



# The Soils of Puerto Rico

By Dr. Antonio Sotomayor-Ríos, HSPR Member

The soil classification system used in the United States and some other countries is referred to as Soil Taxonomy. Soil Taxonomy has six categories or levels: order, suborder, great group, subgroup, family, and series. In the world there are 12 orders and more than 17,000 series. Most soil orders are defined on the basis of diagnostic horizons (layers) and diagnostic materials. Suborder definitions are based mostly on soil moisture regimes or how wet the soil is throughout the year. Great group and subgroup definitions are based on the presence or absence of certain kinds of soil horizons and other soil properties. Family definitions are based mainly on texture, mineralogy, and temperature. Soil series definitions are based on a wide set of properties, and are named for the local area or community in which the soil was first identified; this category is the most familiar to users of soil information.

Of the 12 orders, 10 are found in Puerto Rico: Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols (see soil map on page 2). Inceptisols is the most extensive order; these soils occur predominantly on the steep slopes of the interior mountains, or on young alluvial floodplains along the

coasts. Representative series are Múcara, Caguabo, Pellejas, Coloso, and Vieques. Ultisols is the second most extensive soil order; these soils occur in undulating uplands of the island. A special characteristic of the soils in this order is that they tend to be acid, with high exchangeable aluminum (Al) content, the latter of which is a major limitation to crops. Representative series are Humatas, Consumo, Corozal, Lares, Maricao, and Patillas.

Mollisols is the third most extensive soil order; these soils occur in the Tertiary Limestone belts to the north and south of the Cordillera Central, and in the alluvial floodplains mainly along the south coast of the island. They usually have a thick dark-colored surface with high organic matter content, with neutral to alkaline soil pH. Representative series are San Antón, Pozo Blanco, Desclabrado, and Soler.

Oxisols occur in the central part of the island (Catalina series), on serpentine near Mayaguez (Nipe series), and on the “blanket deposits” along the northwestern coast (Coto series). Other representative series are Bayamón and Los Guineos. Bayamón series is the official state soil ([http://soils.usda.gov/gallery/state\\_soils/](http://soils.usda.gov/gallery/state_soils/)).

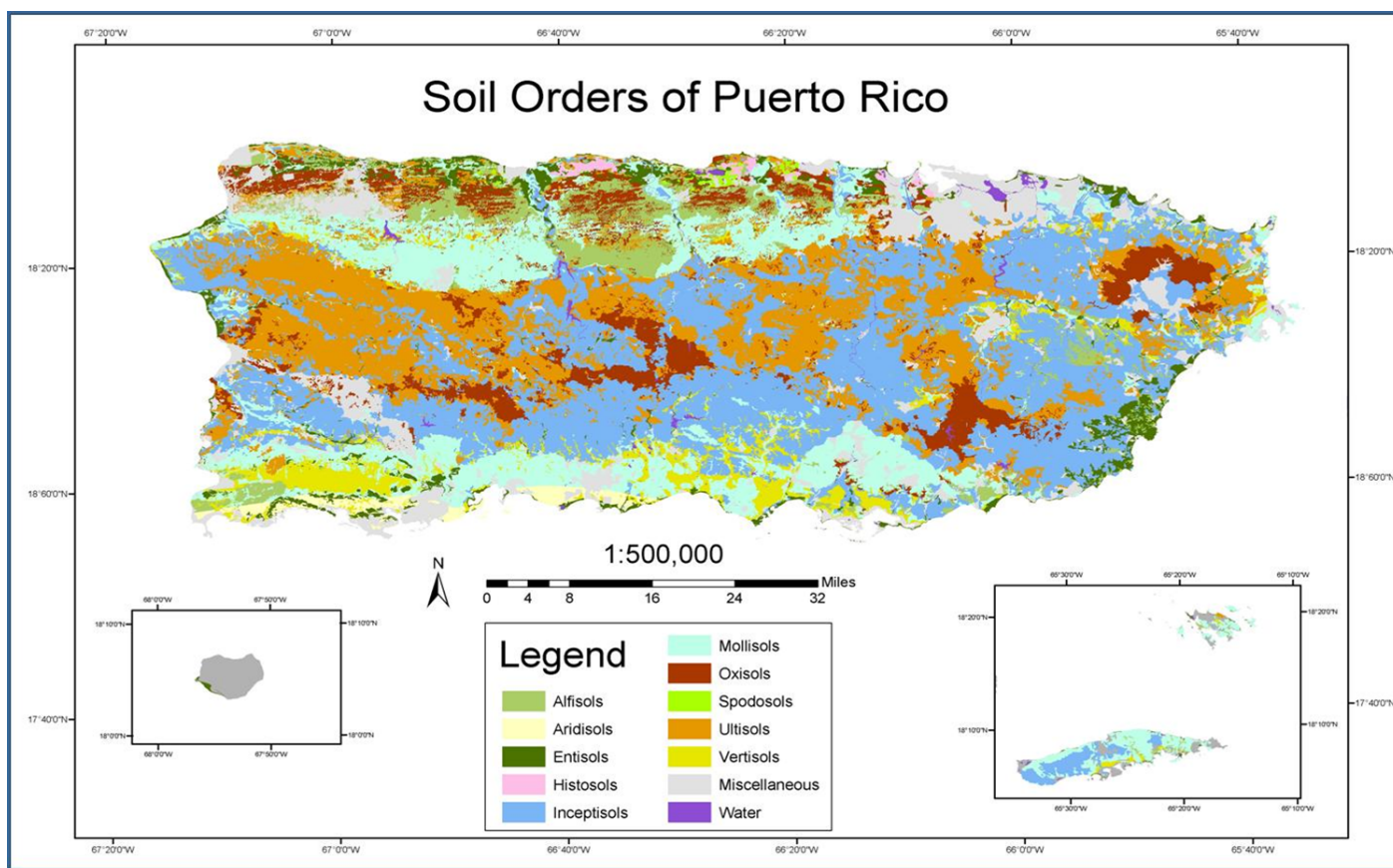
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## Dates to Remember

- HSPR Meeting, 10:00 am, Sunday, December 9, 2012. UPR Experiment Station (south), Botanical Garden library annex room, Río Piedras, P.R.

## The Soils of Puerto Rico (continued)



Alfisols occur mainly in the limestone region of northwestern Puerto Rico; they differ from the Ultisols in that they have a high base saturation in the subsoil. Most representative series is Tanamá.

Entisols occur in recent deposits along streams or on coastal floodplains, or on steep slopes undergoing active erosion. The Cataño series is an example of sandy Entisol of the humid areas.

Vertisols occur in the subhumid and semiarid areas along the south coast of Puerto Rico. They are dark-colored clay soils which shrink and swell with changing soil moisture and produce wide, deep cracks that are diagnostic for these soils. Representative series are Fraternidad and Aguirre.

Histosols occur mainly in association with mangrove swamps, marshes, and lagoons near Arecibo, the largest area of organic soils on the island. They are very limited in extent, representing about 0.1% of the island's soils. Representative series is Tiburones.

Spodosols occur exclusively in quartz sand deposits near Arecibo. These soils have a subsurface horizon of alluvial accumulation of amorphous organic matter and aluminum, with or without iron. The representative series is Algarrobo.

Aridisols is the most recently discovered soil order of the island and occupies an area of 10,000 ha (24,700 acres). Representative series are La Covana, Maguayo and Llanos Costa. Some soils that were previously classified as Mollisols and Vertisols were reclassified into this soil order. The total extent of soil coverage that includes these soil orders is 780,569 ha (1,928,005 acres).

In any scientific publication, the author describes the location where the experiment was conducted, followed by the soil series name and corresponding taxonomic classification. For example a typical narrative may be: "An experiment was conducted in the Fortuna Experimental Station of the University of Puerto Rico in Juana Díaz, in a San Anton soil (fine-

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loamy, mixed isohyperthermic Cumulic Haplustolls)”. Notice that the author will first mention the series (San Anton) followed by its family (fine-loamy, mixed, isohyperthermic), then the sub-group (Cumulic Haplustolls), and finally its great-group (Haplustolls). This classification falls under the Mollisol order. In this example the level of specificity increases from series to order. Soil class names are useful to agronomists, soil scientists, horticulturists, land managers and farmers. Often needed are quantitative data such as soil pH (in chemistry, used to indicate whether any system is either acid or alkaline), organic matter, bulk density, and cation exchange capacity. These specific characteristics are usually associated with selected soil series and hence taxonomic description.

As an example, soil pH is a typical characteristic often used by agronomists because it is also related to many other soil properties that affect plant growth. Soil pH is ranked on a scale of 0 to 14, and each range of values is usually given a descriptor. For example, soils with a pH range of 4.5 to 5.0 are given the descriptive term “Very Strongly Acid”. About one-third of all soils in the world and in Puerto Rico are termed “Strongly Acid” with soil pH less than 5.5. An unmanaged soil in its natural state may have a characteristic pH value, but will vary as a result of its management. Thus, site-specific knowledge of soil characteristics by soil testing will complement information provided by Soil Taxonomy.

Natural processes that acidify soils are precipitation/leaching events, CO<sub>2</sub> input from soil and root respiration, acid rain, and soil mineral weathering. Anthropogenic management practices that decrease soil pH are tillage, addition of nutrient sources that are oxidized, such as fertilizer-NH<sub>4</sub><sup>+</sup> or animal excreta, and sulfur addition. Some agronomic problems associated with acid soils are the high exchangeable and soil solution Al at soil pH below 5.5, and exchangeable Mn in soils with pH below 6.0 and undergoing reducing (oxidation/reduction) conditions. Crop tolerance to these two elements varies among crops, with some groups exhibiting improved tolerance.

Plantains and bananas (Musaceae family) have been shown to exhibit relatively high tolerance to soil acid-

ity. Being of the same family, heliconias in general may also exhibit similar tolerance, and may thrive perfectly well under conditions of soils acidity. Conversely, when these plants are grown in calcareous soils, they may exhibit nutrient deficiencies associated with the soil, deficiencies that other “alkaline tolerant” crops may not reveal. Thus growing heliconias in calcareous soils may need special management that may not be needed when these are grown in an acid soil.

Many studies on nutrient availability and deficiencies have been, and continue to be done, in many crops worldwide. Fertilizer nutrients are considered to contribute between 50 to 90% of yield response in agronomic and horticultural crops, and to the economic qualities of ornamentals. With respect to heliconias, there are only a few studies that have evaluated crop response to fertilizer nutrients; therefore, we are not clear as to which are the exact nutrient requirements for maximum aesthetic plant quality.

In general, nutrient deficiencies or toxicities have not been considered a significant problem in the heliconias or other members of the Zingiberales except bananas and plantains, which are of agronomic and economic importance. According to Jerez (2007), N deficiencies are very frequent on the heliconias and are characterized by a general yellowing of the foliage and stunted growth. In central and southern Florida where sandy soils predominate, most plants in the order Zingiberales are highly susceptible to N and K deficiency (Broschat, 1989). This author has observed K deficiencies on *Canna*, *Heliconia*, *Calathea*, *Musa*, and *Etilingera elatior*. Symptoms include chlorotic foliage with scattered necrotic streaking and extensive marginal necrosis on the oldest leaves. Nutrient deficiencies may be so severe that plant death results.

Broschat adds that K deficiencies can be induced or made worse by continued use of fertilizers that contain inadequate K relative to N (K to N ratios). Heliconias grown in similar sandy soils of alkaline nature may also exhibit micronutrient (Fe, Mn, and Zn) deficiencies, which may be difficult to correct solely by fertilizer management and soil organic matter; build-up will be necessary. Leaf analysis and/or response to

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the application of fertilizer potassium sulfate are used to confirm K deficiency.

In medium to fine texture and neutral to acid soils of Puerto Rico and other tropical areas, major nutritional problems are not expected for adequate plant quality. Soils used for landscaping are typically disturbed, have low organic matter content, and thus initial fertilizer applications are usually needed. After a few months, heliconias develop extensive root systems, “scavenging” N, P and K, thus permitting adequate growth and crop development. But in order to have “beautiful” plants with extensive foliage and colorful inflorescences, precise and adequate fertilizer application are required during the growth of the plant. Unfortunately, the information as to what fertilizer and amount to use on different soils is not available, although ornamentals in general are one of the top contributors (fourth in importance; \$40 million) to the Gross Agricultural Income of Puerto Rico.

In conclusion, knowing the soil classification and its associated characteristics prior to planting any crop, especially heliconias, is vital for knowing how to manage the given crop successfully. Once soil characteristics are known, soil testing and foliar analysis, as well as visual observation of the plants, can aid in improving nutrient management of heliconias.

### Acknowledgements

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## From Our Last Meeting By Héctor Méndez Caratini, HSPR Secretary

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Approximately 90 persons attended our September meeting, which was held at the legendary estate Marín Alto Tropicals, owned by Susan Brooks and Judy Nelson. It was a clear, blue day from which we could see, at 2,000 feet elevation, far in the distance, the beautiful Patillas lake, way down below us.

Judy gave us the official welcome and immediately proceeded to recount the amazing story behind their business. She told us that they started out in 1982 cultivating anthuriums and after Hurricane Hugo wiped them out in 1989, they had to rebuild the farm, but this time with heliconias. This interesting story can be found, in a previous article I wrote for HSPR Newsletter Vol. 10, No. 4, December 2005 ([http://www.heliconiasocietypr.org/HSPR%20Newsletter%2010\(4\).pdf](http://www.heliconiasocietypr.org/HSPR%20Newsletter%2010(4).pdf)). After lunch, we toured the 131 mountainous “cuerdas”.

Dr. Antonio Sotomayor Ríos (HSPR member) gave us a brief lecture on “Diseases of Heliconias” and the correct application of different fungicides to control them. He also lectured us on the different types of soils found in Puerto Rico.

Our Treasurer, Reily Rodríguez, informed us that we currently have \$4,109.17 deposited in the society’s bank account. Today’s income, generated from the Raffle and membership dues, accounted for another \$1,206.00.

Our President, Jorge L. Matta Serrano, informed the group that the HSPR Board of Directors had recently met (August 18, 2012) and approved the following new regulations:

- 1) A change in the amount of membership dues, as follows: Student (from \$10 to \$20), Individual (from \$15 to \$25), Family (from \$20 to \$35). Also, a new category was added: International member (\$25). It was agreed that members would be notified when their membership will expire, via a note found inside the HSPR Newsletter (the second last and last issues). NO more HSPR Newsletters will be sent to members that have not paid their membership dues.
- 2) For security reasons, NO pets are allowed at HSPR activities.
- 3) To manage the number of non-paying members and guests at HSPR meetings, from now on, each HSPR member’s guest will pay \$5.00 at the entrance,

## From Our Last Meeting (continued)

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to attend each quarterly meeting. Every person who attends the activities will have to register at the front desk. Each person will be given a colored wrist bracelet to help identify those that have paid their membership dues.

4) During the summer HSI Post Conference Trip, to Colombia, HSPR's directive made a formal invitation to Professor Gustavo Morales to visit Puerto Rico. He is the Director of the Jardín Botánico de Bogotá. Dr. Morales will be our next HSPR Invited Guest of Honor, for the Meet the Experts Conference, to be held next year, in March 10, 2013. HSPR will pay the expenses related for this trip, such as air-fare (for one person) and hotel accommodations.

5) Isabelita Wadsworth will be provided with HSPR's current members list, so she will be able to call them ahead of time, in advance, and find out what food products they will bring to the next meeting. The food will be served by various volunteer members, instead of self-service by each person.

6) The Raffle will be held in enclosed quarters. A rope will encircle the area, to avoid unauthorized persons from entering the Raffle area. The plants will be numbered and identified with tape. Heliconias will be separated from bromeliads, orchids, palms and other plant species.

7) HSPR is a non-for profit organization. Therefore, members are not allowed to sell plants during the meetings. Otherwise, our legal status could be affected. We are not allowed to sell, nor pay IVU taxes.

8) The maximum number of members allowed in a year will be limited to 125. This number includes the international members. The membership list will be actualized.

9) Members who steal plants, or other products, during the meetings, will be reprimanded and expelled from the organization.

10) Each person entering an HSPR sponsored activity / meeting will have to sign a Release Form stating that neither HSPR, nor the place hosting the event, are responsible for accidents caused. They cannot be sued. Members are entering the premises at their own risk.

11) A HSPR membership directory will be created and sold to active members. Those members that do not wish to have their names and addresses made public should state so.

12) Ads can be sold, to be included in HSPR News-

letters. The ads will help fund the costs associated with the publication. Their prices will range from \$50.00 to \$280.00

Our dear friend Mark Dietrich, from Excelsa Gardens, came all the way from Florida to our meeting. He brought along with him, for the Raffle, several rhizomes of two very rare specimens of *H. rostrata*, the 'Pink Peru' variety and a yellowish-gold form of *rostrata*. Both of them, he had originally acquired during his 2008 excursion trip to the Amazon River basin, in Peru.

Dave Skinner, from Florida's Costus R'Us, generously donated to our precious HSI/HSPR Conservation Centers fifteen different varieties of Costaceae. They were distributed among the seven HSPR CCs present, during this particular meeting. Dave collects them in the wild, during his annual expeditions to tropical forests. This is the third time he has generously shared with us, in Puerto Rico, specimens from his unique collection.

I brought along with me several batches of rare seeds, which I had collected in Colombia, this past summer. Among these were seeds from the elusive *H. gigantea* and *H. titanum*. The proceeds from the sale of these unique seeds were donated to HSPR.

It was publicly announced that our next HSPR Invited Guest of Honor, for the Meet the Experts Conference, would be Professor Gustavo Morales. Also, the main conference for the December meeting, our traditional Christmas Party, would consist of over 100 color photographs, in a Power Point Presentation, to be given by Dr. José Abreu Deliz and myself, of our travel adventures in Panamá, Costa Rica and Colombia.

The Raffle turned out to be another incredible success. There were over 100 plants up for auction!!! Among the collectable heliconias were: *H. 'Stairway to Heaven'*, *H. curtispatha*, *H. vellerigera* 'She Kong', *H. regalis* red, *H. caribaea* 'Black Magic', a dozen different varieties of *H. orthotricha*, *Calathea* 'Blue Ice', *H. 'Siberia Lemon'*, *H. champneiana* 'Maya Blood', *H. bihai* 'Emerald Forest', *H. pogonantha*, and many, many other kinds of exotic plants.

**HELICONIA SOCIETY OF  
PUERTO RICO, INC.**

www.heliconiasocietypr.org

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**HSPR**

*Promoting Zingiberales in  
Puerto Rico since 1996.*



*The Heliconia Society of Puerto Rico, Inc. was founded in 1996. The objectives of the society are to stimulate and promote the enjoyment and understanding of Heliconia and related plants of the order Zingiberales through education, research and communication, and to interact with the Heliconia Society International and other institutions which share similar interests, purposes or objectives.*

## President's Corner

With an extraordinary attendance, on September 9th we held our quarterly meeting at the estate of Judy Nelson and Susan Brooks (Marin Alto Tropicals, Patillas), which was a success. We would like to give our most sincere thanks to Judy and Susan for their hospitality. We would also want to thank Dr. Antonio Sotomayor Ríos for his interesting lecture on different soils and the best ones in which to plant heliconias, as well as the article on Soils of Puerto Rico (that is currently being presented in this newsletter).

At the meeting, various changes to the bylaws of the HSPR were presented to the members, including an increase in membership fees and limiting the total number of members to 125. Both actions, as well as others mentioned elsewhere in this bulletin, were unanimously approved by the Board of Directors and by the assembly during the last meeting.

Once again, we would like to thank Isabelita Colorado for coordinating the meals, as well as to all the participants who brought snacks.

The Raffle was extraordinary. Judy Nelson provided different varieties of heliconias. We thank all of those who brought rhizomes for the raffle.

In the afternoon, we had the opportunity to visit, divided in two groups, a section of the interesting estate of Judy and Susan.

On the other hand, we wish to remind you of the Socie-

ty's next meeting, which will take place on Sunday, December 9th at the UPR Experiment Station (South), in Río Piedras (Botanical Garden library annex room). Héctor Méndez Caratini and José Abreu Deliz will give us an excellent presentation about the recently held Heliconia Society International Conference recently held in Panamá, Costa Rica and Colombia. Multiple color photographs of heliconias from these three countries will be presented.

We will start a new year (in March) with an excellent conference conducted by our guest speaker Prof. Gustavo Morales, Director of the Colombian Botanical Garden.

As usual, we remind you to bring snacks and nice plants for the Raffle.

Cordially,  
Jorge L. Matta Serrano

### New Membership Categories and Fees for 2013

Student \$20

Individual \$25

Family \$35

International member \$25