents	fine, kaolinitic, nonacid, isohyperthermic Typic Fluvaquents
Arena	mixed, isohyperthermic, coated Orthoxic Quartzipsamments	isohyperthermic, coated Udoxic Quartzipsamments
Aripo	clayey, kaolinitic, isohyperthermic Typic Densiaquults	fine-loamy, mixed, subactive, isohyperthermic, Typic Fragiaquults
Austin Road	clayey, mixed, isohyperthermic Typic Haplustults	fine-loamy, mixed, isohyperthermic Kanhaplic Haplustults
Avocat	clayey, kaolinitic, isohyperthermic Plinthic Haplustults	fine, kaolinitic, isohyperthermic Plinthic Haplustults
Barataria	clastic, dysic, Fluvaquentic Tropohemists	Dysic, isohyperthermic Fluvaquentic Haplohemists
Basseterre	very-fine, mixed (calcareous), isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Chromic Calciusterts
Bejucal	very-fine, mixed, acid, isohyperthermic Entic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
Bel Aire	very-fine, mixed, nonacid, isohyperthermic Entic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Aquic Hapluderts
Biche	very-fine, mixed, nonacid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Aquertic Eutrudepts
Blanchisseuse	fine, mixed isohyperthermic Typic Tropudalfs	fine, mixed, subactive, isohyperthermic Typic Hapludalfs
Bois Bourg	fine, mixed, isohyperthermic Aquic Haplustalfs	fine, mixed, active, isohyperthermic Aquic Haplustalfs
Bois Neuf	very-fine, mixed acid, isohyperthermic Tropic Fluvaquents	very-fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
Brasso	very-fine, montmorillonitic, nonacid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, subactive, isohyperthermic Aquertic Eutrudepts
Brazil	fine-loamy, siliceous, isohyperthermic Umbric Tropaquults	fine-loamy, siliceous, active, isohyperthermic Typic Umbraquults
Brighton	fine, mixed, acid, isohyperthermic Sulfic Tropaquepts	very-fine, mixed, active, isohyperthermic Sulfic Endoaquepts
Buenos Aires Savannah	very-fine, mixed, acid, isohyperthermic Entic Pellusterts	very-fine, mixed, subactive, isohyperthermic Chromic Dystrusterts
Cacandee	very-fine, montmorillonitic, nonacid, isohyperthermic Typic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Chromic Endoaquerts
Canterbury	fine, mixed, isohyperthermic Aquic Tropudalfs	very-fine, kaolinitic, isohyperthermic Aquic Kandiudalfs
Cap-de-Ville	very-fine, mixed, isohyperthermic Aquultic Haplustalfs	very-fine, mixed, subactive, isohyperthermic Aquultic Haplustalfs
Caracas	fine, montmorillonitic, isohyperthermic Fluvaquentic Tropudolls	very-fine, mixed, active, isohyperthermic Fluvaquentic Hapludolls

Carapal	fine, mixed, isohyperthermic Ultic Haplustalfs	fine, mixed, semiactive, isohyperthermic Ultic Haplustalfs
Caroni	very-fine, mixed, isohyperthermic Typic Sulfaquents	very-fine, mixed, subactive, isohyperthermic Thapto-Histic Sulfaquents
Cedros	very-fine, mixed, nonacid, isohyperthermic Entic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Chromic Haplusterts
Chatham	fine-loamy, siliceous, isohyperthermic Oxic Haplustults	fine-loamy, siliceous, isohyperthermic Typic Kanhaplustults
Chaudiere	very-fine, mixed, isohyperthermic Aquultic Tropudalfs	very-fine, mixed, subactive, isohyperthermic Aquic Hapludalfs
Chickland	very-fine, mixed, isohyperthermic Aquic Tropudalfs	very-fine, mixed, semiactive, isohyperthermic Aquollic Hapludalfs
Cleaver	clayey, kaolinitic, isohyperthermic Orthoxic Tropudults	fine, kaolinitic, isohyperthermic Ombroaquic Kandiudults
Cocal	isohyperthermic, uncoated Typic Quartzipsamments	coarse-loamy, siliceous, subactive, isohyperthermic Typic Udorthents
Columbia	very-fine, mixed, acid, isohyperthermic Udic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Aquertic Hapludalfs
Couva	fine, mixed Typic Tropaqualfs	fine, mixed, subactive, isohyperthermic Mollic Endoaqualfs
Cromarty	very-fine, mixed, nonacid, isohyperthermic Entic Pelluderts	fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
Cunupia	fine, mixed, isohyperthermic Aquic Eutropepts	fine, mixed, semiactive, isohyperthermic Aquic Hapludalfs
Debe	very-fine, mixed, acid, isohyperthermic Entic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
Delhi	fine-loamy, siliceous, isohyperthermic Typic Tropudults	fine-loamy, siliceous, semiactive, isohyperthermic Typic Hapludults
Diego Martin	coarse-loamy, carbonatic, isohyperthermic Eutropeptic Rendolls	coarse-loamy, carbonatic, isohyperthermic Inceptic Haprendolls
Ecclesville	very-fine, mixed, acid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Aquertic Eutrudepts
Erin River	fine, mixed, isohyperthermic Fluvaquentic Eutropepts	fine, mixed, semiactive, isohyperthermic Fluvaquentic Eutrudepts
Frederick	very-fine, mixed, isohyperthermic Vertic Tropaquolls	very-fine, mixed, semiactive, isohyperthermic Chromic Endoaquerts
Freeport	fine-loamy, mixed, isohyperthermic Aeric Tropaqualfs	fine-loamy, mixed, semiactive, isohyperthermic Aeric Endoaqualfs
Galera	loamy-skeletal, mixed, isohyperthermic Typic Dystropepts	loamy-skeletal, mixed, subactive, isohyperthermic Oxyaquic Dystrudepts
Galpha	fine, mixed, isohyperthermic Fluvaquentic Eutropepts	fine-loamy, mixed, semiactive, isohyperthermic Fluvaquentic Eutrudepts
Godineau	very-fine, mixed, acid, isohyperthermic Thapto-Histic Sulfic Tropic Fluvaquents	very-fine, mixed, semiactive, isohyperthermic Typic Sulfaquerts
Golden Grove	fine-loamy, mixed, isohyperthermic Fluventic Dystropepts	fine-loamy, mixed, subactive, isohyperthermic Aquic Dystrudepts
Grand Riviere	fine-loamy, micaceous, acid, isohyperthermic Typic Tropofluvents	fine-loamy, micaceous, acid, isohyperthermic Typic Udifluvents
Granville	coarse-loamy, siliceous, isohyperthermic, Arenic Paleustults	coarse-loamy, siliceous, semiactive, isohyperthermic Typic Paleustults
Green Hill	very-fine, mixed, isohyperthermic Vertic Ustropepts	very-fine, mixed, semiactive, isohyperthermic Vertic Haplustepts
Guanapo	fine-loamy over sandy or sandy-skeletal, micaceous, isohyperthermic Typic Eutropepts	fine-loamy, micaceous, isohyperthermic Dystric Eutrudepts
Guayaguayare	fine, mixed, isohyperthermic Vertic Tropudalfs	fine, mixed, semiactive, isohyperthermic Aquertic Hapludalfs

Icacos	mixed, isohyperthermic Typic Ustipsamments	mixed, isohyperthermic Typic Ustipsamments
La Brea	very-fine, mixed, acid, isohyperthermic Entic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystrusterts
La Fortune	very-fine, mixed, nonacid, isohyperthermic Entic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
La Pastora	fine, kaolinitic, isohyperthermic Oxic Tropudalfs	fine, kaolinitic, isohyperthermic, Typic Kanhapludalfs
La Retraite	very-fine, mixed, acid, isohyperthermic Udorthentic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystrusterts
Las Lomas	clayey, kaolinitic, isohyperthermic Orthoxic Tropudults	fine-loamy, kaolinitic, isohyperthermic Typic Kanhapludults
L'Ebranche	fine, mixed, acid, isohyperthermic Aeric Tropaquepts	very-fine, mixed, semiactive, isohyperthermic Aeric Endoaquepts
Long Stretch	clayey, kaolinitic, isohyperthermic Plinthic Tropaquults	fine, kaolinitic, isohyperthermic Kandic Plinthaquults
Macaw	fine, mixed, nonacid, isohyperthermic Tropic Fluvaquents	fine-mixed, semiactive, nonacid, isohyperthermic Mollic Fluvaquents
Macoya	Was not classified - too little information.	fine-loamy, mixed, subactive, isohyperthermic Fragic Endoaqualfs
Mahaut	fine-loamy, mixed, isohyperthermic Fluventic Dystropepts	fine-loamy, mixed, subactive, isohyperthermic Dystric Fluventic Eutrudepts
Marac	very-fine, mixed (calcareous), isohyperthermic Udorthentic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Chromic Haplusterts
Maracas	clayey, oxidic, isohyperthermic Orthoxic Tropudults	fine, sesquic, isohyperthermic Typic Kandihumults
Maraval	fine, kaolinitic, isohyperthermic Oxic Tropudalfs	fine, kaolinitic, isohyperthermic, Typic Kanhapludalfs
Marper	fine, mixed, isohyperthermic Typic Tropudalfs	fine, mixed, semiactive, isohyperthermic Typic Hapludalfs
Matelot	fine-loamy, micaceous, isohyperthermic Orthoxic Tropudults	fine-loamy, allitic, isohyperthermic Typic Kandihumults
Mayaro	coarse-loamy, mixed, isohyperthermic Typic Tropudalfs	sandy, mixed, isohyperthermic Typic Udipsamments
McBean	fine-loamy, mixed, isohyperthermic Typic Tropudults	fine-loamy, mixed, semiactive, isohyperthermic Aquic Hapludults
Mitan	very-fine, mixed, isohyperthermic Aquic Tropudalfs	very-fine, kaolinitic, isohyperthermic Aquic Hapludalfs
Mon Pariel	clayey, kaolinitic, isohyperthermic Oxic Haplustults	very-fine, kaolinitic, isohyperthermic Kanhaplic Haplustults
Montserrat	fine, oxidic, isohyperthermic Typic Tropudolls	fine, mixed, superactive, isohyperthermic Mollic Hapludalfs
Morne Diablo	very-fine, mixed, nonacid, isohyperthermic Udorthentic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Vertic Haplustepts
Moruga	fine-loamy, mixed, isohyperthermic Typic Haplustults	fine, mixed, semiactive, isohyperthermic Ombroaquic Haplustults
Mount Harris	clayey, mixed, isohyperthermic Aquic Tropudults	fine, mixed, subactive, isohyperthermic Plinthaquic Paleudults
Nariva	very-fine, mixed, acid, isohyperthermic Typic Hydraquents	very-fine, mixed, semiactive, acid, isohyperthermic Mollic Fluvaquents
Navet	very-fine, mixed, acid, isohyperthermic Aeric Tropaquepts	very-fine, mixed, semiactive, acid, isohyperthermic Fluvaquentic Endoaquepts
Orange Grove	fine-loamy, mixed, nonacid, isohyperthermic Aeric Tropaquepts	fine-loamy, mixed, subactive, nonacid, isohyperthermic Mollic Endoaquepts
Orapuna	fine, kaolinitic, nonacid, isohyperthermic Aeric Tropaquepts	fine, kaolinitic, nonacid, isohyperthermic Typic Endoaquepts
Oropouche	fine, mixed, acid, isohyperthermic Aeric Tropaquepts	fine, kaolinitic, isohyperthermic Aquic Dystrudepts

Pasea	fine, mixed, isohyperthermic Fluvaquentic Dystropepts	fine, kaolinitic, isohyperthermic Fluvaquentic Eutrudepts
Perseverance	very-fine, mixed, isohyperthermic Vertic Haplustalfs	very-fine, mixed, semiactive, isohyperthermic Vertic Haplustepts
Phoenix	fine-loamy, siliceous, isohyperthermic Plinthaquic Tropudults	fine-loamy, siliceous, semiactive, isohyperthermic Plinthaquic Paleudults
Piarco	clayey, kaolinitic, isohyperthermic Aquoxic Tropudults	fine, kaolinitic, isohyperthermic Typic Kanhaplaquults
Piparo	fine, mixed, isohyperthermic Vertic Eutropepts	very-fine, mixed, subactive, isohyperthermic Oxic Haplustepts
Platanal	fine, kaolinitic, isohyperthermic Typic Eutropepts	fine, kaolinitic, isohyperthermic Typic Kandiudalfs
Point d'Or	clayey, mixed, isohyperthermic Aquic Haplustults	fine, mixed, subactive, isohyperthermic Aquic Haplustults
Poui	fine-loamy, mixed, isohyperthermic Aquic Tropudalfs	fine-loamy, mixed, semiactive, isohyperthermic Aquic Hapludalfs
Princess Town	very-fine, montmorillonitic, nonacid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Aquertic Eutrudepts
Quinam	very-fine, mixed, nonacid Entic Chromusterts	very-fine, mixed, semiactive, isohyperthermic Vertic Haplustalfs
River Estate	fine-loamy, micaceous, isohyperthermic Fluventic Eutropepts	fine-loamy, micaceous, isohyperthermic Dystric Fluventic Eutrudepts
Rochard	fine, mixed, isohyperthermic Vertic Haplustalfs	fine, mixed, active, isohyperthermic Vertic Haplustalfs
Rock Road	clayey over loamy, mixed, isohyperthermic Aquic Eutropepts	clayey over loamy, mixed, semiactive, isohyperthermic Aquic Haplustepts
San Fernando	Not classified, no data or profile description.	
San Francique	very-fine, mixed, acid, isohyperthermic Entic Pelluderts	very-fine, mixed, semiactive, isohyperthermic Chromic Dystraquerts
San Quintin	isohyperthermic, coated, Ustoxic Quartzipsamments	isohyperthermic, coated Ustoxic Quartzipsamments
Sangre Grande	fine, mixed, acid, isohyperthermic Aeric Tropaquepts	fine, mixed, semiactive, acid, isohyperthermic Fluvaquentic Endoaquepts
Sans Souci	fine, mixed, isohyperthermic Typic Tropudalfs	fine, mixed, semiactive, isohyperthermic Aquic Hapludalfs
Santa Cruz	loamy-skeletal, mixed, isohyperthermic Typic Eutropepts	loamy-skeletal, kaolinitic, isohyperthermic Typic Kanhapludalfs
Saunders Road	Fine, mixed, isohyperthermic Aquic Tropudalfs	fine, mixed, semiactive, isohyperthermic Typic Hapludalfs
Savaneta	clayey over loamy, mixed, acid, isohyperthermic Tropic Fluvaquents	clayey over loamy, mixed, semiactive, acid, isohyperthermic Vertic Fluvaquents
Schooners	fine-loamy, siliceous, isohyperthermic Typic Tropudalfs	fine-loamy, siliceous, semiactive, isohyperthermic Typic Hapludalfs
Sevilla	very-fine, montmorillonitic, nonacid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Aquic Eutrudepts
Siparia	coarse-loamy, siliceous, isohyperthermic Typic Haplustults	loamy, siliceous, isohyperthermic Arenic Plinthic Kandiustults
Spring Hill	clayey, kaolinitic, isohyperthermic Orthoxic Tropohumults	fine, kaolinitic, isohyperthermic Typic Kandihumults
St Augustine	clayey, kaolinitic, isohyperthermic Orthoxic Tropudults	fine, kaolinitic, isohyperthermic Aquic Hapludalfs
St James	very-fine, mixed, isohyperthermic Aquic Tropudalfs	very-fine, mixed, active, isohyperthermic Aquertic Hapludalfs
St John	coarse-loamy, mixed, isohyperthermic Aquic Tropudalfs	coarse-loamy, mixed, semiactive, isohyperthermic Aquic Dystric Eutrudepts
St Joseph	coarse-loamy, micaceous, nonacid, isohyperthermic Typic Tropofluvents	coarse-loamy, micaceous, nonacid, isohyperthermic Typic Udifluvents

St. Marie	fine-loamy, mixed, isohyperthermic Typic Tropudalfs	fine-loamy, mixed, semiactive, isohyperthermic Typic Hapludalfs
Streatham	Clayey kaolinitic, isohyperthermic Plinthic Tropudults	fine, kaolinitic, isohyperthermic Typic Plinthudults
Tacarigua	coarse-loamy, micaceous, isohyperthermic Fluventic Eutropepts	coarse-loamy over clayey, micaceous over kaolinitic, isohyperthermic Dystric Fluventic Eutrudepts
Talparo	very-fine, mixed, acid, isohyperthermic Aquentic Chromuderts	very-fine, mixed, semiactive, isohyperthermic Aquertic Eutrudepts
Tamana	very-fine, montmorillonitic, isohyperthermic Typic Tropudalfs	very-fine, montmorillonitic isohyperthermic Udertic Haplustalfs
Tarouba	very-fine, montmorillonitic , calcareous, isohyperthermic Aquentic Chromuderts	very-fine, smectitic, isohyperthermic Aquic Hapluderts
Toco	fine, mixed, isohyperthermic Typic Eutropepts	fine, mixed, semiactive, Dystric Eutrudepts
Valencia	coarse-loamy, siliceous, isohyperthermic, ortstein Typic Troporthods	fine-loamy, siliceous, isohyperthermic Kandic Plinthaquults
Washington	coarse-loamy, mixed, isohyperthermic Typic Eutropepts	fine-loamy, mixed, semiactive, isohyperthermic Aquultic Hapludalfs
Waterloo	fine, mixed, isohyperthermic Typic Tropaqualfs	fine, mixed, subactive, isohyperthermic Typic Endoaqualfs

Table 2. Classification of soil series from Tobago updated from the 1983 report to the 12th edition Keys to Soil Taxonomy, 2014.

Series	**Old Classification**	**New Classification**
Adventure	fine-loamy, mixed, isohyperthermic Typic Tropudalfs	fine-loamy, mixed, semiactive*, isohyperthermic Typic Hapludalfs
Arnos Vale	Not classified due to overly broad concept.	No information available - not classified
Bacolet	fine-loamy, mixed, isohyperthermic Fluvaquentic Eutropepts	fine-loamy, mixed, active*, isohyperthermic Dystric Fluventic Eutrudepts
Bishop's School	fine, montmorillonitic, isohyperthermic Vertic Haplustalfs	fine, smectitic, isohyperthermic Udertic Haplustalfs
Blackrock	fine-loamy, mixed, isohyperthermic Typic Haplustalfs	coarse-loamy, mixed, semiactive* isohyperthermic Typic Haplustalfs
Bloody Bay	very-fine, mixed, isohyperthermic Typic Eutropepts	fine, mixed, subactive*, isohyperthermic Typic Dystrudepts
Bon Accord	Not classified due to overly broad concept.	*fine-loamy, mixed, semiactive, isohyperthermic Aquic Udifluvents***
Buccoo	fine, montmorillonitic, (calcareous), isohyperthermic Typic Fluvaquents	fine, smectitic, calcareous, isohyperthermic Vertic Fluvaquents
Castara	Not classified due to overly broad concept.	No information available - not classified
Concordia (eroded)	fine-loamy, mixed, isohyperthermic Typic Eutropepts	loamy-skeletal, mixed, active*, isohyperthermic Dystric Eutrudepts
Concordia (uneroded)	fine, montmorillonitic, isohyperthermic Argic Tropudolls	fine, smectitic, isohyperthermic Aquic Argiudolls
Courland	fine-loamy, mixed, isohyperthermic Fluventic Eutropepts	fine-loamy, mixed, active*, isohyperthermic Dystric Fluventic Eutrudepts
Crown Point	clayey, montmorillonitic, isohyperthermic Lithic Vertic Ustropepts	clayey, smectitic, isohyperthermic Lithic Haplustepts
Diamond	fine, montmorillonitic, nonacid, isohyperthermic Entic Chromusterts	fine, smectitic, isohyperthermic Chromic Haplusterts
Fort George	very-fine, montmorillonitic, isohyperthermic Typic Haplustalfs	very-fine, smectitic, isohyperthermic Typic Haplustalfs
Friendship	fine, mixed, isohyperthermic Aquic Haplustalfs	fine, mixed, active*, isohyperthermic Aquic Haplustalfs

Goldsborough	fine, montmorillonitic, isohyperthermic Aquic Haplustalfs	fine, smectitic, semiactive*, isohyperthermic Aquic Haplustalfs
Goodwood	fine, mixed, isohyperthermic Ultic Haplustalfs	fine, mixed, semiactive*, isohyperthermic Ultic Haplustalfs
Grange	clayey, montmorillonitic, isohyperthermic Lithic Vertic Ustropepts	clayey-skeletal, smectitic, isohyperthermic Lithic Haplustepts
Hawk's Bill	fine-loamy, oxidic, isohyperthermic Ultic Haplustalfs	fine-loamy, sesquic, isohyperthermic Ultic Haplustalfs
Hermitage	fine-loamy, mixed, isohyperthermic Fluventic Eutropepts	fine-loamy, mixed, semiactive*, isohyperthermic Dystric Fluventic Eutrudepts
Hillsborough	Not classified due to overly broad concept.	No information available - not classified
Hope	fine, mixed, isohyperthermic Vetic Tropudalfs	fine, mixed, active*, isohyperthermic Vertic Hapludalfs
Lambeau	Not classified due to overly broad concept.	*fine-loamy, mixed, semiactive, isohyperthermic Aquultic Haplustalfs***
Les Coteaux	fine-loamy, mixed, isohyperthermic Typic Tropudalfs	fine-loamy, mixed, active*, isohyperthermic Typic Hapludalfs
Mena	fine, montmorillonitic, isohyperthermic Typic Eutropepts	fine, smectitic, superactive*, isohyperthermic Dystric Eutrudepts
Milford	fine, montmorillonitic, nonacid, isohyperthermic Udorthentic Chromusterts	fine, smectitic, isohyperthermic Leptic Udic Haplusterts
Minister	fine, montmorillonitic, nonacid Udic Chromusterts	fine, smectitic, isohyperthermic Chromic Udic Haplusterts
Montgomery	clayey, mixed, isohyperthermic Lithic Vertic Eutropepts	clayey, smectitic, isohyperthermic Lithic Humudepts
Mount Dillon	loamy-skeletal, mixed, isohyperthermic Typic Eutropepts	loamy-skeletal, mixed, subactive*, isohyperthermic Dystric Eutrudepts
Petit Trou	clayey over sandy or sandy-skeletal, montmorillonitic, isohyperthermic Anthropic Ustorthents	clayey over sandy or sandy-skeletal, smectitic, isohyperthermic Anthroportic Ustorthents
Pigeon Point	carbonatic, isohyperthermic Typic Ustipsamments	carbonatic, isohyperthermic Typic Ustipsamments
Prospect	fine, mixed, isohyperthermic Aquic Tropudalfs	fine, mixed, active*, isohyperthermic Aquollic Hapludalfs
Queens	fine, montmorillonitic, isohyperthermic Typic Eutropepts	fine, smectitic, isohyperthermic Dystric Eutrudepts
Richmond	Not classified due to overly broad concept.	*fine-loamy, mixed, active, isohyperthermic Fluvaquentic Epiaquepts***
Sereviche	fine, montmorillonitic, isohyperthermic Vertic Ustropepts	fine, smectitic, isohyperthermic Vertic Haplustepts
Shaw Park	fine, montmorillonitic, nonacid Udorthentic Chromusterts	fine, smectitic, isohyperthermic Chromic Udic Haplusterts
Shirvan	fine, mixed, isohyperthermic Aquic Haplustalfs	fine, mixed, semiactive*, isohyperthermic Aquultic Haplustalfs
Signal Hill	fine-loamy, mixed, isohyperthermic Typic Natrustalfs	fine-loamy, mixed, semiactive*, isohyperthermic Typic Natrustalfs
Trig Point	fine, oxidic, isohyperthermic Typic Dystropepts	fine, magnesic, semiactive*, isohyperthermic Dystric Eutrudepts

*clay activity class assigned based on CEC and particle-size class alone.
**Soil was not originally classified. New classification assigned based on minimal descriptive information and laboratory data.

Alternative Classifications

As discussed previously, there are several factors contributing to uncertainty of the classifications assigned to the soils. Tables 3 and 4 provide examples of some alternative classifications for some soils from the islands of Trinidad and Tobago respectively. Each table includes a brief note indicating what issue is involved. In reality, these tables could be expanded to include alternative classifications for most of the soils. The soils listed provide examples of some of the issues and how their resolution might impact the classification.

Table 3. Alternative classification for some Trinidad soil series.

Series	Note	Alternative Classification
Acono	Possibly skeletal.	clayey-skeletal, kaolinitic, isohyperthermic Typic Kanhapludults
Austin Road	May be pale great group, need deeper clay data.	fine-loamy, mixed, subactive, isohyperthermic Typic Paleustults
Barataria	This soil possibly has a mineral layer 12 inches thick in the profile.	clayey, mixed, dysic, isohyperthermic Terric Haplohemists
Biche	Possibly a Vertisol.	very-fine, mixed, semiactive, isohyperthermic Aquic Hapluderts
Bois Neuf	Possibly fails Vertisol.	very-fine, mixed, semiactive, acid, isohyperthermic Vertic Fluvaquents
Cacandee	Possibly fails Vertisol.	very-fine, mixed, semiactive, nonacid, isohyperthermic Vertic Fluvaquents
Cap-de-Ville	Possibly better drained than aquic subgroup.	very-fine, mixed, subactive, isohyperthermic Ultic Haplustalfs
Chatham	Some "cementation" - possible plinthite?	fine-loamy, siliceous, isohyperthermic Plinthic Kanhaplustults
Cleaver	Possibly has plinthite.	fine, kaolinitic, isohyperthermic Plinthic Kandiudults
Cunupia	Possibly has cambic rather than argillic.	fine, mixed, semiactive, isohyperthermic Aquic Dystric Eutrudepts
Ecclesville	Possibly a Vertisol.	very-fine, mixed, semiactive, isohyperthermic Aquic Hapluderts
La Brea	Possibly fails Vertisol.	very-fine, mixed, semiactive, isohyperthermic Vertic Haplustalfs
Morne Diablo	Possibly a Vertisol.	very-fine, mixed, semiactive, isohyperthermic Chromic Haplusterts
Nariva	"Permanently" flooded, possibly a Wassent.	very-fine, mixed, semiactive, acid, isohyperthermic Hydric Frasiwassents
Orapuna	Need carbon data with depth to check for flooding stratification.	fine, kaolinitic, nonacid, isohyperthermic Fluvaquentic Endoaquepts
Pasea	High base saturation may be from liming.	fine, kaolinitic, isohyperthermic Fluvaquentic Dystrudepts
Princess Town	Possibly a Vertisol.	very-fine, mixed, semiactive, isohyperthermic Aquic Hapluderts
Quinam	Possibly a Vertisol.	very-fine, mixed, semiactive, isohyperthermic Chromic Haplusterts
St Augustine	High base saturation may be from liming.	fine, kaolinitic, isohyperthermic Aquultic Hapludalfs

Table 4. Alternative classification for some Tobago soil series.

Series	Notes	Alternative Classification
Diamond	Possibly fails Vertisol.	fine, smectitic, isohyperthermic Aquic Haplustepts
Hawk's Bill	Color appears to fit Rhodic great group, but Dr. Smith's original decision did not place it there.	fine-loamy, sesquic, isohyperthermic Typic Rhodustalfs
Hope	Possibly a Vertisol. Appears to have paralithic contact at 38".	fine, mixed, active*, isohyperthermic Leptic Hapluderts

*clay activity class assigned based on CEC and particle-size class alone.

Future Considerations

In the course of reviewing the soil survey information and original classifications of the soils of Trinidad and Tobago it seemed desirable to provide a summary of the kinds of issues that should be addressed if there is ever an effort made to update and modernize the soil survey of the country. For the record, they are presented here. These items deal solely with the needs for describing the soils in the field and analyzing samples in the laboratory so they can be classified accurately. They do not address other issues such as digital mapping, proximal sensing of soil properties, or use of geographic information systems and global positioning systems as well as other techniques important to modern soil survey activities.

Field Descriptions of the Soils. The following were noted as particularly important items lacking in the original descriptions, but which are needed to improve the accuracy of the classification of the soils.

- The use of standard horizon nomenclature (A, E, Bt, Cr, etc.) adds significantly to the usefulness of the descriptions, especially for future evaluation. The nomenclature serves as a kind of short-hand for the soil scientist describing the soil to record what soil forming processes likely produced the horizon being described, thus communicating this information to anyone reading the descriptions.
- Munsell color should be described in both the moist and dry state, especially for surface layers so that possible mollic or umbric epipedons can be identified.
- Organic layers should have fiber content noted (rubbed and unrubbed) so that the level of decomposition can be assessed (i.e. sapric, hemic, fibric) and the proper classification assigned.
- The volume percentage of rock fragments in individual horizons should be estimated in the field and its mass measured in the laboratory. This is needed for family particle-size class placement.
- Terms for describing redoximorphic features need to be used in association with color patterns in the horizon that result from contemporary conditions of wetness. Many Trinidad and Tobago soils have formed in parent materials with naturally gray colors, and some soils appear to have relict color patterns related to past wetness. It is very difficult to assess which colors are associated with current wetness rather than other factors with the descriptions in the original report.
- Features of cracks, slickensides, and wedge-shaped peds in soils with a significant capacity to shrink and swell need to be described. This is critical for identification of Vertisols and soils in vertic subgroups.
- Clay films coating peds need to be noted where present so argillic horizons can be more reliably identified.
- The presence of plinthite, and estimates of its amount needs to be recorded.

Laboratory data. The following were noted as particularly important items lacking in the original laboratory data, and are needed to improve the accuracy of the classification of the soils.

- Mineralogy data for both the sand and clay fractions. The lack of this information is one of the most limiting factors contributing to uncertainty of the classification for many of the soils.
- Effective cation exchange capacity (ECEC) values are needed for the identification of kandic horizons.
- Bulk density values for individual horizons has many uses, but is particularly important for calculating organic carbon on an aerial basis for taxonomic placement of Humults.
- Organic carbon data for all horizons below the surface layer should be reported. In addition to identification of Humults, this is needed to assess the stratified nature of soils subject to flooding ("Fluv" great groups and subgroups).
- Standard water retention values are useful. Water retention at 1500 kPa suction is particularly important for assessing the quality of laboratory-measured clay in particle-size data from water column settling

procedures (i.e. pipette method). Effective clay dispersion is commonly a problem in highly weathered soils such as those occurring in the area. When identified as a problem, adjustments to the clay estimates are required for proper classification.

- Incubation pH (assessing changes in pH over a few days or weeks after sampling) is needed to identify sulfidic materials occurring in “acid-sulphate” soils. Production of extremely acid conditions of some soil materials upon exposure to air is a likely hazard for some coastal soils of Trinidad and Tobago (e.g. Caroni and Godineau).
- Exchangeable sodium percentage (ESP) and sodium absorption ratio (SAR) are needed to identify natric horizons and other features associated with sodium-affected soils such as Signal Hill. A number of the parent materials present on the islands were noted to contain sodium and this information would be very useful in assessing and classifying the soils in the future.

Standard nomenclature and terminology for describing soils is presented in the Soil Survey Manual (Soil Science Division Staff, 2017). Procedures for analyzing soil samples in soil survey projects is presented in the Kellogg Soil Survey Laboratory Methods Manual (Soil Survey Staff, 2014a).

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