

LOCATION ACEITUNAS PR
Established Series
Rev. RER
06/2002

ACEITUNAS SERIES

The Aceitunas series consists of deep, well drained, moderately permeable soils. They formed in fine textured alluvial and colluvial sediments. These soils are on footslopes, alluvial fans and valleys in coastal plains. Slopes range from 2 to 12 percent. Mean annual precipitation is 66 inches and the mean annual temperature is 77 degrees F.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Typic Paleudults

TYPICAL PEDON: Aceitunas clay in a sugarcane field. (Colors are for moist soil)

Ap--0 to 7 inches; dark reddish brown (5YR 3/4) clay; moderate medium granular structure; firm, slightly sticky, plastic; many fine roots; many fine quartz grains; very strongly acid; abrupt smooth boundary. (5 to 10 inches thick.)

Bt1--7 to 15 inches; yellowish red (5YR 4/6) clay; moderate fine and medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; thin patchy clay films; many fine quartz grains; very strongly acid; clear smooth boundary. (6 to 10 inches thick)

Bt2--15 to 23 inches; yellowish red (5YR 4/8) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; thin patchy clay films; common fine quartz grains; common root channels; very strongly acid; clear wavy boundary. (6 to 10 inches thick)

Bt3--23 to 36 inches; yellowish red (5YR 4/8) clay; weak fine subangular blocky structure breaking to weak fine granular structure; friable slightly sticky, plastic; few fine roots; common fine quartz grains; common root channels; very strongly acid; clear wavy boundary. (10 to 15 inches thick)

Bt4--36 to 60 inches; red (2.5YR 4/8) clay; weak fine subangular blocky structure with shiny ped surfaces; firm, slightly sticky, plastic; few fine roots; many fine quartz grains; very strongly acid.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 2.5 miles southeast of the town of Aquadilla. 2.3 kilometers on unnumbered paved road south of kilometer marker 123.5 of highway 2. 25 feet west of highway.

RANGE IN CHARACTERISTICS: The solum is more than 60 inches thick and the argillic horizon is more than 50 inches.

The A horizon has hue of 5YR or 2.5YR and value and chroma of 2 through 4.

The Bt horizon has hue of 5YR or 2.5YR values of 4 to 6 and chromas of 6 to 8. Structure ranges from weak, fine and medium to moderate fine and medium subangular blocky.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: The Aceitunas soils occur on gently to moderately sloping footslopes, alluvial fans and valleys associated with limestone hills with slope gradient from 2 to 12 percent. The regolith consists of fine textured sediments washed from the surrounding limestone hills. The climate is humid tropical. The average annual precipitation is 66 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Tanama, Coto, and Matanzas series and the land type Limestone Outcrop, all of which are nonacid. The Tanama soils are neutral and shallow to hard limestone. The Coto soils are yellow and have oxic horizon that extends to more than 50 inches below the surface. The Matanzas soils are redder, shallower and have oxic horizons. Limestone Outcrop is a land type that consists of outcrops covering 75 percent or more of the surface area.

DRAINAGE AND PERMEABILITY: Well drained, medium runoff, moderate permeability.

USE AND VEGETATION: Most of the acreage is in sugarcane.

DISTRIBUTION AND EXTENT: Northwestern coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Noroeste SCD, Puerto Rico, 1963.

REMARKS: These soils were formerly included in the Coto series.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - 0 to 7 inches (Ap)

Argillic horizon - 7 to 60 inches (Bt1, Bt2, Bt3, and Bt4)

ADDITIONAL DATA: S72PR-16-1, NSSL

**National Cooperative Soil Survey
U.S.A.**

LOCATION ADJUNTAS PR

**Established Series
Rev. RER
06/2002**

ADJUNTAS SERIES

The Adjuntas series consists of deep, well drained, moderately permeable soils on uplands. They formed in clayey residuum weathered from volcanic rock. Slopes range from 40 to 60 percent. Mean annual precipitation is 85 inches and the mean annual temperature is 76 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Inceptic Hapludox

**TYPICAL PEDON: Adjuntas clay in a native pasture.
(Colors are for moist soil.)**

Ap--0 to 5 inches; dark brown (10YR 3/3) clay; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many pores; very strongly acid; clear smooth boundary. (4 to 6 inches thick)

Bw1--5 to 10 inches; dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) clay; weak fine subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few patchy clay films; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many fine pores; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bw2--10 to 17 inches; strong brown (7.5YR 5/6) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; common patchy clay films; 3 percent volcanic fragments 1/4 to 1 inch in diameter; few fine quartz grains; many fine pores; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

Bw3--17 to 24 inches; yellow (10YR 7/6), white (10YR 8/2), and brownish yellow (10YR 6/8) clay with common fine prominent red mottles; weak medium subangular blocky structure; friable, slightly sticky, plastic; few fine roots; many fine pores; many quartz grains; very strongly acid; clear wavy boundary. (6 to 10 inches thick)

CR--24 to 48 inches; strongly and partially weathered volcanic rock.

R--48 inches; semi-consolidated volcanic rock.

TYPE LOCATION: Sur SCD, Puerto Rico; 320 meters east of school at dead end of Highway No. 602.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the CR horizon is 20 to 40 inches. Depth to R horizon is 40 to 60 inches. Reaction ranges from strongly to extremely acid. Fine or medium rock fragments in the solum varies from 2 to 5 percent. Quartz grains in the solum ranges from few to many. Base saturation is less than 50 percent in the cambic horizon.

The A horizon has hue of 10YR, values of 3 or 4, and chroma of 2 to 4. Structure is fine or medium granular.

The Bw horizon has hues of 10YR or 7.5YR, values of 4 or 5, and chroma of 4 to 8. Structure is weak, fine or medium subangular blocky. The lower Bw horizon has yellow, white, and brownish yellow colors and prominent red mottles.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: The Adjuntas soils are very steep soils on side slopes and narrow ridges at elevations below 550 meters. Slope gradients range from 40 to 60 percent. The soil formed in clayey residuum weathered from volcanic rock. The climate is humid tropical. The average annual precipitation ranges from 80 to 90 inches, and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Consejo, Consumo, Daguey, Humatas, and Maraquez series. The Consumo, Daguey, and Humatas soils, are redder throughout, and deeper to the volcanic rock, and have argillic horizons. The Maraquez soils occupy similar positions and are less acid and have loamy B horizons. The Consejo soils are deeper, yellower, and have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; very rapid runoff; moderate permeability.

USE AND VEGETATION: Mostly in native pasture and brush.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent, with about 2,200 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - 0 to 5 inches (Ap)

Cambic horizon - 5 to 24 inches (Bw1, Bw2, Bw3,)

Paralithic contact - 24 inches (CR)

Lithic contact - 48 inches (R)

ADDITIONAL DATA: Characterization data - S73PR-01-1. Sample numbers 74B174-74B179.

**National Cooperative Soil Survey
U.S.A.**

LOCATION ALGARROBO PR

**Established Series
Rev. RER
06/2002**

ALGARROBO SERIES

The Algarrobo series consists of moderately deep to deep, well drained, very rapidly permeable soils. They formed in sands underlain by clayey sediments. These gently sloping to moderately steep soils are on a coastal plains. Slopes range from 2 to 12 percent. Mean annual precipitation is 60 inches and the mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Coarse-loamy over clayey, siliceous over mixed, subactive, isohyperthermic Entic Alorthods

**TYPICAL PEDON: Algarrobo fine sand - coconuts - native pasture
(Colors are for moist soils unless otherwise stated.)**

A--0 to 11 inches, gray (10YR 5/1) fine sand; single grain; loose, very friable, nonsticky, nonplastic; many fine and medium roots; 15 percent black (10YR 2/1) rounded and elongated concretions, extremely acid, abrupt smooth boundary. (10 to 16 inches thick)

E--11 to 32 inches, light gray (10YR 7/1) fine sand; single grain; very friable, nonsticky, nonplastic; common medium roots; extremely acid, clear wavy boundary. (20 to 34 inches thick)

Bhs--32 to 37 inches, black (10YR 2/1), dark brown (10YR 3/3) and very dark brown (10YR 2/2) stratified sandy loam. The black layer is the uppermost; single grain; very friable, nonsticky, nonplastic; few medium roots; extremely acid, abrupt wavy boundary. (3 to 7 inches thick)

2Bt--37 to 50 inches, light gray (10YR 7/1) clay; many prominent brown (7.5YR 5/2) and common, strong brown (10YR 5/8) mottles; weak coarse subangular blocky structure; extremely firm, extremely hard, slightly sticky, plastic; very dark gray (10YR 3/1) stains along root channels; very strongly acid, clear wavy boundary. (10 to 15 inches thick)

2C1--50 to 68 inches, light gray (10YR 7/1) clay; many distinct brown (7.5YR 5/2) mottles; massive; extremely firm, extremely hard, slightly sticky, plastic; very strongly acid, clear wavy boundary. (15 to 20 inches thick)

2C2--68 to 80 inches, light gray (10YR 7/1) sandy clay loam; massive; very firm, slightly sticky, plastic; very strongly acid.

TYPE LOCATION: Arecibo, Puerto Rico; 300 meters northeast of kilometer marker 2.4 of highway 687.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 40 to 60 inches. Depth to the Bh horizons ranges from 30 to 50 inches. Reaction ranges from strongly acid to extremely acid. The extremely firm, extremely hard horizons slake in water.

The A horizon has hue of 10YR, value of 5 to 8 and chroma of 1 or 2. These horizons are loose, very friable, nonsticky, nonplastic fine sands.

The Bh horizon has hue of 10YR or 7.5YR, with values of 2 through 4 and chroma of 1 through 3. It is sandy loam or loamy sand.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 5 to 7 and chroma of 1 to 8. It is clay or sandy clay.

The 2C horizon has hue of 10YR to 2.5Y, value of 4 to 7 and chroma of 1 to 6.

COMPETING SERIES: There are no other series in the same family.

GEOGRAPHIC SETTING: The Algarrobo soils occur on gently sloping to sloping coastal plains. They have formed in sands high in quartz underlain by coastal plain deposits. The climate is humid tropical. The average annual precipitation is 60 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Arecibo, Carrizales, Guerrero and Jobos soils. Arecibo soils have surface layers thicker than 50 inches to the spodic horizon. The Guerrero and Jobos are underlain by coastal plain materials and contain Plinthite. The Carrizales soils are browner and sandy throughout.

DRAINAGE AND PERMEABILITY: Well drained, slow runoff, very rapid permeability in the A and Bh horizons, slow in the B2 and the upper part of the C horizon.

USE AND VEGETATION: Native pasture; coconuts.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. The series is of minor extent, with about 2,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico, 1942.

REMARKS: Following periods of heavy rains, water moves laterally through these soils, mostly through the E horizons.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - 0 to 32 inches (A and E)

Albic horizon - 11 to 32 inches (E)

Spodic horizon - 32 to 37 inches (Bhs)

**National Cooperative Soil Survey
U.S.A.**

LOCATION ALMIRANTE PR

**Established Series
Rev. RER
06/2002**

ALMIRANTE SERIES

The Almirante series consists of deep, well-drained, moderately permeable soils on coastal plains and valleys. They formed in clayey sediments of mixed origin. Slopes range from 2 to 12 percent. Mean annual precipitation is 65 inches and the mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Plinthic Hapludox

**TYPICAL PEDON: Almirante clay - Pangolagrass
(Colors are for moist soil unless otherwise stated.)**

Ap--0 to 7 inches; dark yellowish brown (10YR 4/4) clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; common quartz sand grains; common fine dark concretions; very strongly acid; clear smooth boundary. (6 to 10 inches thick)

Bt--7 to 25 inches; strong brown (7.5YR 5/6) clay; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; common fine roots; few thin patchy clay films; few fine pores; common quartz sand grains; few fine dark concretions; common black stains on surfaces of peds; very strongly acid; clear smooth boundary. (12 to 20 inches thick)

Btv1--25 to 40 inches; brownish yellow (10YR 6/8) clay with common medium distinct dark red (10YR 3/6) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few thin patchy clay films; few fine dark concretions; few dark stains; few fine quartz sand grains; very strongly acid; 8 percent plinthite; gradual smooth boundary. (12 to 18 inches thick)

Btv2--40 to 60 inches; red (10R 3/6), brownish yellow (10YR 6/8) and light gray 5Y 7/1) clay; weak medium subangular blocky structure; firm, sticky, plastic; thin patchy clay films; few quartz sand grains; very strongly acid; 15 percent plinthite.

TYPE LOCATION: San Juan SCD, Puerto Rico; 40 feet north of kilometer marker 0.6, highway 694, township of Dorado.

RANGE IN CHARACTERISTICS: Argillic horizons are thicker than 60 inches. Depth to non-indurate plinthite ranges from 20 to 40 inches. The soil ranges from strongly through extremely acid.

The A horizon has hues of 10YR, 7.5YR, or 5YR, values of 3 or 4, and chroma of 2 through 4. The A horizon is sandy clay loam or clay.

The Bt and upper Btv horizons have colors in hues of 10YR, 7.5YR, 5YR, values of 4 through 6, and chroma of 4 through 8. The lower Btv horizon is mottled in shades of brown, red, and gray. Plinthite ranges from 5 to 20 percent by volume.

COMPETING SERIES: There are no other series in this family.

GEOGRAPHIC SETTING: The Almirante soils are in coastal plains and in valleys between the limestone hills (haystacks). Slope gradients range from 2 to 12 percent. The soils have formed in fine textured sediments of mixed origin. These are known locally as coastal plains clays or tertiary clays and are variegated with brown, red, gray and contain plinthite. The climate is humid tropical. The average annual precipitation is 65 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bayamon, Pina, Tanama, and Vega Alta soils, and the land type Limestone outcrops. The Bayamon and Pina soils also occupy similar positions in the landscape, but are red, more weathered and have oxic rather than argillic horizons. The Tanama soils have a solum, which ranges from 12 to 20 inches in thickness underlain by hard limestone. The Vega Alta soils occupy similar positions in the coastal plains but have plinthite closer to the surface.

DRAINAGE AND PERMEABILITY: Well drained; slow to medium runoff; moderate permeability.

USE AND VEGETATION: Used for sugarcane, food crops, pineapple and grasses.

DISTRIBUTION AND EXTENT: Humid coastal plains of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon: the zone from 0 to 7 inches (Ap horizon)

Argillic Horizon: the zone from 7 to 60 inches (Bt, Btv1, and Btv2 horizons)

Plinthite: more than 5 percent in Btv1 and Btv2 horizons

ADDITIONAL DATA: Characterization Data for two pedons, S72PR-9-1 and S73PR-07-3, NSSL.

**National Cooperative Soil Survey
U. S. A.**

LOCATION ALONSO PR

**Established Series
Rev. BCD
07/2001**

ALONSO SERIES

The Alonso series consists of very deep, well drained, moderately permeable soils on sideslopes in maturely dissected uplands. They formed in fine textured residuum weathered from basic volcanic rock. Slopes range from 12 to 60 percent. The mean annual precipitation is about 92 inches and the mean annual temperature is about 73 degrees F.

TAXONOMIC CLASS: Very-fine, parasesquic, isohyperthermic Oxic Dystrudepts

TYPICAL PEDON: Alonso clay--coffee plantation. (Colors are for moist soil.)

Ap--0 to 6 inches; dark reddish brown (5YR 3/3) clay; weak medium subangular blocky structure parting to granular; firm, slightly sticky, plastic; many fine roots; very strongly acid; clear smooth boundary. (5 to 7 inches thick)

Bt1--6 to 16 inches; dusky red (10YR 3/2) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; few faint clay films; very strongly acid; clear wavy boundary. (7 to 12 inches thick)

Bt2--16 to 25 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine and medium subangular blocky structure; firm, slightly sticky, plastic, common fine roots; many faint clay films; very strongly acid; clear wavy boundary. (7 to 12 inches thick)

Bt3--25 to 32 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

Bt4--32 to 47 inches; dark reddish brown (5YR 3/3) clay with common, medium distinct dark red (2.5YR 3/6) mottles; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; very strongly acid; clear wavy boundary. (10 to 16 inches thick)

BC--47 to 53 inches; dark reddish brown (5YR 3/3) and dark red (2.5YR 3/6) clay; weak fine subangular blocky structure; friable, slightly sticky, plastic; very strongly acid; 15 percent of horizon is saprolite; gradual wavy boundary. (5 to 8 inches thick)

C--53 to 60 inches; mottled reddish brown (5YR 4/3), red (2.5YR 4/6), very dark gray (5YR 3/1) and white (5YR 8/1) clay; massive; friable, slightly sticky, plastic; 90 percent saprolite; very strongly acid.

TYPE LOCATION: Sur SCD, Puerto Rico, 50 feet east of kilometer marker 67.0 on Highway 135.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 40 to 64 inches. Thickness of the argillic horizon varies from 35 to 53 inches. Reaction is strongly or very strongly acid.

The A horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 2 or 3. Texture is clay.

The Bt horizon has hue of 10R to 5YR, values of 3 or 4, and chroma of 2 to 4. Texture is clay.

The C horizon is clay, clay loam or silty clay loam saprolite of variegated colors.

COMPETING SERIES: The Aibonito and Daguey series are in the same family. The Aibonito and Daguey soils have B horizons with higher chromas of 6 to 8.

GEOGRAPHIC SETTING: The Alonso soils are moderately steep and very steep soils on side slopes and ridges of maturely dissected uplands with slope gradients from 12 to 60 percent. The soil formed in fine textured residuum weathered from very highly weathered basic volcanic reddish brown rocks. The climate is humid tropical with mean annual rainfall of 80 to 90 inches. The mean annual air temperature is 76 degrees F., at the type location.

GEOGRAPHICALLY ASSOCIATED SOILS: The competing Daguey and the Consumo, Humatas and Morado soils. Consumo and Humatas soils have thinner B2 horizons and higher chroma colors. Morado soils have thinner sola and lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in coffee and pasture. Small acreage is in crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of limited extent, with about 7,300 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1943.

REMARKS: The classification was updated with the 4/91 draft from Clayey, oxidic, isohyperthermic Orthoxic Tropohumults to Clayey, oxidic, isohyperthermic Typic Haplohumults. The previous OSED date was 4/87.

Diagnostic horizons and features recognized in this pedon are:

Umbric epipedon - zone from 0 to 16 inches (Ap horizon)

Argillic horizon - zone from 6 to 47 inches (Bt horizons)

**National Cooperative Soil Survey
U.S.A.**

LOCATION ARECIBO PR

**Established Series
Rev. RER
07/2001**

ARECIBO SERIES

The Arecibo series consists of deep, excessively drained, very rapidly permeable soils on coastal plains. They formed in sandy sediments high in quartz. Slopes range from 2 to 12 percent. Mean annual precipitation is 60 inches and the mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Sandy, siliceous, isohyperthermic Entic Grossarenic Alorthods

**TYPICAL PEDON: Arecibo fine sand - Pangola grass - coconut palms
(Colors are for moist soils unless otherwise stated.)**

A1--0 to 6 inches; gray (10YR 5/1) fine sand; single grain; loose, nonsticky, nonplastic; many round black (10YR 2/1) concretions; many fine roots; very strongly acid; clear smooth boundary. (4 to 8 inches thick)

A2--6 to 12 inches, gray (10YR 6/1) and (10YR 5/1) fine sand; single grain; loose, nonsticky, nonplastic; common round black (10YR 2/1) concretions; many fine roots; very strongly acid; clear wavy boundary. (4 to 8 inches thick)

E1--12 to 20 inches, gray (10YR 7/1) fine sand; single grain; loose, nonsticky, nonplastic, few fine roots; very strongly acid; clear wavy boundary. (6 to 12 inches thick)

E2--20 to 40 inches, white (10YR 8/1) fine sand; single grain; loose, nonsticky, nonplastic; few fine roots; very strongly acid; diffuse wavy boundary. (18 to 24 inches thick)

E3--40 to 59 inches, white (10YR 8/1) fine sand; many medium brown (10YR 5/3) mottles and splotches; single grain; loose, nonsticky, nonplastic, decayed roots; very strongly acid; clear wavy boundary. (16 to 22 inches thick)

Bw--59 to 68 inches, brown (10YR 5/3) fine sand; single grain; loose, nonsticky, nonplastic; very strongly acid; abrupt wavy boundary. (7 to 11 inches thick)

Bhg1--68 to 74 inches, black (10YR 2/1), very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) stratified sand. The black layer is the uppermost and is 1 cm thick; single grain; loose, nonsticky, nonplastic; very strongly acid; clear wavy boundary. (4 to 8 inches thick)

Bhg2--74 to 82 inches, yellowish brown (10YR 5/6) loamy sandy; single grain; loose, nonsticky, nonplastic; 15 percent thin black lamellae, 1 to 3 cm wide and 8 cm apart; very strongly acid; clear wavy boundary. (6 to 10 inches thick)

2Bw1--82 to 88 inches, very pale brown (10YR 8/4), white (10YR 8/1), brown (10YR 5/3), reddish yellow (7.5YR 6/8), sandy loam; massive; slightly sticky, slightly plastic; extremely firm, extremely hard; strongly cemented; few tongues of Bh; very strongly acid; gradual wavy boundary. (4 to 8 inches thick)

2Bw2--88 to 91 inches, very pale brown (10YR 8/4), white (10YR 8/1), brown (10YR 5/3), reddish yellow (7.5YR 6/8) loamy sand; massive; slightly sticky, slightly plastic; extremely hard, extremely firm; very strongly cemented; very strongly acid; clear wavy boundary. (2 to 5 inches thick)

2C3--91 to 113 inches, white (5Y 8/1) and light gray (5Y 7/2) loamy sand; single grain; loose, nonsticky, nonplastic; sulfide smell; very strongly acid.

TYPE LOCATION: Norte SCD, Puerto Rico; 600 meters west of kilometer marker 15.2 of Highway 686.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 60 to more than 80 inches. Depth to the horizons of illuvial organic matter accumulations ranges from 50 to 80 inches. Reaction of the soil ranges from very strongly acid to extremely acid. The extremely firm, extremely hard horizons slake in water.

The A horizons has hue of 10YR, value of 5 to 8 and chroma of 1 or 2.

The Bh horizons have hues of 10YR or 7.5YR, value of 2 to 5 and chroma of 1 to 8. It is loamy fine sand, or loamy sand.

The 2Bw horizon has hue of 10YR or 7.5YR, value of 4 to 8 and chroma of 1 to 8. It is sandy loam, loamy fine sand, or loamy sand.

COMPETING SERIES: There are no other presently known series in the same family.

GEOGRAPHIC SETTING: The Arecibo soils occur on gently sloping to sloping coastal plains at low elevations above sea level. The soil has formed in sands high in quartz, underlain by coastal plain deposits. The climate is humid tropical. The average annual precipitation is 60 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Carrizales, Guerrero and Jobos soils. The Carrizales soils are browner and lack the layers of illuvial organic matter accumulations. The Jobos and the Guerrero soils have browner sandy surface layers and are underlain by coastal plain clays with plinthite.

DRAINAGE AND PERMEABILITY: Excessively drained; slow runoff; very rapid permeability.

USE AND VEGETATION: Pangola grass, native pasture and coconuts.

DISTRIBUTION AND EXTENT: Northern coastal plains. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Arecibo Soil Survey Area, Puerto Rico.

REMARKS: Following periods of heavy rains, water moves laterally through these soils, mostly through the E horizons.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 12 inches (A1, A2 horizons)

Albic horizon - zone from 12 to 59 inches (E1, E2, E3 horizons)

Spodic horizon - zone from 59 to 82 inches (Bhg1, Bhg2 horizons)

ADDITIONAL DATA: Characterization data is available on the typical pedon; sample No. S73PR-07-02, lab. No.74B111-74B122.

**National Cooperative Soil Survey
U.S.A.**

LOCATION BAJURA PR

**Established Series
Rev. RER
06/2002**

BAJURA SERIES

The Bajura series consists of deep poorly drained, slowly permeable soils on river flood plains. They formed in sediments of mixed origin. Slopes range from 0 to 2 percent. Mean annual precipitation is 84 inches and the mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Vertic Endoaquolls

TYPICAL PEDON: Bajura clay – sugarcane (Colors are for moist soil)

Ap--0 to 6 inches, very dark grayish brown (10YR 3/2) clay; massive; hard, firm, slightly sticky, plastic; many fine roots; common fine black concretions; few pressure faces; medium acid; clear smooth boundary. (4 to 8 inches thick)

Bw--6 to 12 inches, very dark grayish brown (2.5Y 3/2) clay, many medium distinct gray (N 6/) and few medium distinct reddish brown (5YR 4/4) mottles; weak fine and medium subangular blocky structure; very firm, sticky, plastic; common fine roots; common fine black concretions; few pressure faces; medium acid; gradual smooth boundary. (4 to 10 inches thick)

Bg1--12 to 32 inches, dark gray (N 4/) clay, many medium distinct dark greenish gray (5BG 4/1) and few medium distinct brown (7.5YR 4/4) mottles; weak medium angular blocky structure; very firm, sticky, plastic; few fine roots; few pressure faces; medium acid; gradual smooth boundary. (15 to 25 inches thick)

Bg2--32 to 60 inches, dark greenish gray (5BG 4/1) clay, few fine distinct brown (7.5YR 4/4) mottles; weak medium angular blocky structure; very firm, sticky, plastic; few fine roots; few slickensides and pressure faces; medium acid.

TYPE LOCATION: Suroeste SCD, Puerto Rico; 2 miles northwest of the town of Cabo Rojo; 500 feet northeast on old railroad from kilometer marker 3.2 of highway 103. 50 feet north of old railroad.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. The soil is medium acid and slightly acid throughout. The soil has cracks 1/2 to 2 inches wide to a depth of 30 inches during dry seasons in most years. Some polypedons are saline.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is silty clay or clay.

The Bw horizon has hue of 2.5Y, value of 3 to 6, and chroma of 0 to 2. It is clay and has few to many mottles.

The Bg horizon has hue of 2.5Y to 5BG, value of 4 or 5, and chroma of 0 to 2. It is clay and has few to many mottles.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: The Bajura soils are nearly level soils on river flood plains with slopes of 0 to 2 percent. The soils formed on fine textures sediments of mixed origin. The climate is humid tropical. The average annual precipitation is 84 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coloso, Dique, Igualdad, Maunabo, Santoni and Toa soils all of which are on river flood plains. Coloso soils are somewhat poorly drained and lack cracks. Dique soils are well drained and lack cracks. Igualdad soils have clayey over sandy or sandy-skeletal particle-size control sections. Maunabo soils do not have shrink-swell properties. Santoni soils are calcareous. Toa soils are well drained and moderately well drained and have a mollic epipedon.

DRAINAGE AND PERMEABILITY: Poorly drained, slow run-off, slow permeability.

USE AND VEGETATION: Most of the acreage is planted to sugarcane but some areas are used for growing pasture.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of moderate extent with about 13,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico. (San Juan Soil Survey Area), 1972.

REMARKS: These soils were formerly included with the Coloso series, poorly drained phase.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedons - zone from 0 to 6 inches (Ap horizons)

Vertic property - cracks and pressure faces and slickensides.

National Cooperative Soil Survey

U. S. A.

LOCATION BAYAMON PR

**Established Series
Rev. GRB
08/1999**

BAYAMON SERIES

The Bayamon series consists of very deep, well drained, very slowly permeable soils on coastal plains interspersed among limestone hills (haystacks or pipino hills). They formed in highly weathered fine-textured sediments of mixed origin. Slopes range from 2 to 12 percent. The mean annual precipitation is about 65 inches and the mean annual temperature is about 78 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Typic Hapludox

TYPICAL PEDON: Bayamon clay - cultivated. (Colors are for moist conditions.)

Ap--0 to 6 inches; dark reddish brown (5YR 3/3) clay; weak fine subangular blocky structure parting to moderate fine granular; friable, slightly sticky, slightly plastic; many fine roots; many fine quartz sand grains; very strongly acid; clear smooth boundary. (4 to 12 inches thick)

A/B--6 to 11 inches; red (2.5YR 4/6) and dark reddish brown (5YR 3/4) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; many fine quartz sand grains; very strongly acid; abrupt smooth boundary. (0 to 6 inches thick)

Bo1--11 to 20 inches; red (2.5YR 4/6) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; common fine tubular and vesicular pores; common black coatings in old root channels; few fine iron concretions; common quartz sand grains; very strongly acid; gradual wavy boundary.

Bo2--20 to 33 inches; red (2.5YR 4/6) clay; weak very fine subangular blocky structure; firm, slightly sticky, plastic; common fine tubular and vesicular pores; common fine quartz sand grains; few fine black sand-size particles; very strongly acid; gradual wavy boundary.

Bo3-33 to 47 inches; red (2.5YR 4/6) clay; weak, very fine subangular blocky structure; very friable, slightly sticky, plastic; few fine pores; few quartz sand grains; very few fine black sand-size particles; common fine yellow (10YR 7/6) masses of iron accumulations on ped surfaces and in old root channels; very strongly acid; gradual wavy boundary.

Bo4-47 to 61 inches, red (10R 4/6) clay; weak, very fine subangular blocky structure; very friable, slightly sticky, plastic; few fine pores; few quartz sand grains; very few fine black sand-size particles; common fine yellow (10YR 7/6) iron accumulations on ped surfaces and in old root channels; very strongly acid; clear wavy boundary.

Bo5-61 to 66 inches, dark red (10R 3/6) clay; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm, slightly sticky, slightly plastic; common fine tubular and vesicular pores; common fine quartz sand grains; few fine concretions; very strongly acid.

TYPE LOCATION: Manati Municipio, Puerto Rico. Approximately 150 feet north of Kilometer marker 2.75 of highway 670. Manati topographic quadrangle; lat. 18 degrees 26 minutes 03 seconds N., long. 66 degrees 26 minutes 09 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Thickness of the solum is more than 60 inches. Reaction is very strongly acid or strongly acid throughout. Quartz sand grains range from few to many throughout.

The A or Ap horizon has hue of 10R to 5YR, value of 3 or 4, and chroma of 3 or 4. Texture is sandy clay loam, clay loam, or clay. Iron concretions range from none to common.

The A/B horizon, where present, is a mix of the Ap and Bo horizons. It has hue of 2.5YR, value of 3 or 4, and chroma of 4 or 6; or there is no dominant color and is a mix of the colors of the Ap and Bo horizons. Texture is clay loam or clay.

The Bo horizon has hues of 10R or 2.5YR, value of 4 through 6, and chroma of 3 through 8. Iron concretions range from none to common in the upper part and generally decrease with depth. Redoximorphic accumulations as coatings on ped faces in shades of brown and yellow range from none to common in the lower horizons.

COMPETING SERIES: This is the Coto series in the same family. Coto soils are less strongly weathered and are strong brown in color in the middle and lower horizons.

GEOGRAPHIC SETTING: Bayamon soils are in stable coastal plains and in valleys interspersed among the limestone hills (haystacks or pepino hills). They formed in fine-textured sediments of mixed origin. The stability of the landforms enhances the weathering processes, the leaching of bases and weatherable minerals and the accumulation of more stable minerals and sesquioxides. The climate is humid tropical. Slopes range from 2 to 12 percent. The average annual precipitation is 65 inches, and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Almirante, Matanzas, Tanama, and Vega Alta soils. Almirante and Vega Alta soils are on similar positions, have more than 5 percent, by volume, plinthite, and do not have Oxic horizons. Matanzas soils are on similar positions but are deep to limestone bedrock. Tanama soils are on higher positions of toeslopes and side slopes of the limestone hills. In addition, they are shallow to limestone bedrock and do not have an Oxic horizon.

DRAINAGE AND PERMEABILITY: Well-drained; very slow permeability.

USE AND VEGETATION: Most areas of Bayamon soils are used for cropland. Many areas are used for pasture and hayland. This soil is specially suited for pineapples.

DISTRIBUTION AND EXTENT: Humid coastal plains of northern Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon - zone from 0 to 11 inches (Ap and A/B horizons).

Oxic horizon - zone from 11 to 66 inches. (Bo horizons).

ADDITIONAL DATA: Characterization pedon: Manati Municipio, Puerto Rico. Sample number S73PR-091-001. NSSL Lab sample pedon number - 40A1257. Sample by NSSL, Lincoln, NE.

MLRA: 272.

**National Cooperative Soil Survey
U.S.A.**

LOCATION CAGUABO PR

**Established Series
Rev. GRB
06/2002**

CAGUABO SERIES

The Caguabo series consists of shallow, well drained soils on side slopes of strongly dissected uplands. They formed in material that weathered from igneous rocks. Near the type location, the mean annual precipitation is about 80 inches and the mean annual temperature is 76 degrees F. Slopes range from 5 to 70 percent.

TAXONOMIC CLASS: Loamy, mixed, active, isohyperthermic, shallow Typic Eutrudepts

TYPICAL PEDON: Caguabo clay loam - native pasture and weeds. (Colors are for moist conditions.)

Ap--0 to 4 inches; dark grayish brown (10YR 4/2) clay loam; weak fine granular structure; friable, slightly sticky, slightly plastic; about 10 percent, by volume, igneous rock fragments; common fine roots; slightly acid; clear smooth boundary. (2 to 5 inches thick)

Bw--4 to 10 inches; brown (10YR 4/3) very gravelly clay loam; weak fine subangular blocky structure parting to weak fine granular; friable, slightly sticky, slightly plastic; about 60 percent, by volume, igneous rock fragments; few fine roots; slightly acid; clear smooth boundary. (4 to 8 inches thick)

C--10 to 16 inches; mixture of weathered and partially weathered igneous rock fragments and saprolite that can be penetrated with the spade. (0 to 7 inches thick)

R--16+ inches; consolidated igneous rock.

TYPE LOCATION: Oeste SCD, Puerto Rico. Approximately 1.5 miles northwest of the town of Anasco; about 300 feet north of intersection of Highways 2 and 110.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 6 to 20 inches and depth to bedrock ranges from 10 to 20 inches. The soil is slightly acid throughout.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 6. Texture is loam, clay loam, or their gravelly analogs.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 3 to 6. Texture is gravelly to extremely analogs of silty clay loam, clay loam, or clay. Content of saprolite ranges from 0 to 20 percent, by volume.

The C horizon, where present, has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 3 to 6; or it has no dominant matrix color and is multicolored. Texture is gravelly or very gravelly analogs of sandy clay loam or clay loam. Content of saprolite ranges from 20 to 60 percent, by volume.

The Cr horizon, where present, is saprolite that is similar in color and texture as the C horizon.

The R layer is consolidated igneous rock.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Caguabo soils are on lower positions of strongly dissected volcanic uplands at elevations below 1,800 feet or 550 meters. Slope range from 5 to 70 percent. They formed in fine-textured residuum or partially weathered igneous rocks. The climate is humid tropical. The average annual precipitation ranges from 75 to 85 inches and the average annual temperature ranges from 75 to 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Juncos, Mabi, Maraquez, Maresua, Morado, Mucara, and Quebrada soils. All of these soils are deeper to bedrock. In addition, the Juncos, Mabi, and Mucara soils are have clayey, smectitic control sections. The Maraquez and Morado soils and have fine-loamy, mixed control sections. Maresua soils have mixed, clayey-skeletal control sections. Quebrada soils have mixed, clayey control sections.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of this soil are used for pasture. A few small areas are planted to woodland. Vegetation consists of native and introduced grasses, shrubs, and trees.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Survey Area, Puerto Rico; 1969.

REMARKS: These soils were formerly included in the Mucara series.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - the zone from 0 to 4 inches (Ap horizon).

Cambic horizon - the zone from 4 to 10 inches (Bw horizon).

Lithic contact - hard bedrock at 16 inches (R layer).

MLRA: 270.

**National Cooperative Soil Survey
U.S.A.**

LOCATION CARACOLES PR

**Established Series
Rev. GA:RER:RLV
06/2002**

CARACOLES SERIES

The Caracoles series consists of very shallow, well drained, moderate to moderately rapidly permeable soils. They formed in material weathered from calcareous sandstone. They are sloping to steep soils on sideslopes and small hills. Slopes range from 5 to 40 percent.

TAXONOMIC CLASS: Loamy, mixed, superactive, isohyperthermic Lithic Haplustolls

TYPICAL PEDON: Caracoles loam - native pasture (Colors are for the moist soil)

Ap--0 to 6 inches, very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable, nonsticky, slightly plastic; many fine roots; neutral; abrupt wavy boundary. (4 to 8 inches thick)

R--6 plus inches, semiconsolidated calcareous sandstone.

TYPE LOCATION: Atlantico SCD, Puerto Rico, 50 meters south of kilometer marker 6.25, Highway 681.

RANGE IN CHARACTERISTICS: Depth to the semiconsolidated sandstone is less than 10 inches. The soil is neutral to mildly alkaline. Loam and sandy loam are the dominant textures.

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3.

The lower part consists of semiconsolidated sandstone.

COMPETING SERIES: There are no other known series in the same family. The Teja and San German series are similar soils in related family. The Teja soils are gravelly, redder and acid. The San German soils are gravelly and calcareous.

GEOGRAPHIC SETTING: The Caracoles soils are sloping to steep on sideslopes and small hill tops. Slopes range from 5 to 40 percent. The soil formed in medium textured residuum weathered from semiconsolidated calcareous sandstone. The climate is subhumid. The average annual precipitation is 50 inches. The average annual temperature ranges from 75 to 79 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the similar San German soils, these include the Islote soils. The Islote soils are deeper and have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained, medium runoff and permeability is moderate to moderately rapid.

USE AND VEGETATION: Native pasture and brush.

DISTRIBUTION AND EXTENT: Northern subhumid coastal plains. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Arecibo Soil Survey Area, Puerto Rico. Caracoles is the name of a "barrio" or ward near to where this soil was first recognized.

National Cooperative Soil Survey
U.S.A.

LOCATION CARRIZALES PR

Established Series

Rev. REG

06/2002

CARRIZALES SERIES

The Carrizales series consists of deep excessively drained soils formed in sands high in quartz. They are gently sloping and sloping soils on the coastal plain. These soils are dark brown, strongly acid, fine soil in the A horizon, and brown fine soil in the upper C horizon over lighter colored, fine soil in the lower C horizon.

TAXONOMIC CLASS: Siliceous, isohyperthermic, uncoated Typic Quartzipsamments

**TYPICAL PEDON: Carrizales fine sand--native pasture.
(Colors are for moist soil.)**

A1--0 to 8 inches; dark brown (10YR 3/3) fine sand; single grain; loose, nonsticky, nonplastic; few fine roots; strongly acid; abrupt smooth boundary. (6 to 12 inches thick)

C1--8 to 21 inches; brown (7.5YR 5/2) fine sand; single grain; loose, nonsticky, nonplastic; few fine roots; strongly acid; clear smooth boundary. (10 to 15 inches thick)

C2--21 to 32 inches; brown (7.5YR 5/4) fine sand; single grain; loose, nonsticky, nonplastic; few fine roots; very strongly acid; clear smooth boundary. (8 to 14 inches thick)

C3--32 to 50 inches; light brown (10YR 6/4) fine sand; single grain; loose, nonsticky, nonplastic; very strongly acid; clear smooth boundary. (16 to 22 inches thick)

C4--50 to 60 inches; yellow (10YR 7/6) fine sand; single grain; loose, nonsticky, nonplastic; very strongly acid.

TYPE LOCATION: Atlantic SCD, Puerto Rico; 0.6 kilometer on municipal paved road, southeast of kilometer marker 87.1 on Highway 2.

RANGE IN CHARACTERISTICS: Thickness of the fine soil is over 60 inches. Sand consists of 95 percent or more quartz in the soil fraction. They are single grain, loose, nonsticky, and nonplastic throughout. Reaction of the whole profile is strongly to extremely acid. The mean annual soil temperature is 76 degrees F.

The A horizon has hue of 10YR and values and chroma of 3 and 4.

The C horizon has hues of 7.5YR and 10YR, values of 5 to 7, and chroma of 2 to 6.

COMPETING SERIES: There are no other known series in the same family. The Aquadilla, Arenales, Catano, Espinal, Meros, and Jaucas series are similar soils in related families. The Aquadilla soils have more weatherable minerals. The Arenales, Meros and Jaucas soils have ustic moisture regimes. The Catano soils are calcareous throughout. The Espinal soils are calcareous in the lower C horizons.

GEOGRAPHIC SETTING: The Carrizales soils are gently sloping and sloping soils along the coastal plains with slope gradient of 2 to 12 percent. The soils formed in sandy sediments high in quartz. The climate is humid tropical. The average annual precipitation is 60 to 70 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Algarrobo, Areabo, Corozo, Guerrero, Jobos, and Rio Lajas series. The Jobos and the Guerrero soils have sandy surface layers but are underlain by coastal plain clays with plinthite. The Corozo and Rio Lajas soils have argillic horizons. The Algarrobo and Areabo soils have illuvial accumulations of organic matter.

DRAINAGE AND PERMEABILITY: Excessively drained; slow runoff; very rapid permeability.

USE AND VEGETATION: Native grasses, used as pasture.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. The series is of minor extent with about 2,700 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Series established in Atlantico SCD, Puerto Rico.

REMARKS: This soil was formerly included in the Guerrero series.

ADDITIONAL DATA: Lincoln Lab. data, S-73PR-01-5, Lab. nos. 74B180 to 74B182.

**National Cooperative Soil Survey
U. S. A.**

LOCATION CATANO PR

**Established Series
Rev. REG
04/2000**

CATANO SERIES

The Catano series is excessively drained, rapidly permeable upland soils. These soils are deep, calcareous, brown sands having more than 4 percent silt plus clay in the control section.

TAXONOMIC CLASS: Carbonatic, isohyperthermic Typic Udipsamments

**TYPICAL PEDON: Catano sand--coconut grove.
(Colors are for moist soil.)**

A1--0 to 4 inches; light gray (10YR 7/2) sand sized shell fragments, and very dark brown (10YR 2/2) subrounded grains of quartz and miscellaneous volcanic rock fragments with organic matter coatings; overall color is very dark grayish brown (10YR 3/2); single grain; loose, nonsticky, and nonplastic; many fine roots; strong effervescence; clear smooth boundary. (3 to 6 inches thick)

AC--4 to 10 inches; dark brown (overall color) (10YR 3/3) sand and more than 4 percent silt plus clay consisting of light gray (10YR 7/2) shell fragments and very dark brown (10YR 2/2) miscellaneous volcanics; single grain; loose, nonsticky, and nonplastic; common fine roots; strong effervescence; clear smooth boundary. (4 to 8 inches thick)

C1--10 to 50 inches; brown (overall color) (10YR 4/3) sand and more than 4 percent silt plus clay consisting of light gray (10YR 7/2) shell fragments and very dark brown (10YR 2/2) miscellaneous subrounded volcanic; singly grain; loose, nonsticky and nonplastic; few fine roots; strong effervescence; clear smooth boundary. (30 to 60 inches thick)

C2--50 to 60 inches; grayish brown (10YR 5/2) (overall color) sand; single grain; loose, nonsticky and nonplastic; very few fine roots; strong effervescence.

TYPE LOCATION: Oeste SCD, Puerto Rico; 2 miles north of the city of Mayaguez; 1/2 mile on dirt road North of

Boquilla bridge, 300 feet East of dirt road.

RANGE IN CHARACTERISTICS: The sandy materials extend to depth of more than 5 feet. Texture of the whole profile is sand. The sand consists of shell fragments, quartz grains, and volcanic subrounded fragments. Percent of silt plus clay in the control section varies from 4 to 10. These soils are single grain, nonsticky, and nonplastic throughout. Effervescence with dilute HCL varies from slight to violent.

Overall colors of the A and AC horizons have hues of 10YR and values and chromas of 2 to 3. The C horizons have hues of 10YR, values of 4 and 5, and chromas of 2 and 3.

COMPETING SERIES: These are the St. Lucie (P.R.), Aguadilla, Espinal, Arenales, Meros, and Jaucas series. The St. Lucie (P.R.) soils have sands with more than 95 percent quartz. The Aguadilla soils are acid. The Espinal soils have noncalcareous A horizons and lighter colored C horizons. The Arenales, Meros, and Jaucas soils are dry for more than 90 cumulative days in most years. The Arenales and Meros soils are noncalcareous. The Jaucas soils have lighter colored profile.

GEOGRAPHIC SETTING: The Catano soils occur along the coast at elevations close to sea level with slope gradients from 0 to 5 percent. The regolith consists of sand size shell fragments, quartz grains, and miscellaneous volcanic subrounded fragments. The climate is humid tropical. The average annual precipitation is 76 inches and the mean annual temperature is 78 degrees F. The mean annual soil temperature at 20 inches is more than 71.6 degrees F. with less than 9 degrees F. difference between mean summer and winter temperatures.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Aguadilla, St. Lucie (P.R.), and Espinal series in addition to the Corcega, and Coloso series and the land type coastal Beach. The Corcega and Coloso soils are finer textured, have low chroma mottles, and occur farther inland. The land type coastal Beach consists of unstabilized wave reworked narrow strips of sand along the coast.

DRAINAGE AND PERMEABILITY: Excessively drained; runoff is very slow, and permeability is rapid.

USE AND VEGETATION: Mostly on coconuts and undergrowth of pasture. Small acreage is in subsistence crops.

DISTRIBUTION AND EXTENT: Humid coastal plains of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, 1942; Soil Survey of Puerto Rico.

**National Cooperative Soil Survey
U. S. A.**

LOCATION COLINAS PR

**Established Series
Rev. LHR:REG
06/2002**

COLINAS SERIES

The Colinas series is well drained, moderately permeable upland soils. These soils have dark brown, granular A horizons and lighter colored, friable, weakly developed B horizons over soft limestone.

TAXONOMIC CLASS: Coarse-loamy, carbonatic, isohyperthermic Typic Haprendolls

**TYPICAL PEDON: Colinas clay loam--sugarcane.
(Colors are for moist soil.)**

Ap--0 to 6 inches; dark brown (10YR 3/3) moist and grayish brown (10YR 5/2) dry, clay loam; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; 3 percent by volume limestone fragments; violent effervescence; clear smooth boundary. (4 to 8 inches thick)

B2--6 to 12 inches; dark grayish brown (10YR 4/2) clay loam with few fine light yellowish brown (2.5Y 6/4) wormcasts; weak medium subangular blocky breaking to weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; 8 percent by volume common fine and medium limestone fragments 1/2 inch to 1 inch in diameter; violent effervescence; gradual smooth boundary. ((4 to 8 inches thick)

B3--12 to 16 inches; pale brown (10YR 6/3) clay loam; weak medium subangular blocky structure with stringers of B2 along fracture planes; friable, nonsticky and slightly plastic; few fine roots; 8 percent by volume common fine and medium limestone fragments 1/4 inch to 1 inch in diameter; strong effervescence; gradual smooth boundary. (4 to 8 inches thick)

C1--16 to 20 inches; light yellowish brown (10YR 6/4) clay loam with dark coatings along root channels; massive; friable, nonsticky, slightly plastic; common fine and medium limestone fragments 1/4 inch to 1 inch in diameter; few fine roots; violent effervescence; gradual wavy boundary. (4 to 6 inches thick)

C2--20 to 60 inches; mixture of soft yellow and white limestone containing 8 percent by volume common fine and medium fragments and concretions 1/4 inch to 1 inch in diameter.

TYPE LOCATION: Culebrinas SCD, Puerto Rico; 3.5 miles east of the town of Moca; 900 meters on dirt road north of kilometer marker 9.65 of Highway 111. 50 feet west of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 12 to 24 inches. Depth to the soft limestone is 16 to 32 inches. Limestone fragments below the A horizon ranges from 5 percent to 10 percent by volume and from 1/4 to 1 inch in diameter. It is calcareous throughout. The mean annual soil temperature ranges from 74 degrees F. to 76 degrees F.

The A horizon has hues of 10YR, values of 3, and chromas of 2 and 3. It is clay loam. Some pedons have 20 to 50 percent cobbles in the A horizon. It is friable, slightly sticky and slightly plastic.

The B2 horizon has hues of 10YR, values of 4 to 6, and chromas of 2 and higher. It is clay loam or silty clay loam. It is slightly sticky to nonsticky and plastic. The B3 horizon is slightly plastic to plastic.

COMPETING SERIES: There are no other known series in the same family. The Aguilita, Fredensborg, Naranjo, Pozo Blanco, Santa Clara, Sion, Sollar, Tuque and Yauco series are similar soils in related families. The Aguilita, Fredensborg, Pozo Blanco, Sion, Yauco and Tuque soils have ustic moisture regimes. The Naranjo and Santa Clara soils are not calcareous in the B horizons. The Sollar soils are finer textured and are underlain by hard limestone.

GEOGRAPHIC SETTING: The Colinas soils are moderately steep to very steep. They are on ridges and sideslopes of low limestone hills. Slopes range in gradient from 12 to 60 percent. They formed in residuum from soft limestone. The climate is humid tropical. The average annual precipitation is 80 inches and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Santa Clara, Naranjo, and Sollar series in addition to the Camaguey series and the land type Limestone Outcrop. The Camaguey series have thicker and darker A horizons, lack cambic horizons, and have slickensides and pressure faces. The land type Limestone Outcrop has 75 percent or more of the surface area covered by limestone rock outcrops.

DRAINAGE AND PERMEABILITY: Well drained, runoff is medium to rapid, and permeability is moderate.

USE AND VEGETATION: Sugarcane and pasture. Small acreage is in brush.

DISTRIBUTION AND EXTENT: Humid limestone uplands in the northern coastal plains of Puerto Rico. The series is of moderate extent with about 35,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, 1942; Soil Survey of Puerto Rico.

Additional Data: Lincoln Lab. characterization data S-73PR-07-5, 74B-186 to 74B-188.

**National Cooperative Soil Survey
U. S. A.**

LOCATION COLOSO PR

**Established Series
Rev. GRB
10/2001**

COLOSO SERIES

The Coloso series consists of very deep, somewhat poorly drained, slowly permeable soils on flood plains and terraces. They formed in stratified loamy and clayey alluvial sediments. Near the type location, the mean annual precipitation is about 80 inches and the mean annual air temperature is about 78 degrees F. Slopes range from 0 to 8 percent.

TAXONOMIC CLASS: Very-fine, kaolinitic, acid, isohyperthermic Aeric Endoaquepts

TYPICAL PEDON: Coloso silty clay loam - sugarcane. (Colors are for moist soil.)

Ap--0 to 7 inches; brown (10YR 4/3) silty clay loam; weak medium granular structure; firm, slightly sticky, plastic; many fine roots; few worm holes; slightly acid; clear smooth boundary. (5 to 12 inches thick)

Bw--7 to 13 inches; brown (10YR 4/3) silty clay loam, weak fine subangular blocky structure; firm, slightly sticky, slightly plastic; common fine roots; few worm holes; few fine black (10YR 2/1) concretions; common fine distinct yellowish red (5YR 4/6) masses of iron accumulation and common fine faint light gray (10YR 7/2) areas of iron depletion; slightly acid; clear smooth boundary. (0 to 10 inches thick)

Cg1--13 to 33 inches; about 50 percent dark gray (10YR 4/1) and 50 percent light gray (5Y 7/1) silty clay loam; massive; firm, slightly sticky, plastic; few fine roots; few worm holes; common fine black (10YR 2/1) concretions; many medium distinct reddish brown (5YR 4/3) masses of iron accumulation; the areas in colors of dark gray and light gray are iron depletions; slightly acid; gradual smooth boundary. (15 to 25 inches thick)

Cg2--33 to 60 inches; dark gray (10YR 4/1) silty clay; massive; firm, slightly sticky, plastic; few fine roots; few worm holes; common fine black (10YR 2/1) concretions; many fine faint yellowish brown (10YR 5/8) masses of iron accumulation and common fine distinct greenish gray (5GY 5/1) areas of iron depletion; slightly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico. Approximately one kilometer west of the town of Anasco; about 250 meters west of kilometer marker 145.5 of Highway 2, and fifty feet north of farm road.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 7 to 22 inches. Rock fragments range from 0 to 10 percent by volume throughout the profile. Reaction ranges from moderately acid to slightly acid throughout the profile.

The A or Ap horizon have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is silty clay loam or silty clay.

The Bw horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. Redoximorphic features in shades of red, yellow, brown, or gray range from few to many. Texture is silty clay loam, silty clay, or clay.

The C horizons have hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 to 4. Redoximorphic features in shades of red, yellow, or brown range from few to many. Texture is silty clay loam, silty clay, or clay.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Coloso soils are on river flood plains and terraces. They formed in stratified loamy and clayey alluvial sediments of mixed origin. Slopes range from 0 to 8 percent. The climate is humid tropical. The average annual precipitation ranges from 78 to 82 inches and the mean annual air temperature is 77 to 79 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Bajura, Corcega, Dique, and Toa series. The poorly drained Bajura soils have mixed mineralogy and Vertic subgroups. Corcega soils are fine-loamy over sandy or sandy-skeletal. The well drained Dique soils are fine-loamy. The well drained Toa soils have mixed mineralogy and a Mollic epipedon.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow permeability.

USE AND VEGETATION: Most areas of Coloso soils are used for sugarcane production. Some areas are used for pasture. A few areas are in woodland consisting of native and introduced species.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon.

Ochric epipedon - the zone from 0 to 7 inches (Ap horizon).

Cambic horizon - the zone from 7 to 13 inches (Bw horizon).

Aquic feature - apparant water table; 2 to 4 feet; July through September.

ADDITIONAL DATA: Rio Grande Municipality, Puerto Rico; S93PR-119-009 and S93PR-119-012. Samples by NSSL, Lincoln, NE. MLRA: 270, 272.

**National Cooperative Soil Survey
U.S.A.**

LOCATION CONSEJO PR

**Established Series
Rev. BCD
07/2001**

CONSEJO SERIES

The Consejo series consists of very deep, well drained, moderately permeable soils formed in materials weathered from volcanic rocks. They are on side slopes and ridges of uplands. Slopes range from 20 to 60 percent. The mean annual precipitation is about 77 inches and the mean annual temperature is about 76 degrees F.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Xanthic Hapludox

TYPICAL PEDON: Consejo clay--Merker grass. (Colors are for moist soils.)

Ap--0 to 5 inches; dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) clay; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; few quartz grains; few worm holes; extremely acid; clear smooth boundary. (4 to 7 inches thick)

Bt1--5 to 10 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; many faint clay films; few quartz grains; few wormholes, extremely acid; clear smooth boundary. (4 to 7 inches thick)

Bt2--10 to 18 inches; Yellowish brown (10YR 5/8) clay; moderate fine and medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; many faint clay films; common quartz grains; extremely acid; clear wavy boundary. (8 to 14 inches thick)

BC--18 to 28 inches; yellow (10YR 7/6), brownish yellow (10YR 6/8) and white (10YR 8/2) clay loam; weak fine and medium subangular blocky structure; friable, slightly sticky, plastic; few fine roots; many quartz grains; 25 percent saprolite extremely acid; clear wavy boundary. (8 to 14 inches thick)

C--28 to 60 inches; brownish yellow (10YR 6/8), yellow (10YR 7/6), yellowish brown (10YR 5/6) and white (10YR 8/2)

clay loam; massive; friable, slightly sticky, plastic; many quartz grains; extremely acid.

TYPE LOCATION: Caonillas SCD, Puerto Rico; 0.7 miles south of kilometer marker 12.1 on Highway 605.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 24 to 42 inches. Thickness of the argillic horizon varies from 20 to 35 inches. Quartz grains in the profile range from few to common in the surface and upper B horizon and from common to many in the lower B and C horizons. Reaction is strongly to extremely acid in the profile. Organic carbon content in the upper 6 inches of the argillic is 0.6 to 0.8 percent. The mean annual soil temperature ranges from 74 to 76 degrees F.

The A horizon has hues of 10YR or 7.5YR, value of 4, and chroma of 2 to 4. It is clay. Structure is weak to moderately fine and medium granular or weak fine and medium subangular blocky. Consistence is slightly sticky or sticky and plastic.

The Bt horizons have hues of 10YR or 7.5YR, values of 4 to 6, and chroma of 4 to 8. Texture is clay. Structure is weak or moderate, fine or medium subangular blocky. Consistence is slightly sticky or sticky, and plastic. Clay films range from few faint to common distinct.

The BC horizon ranges in texture from clay to clay loam. Saprolite ranges from 15 to 30 percent.

The C horizon is mainly saprolite of variegated colors. Texture varies from clay loam to loam.

COMPETING SERIES: There are no other known series in the same family. The Consumo, Corozal, Corozo, Ingenio, Jagueyes, Lirios, Maricao, Moca, Patillas and Rio Piedras series are similar soils in related families. The Consumo, Maricao and Patillas soils have thinner argillic horizons. The Corozal soils have low chroma mottles in the upper part of the B horizons. The Corozo have coarser surface layer and lower exchange capacity. The Ingenio soils are redder and have exchange capacity. The Jagueyes soils have coarser textured profiles. The Lirios soils have coarser textured C horizons. The Moca soils have horizons with shrink-swell behavior. The Rio Piedras soils have the clay fraction dominated by kaolinite.

GEOGRAPHIC SETTING: The Consejo soils are steep and very steep soils in sideslopes and hilltops in the humid volcanic uplands with slope gradient of 20 to 60 percent. This soil formed in fine and moderately fine textured residuum weathered from volcanic rocks. The climate is humid and tropical. The average annual precipitation is 70 to 85 inches, and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adjuntas, Consumo, and Humatas series. The Humatas soils are redder and the clay fraction is dominantly kaolinite. The Consumo soils have thinner argillic horizons. The Adjuntas soils are shallower to the volcanic rocks and lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Coffee, pasture and food crops.

DISTRIBUTION AND EXTENT: Humid uplands. The series is of minor extent with about 240 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

ESTABLISHED SERIES: Series established in the Arecibo Soil Survey Area.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Typic Tropudults to Clayey, mixed, isohyperthermic Typic Hapludults. The previous OSED was dated 11/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 5 inches (Ap horizon)

Argillic horizon - zone from 5 to 18 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION CONSUMO PR

**Established Series
Rev. BCD
02/98**

CONSUMO SERIES

The Consumo series consists of moderately deep to saprolite, well drained, moderately permeable soils formed in residuum from basic volcanic rocks. They are steep to very steep soils on side slopes and ridges of maturely dissected uplands. Slopes range from 20 to 60 percent. The mean annual precipitation is about 76 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Fine, mixed, semiactive, isohyperthermic Typic Haplohumults

TYPICAL PEDON: Consumo clay--Pangolagrass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; reddish brown (5YR 4/4) clay; moderate medium granular structure; slightly hard friable, slightly sticky and slightly plastic; many fine roots; very strongly acid, clear smooth boundary. (4 to 8 inches thick)

Bt1--6 to 14 inches; red (2.5YR 4/8) clay; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; common fine roots; common fine pores and root channels; thin patchy clay films; very strongly acid; gradual smooth boundary. (6 to 8 inches thick)

Bt2--14 to 20 inches; red (2.5YR 4/8) rubbed color clay; weak fine subangular blocky structure; friable, nonsticky, slightly plastic; few fine roots; thin patchy clay films; 50 percent of the horizon consists of saprolite; very strongly acid; gradual smooth boundary. (4 to 8 inches)

C--20 to 60 inches; variegated colors of the saprolite, which include red (2.5YR 4/8, 5/8), yellow (10YR 7/8), brown (7.5YR 5/4), light gray (10YR 7/1), silty clay loam; massive; black coatings on some faces; very friable, nonsticky, slightly plastic; very strongly acid. Original rock structure is visible and weathered rock fragments can be easily broken between fingers.

TYPE LOCATION: Oeste SCD, Puerto Rico; 8 miles east of the city of Mayaguez; 100 feet west and 50 feet south of kilometer marker 13.5 on Highway 106.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 14 to 24 inches. Thickness of the argillic horizon varies from 10 to 16 inches. This soil is strongly to very strongly acid throughout. The mean annual soil temperature ranges from 74 to 76 degrees F.

The A horizon has hues of 5YR or 2.5YR, values of 4 or 5, and chromas of 4 to 6. It is slightly sticky and slightly plastic or plastic.

The Bt horizon has hues of 5YR or 2.5YR, values of 4 or 5, and chroma of 6 or 8. It is clay in the upper part and clay or silty clay in the lower part. Structure varies in grade from weak to moderate subangular blocky. It is slightly sticky to nonsticky, and slightly plastic. Clay films vary from thin patchy to thin discontinuous. Saprolite ranges from 10 to 60 percent in the lower part.

The BC horizon, where present is clay or silty clay. Saprolite ranges from 40 to 80 percent. Consistence is nonsticky to slightly sticky.

COMPETING SERIES: There are no other known series in the same family. The Caspar, Consejo, Corozal, Corozo, Ingenio, Jagueyes, Lirios, Maricao, Moca, Patillas, and Rio Piedras series are similar soils in related families. The Caspar, Consejo, Lirios and Rio Piedras soils have argillic horizons thicker than 16 inches. The Corozal soils have thicker argillic horizons and low chroma mottles. The Corozo, Ingenio, and Jagueyes soils have thicker argillic horizons and CEC values lower than 24 meq/100 grams of clay. The Maricao soils have colder soil temperatures, lower than 72 degrees F. (mean annual). The Moca soils have thicker argillic horizons and also have higher COLE values and cracks when dry. The Patillas soils have coarser textured profiles with less than 35 percent clay.

GEOGRAPHIC SETTING: The Consumo soils are steep to very steep soils on side slopes and ridges. Slope gradients range from 20 to 60 percent. The soils formed in fine over coarser textured residuum weathered from basic volcanic rock. The climate is humid tropical. The average annual precipitation is 73 to 80 inches, and the mean annual temperature is 75 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Anones, Daguey, Humatas, Morado, and Mucara series. The Anones soils have weaker structure in the B horizons, lack clay skins, and are pinkish colored. Daguey and Humatas

soils are deeper and have argillic horizons thicker than 16 inches. Morado and Mucara soils have coarser textured profiles, are less acid, and shallower to the basic volcanic rock.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Used for coffee, pasture and food crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Dystropeptic Haplohumults to Clayey, mixed, isohyperthermic Typic Haplohumults. The previous OSED date was 10/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 6 inches (Ap horizon)

Argillic horizon - zone from 6 to 20 inches (Bt horizons)

**National Cooperative Soil Survey
U.S.A.**

LOCATION COROZAL PR

**Established Series
Rev. BCD
07/2001**

COROZAL SERIES

The Corozal series consists of very deep, somewhat poorly drained, slowly permeable soils formed in residuum on volcanic hills. Slopes range from 2 to 12 percent. The mean annual precipitation is about 77 inches and the mean annual temperature is about 76 degrees F.

TAXONOMIC CLASS: Very-fine, parasesquic, isohyperthermic Typic Hapludults

TYPICAL PEDON: Corozal clay - Pangola grass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 7 inches; dark reddish brown (5YR 3/4) clay; moderate fine subangular blocky structure; firm, slightly sticky, slightly plastic, many fine roots; very strongly acid, clear wavy boundary. (6 to 10 inches thick)

Bt1--7 to 9 inches; mixed dark red (2.5YR 3/6) and grayish brown (10YR 5/2) clay; moderate fine subangular blocky structure; firm, slightly sticky, plastic; thick continuous clay films, many fine roots; very strongly acid; clear wavy boundary. (1 to 3 inches thick)

Bt2--9 to 13 inches; red (2.5YR 4/6) clay with reddish brown (5YR 4/4) on surfaces of peds and root channels; moderate medium prismatic breaking to moderate medium subangular blocky structure; firm, slightly sticky, plastic; thick continuous clay films, many fine roots; very strongly acid; gradual wavy boundary. (4 to 10 inches thick)

Bt3--13 to 24 inches; red (2.5YR 4/6) clay with yellowish brown (10YR 5/6) coatings on surfaces of peds and root channels; moderate medium subangular blocky structure; firm, slightly sticky, plastic; thin continuous clay films on faces of peds and root channels; common fine roots; very strongly acid; gradual wavy boundary. (8 to 15 inches thick)

Bt4--24 to 32 inches; red (2.5YR 5/6) clay with yellowish brown (10YR 5/6) on surfaces of peds and root channels; moderate medium subangular blocky breaking to weak fine subangular blocky structure; friable, slightly sticky, slightly

plastic; very few patchy clay films on vertical faces of peds; few fine roots; very strongly acid; gradual wavy boundary. (7 to 14 inches thick)

Bt5--32 to 40 inches; yellowish red (5YR 5/6) clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; very few patchy clay films on vertical faces of peds; about 30 percent by volume of soil mass is saprolite; pseudomorphs of feldspars easily crushed to shiny faces (kaolin books); very strongly acid; gradual irregular boundary. (6 to 18 inches thick)

C--40 to 60 inches; variegated colors of the saprolite; yellowish red (5YR 5/6), light gray (5YR 7/1), and strong brown (7.5YR 5/6) clay loam; massive; friable, slightly sticky, slightly plastic; saprolite easily worked with fingers, rock structure visible, pseudomorphs of feldspars easily crushed to shiny faces (kaolin books); very strongly acid.

TYPE LOCATION: Cibuco SCD, 3 miles southwest of Corozal, Puerto Rico, at Corozal Experiment Substation farm, 60 feet west of cattle weighing pen.

RANGE IN CHARACTERISTICS: The base saturation (by sum of cations) is below 35 percent throughout the solum.

The Ap horizon has color values of 3 or 4, with chromas of 4 in hues of 5YR or 7.5YR.

The Bt horizons have values of 4 or 5, with chromas of 4 to 8 in hues of 2.5YR or 5YR. Structure ranges from strong to moderate, and clay films range from thick continuous to thin patchy. Percent by volume of saprolite in the lower Bt horizon ranges from 20 to 40. Organic matter in the upper 6 inches of the argillic is below the 1.5 percent level.

The BC horizon, where present has value of 4 or 5, chroma of 4 or 6 in hues of 5YR. This horizon lacks clay films and has 30 to 60 percent saprolite.

COMPETING SERIES: These include the Cialitos, Consumo, Daguey, Humatas, Ingenio, Jagueyes, Lares, Rio Piedras, and Vega Alta series all of which are well drained and lack low chroma mottles in the upper part of the argillic horizon. Cialitos, Daguey, Humatas, and Lares soils have more than 1.5 percent organic matter in the upper part of the argillic horizons. The Consumo soils have Bt horizons less than 10 inches thick. The Ingenio and Jagueyes soils are more weathered and have lower exchange capacities in the argillic horizon. The Vega Alta soils have more than 10 percent plinthite by volume in the upper 60 inches of the soil.

GEOGRAPHIC SETTING: The Corozal soils occur on gently to moderately sloping interfluvial areas of strongly dissected low volcanic hills with slope gradients range from 2 to 12 percent. These low hills occupy a transitional area between limestone and volcanic geologic formations. The soil formed in moderately fine to fine textured residuum of highly weathered volcanic rocks. The climate is humid tropical. The annual rainfall ranges from 75 to 90 inches and the mean annual temperature is from 74 to 78 degrees F. The variation between mean summer and mean winter soil temperatures at 20 inches is less than 9 degrees F.

GEOGRAPHICALLY ASSOCIATED: These include the competing Consumo and Humatas series.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow to medium runoff; slow permeability. A perched water table occurs during the rainy season.

USE AND VEGETATION: Previously used for pineapple, sugarcane and clean tilled subsistence crops. At present time in Pangola grass and used for pasture.

DISTRIBUTION AND EXTENT: The Corozal series was recognized and classified at the Corozal Experiment substation farm. It occurs in a narrow band in the contact between the limestone and the volcanic geologic formations in the northern part of Puerto Rico.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: San Juan Area, Puerto Rico; 1974.

REMARKS: The classification was changed with the 4/91 draft from Clayey, mixed, isohyperthermic Aquic Tropudults to Clayey, mixed, isohyperthermic Aquic Haplohumults. The previous OSED date was 2/86.

The Corozal series was formerly mapped with the Lares series in the Soil Survey of Puerto Rico. The lower subsoil colors are characteristic of a well drained soil, but the upper subsoil has characteristics of a somewhat poorly drained soil. This is due to a perched water table that persists during the rainy season.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 9 inches (Ap and Bt1 horizon)

Argillic horizon - zone from 7 to 40 inches (Bt horizons)

**National Cooperative Soil Survey
U.S.A.**

LOCATION COROZO PR

**Established Series
Rev. GA,LHR,RLV
07/2001**

COROZO SERIES

The Corozo series consists of moderately deep to deep well drained soils formed in a mantle of sand underlain by clayey coastal plain deposits. Typically, they have light gray and gray fine sand, a thin black sandy loam Bh horizon, very dark grayish brown to pale brown sandy loam to clay argillic horizon, underlain by an extremely hard and extremely firm loamy sand and sandy clay loam 3C horizon.

TAXONOMIC CLASS: Sandy over clayey, aniso, siliceous over kaolinitic, isohyperthermic Typic Alorthods

**TYPICAL PEDON: Corozo fine sand--Native pasture - coconuts.
(Colors are for moist soils unless otherwise stated.)**

A1--0 to 4 inches; light gray (10YR 5/1) fine sand with 15 percent black (10YR 2/1) spherical and elongated bodies; single grain; loose, nonsticky, nonplastic; many fine roots; very strongly acid; clear wavy boundary. (3 to 8 inches thick)

A2--4 to 12 inches; gray (10YR 6/1) fine sand with 15 percent black (10YR 2/1) rounded and elongated bodies; single grain; loose, nonsticky, nonplastic; common fine roots; very strongly acid; clear wavy boundary. (6 to 12 inches thick)

E--12 to 18 inches; light gray (10YR 7/1) fine sand with tongues of A2 in root channels; single grain, loose, nonsticky, nonplastic; few fine roots; very strongly acid; abrupt smooth boundary. (4 to 10 inches thick)

Bh1--18 to 18.5 inches; black (10YR 2/1) sandy loam; single grain; loose, nonsticky, nonplastic; very strongly acid; abrupt smooth boundary (0.5 to 1.0 inches thick)

2Bh2--18.5 to 19.5 inches; very dark grayish brown (10YR 3/2) sandy loam; single grain; loose, nonsticky, nonplastic; few clay bridges between sand grains; very strongly acid; clear wavy boundary. (1 to 1.5 inches thick)

2Bh3--19.5 to 24 inches; very dark brown (10YR 2/2) sandy clay loam; single grain; loose, nonsticky, nonplastic; few clay coatings on sand grains, common clay bridges between grains and small pockets of clay; very strongly acid; abrupt irregular boundary. (3 to 5 inches thick)

2Bt--24 to 33 inches; pale brown (10YR 6/3) with brown (7.5YR 5/2) stains along old root channels and cleavage planes, clay; moderate coarse prismatic structure, with tongues of 2Bh3. Prisms dominantly 2 to 4 inches in diameter; firm; slightly sticky, plastic; very strongly acid, clear wavy boundary. (8 to 14 inches thick)

3C1--33 to 40 inches; brown (10YR 5/3) with dark brown (7.5YR 4/4) stains along old root channels and cleavage planes, loamy sand; massive; extremely firm, extremely hard; nonsticky, nonplastic; very strongly acid; gradual wavy boundary. (6 to 10 inches thick)

3C2--40 to 60 inches; light gray (2.5YR 7/2) sandy clay loam; massive; very firm, extremely hard; nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: Norte SCD, Puerto Rico, Camp Tortuguero, 600 meters west of Officers Club on Highway 687. Municipality of Vega Baja. Photo ELT-2DD-56.

RANGE IN CHARACTERISTICS: Thickness of solum ranges from 30 to 60 inches. Depth to the horizons of accumulation of illuvial organic matter ranges from 13 to 26 inches. They are from extremely and very firm and extremely hard horizons. They slake in water. Soil reaction ranges from very strongly acid to extremely acid.

The A horizon has hue of 10YR, value of 5 through 8, and chroma of 1 or 2. It is loose, friable, nonsticky, nonplastic fine sand.

The Bh and 2Bh horizons have hue of 10YR or 7.5YR, with value of 2 through 4, and chroma of 1 or 2. They range from sandy clay loam to loamy sand. They are single grain.

The 2Bt horizon has hue of 10YR or 7.5YR, with value of 5 through 7, and chroma of 2 to 4. It is clay or sandy clay. It has moderate coarse to moderate medium prismatic structure.

The 3C horizon has hue of 7.5YR to 2.5Y, value of 4 through 8, and chroma of 2 to 6. It is from very firm to extremely firm, and extremely hard. It slakes in water. Texture is sandy loam to loamy sand.

COMPETING SERIES: There are no other presently known series in the same family. The Arecibo, Algarrobo, Cassia and Pomello series are in related families. All of these have sandy particle-size control sections and lack argillic horizons; in addition, the Cassia and Pomello soils have more than 9 degrees F. difference between mean summer and mean winter soil temperatures.

GEOGRAPHIC SETTING: The Corozo soils are on gently sloping to sloping terrain coastal plains. They formed in sands underlain by clayey coastal plain deposits. The climate is humid tropical. The average annual precipitation is 60 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Arecibo, Algarrobo, and the Carrizales, Guerrero, and Jobos soils. The Guerrero and Jobos soils have browner sandy surface layers and have subhorizons with plinthite. The Carrizales soils are browner and sandy throughout.

DRAINAGE AND PERMEABILITY: Well drained; slow runoff; very rapid permeability in upper part, slow in the lower part of the profile.

USE AND VEGETATION: Native pasture, trees and coconuts.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico, 1942.

REMARKS: When sampled, it was believed the Corozo soils would classify as Tropudults. The characterization data, however, did not support this classification. Following periods of heavy rains, water moves laterally through these soils, mostly through the E horizons. This update reclassifies the soil as Entic Alorthods.

MLRA = 272

SIR = PR0095

ADDITIONAL DATA: Characterization data is available on the Typical Pedon; sample nos. S73PR-07-4, lab. nos. 74B-132-74B-140, and 74B-197.

**National Cooperative Soil Survey
U.S.A.**

LOCATION COTO PR

**Established Series
Rev. BCD
06/2002**

COTO SERIES

The Coto series consists of very deep, well drained, moderately permeable soils formed in sediments weathered from limestone. They are on upland foot slopes and valleys adjacent to limestone hills. Slopes range from 2 to 12 percent. The mean annual precipitation is about 69 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Typic Eutruxox

TYPICAL PEDON: Coto clay--Native pasture. (Colors are for moist soil.)

Ap--0 to 9 inches; dark brown (7.5YR 4/4) clay; moderate fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; many fine roots; strongly acid; clear smooth boundary. (7 to 11 inches thick)

Bo1--9 to 14 inches; reddish brown (5YR 4/4) clay; moderate fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; thin discontinuous clay films; common fine roots; few fine black nodules; very strongly acid; gradual smooth boundary. (4 to 7 inches thick)

Bo2--14 to 19 inches; yellowish red (5YR 4/8) clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few thin patchy clay films; few fine roots; few fine black nodules; common fine pores; very strongly acid; gradual smooth boundary. (4 to 7 inches thick)

Bo3--19 to 26 inches; strong brown (7.5YR 5/8) clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few thin patchy clay films; few fine roots; many fine pores; few fine black nodules; strongly acid; gradual smooth boundary. (6 to 9 inches thick)

Bo4--26 to 37 inches; strong brown (7.5YR 5/8) clay; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic, thin patchy clay films; few fine roots; common fine pores; few fine quartz grains; few fine

black nodules; strongly acid; gradual smooth boundary. (9 to 13 inches thick)

Bo5--37 to 49 inches; strong brown (7.5YR 5/8) clay with few fine distinct red (7.5R 4/8) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films; many sand sized quartz grains; strongly acid; gradual smooth boundary. (10 to 14 inches thick)

Bo6--49 to 70 inches; strong brown (7.5YR 5/8) clay with common fine and medium distinct red (7.5R 4/8) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few thin patchy films; many sand sized quartz grains; strongly acid; gradual smooth boundary. (15 to 25 inches thick)

Bo7--70 to 92 inches; strong brown (7.5YR 5/8) clay with common medium distinct red (7.5R 4/8) mottles; massive; friable, slightly sticky, slightly plastic; very strongly acid.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 11 kilometers east from town of Aguadilla; 6 kilometers southwest of town of Isabela; 200 feet south of kilometer marker 120 on Highway 2. Aerial Photograph GS-LR 5-94.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the hard limestone is over 40 inches. Consistence is slightly sticky and slightly plastic in the Bo horizons. Reaction is strongly or very strongly acid in the whole profile. Bases plus aluminum meq/100 grams of clay range from 2.7 to 4.7 in the oxic horizon. CEC, by Nh4OAC, ranges from 7 to 15.0 meq/100 grams of clay in the oxic horizon. Base saturation by NH4OAC, in the upper part of the oxic horizon ranges from 20 to 34 percent. Some part of the oxic horizon has thin patchy films or reflective ped surfaces with pressure induced clay orientation. The mean annual soil temperature is 76 degrees F.

The A horizon has hues of 5YR or 7.5YR and values and chroma of 3 to 4. Texture is clay or sandy clay loam. Structure is weak or moderate, fine or medium subangular blocky.

The upper Bo horizons have hues of 5YR, value of 4 and chroma of 4 to 8. Texture is clay. Structure is weak to moderate, fine or medium subangular blocky. The lower Bo horizons have hues of 7.5YR, values of 4 or 5, and chromas of 6 to 8. Red mottles may or may not be present. Structure of the lower Bo horizon is weak fine to coarse or structureless (erosive).

COMPETING SERIES: There are no other known series in the same family. The Bayamon, Catalina, Cotito, Delicias, Hanamaulu, Kapaa, Kunuweia, Lawai, Makopili, Matanzas, Nipe, Pooku, Puhí, and Rosario series are similar soils in related families. The Bayamon and Delicias soils are more strongly weathered. The Catalina soils are redder, with color in hues of

2.5YR and redder, and have clay mineralogy dominated by oxides of iron. The Cotito, Matanzas, and Puhi soils have base saturation values higher than 35 percent in all parts of the oxic horizon. The Hanamaulu, Lawai and Makopili soils have an umbric surface horizon. The Kapaa and Pooku soils have sheets that contain 30 percent or more gibbsite. The Kunuweia and Nipe soils are extremely weathered and have much lower cation retention values. The Rosario soils have serpentine rock within 40 inches of the surface.

GEOGRAPHIC SETTING: The Coto soils are gently to moderately sloping soils on foot slopes and valleys adjacent to the limestone hills on slope gradients of 2 to 12 percent. They formed in fine textured sediments derived from limestone. The climate is humid tropical. The average annual precipitation is 67 to 70 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bayamon, Cotito, Matanzas series and the Aceitunas, Almirante, Espinosa, Tanama series. The Tanama soils are shallower to the fragmental limestone and have argillic horizons. The Almirante and Espinosa soils have thick argillic horizons. The Aceitunas soils are redder, acid and have thick argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained, runoff is slow to medium and permeability is moderate.
USE AND VEGETATION: Most of the acreage is in sugarcane. Small acreage is in pasture and food crops.

DISTRIBUTION AND EXTENT: North central and Northwestern coastal plains of Puerto Rico. The series is of moderate extent with about 13,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico, 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, kaolinitic, isohyperthermic Tropeptic Haplorthox to Very-fine, kaolinitic, isohyperthermic Typic Hapludox. The previous OSED was dated 11/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 9 inches (Ap horizon)

Oxic horizon - zone from 9 to 92 inches (Bo horizons)

ADDITIONAL DATA: Laboratory data is available for typical pedon. S63PR-6-2.

**National Cooperative Soil Survey
U.S.A.**

LOCATION CUCHILLAS PR

**Established Series
Rev. REG: LHR
08/1999**

CUCHILLAS SERIES

The Cuchillas series is of moderately deep, moderately permeable soils formed in materials weathered from volcanic rocks.

TAXONOMIC CLASS: Loamy, mixed, active, isothermic, shallow Typic Dystrudepts

TYPICAL PEDON: Cuchillas silty clay loam - coffee.

Ap--0 to 5 inches; dark brown (10YR 3/3) silty clay loam, moderate fine and medium granular structure; firm, slightly sticky, slightly plastic; many fine roots; weathered rock fragments 1/4 to 1/2 inch in diameter; very strongly acid; worm activity; clear smooth boundary. (4 to 8 inches thick)

B--5 to 15 inches; dark yellowish brown (10YR 3/4) silty clay loam; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; few fine roots; very strongly acid; partially weathered rock fragments 1/4 to 1/2 inch in diameter; worm activity; clear smooth boundary. (6 to 12 inches thick)

C--15 to 26 inches; weathered volcanic rock, slightly acid.

R--26 plus inches; Semi-consolidated volcanic rock.

TYPE LOCATION: Oeste SCD, Puerto Rico; 8.0 miles southeast of town of Maricao; 400 meters south on dirt road from kilometer marker 2.3 on Highway 374; 20 feet east of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 10 to 20 inches. Depth to the semi-consolidated volcanic rock varies from 20 to 36 inches. Fine volcanic fragments in the sola may range from 0 to 5 percent. Base saturation is less than 50 percent in some parts of the epipedon and cambic horizon. Organic carbon content decreases regularly with depth. The mean annual soil temperature ranges from 69 to 71 degrees F.

The A horizon has hue of 10YR, values of 3 or 4, and chroma of 2 or 3. Texture is silty clay loam. Structure is weak or moderate, fine or medium granular. Consistence is slightly sticky and slightly plastic or plastic. Reaction is strongly or very strongly acid.

The B horizon has hue of 10YR, values of 3 or 4, and chroma of 4 and higher. Texture is silty clay loam or silty clay. Structure is weak, fine, or medium subangular blocky. Consistence is slightly sticky and slightly plastic or plastic. Reaction is strongly to very strongly acid.

The C horizon is slightly or medium acid.

COMPETING SERIES: The Utuado series in the same family. The Utuado soils have coarser textured C horizons. The Adjuntas, Anones, Callabo, Mayo, Maraguez, Maresua, Morado, Pandura, Pellejas, Plata, Quebrada, Santa Marta, Victory, Vieques and Yunes series are similar soils in related families. The Adjuntas, Anones, Mayo, Pellejas, Santa Marta and Yunes soils all have base saturation of less than 50 percent and have mean annual soil temperatures above 72 degrees F. The Callabo, Victory and Vieques soils have ustic moisture regimes and have less organic carbon to a depth of 1 meter. The Maraguez, Maresua, Morado, Pandura, Plata and Quebrada soils have base saturation of more than 50 percent.

GEOGRAPHIC SETTING: The Cuchillas are steep and very steep soils in sideslopes and ridges strongly dissected volcanic uplands with slope gradients from 20 to 60 percent. They formed in moderately fine textured residuum overlying hard bedded volcanic rock. The climate is humid tropical with annual rainfall ranging from 90 to 120 inches and the mean annual temperature is 74 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Humatas, Los Guineos, and Maricao series, all being redder, deeper, and having finer textured profiles.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in brushland and abandoned coffee.

DISTRIBUTION AND EXTENT: Humid and high mountainous areas of Puerto Rico. The series is of minor extent with about 2,500 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Oeste SCD, Puerto Rico.

National Cooperative Soil Survey

U. S. A.

LOCATION DAGUEY PR

**Established Series
Rev. BCD
06/2002**

DAGUEY SERIES

The Daguey series consists of very deep, well drained, moderately permeable soils on sideslopes, ridgetops and footslopes in volcanic uplands. They formed in fine textured residuum weathered from volcanic rock. Slopes range from 2 to 40 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 76 degrees F.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Inceptic Hapludox

TYPICAL PEDON: Daguey clay--pasture. (Colors are for moist soil.)

Ap--0 to 10 inches; brown (7.5YR 4/4) clay; weak medium subangular blocky parting to moderate fine granular structure; firm, slightly sticky, slightly plastic; very strongly acid; abrupt wavy boundary. (8 to 12 inches thick)

Bo1--10 to 14 inches; reddish brown (5YR 5/4) clay; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; clear smooth boundary. (3 to 5 inches thick)

Bo2--14 to 23 inches; yellowish red (5YR 4/6) clay; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular and angular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; clear smooth boundary. (6 to 11 inches thick)

Bo3--23 to 31 inches; red (2.5YR 4/6) clay; strong medium and fine subangular blocky structure; firm, slightly sticky, slightly plastic; thin continuous clay films on ped faces; very strongly acid; gradual smooth boundary. (6 to 10 inches thick)

Bo4--31 to 43 inches; red (2.5YR 4/6) clay; strong medium and fine subangular blocky structure; firm, slightly sticky, slightly plastic; thin patchy clay films; very strongly acid; gradual smooth boundary. (8 to 14 inches thick)

Bo5--43 to 59 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm, slightly sticky, slightly plastic;

thin patchy clay films; very strongly acid; gradual smooth boundary. (10 to 20 inches thick)

Bo6--59 to 72 inches; red (2.5YR 4/6) clay; weak medium and fine subangular blocky structure; firm, slightly sticky, slightly plastic; very thin patchy clay films; few small angular fragments of rock; very strongly acid; clear smooth boundary. (10 to 16 inches thick)

C--72 to 86 inches; yellowish red (5YR 4/6) silty clay loam; common fine strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/6) mottles; massive with evidence of original rock structure; friable, slightly sticky, slightly plastic; very strongly acid; gradual smooth boundary. (12 to 18 inches thick)

Cr--86 to 90 inches; Saprolite with well defined rock structure, similar in color and texture to C1 horizon.

TYPE LOCATION: Cibuco SCD, Puerto Rico; 40 feet west of Highway 113, 80 feet south of road junction to house.

RANGE IN CHARACTERISTICS: The solum is 60 to 80 inches thick. The soil is strongly or very strongly acid. Cation exchange capacity ranges from 8 to 16 meq/100 grams of clay in the kandic horizon. The organic carbon content in the upper 6 inches of the kandic horizon ranges from 1.0 to 1.6.

The Bo horizon has hue of 10R or 2.5YR, value of 4 to 5 and chroma of 6 through 8. Yellowish brown mottles are few or common and are more evident in the upper B horizons.

COMPETING SERIES: The Aibonito and Alonso series are in the same family. The Aibonito soils have yellower B horizons. The Alonso soils have darker colors with chroma of 3 or less.

GEOGRAPHIC SETTING: The Daguey soils are gently sloping to steep soils on stable hilltops, side slopes, and foot slopes of the volcanic uplands with slope of 2 to 40 percent. The soil is formed in fine textured residuum from very highly weathered basic volcanic rocks. The climate is humid tropical. The average annual precipitation ranges from 70 to 85 inches and the mean annual temperature ranges from 74 to 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Consumo and Humatas soils. The Consumo soils occur on steeper less stable surfaces and have thinner B horizons. The Humatas soils have a CEC of more than 24 megs.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Coffee, pasture and food crops.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of moderate extent, about 16,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, oxidic, isohyperthermic Orthoxic Tropohumults to Very-fine, mixed, isohyperthermic Typic Kandiudox. The previous OSED was dated 4/87.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 10 inches (A horizon)

Oxic horizon - zone from 10 to 72 inches (Bo horizons)

ADDITIONAL DATA: Characterization data are available for pedon S61PR-8-3 and S61PR-8-6.

**National Cooperative Soil Survey
U.S.A.**

LOCATION ESPINOSA PR

**Established Series
Rev. RER
06/2002**

ESPINOSA SERIES

The Espinosa series consists of deep, well drained, moderately permeable soils. They formed in fine textured sediments of mixed origin. These nearly level to moderately steep soils are on valleys in coastal plains. Slopes range from 2 to 12 percent. Mean annual precipitation is 65 inches and the mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Fine, parasesquic, isohyperthermic Typic Kandiudults

**TYPICAL PEDON: Espinosa sandy loam - sugarcane.
(Colors are for moist soil unless otherwise stated.)**

Ap--0 to 10 inches; dark brown (10YR 4/3) sandy loam; weak fine granular structure parting to single grain; friable, nonsticky, nonplastic; many fine roots; very strongly acid; abrupt smooth boundary. (8 to 12 inches thick)

Bt1--10 to 16 inches; strong brown (7.5YR 5/6) sandy clay; weak fine subangular blocky structure; firm, slightly sticky, plastic; many fine roots; very strongly acid; clear smooth boundary. (4 to 8 inches thick)

Bt2--16 to 36 inches; strong brown (7.5YR 5/6) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few thin clay films; many black stains on ped surfaces; many fine quartz grains; very strongly acid; clear smooth boundary. (18 to 22 inches thick)

Bt3--36 to 47 inches; strong brown (7.5YR 5/6) clay; many medium distinct yellowish red (5YR 5/8) mottles; weak medium and fine subangular blocky structure; firm, slightly sticky, plastic; few fine roots; thin discontinuous clay films, many fine quartz grains, very strongly acid, clear smooth boundary. (9 to 13 inches thick)

Bt4--47 to 66 inches; yellowish brown (10YR 5/8) clay; few fine distinct yellowish red (5YR 5/8) and dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm, slightly sticky, plastic; thin discontinuous yellowish

brown clay films; very strongly acid.

TYPE LOCATION: Atlantico SCD, Puerto Rico; 33 meters east of kilometer marker 3.2 on Highway 119. Photo GS-LR 2DD-80.

RANGE IN CHARACTERISTICS: The argillic horizon is more than 60 inches thick. Depth to plinthite is more than 60 inches. Reaction is strongly or very strongly acid. Organic carbon content in the upper 6 inches of the argillic horizon is less than 0.9 percent.

The A horizon has hue of 10YR or 7.5YR, value and chroma of 3 or 4. Texture is sandy loam, sandy clay loam or clay.

The upper Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 6 to 8. Texture is sandy clay, sandy clay loam, or clay. The lower Bt horizon has hue of 10YR, 7.5YR and 5YR value of 5 or 6, and chroma of 2 to 8. Texture is clay.

COMPETING SERIES: The Cidral series is in the same family. The Cidral soils have redder B horizons.

GEOGRAPHIC SETTING: The Espinosa soils are gently sloping and sloping soils on valley-like positions in the coastal plains and between limestone hills with slope gradient of 2 to 12 percent. These soils have formed in fine textured sediments of mixed origin. The climate is humid tropical. The average annual precipitation ranges from 65 to 70 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Almirante, Vega Alta and Bayamon series. The Almirante soils occupy similar land forms, have similar soil characteristics but have plinthite at a depth of 20 to 60 inches from the surface. The Vega Alta soils have plinthite within 20 inches from the surface. The Bayamon soils are highly weathered red soils, plinthite-free, and friable throughout the profile.

DRAINAGE AND PERMEABILITY: Well drained, slow to medium runoff, moderate permeability.

USE AND VEGETATION: Sugarcane, pineapple, food crops and pasture.

DISTRIBUTION AND EXTENT: Northern humid coastal plains. The series is of minor extent with about 8,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - zone from 0 to 10 inches. (Ap horizon)

Argillic horizon - zone from 10 to 66 inches. (Bt1, Bt2, Bt3, Bt4 horizons)

**National Cooperative Soil Survey
U. S. A.**

LOCATION ESTACION PR

**Established Series
Rev. RER
06/2002**

ESTACION SERIES

The Estacion series consists of deep, well drained, moderately permeable soils. They formed in moderately fine textured sediments over gravel of mixed origin. These nearly level soils are on terraces and in floodplains. Slopes range from 0 to 2 percent. Mean annual precipitation is 70 inches and mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, active, isohyperthermic Fluventic Hapludolls

**TYPICAL PEDON: Estacion silty clay loam - pasture
(Colors are for moist soil unless otherwise stated.)**

Ap--0 to 8 inches; dark brown (10YR 3/3) silty clay loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine roots; few subrounded gravel, 1/2 to 2 inches in diameter; medium acid; clear smooth boundary. (6 to 12 inches thick)

A--8 to 20 inches; very dark grayish brown (10YR 3/2) gravelly clay loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many fine to coarse gravel sized subrounded fragments; medium acid; gradual smooth boundary. (10 to 16 inches thick)

2C--20 to 50 inches; dark brown (10YR 4/3) gravelly sand; single grained; nonsticky, nonplastic; about 50 percent coarse gravel; many rounded cobbles 3 to 7 inches in diameter; slightly acid.

TYPE LOCATION: Turabo SCD, Puerto Rico, 0.5 mile northwest from kilometer marker 32.8 of highway 1, 50 feet east of the Bairoa River bank.

RANGE IN CHARACTERISTICS: The soil is slightly acid or medium acid. Depth to the skeletal layers ranges from 16 to 28 inches. Cobbles, 3 to 7 inches in diameter, range from few to many.

The A horizon has hue of 10YR or 7.5YR, value of 3 and chroma of 2 or 3. It is clay loam, silty clay loam, gravelly clay loam or gravelly silty clay loam. Gravel ranges from 5 to 20 percent by volume in the upper part to 15 to 30 percent in the lower part.

The 2C horizon has hue of 10YR, value of 4 or 5 and chroma of 3 through 6. Gravel ranges from 35 to 60 percent.

COMPETING SERIES: There is no other series in this family.

GEOGRAPHIC SETTING: The Estacion soils occur very close to the river banks on nearly level to gently sloping river flood plains with slope gradients ranging from 0 to 2 percent. The soil formed in stratified moderately fine textured sediments over gravelly layers of mixed origin. The climate is humid. The mean annual precipitation ranges from 60 to 80 inches and the mean annual temperature is 76 to 79 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bajura, Coloso, and Dique soils, all of which occur in the river flood plains of the humid areas. The Bajura and Coloso soils are poorly drained. The Dique soils lack the thick dark surface horizons and the gravelly lower C horizons.

DRAINAGE AND PERMEABILITY: Well drained; slow runoff; moderate permeability.

USE AND VEGETATION: Mostly used for pasture. Small area is in sugar cane.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 20 inches. (Ap and A horizon)

Contrasting materials at 20 inches.

**National Cooperative Soil Survey
U.S.A**

LOCATION GARROCHALES PR

**Established Series
Rev. GA
04/2000**

GARROCHALES SERIES

The Garrochales series consists of deep, poorly drained organic soils formed in sediments of highly and partially decomposed plant tissues and marl. They occur on nearly level, depressional areas and bottomlands. The Garrochales soils have black, friable, organic layers over marl.

TAXONOMIC CLASS: Marly, euic, isohyperthermic Limnic Haplosaprists

**TYPICAL PEDON: Garrochales muck - Native pasture.
(Colors are for the moist soil.)**

Oap--0 to 8 inches; black (N 2/0) broken face and rubbed colors; moderate fine granular structure; very friable; slightly sticky, slightly plastic; many fine roots; low mineral content, medium acid (pH 6.0 in water); clear smooth boundary. (6 to 10 inches thick)

Oe2--8 to 16 inches; very dark brown (10YR 2/2), broken face and rubbed colors; about 60 percent fiber and 10 percent rubbed; massive; friable, slightly sticky, slightly plastic; few fine roots; low mineral content; extremely acid (pH 3.7 in water); clear smooth boundary. (6 to 10 inches thick)

Oe3--16 to 29 inches; black (10YR 2/1) broken face and rubbed colors; about 40 percent fiber and 10 percent rubbed; massive; friable, slightly sticky, slightly plastic; low mineral content; strongly acid (pH 5.2 in water); abrupt smooth boundary. (10 to 15 inches thick)

Oe4--29 to 46 inches; very dark grayish brown (10YR 3/2); broken face and rubbed colors; about 60 percent fiber and 15 percent rubbed; massive; friable, slightly sticky, slightly plastic; lower mineral content; slightly acid (pH 6.3 in water); abrupt smooth boundary. (12 to 18 inches thick)

IILca1--46 to 47 inches; bluish gray (5B 5/1) silt loam; massive; slightly sticky, slightly plastic; calcareous; clear smooth boundary. (1 to 2 inches thick)

IILca2--47 to 56 inches; light gray (10YR 7/1) silt loam, massive, slightly sticky, slightly plastic; calcareous; abrupt smooth boundary. (7 to 10 inches thick)

Oe4--56 to 74 inches; very dark grayish brown (10YR 3/2) broken face and rubbed colors; about 60 percent fiber and 15 percent rubbed; massive; slightly sticky, slightly plastic; low mineral content; neutral (pH 6-8 in water).

TYPE LOCATION: Atlantico SCD, Cano Tiburones Area, 0.5 kilometers east of junction with dirt road, 1.4 kilometers north of kilometer marker 10.7 of Highway 682.

RANGE IN CHARACTERISTICS: Thickness of the organic layers and depth to the marl layers varies from 39 to 53 inches. They are slightly sticky and slightly plastic throughout.

The Ap horizons are black, friable, granular, with low mineral content and less than 5 percent fiber.

The subsurface organic layers have colors in hues of 10YR, values of 2 and 3, and chroma of 1 and 2. The unrubbed fiber content varies from 30 to 60 percent. The rubbed fiber content varies from 10 to 15 percent.

The marly layers consist of silt loam or loams, calcareous material and light gray to white.

COMPETING SERIES: There are no other known series in the same family. The Tiburones, Palmas Altas, and Saladar series are similar soils in related families. They do not have marly layers in their profiles. The Tiburones soils have lower unrubbed fiber content. The Saladar soils have higher rubbed fiber and content and are more alkaline.

GEOGRAPHIC SETTING: The Garrochales soils are nearly level soils that occur on depressional areas near the coast. They formed in the sediments of partially decomposed plant residual under wet conditions over marl. The climate is humid tropical. The average annual rainfall ranges from 60 to 70 inches and the average annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Palmas Altas and Tiburones and the Jareales and Vigia series. The Jareales soils have fine textured mineral surface layers. The Vigia soils have fine textured mineral subsurface layers.

DRAINAGE AND PERMEABILITY: Poorly drained, slow runoff, and slow permeability. The water table varies from 0 to 30 inches.

USE AND VEGETATION: Most of the acreage is on native grasses and shrubs. It is used for pasture.

DISTRIBUTION AND EXTENT: Humid northern coastal plain of Puerto Rico. The series is of small extent with about 400 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Atlantico SCD, Puerto Rico; 1980.

National Cooperative Soil Survey
U.S.A

LOCATION GUERRERO PR

**Established Series
Rev. REG/LHR
06/2002**

GUERRERO SERIES

These soils have thick dark brown sandy surface horizons over thick, fine textured B2t horizons.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Arenic Paleudalfs

TYPICAL PEDON: Guerrero sand-pasture and coconuts (Colors are for moist soil).

Ap--0 to 10 inches; grayish brown (10YR 5/2) dry, dark brown (7.5YR 4/2) moist, sand; single grain; loose, nonsticky, nonplastic; many fine roots; medium acid; clear smooth boundary. 8 to 12 inches thick.

A12--10 to 22 inches; dark brown (7.5YR 4/4) sand; single grain; loose, nonsticky, nonplastic; many fine roots; few fine soft black concretions; medium acid; clear smooth boundary. 8 to 18 inches thick.

A13--22 to 28 inches; yellowish red (5YR 4/6) loamy sand; single grain; loose, nonsticky, nonplastic; few fine roots; few black concretions; medium acid; clear smooth boundary. 4 to 10 inches thick.

B21t--28 to 36 inches; yellowish red (5YR 4/6) sandy clay; weak coarse subangular blocky structure; firm, slightly sticky, plastic; very few roots; common fine soft black concretions; strongly acid; sand grains are coated and bridged by red colored clays; clear wavy boundary. 6 to 10 inches thick.

B22t--36 to 44 inches; strong brown (7.5YR 5/6) clay with common fine prominent red (2.5YR 4/6), and common fine faint dark brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; firm, slightly sticky, plastic; few fine black concretions; many fine quartz grains; strongly acid; 10 to 20 percent soft plinthite; clear wavy boundary. 6 to 10 inches thick

B23t--44 to 50 inches; strong brown (7.5YR 5/8) clay with common medium distinct yellowish brown (10YR 5/6), common fine and medium prominent dark red (2.5YR 3/6), and common medium prominent light gray (10YR 6/1) mottles; weak

coarse subangular blocky structure; firm, slightly sticky, plastic; many fine quartz grains; very strongly acid; 10 to 20 percent soft plinthite; clear wavy boundary. 6 to 8 inches thick.

B24t--50 to 70 inches +; yellowish brown (10YR 5/6) clay with common medium prominent light gray (10YR 7/1) and few fine prominent dark red (2.5YR 3/6) mottles; weak coarse subangular blocky structure; firm, slightly sticky, plastic, many fine quartz grains; very strongly acid; 5 to 10 percent soft plinthite.

TYPE LOCATION: Noroeste SCD, Puerto Rico, 1.0 mile west of the town of Isabela; 80 feet north and 30 feet west of kilometer marker 1.7 of highway 459.

RANGE IN CHARACTERISTICS: These soils have medium acid A horizons and strongly or very strongly acid B2t horizons. Thickness of the sandy A horizons varies from 20 to 40 inches. Thickness of the argillic horizon is over 50 inches. Colors of surface horizons range in hues of 7.5YR and 10YR, values of 4 or more and chromas of 2 to 4. Colors of the B2t horizons range in hues of 7.5YR and 5YR, values of 4 and 5 and chromas higher than 6. The B2t horizons have more than 5 percent nonindurated plinthite nodules. Texture of the A horizons is sand and that of the B2t horizons varies from sandy clay to clay. Structure of the B2t horizons ranges from weak moderate to weak coarse subangular blocky. Base saturation (by sum of cations) is less than 35 percent at 50 inches below the top of the argillic horizon. The organic matter content is less than 1.5% in the upper 6 inches of the argillic horizon.

COMPETING SERIES: These are the Cabo Rojo, Cidral, Maleza, Bejucos, Rio Lajas, Jobos and Guanajibo series in the same Great Group. The Cabo Rojo soils have surface horizons with moist color values of less than 4. The Cidral soils have finer textured and thinner A horizons and lack the nonindurated plinthite nodules. The Maleza and Bejucos soils have thinner sandy A horizons, lack the plinthite nodules, and, in addition, the Maleza soils are redder, with hues redder than 5YR. The Rio Lajas soils have darker surface horizons and less than 35 percent clay in the B horizons. The Jobos and Guanajibo soils lack the thick sandy A horizon.

GEOGRAPHIC SETTING: The Guerrero soils occur on gently sloping coastal plains with slope gradients of 2 to 5 percent. The regolith consists of coarse over fine textured sediments. The climate is humid tropical. The average annual precipitation is 60 inches and mean annual temperature 75 degrees F. The mean annual soil temperature at depth of 20 inches is more than 72 degrees F. and the difference between mean summer and winter temperatures is less than 9 degrees F.

PRINCIPAL ASSOCIATED SOILS: These are the competing Jobos, Rio Lajas and Maleza series.

DRAINAGE AND PERMEABILITY: Excessively drained and slow runoff, permeability is rapid in the surface and moderately slow in the subsoil.

USE AND VEGETATION: Native pasture and subsistence crops.

DISTRIBUTION AND EXTENT: Humid coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES PROPOSED: Norosete SCD, Puerto Rico; Guerrero is the name of a "barrio" where the series was first recognized.

REMARKS: These soils were formerly mapped in the Guayabo series but differ from it being usually moist and not having a subhorizon from 7 to 20 inches dry for as much as 60 consecutive days in most years.

OSD scanned by SSQA. Last revised by state on 4/67.
National Cooperative Soil Survey
U.S.A.

LOCATION HUMATAS PR

**Established Series
Rev. GRB
06/2002**

HUMATAS SERIES

The Humatas series consists of very deep, moderately slowly permeable, well drained soils on side slopes and ridges of strongly dissected uplands. They formed in clayey and loamy material that weathered from igneous rocks. Near the type location, the mean annual precipitation is about 78 inches and the mean annual temperature is about 75 degrees F. Slopes range from 5 to 60 percent.

TAXONOMIC CLASS: Very-fine, parasesquic, isohyperthermic Typic Haplohumults

TYPICAL PEDON: Humatas clay - native pasture. (Colors are for moist conditions.)

Ap-- 0 to 4 inches; dark brown (7.5YR 4/4) clay; moderate fine granular structure; firm, slightly sticky, slightly plastic; many fine roots; very strongly acid; clear smooth boundary. (4 to 8 inches thick)

Bt1--4 to 9 inches; yellowish red (5YR 5/6) clay; moderate fine subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, plastic; many fine roots; few fine vesicular and tubular pores; few fine black particles; very strongly acid; clear smooth boundary.

Bt2--9 to 15 inches; red (2.5YR 5/8) clay; moderate fine and medium subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, plastic; common fine roots; few fine vesicular and tubular pores, very strongly acid; clear smooth boundary.

Bt3--15 to 25 inches; red (2.5YR 5/6) clay; weak fine subangular blocky structure; few faint clay films on faces of peds; firm; slightly sticky, slightly plastic; few fine roots; common fine vesicular and tubular pores; very strongly acid; clear smooth boundary. (Total thickness of the Bt horizons ranges from 12 to 31 inches)

BC--25 to 32 inches; rubbed color red (2.5YR 5/6) silty clay loam; about 30 percent of this horizon consists of saprolite of

variegated colors as: red (2.5YR 4/6), dark red (2.5YR 3/6), very pale brown (10YR 7/4), yellowish brown (10YR 5/8); weak fine and medium subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; many fine vesicular and tubular pores; very strongly acid; clear smooth boundary. (6 to 12 inches thick)

C1--32 to 45 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6); silty clay loam; massive; friable, nonsticky, slightly plastic; many fine pores; very strongly acid; clear smooth boundary.

C2--45 to 60 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6); saprolite that has a silty clay loam texture; massive; friable, nonsticky and slightly plastic; very strongly acid.

C3--60 to 96 inches; about 25 percent red (2.5YR 4/6), about 25 percent dark red (2.5YR 3/6), about 25 percent very pale brown (10YR 7/4), and about 25 percent yellowish brown (10YR 5/8), rubbed color is red (2.5YR 4/6) saprolite that has a clay loam texture; massive; very friable, nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico. Approximately 6.5 miles northeast of the city of Mayaguez; about 660 feet on dirt road from kilometer marker 2.45 on Highway 406, and about 350 feet southwest of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 22 to 51 inches. Reaction is very strongly acid or strongly acid. Rock fragments range from 0 to 20 percent, by volume throughout, except for the A horizon which can range to 40 percent by volume.

The A horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. Texture is silty clay loam, silty clay, clay, or their gravelly analogs.

The Bt horizon has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is silty clay, clay, or their gravelly analogs.

The BC horizon has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8; or there is no dominant matrix color and are multicolored in shades of red, yellow, brown and gray. Texture is silty clay loam, silty clay, clay, or their gravelly analogs.

The C horizons has hue of 10R to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is silty clay loam, clay loam, clay, or

their gravelly analogs.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Humatas soils are on side slopes and ridges of uplands. They formed in fine-textured residuum weathered from basic igneous rock. The climate is humid tropical. Slopes range from 5 to 60 percent. The average annual precipitation ranges from 70 to 86 inches and the average annual temperature ranges from 74 to 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Alonso, Consumo, Daguey, Lares, Los Guineos, and Zarzal soils. Alonso soils have oxidic control sections. Consumo soils are moderately deep to saprolite. Daguey soils have more clay in the control section and are Oxisols. The somewhat poorly drained Lares soils are on terraces at lower elevations. Los Guineos soils are on higher positions, are isothermic, have more clay in the control section, and are Oxisols. Zarzal soils have more clay in the control section and are Oxisols.

DRAINAGE AND PERMEABILITY: Well drained; moderately slowly permeability.

USE AND VEGETATION: Most areas of Humatas soils are used for pasture, food crops, and coffee production. Vegetation consists of native and introduced upland species.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Survey Area, Puerto Rico; 1968.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 4 inches (Ap horizon).

Argillic horizon - zone from 4 to 25 inches (Bt horizons).

ADDITIONAL DATA: Characterization data are available for the typical pedon S61PR-8-1 and pedon S61PR-8-4, both

are published in Soil Survey Investigation Report No. 12. Samples by NSSL, Lincoln, NE.

MLRA: 270.

**National Cooperative Soil Survey
U.S.A.**

LOCATION INGENIO PR

**Established Series
Rev. BCD
08/2000**

INGENIO SERIES

The Ingenio series consists of very deep, well drained, moderately permeable soils formed in residuum from granitic rock on side slopes and narrow ridge tops of uplands. Slopes range from 5 to 40 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 79 degrees F.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Typic Hapludults

TYPICAL PEDON: Ingenio silty clay loam - pasture. (Colors are for the moist soil.)

Ap--0 to 7 inches; yellowish brown (10YR 5/4) silty clay loam, with many medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine roots; common fine quartz grains; few fine black grains; very strongly acid; clear smooth boundary. (5 to 10 inches thick)

Bt1--7 to 15 inches; red (2.5YR 5/6) silty clay; moderate medium and coarse prismatic structure with thin continuous yellowish red (5YR 4/8) coatings on vertical ped surfaces and common distinct coatings on horizontal ped surfaces; friable, slightly sticky, plastic; common fine roots; few fine pores; common fine quartz grains; few fine black grains; few krotovinas about 5 millimeters in diameter; very strongly acid; clear smooth boundary. (6 to 10 inches thick)

Bt2--15 to 31 inches; red (2.5YR 4/6) clay, moderate medium and coarse subangular blocky structure with thin continuous reddish brown (2.5YR 5/4) coatings on vertical ped surfaces and common distinct coatings on horizontal ped surfaces; friable, slightly sticky, slightly plastic; common fine roots; few fine pores; common fine quartz grains; few fine black grains; few krotovinas 2 to 5 millimeters in diameter; strongly acid; gradual smooth boundary. (10 to 16 inches thick)

Bt3--31 to 40 inches; red (2.5YR 4/6) silty clay; weak medium and coarse subangular blocky structure with common distinct reddish brown (2.5YR 5/4) coatings on ped surfaces; friable, slightly sticky, slightly plastic; common fine roots; common fine pores; common fine quartz grains; few fine black grains; few krotovinas one inch in diameter and thick clay

coatings; very strongly acid; clear smooth boundary. (6 to 12 inches thick)

C1--40 to 51 inches; variegated colors; dusky red, yellow and white, crushed color dark yellowish brown (10YR 4/4); silty clay loam; massive; very friable, nonsticky, nonplastic; common fine roots; few fine pores; common fine quartz grains; very strongly acid; gradual smooth boundary. 50 percent of the horizon is saprolite. (8 to 12 inches thick)

C2--51 to 76 inches; saprolite with variegated colors; dusky red, yellow, yellowish brown and white; silt loam; massive; very friable, nonsticky, nonplastic; few dead roots with clay and organic coatings in root channels; many fine weathered feldspar grains; very strongly acid; diffuse smooth boundary. (20 to 30 inches thick)

C3--76 to 110 inches; saprolite of variegated colors; dusky red, yellow, yellowish brown and white, silt loam; massive; very friable, nonsticky, nonplastic; many fine feldspar grains; very strongly acid.

TYPE LOCATION: Este SCD, Puerto Rico; 4.9 kilometers southwest of Humacao, 1.0 kilometer southwest from Surillo School, Tejas ward; Photo GS-LR-13-105.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 27 to 48 inches. Thickness of the argillic horizon varies from 22 to 38 inches. Quartz grains range from common to many in the whole profile. Reaction is strongly or very strongly acid in the whole profile. Cation exchange capacity (by NH₄OAC) in the argillic horizon varies from 7.8 to 9.3 meq/100 grams of clay. Organic content in the upper 6 inches of the argillic horizon varies from 0.6 to 0.8 percent. Base saturation (by sum of cations) ranges from 19 to 25 percent. The mean annual soil temperature ranges from 76 to 78 degrees F.

The A horizon has hues of 10YR to 5YR, values of 3 to 5, and chroma of 3 or 4. High chroma mottles may or may not be present. Texture is clay loam or silty clay loam. Structure is weak fine or medium subangular blocky to moderate fine and medium granular.

The Bt horizons have hues of 2.5YR or 5YR, values of 4 or 5, and chroma of 4 to 8. Texture is clay or silty clay in the upper part and silty clay or silty clay loam in the lower part. Structure is weak or moderate fine to coarse subangular blocky. Consistence is slightly sticky and plastic throughout. Clay films range from very few to many.

The BC horizon, where present, is silty clay or silty clay loam.

The C horizons are mostly saprolite with variegated colors. Texture is silty clay loam, silt loam or loam.

COMPETING SERIES: There are no other known series in the same family. The Aibonito, Alonso, Consejo, Consumo, Corozal, Corozo, Daguey, Lirios, Jagueyes, Magens, Maricao, Moca, Patillas and Rio Piedias series are similar soils in related families. The Aibonito, Alonso and Daguey soils have higher organic matter content in the upper argillic horizon. The Consejo, Consumo, Corozal, Lirios, Maricao, Moca, Patillas and Rio Piedias soils all have higher CEC, more than 24 meq/100 grams of clay in the argillic horizon. The Corozo soils have sandy surface layers. The Jagueyes soils have coarser textured profiles dominantly sandy clay loam. The Magens soils have ustic moisture regimes.

GEOGRAPHIC SETTING: The Ingenio soils are moderately steep to steep soils on side slopes and narrow ridge tops with slope gradients of 5 to 40 percent. The regolith consists of medium and fine textured, highly weathered residuum of plutonic igneous rocks, mainly granodiorite and quartz diorite. The climate is humid tropical. The average annual precipitation ranges from 75 to 85 inches and the mean annual temperature ranges from 77 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Lirios and Jagueyes series and the Limones, Pandura, Pellejas, and Tejas series. The Lirios soils occupy steeper slopes, are shallower to the saprolite and have thinner argillic horizons. The Jagueyes soils occupy similar positions but have coarser textured profiles. The Limones soils occupy similar positions but have upper argillic horizons higher in organic matter. The Padura, Pellejas, and Tejas soils are shallower to the granitic rocks.

DRAINAGE AND PERMEABILITY: Well drained, medium to rapid runoff, moderate permeability.

USE AND VEGETATION: Native grasses and shrubs. Used for pasture and for minor crops.

DISTRIBUTION AND EXTENT: Humid granitic uplands of Puerto Rico. The series is of small extent, with about 4,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Este SCD, Puerto Rico; 1969.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Orthoxic Tropudults to Clayey, mixed, isohyperthermic Typic Hapludults. The previous OSED date was 7/85.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 7 inches (Ap horizon)

Argillic horizon - zone from 7 to 40 inches (Bt horizons)

ADDITIONAL DATA: Laboratory data are available for typical pedon S63PR-12-6

**National Cooperative Soil Survey
U.S.A.**

LOCATION ISLOTE PR

**Established Series
Rev. BCD
06/2002**

ISLOTE SERIES

The Islote series consists of moderately deep, well drained, moderately permeable soils formed in fine textured sediments overlying calcareous sandstone. They are gently sloping and sloping soils on terraces and low hills in the coastal plain. Slopes range from 2 to 12 percent. The mean annual precipitation is about 60 inches and the mean annual temperature is about 78 degrees F.

TAXONOMIC CLASS: Fine, mixed, semiactive, isohyperthermic Typic Rhodudults

TYPICAL PEDON: Islote sandy clay loam - native pasture. (Colors are for moist soil.)

Ap--0 to 8 inches; dark brown (7.5YR 3/2) sandy clay loam; moderate fine granular structure; friable, nonsticky, slightly plastic; many fine roots; medium acid; clear smooth boundary. (6 to 10 inches thick)

Bt1--8 to 12 inches; dark brown (7.5YR 3/2) 60 percent and dark red (2.5YR 3/6) 40 percent, clay; weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few faint clay films; common fine white specks; slightly acid; clear smooth boundary. (3 to 7 inches thick)

Bt2--12 to 18 inches; dark red (2.5YR 3/6) clay; moderate medium and coarse subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; many white specks; neutral; gradual smooth boundary. (6 to 9 inches thick)

Bt3--18 to 24 inches; dark red (2.5YR 3/6) clay; moderate coarse subangular blocky structure; firm, slightly sticky, plastic; common distinct clay films; few black stains; many white specks; neutral; clear smooth boundary. (6 to 9 inches thick)

Bt4--24 to 30 inches; dark red (2.5YR 3/6) clay; weak medium subangular blocky structure; firm, slightly sticky, plastic;

few faint clay films; many white specks, common fine sand grains, neutral. (6 to 8 inches thick)

C--30 plus inches; partially cemented calcareous sandstone that can be penetrated with the spade.

TYPE LOCATION: Atlantico SCD, Puerto Rico; 6 meters west of dirt road, 33 meters south of kilometer marker 7.35 on Highway 681.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the partially cemented calcareous sandstone varies from 27 to 43 inches. Thickness of the argillic horizon ranges from 21 to 33 inches. Clay films in the argillic horizon are thin patchy or discontinuous. The mean annual soil temperature ranges from 75 to 77 degrees F.

The A horizon has hues of 7.5YR or 5YR, values of 3 or 4, and chroma of 2 to 6. It is clay or sandy clay. Structure is weak or moderate, fine or medium subangular blocky.

The Bt horizons have hues of 2.5YR to 10R, values of 3 or 4, and chroma of 4 to 6. Structure is weak or moderate, medium or coarse subangular blocky. Reaction is neutral to mildly alkaline.

The C horizon is calcareous sandstone that can be penetrated with the spade. In places, it is borderline to a Cr horizon.

COMPETING SERIES: There are no other known series in the same family. The Fajardo, Juncal, San Sebastian, Rio Arriba, Rio Lajas, Tanama and Via soils are similar soils in related families. The Fajardo and Rio Arriba soils have shrink-swell behavior and lack the cemented calcareous sandstone. The Juncal soils have thicker argillic horizons and are yellower. The San Sebastain soils have coarse fragments and calcareous throughout. The Rio Lajas soils are sandy throughout. The Tanama soils are shallow to hard calcareous limestone. The Via soils are acid and coarse textured throughout.

GEOGRAPHIC SETTING: The Islote soils are gently sloping soils in terraces and low hills in the coastal plains with slope gradient of 2 to 12 percent. They are formed in fine textured materials derived from calcareous sandstone. The climate is humid tropical. The average annual precipitation ranges from 55 to 65 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Caracoles and San German series. The Caracoles soils are very shallow to similar calcareous sandstone. The San German soils lack argillic horizons and are very shallow to hard

limestone rock.

DRAINAGE AND PERMEABILITY: Well drained, medium to slow runoff; moderate permeability.

USE AND VEGETATION: Sugarcane, food crops and pasture.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Typic Tropudalfs to Fine, mixed, isohyperthermic Mollic Hapludalfs. The previous OSED date was 11/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon with mollic feature - zone from 0 to 8 inches (Ap horizon)

Argillic horizon - zone from 8 to 30 inches (Bt horizons)

Calcareous sandstone feature - zone from 30 plus inches (C horizon)

**National Cooperative Soil Survey
U.S.A.**

LOCATION JAREALES PR

**Established Series
Rev. GA
08/2000**

JAREALES SERIES

The Jareales series consists of deep, poorly drained soils formed in fine textured sediments of mixed origin over decomposed organic materials. They are nearly level soils in the coastal lowlands. These soils have clayey, mottled A horizons and gleyed, plastic clay B horizons over decomposed organic materials.

TAXONOMIC CLASS: Fine, mixed, superactive, nonacid, isohyperthermic Thapto-Histic Fluvaquents

**TYPICAL PEDON: Jareales clay - Sugarcane.
(Colors are for moist soil.)**

Ap--0 to 6 inches; very dark gray (10YR 3/1) clay, with few fine faint dark brown (7.5YR 4/4) mottles, weak medium subangular blocky structure, parting to moderate medium granular; firm, slightly sticky, plastic, many fine roots; neutral; clear smooth boundary. (4 to 8 inches thick)

B1--6 to 13 inches; black (10YR 2/1) clay, with yellowish red (5YR 4/8) in root channels and few fine faint yellowish brown (10YR 5/5) mottles; moderate medium and coarse subangular blocky structure with few pressure faces; firm, slightly sticky, plastic; common fine roots neutral; gradual wavy boundary. (6 to 8 inches thick)

B21g--13 to 20 inches; very dark gray (10YR 3/1) clay with yellowish red (5YR 4/8) in root channels and many medium olive (5Y 5/3) and few fine prominent greenish gray (5GY 5/1) mottles, weak fine and medium subangular blocky structure with few pressure faces; firm, slightly sticky, plastic; few fine roots; neutral; gradual wavy boundary. (5 to 9 inches thick)

B22g--20 to 28 inches; olive gray (5Y 5/2) clay and strong brown (7.5YR 5/5) with few fine faint greenish gray (5GY 5/1) mottles; weak coarse subangular blocky structure; firm, slightly sticky, plastic; decayed roots; neutral; abrupt smooth boundary. (6 to 10 inches thick)

Oa1--28 to 60 inches; black (N 2/0) broken face and rubbed colors; less than 5 percent fiber massive; friable, slightly sticky, slightly plastic; low mineral content; slightly acid.

TYPE LOCATION: Atlantico SCD, Puerto Rico, 1,150 meters north of kilometer marker 2.4 on Highway 682.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the organic horizon varies from 21 to 35 inches. Texture of solum is clay. Consistence of solum is slightly sticky or sticky and plastic. Reaction of the solum is slightly to mildly alkaline. The mean annual soil temperature is 76 degrees F.

The A horizon has hues of 10YR, values of 2 and 3, and chromas of 1 or 2. Dark brown and yellowish mottles are usually present. Structure is weak fine or medium subangular blocky which may part to granular.

The B1 horizon has hues of 10YR, values of 2 and 3, and chromas of 1 or 2. High chroma mottles may be present.

The gley B2 horizons have hues of 10YR to 5Y, values of 2 to 5, and chromas of 1 or 2. Structure is weak fine to coarse subangular blocky. Pressure faces may or may not be present.

The organic layer consists of black, highly decomposed materials with less than 5 percent fiber.

COMPETING SERIES: This is the Reparada series in the same family. The Bajura, Coloso, Corcega, Fortuna, Igualdad, Maunabo, Perchas, Pinones, Santoni, Talante and Vayas series are similar soils in related family. The Reparada soils have an ustic moisture regime. All of these soils, except, Pinones lack underlying organic layers. The Pinones soils are acid throughout the profile.

GEOGRAPHIC SETTING: The Jareales soils are nearly level soils in the coastal lowlands with slope gradients of 0 to 2 percent. They formed in clay sediments of mixed origin overlying decomposed organic materials. The climate is humid. The average annual precipitation ranges from 60 to 70 inches. The mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bajura, Coloso, and Vigia series. The Vigia soils have organic surface layers over mineral layers.

DRAINAGE AND PERMEABILITY: Poorly drained, runoff slow, permeability is very slow.

USE AND VEGETATION: Sugarcane and pasture. These soils are used for sugarcane when drained.

DISTRIBUTION AND EXTENT: Northern coastal areas of Puerto Rico. The series is of minor extent with about 1,850 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Arecibo Soil Survey Area, Puerto Rico; 1980. National Cooperative Soil Survey
U. S. A.

LOCATION JOBOS PR

**Established Series
Rev. REG:LHR
06/2002**

JOBOS SERIES

The Jobos series consists of deep, moderately well drained soils formed in coastal plain clays overlain by sandy sediments. They are gently sloping and sloping soils in the coastal plain. These soils are sandy loam, nonplastic in the A horizon and have clay, plastic thick B horizon with plinthite.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Plinthaquic Paleudults

**TYPICAL PEDON: Jobos sandy loam - native pasture.
(Colors are for moist soil.)**

Ap--0 to 10 inches; dark grayish brown (10YR 4/2) moist and light brownish gray (10YR 6/2) dry, sandy loam; weak medium subangular blocky structure to single grain; loose, nonsticky, nonplastic; few fine roots; few fine subrounded black concretions; strongly acid; abrupt smooth boundary. (6 to 19 inches thick)

B21t--10 to 16 inches; red (10YR 4/6) and strong brown (7.5YR 5/6) clay; strong coarse subangular blocky structure; very hard, very firm, slightly sticky, plastic; few fine roots follow cleavage planes; thick continuous dark brown clay films on ped surfaces; strongly acid; 10 to 25 percent by volume of nonindurated plinthite; gradual smooth boundary. (5 to 8 inches thick)

B22t--16 to 29 inches; red (10R 4/6) and strong brown (7.5YR 5/6) clay with few fine distinct light gray (10YR 7/1) mottles; moderate medium and coarse subangular blocky structure; very hard, very firm, slightly sticky, plastic; few fine roots; continuous brown clay films on vertical cleavage planes and patchy clay films on horizontal planes; few fine black concretions; strongly acid; 10 to 25 percent by volume of nodules of nonindurated plinthite; gradual wavy boundary. (12 to 16 inches thick)

B23t--29 to 34 inches; red (10R 4/6), yellowish brown (10YR 5/6) and light gray (10YR 7/2) clay; weak coarse subangular blocky structure; very hard, very firm, slightly sticky, plastic; very few roots; thin patchy clay films; strongly acid; less than

10 percent by volume of nonindurated plinthite; gradual smooth boundary. (4 to 8 inches thick)

B24t--34 to 54 inches; red (10R 4/6), yellowish brown (10YR 5/6) and light gray (10YR 7/2) clay; weak coarse subangular blocky structure; very hard, very firm, slightly sticky, plastic; very thin patchy clay films on ped faces; strongly acid; less than 6 percent by volume of nonindurated plinthite.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 5 miles west of the town of Isabela; 50 feet south of kilometer marker 9.1 on Highway 459.

RANGE IN CHARACTERISTICS: Thickness of the solum is over 60 inches. Thickness of the argillic horizon is over 50 inches. Content of plinthite in the B horizon varies from 6 to 30 percent. Clay films in the B horizon varies from thin patchy to thick continuous. Reaction ranges from strongly to extremely acid in the whole profile. The mean annual soil temperature is 75 degrees F.

The A horizon has hues of 10YR, values of 3 and 4, and chroma of 2 to 4. Texture is dominantly sandy loam. Structure is weak fine or medium granular or subangular blocky parting to single grain. Thickness of the A horizon is 6 to 19 inches.

The B2t horizons have red, strong brown, light gray, yellowish brown, and dark red colors in varying proportions in a reticulate pattern. Texture is clay. Structure varies from weak to strong and from medium to coarse subangular blocky. Consistence is slightly sticky or sticky and plastic.

COMPETING SERIES: There are no other known series in the same family. The Almirante, Cabo Rojo, Cidral, Espinosa, Guanajibo, Guerrero, Maleza, Sosa, Torres and Vega Alta series are similar soils in related families. The Almirante and Guanajibo soils lack the low chroma mottles. The Bejucos, Cidral, Espinosa and Maleza soils lack the nonindurated plinthite within 60 inches from the surface. The Cabo Rojo and Vega Alta soils have mixed mineralogy in the clay fraction. The Guerrero soils have thicker sandy surface layers. The Sosa soils have ustic moisture regimes. The Torres soils have higher organic matter content in the upper argillic horizons.

GEOGRAPHIC SETTING: The Jobos soils are gently sloping and sloping soils in the coastal plains on slope gradients of 2 to 12 percent. The texture is clay sediments overlain by sandy sediments. The climate is humid tropical. The average annual precipitation ranges from 67 to 70 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bejucos, Guerrero, Maleza, and Rio Lajas series. The Algarrobo, Arecibo, and Corozo soils have illuvial accumulation of organic matter. The Algarrobo, Arecibo,

Corrizales, Corozo soils are sandy throughout.

DRAINAGE AND PERMEABILITY: Moderately well drained, runoff is slow and permeability is rapid in the A horizons and slow in the B2t horizons.

USE AND VEGETATION: Coconuts, food crops and pasture.

DISTRIBUTION AND EXTENT: Humid coastal plains of northern Puerto Rico. The series is of moderate extent with about 6,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Noroeste SCD, Puerto Rico; 1972.

**National Cooperative Soil Survey
U. S. A.**

LOCATION JUNCAL PR

**Established Series
Rev. BCD
08/2000**

JUNCAL SERIES

The Juncal series consists of very deep, moderately well drained, moderately permeable soils on foot slopes and low rounded hill sides of uplands. They formed in limestone residuum. Slopes range from 5 to 20 percent. The mean annual precipitation is about 90 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Fine, mixed, active, isohyperthermic Typic Hapludalfs

TYPICAL PEDON: Juncal clay - Brush. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; dark grayish brown (10YR 4/2) clay; weak coarse subangular block structure; firm, slightly sticky, plastic; many fine roots; medium acid; clear wavy boundary. (6 to 10 inches thick)

Bt1--8 to 14 inches; dark yellowish brown (10YR 4/4) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; few faint clay films; common fine roots; mildly alkaline; clear wavy boundary. (4 to 6 inches thick)

Bt2--14 to 20 inches; yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; common distinct clay films; few fine roots; mildly alkaline; clear wavy boundary. (6 to 8 inches thick)

Bt3--20 to 33 inches; brownish yellow (10 YR 6/6) clay; common fine distinct yellowish red (5YR 5/8) mottles; moderate medium and fine subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; few black stains; mildly alkaline; clear wavy boundary. (8 to 14 inches thick)

Bt4--33 to 43 inches; brownish yellow (10YR 6/6) clay; common fine prominent red (2.5YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm, slightly sticky, plastic; few faint clay films; few fine roots; few black concretions; few black stains; neutrals; clear wavy boundary. 8 to 12 inches thick)

Bt5--43 to 49 inches; yellowish brown (10YR 5/6) clay; few fine prominent light greenish gray (5G 7/1) and few fine prominent red (2.5YR 5/6) mottles; moderate fine subangular blocky structure; firm, slightly sticky; few faint clay films; very few roots; few black stains; moderately alkaline; clear wavy boundary. (4 to 10 inches thick)

C--49 to 66 inches; brownish yellow (10YR 6/8) silty clay loam, many fine faint light gray (10YR 7/2) mottles; crushed color, yellow (10YR 7/8); massive; friable, slightly sticky, plastic; fine lime is from 25 to 35 percent of the horizons; strong effervescence.

TYPE LOCATION: Culebrinas SCD, Puerto Rico, 3 miles north of the town of San Sebastian; 2.4 kilometers on Highway 447 from junction of Highways 447 and 119; and 220 meters south on paved unnumbered road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 36 inches to 60 inches. These soils are slightly sticky and plastic throughout.

The A horizon is in hues of 7.5YR or 10YR, in values of 4, and in chromas from 2 or 3. The A horizon is medium or slightly acid.

The Bt horizons have colors in hues of 7.5YR or 10YR, in values of 4 or 5, and chromas from 4, 6, or 8. Clay is the dominant texture in the solum and coarser in the C horizon. Structure ranges from moderate fine to medium subangular blocky. Reaction is mildly or moderately alkaline.

The C horizon is calcareous and effervescence ranges from slight to strong. Base saturation (by sum of cations) is more than 60 percent at 50 inches below the top of the argillic horizon.

COMPETING SERIES: These are the Machete, Rio Arriba, San Sebastian, and Tanama series. The Machete soils are redder, having hues of 5YR throughout their profiles. The Rio Arriba soils have cracks at some period during most years and clays with COLE values that exceed 0.09. The San Sebastian soils have more than 35 percent coarse fragments in their profiles and are calcareous throughout. The Tanama soils have hard rock within 20 inches of the soil surface.

GEOGRAPHIC SETTING: The Juncal series occur on footslopes and low rounded hills. Slope gradients range from 5 to 20 percent. The soil formed in fine textured residuum of limestone rocks. The climate is humid tropical. The average annual precipitation is 90 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Colinas series. The Colinas soils are darker, shallower, and lack a well developed B horizon.

DRAINAGE AND PERMEABILITY: Moderately well drained; medium runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is planted to sugar cane.

DISTRIBUTION AND EXTENT: Humid northern uplands of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: San Juan Area, Puerto Rico; 1974

REMARKS: The classification was updated with the 4/91 draft from Fine, mixed, isohyperthermic Typic Tropudalfs to Fine, mixed, isohyperthermic Typic Hapludalfs. The previous OSED date was 3/91. This soil was formerly included in the Colinas series.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 8 inches (Ap horizon)

Argillic horizon - zone from 8 to 49 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION LIRIOS PR

**Established Series
Rev. BCD
08/2000**

LIRIOS SERIES

The Lirios series consists of very deep, well drained, moderately permeable soils formed in materials weathered from Plutonic age. They are steep to very steep soils on side slopes and ridgetops of strongly dissected uplands. Slopes range from 3 to 60 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 78 degrees F.

TAXONOMIC CLASS: Fine, mixed, subactive, isohyperthermic Typic Hapludults

TYPICAL PEDON: Lirios silty clay loam - cultivated. (Colors are for moist soil.)

Ap--0 to 4 inches; dark brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable, nonsticky, slightly plastic; many fine roots; many fine quartz crystals; common fine dark concretions; very strongly acid; abrupt smooth boundary. (4 to 8 inches thick)

Bt1--4 to 14 inches; red (2.5YR 4/8) clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; few faint clay films on surfaces of peds and root channels; common fine quartz crystals; few fine white flakes; very strongly acid; gradual smooth boundary. (8 to 12 inches thick)

Bt2--14 to 23 inches; red (10R 4/6) silty clay with common fine distinct reddish yellow (5YR 6/6) mottles; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few faint clay films on surfaces of peds; common fine quartz crystals; many fine shiny white flakes; very strongly acid; gradual smooth boundary. (8 to 14 inches thick)

C--23 to 60 inches; variegated colors; red (10R 4/6), strong brown (7.5YR 5/8), reddish brown (5Y 4/3), pink (5YR 7/3); silty clay loam; massive; friable, nonsticky, slightly plastic; many fine quartz crystals; many fine shiny flakes; very strongly acid. This horizon consists of saprolite.

TYPE LOCATION: Este SCD, Puerto Rico, Barrio Guayabota, Municipality of Yabucoa; 150 feet south of kilometer marker 11.9 on Highway 181. Photo GS-LR 9-25.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 34 inches. Thickness of the argillic horizon varies from 16 to 26 inches. They are strongly or very strongly acid throughout. Quartz crystals vary from none to many. Base saturation by sum of cation ranges from 10 to 18 percent. Organic carbon content in the upper 6 inches of the argillic horizon varies from 0.6 to 0.9 percent. The mean annual soil temperature ranges from 76 to 78 degrees F. The A horizon has hue of 5YR to 10YR, value of 4 and chroma of 3 or 4. Texture is silty clay loam or clay loam and is nonsticky and slightly plastic.

The Bt horizon has hue of 5YR to 10R, value of 4 or 5, and chroma of 6 and higher. It is clay or silty clay and consistence is slightly sticky and slightly plastic, clay films vary from few faint to many prominent.

The BC horizon, where present, has hue of 2.5YR or 10R with reddish yellow, yellowish brown or brownish yellow mottles.

The C horizons are silty clay loam, loam, or silt loam.

COMPETING SERIES: There are no other known series in the same family. The Consumo, Consojo, Corozal, Corozo, Ingenio, Jagueyes, Maricao, Moca, Patillas and Rio Piedras series are similar soils in related families. The Consumo, Maricao and Patillas soils have argillic horizons thinner than 16 inches. The Consejo soils are yellower and finer textured throughout. The Corozal soils are wetter and have low chroma mottles in the upper B horizons. The Corozo soils have sandy surface layers. The Ingenio and Jagueyes soils have lower CEC values, less than 24 meq/100 grams of clay.

GEOGRAPHIC SETTING: The Lirios soils are gently sloping to very steep soils on side slopes and narrow ridgetops. Slope ranges from 3 to 60 percent. The soil formed in fine over mucky-fine textured, very highly weathered residuum weathered from plutonic rocks, mainly granodiorite or quartz diorite. The climate is humid tropical. The average annual precipitation ranges from 70 to 90 inches and the mean annual temperature ranges from 76 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Ingenio soils in addition to the Pandura and Pellejas soils. The Pandura soils occur in similar positions but are shallow to less weathered plutonic rock. The Pellejas soils are thinner, coarser textured and lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate permeability.

USE AND VEGETATION: Original vegetation consists of native grasses and shrubs. The soils are used for pasture and food crops.

DISTRIBUTION AND EXTENT: Plutonic uplands. The series is of minor extent, about 28,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Humacao Area, Puerto Rico; 1968.

REMARKS: The classification was updated with the 4/91 draft from Clayey over loamy, mixed, isohyperthermic Typic Tropudults to Clayey, mixed, isohyperthermic Typic Hapludults. The previous OSED date was 7/85.

The diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 4 inches (Ap horizon)
Argillic horizon - zone from 4 to 23 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION LOS GUINEOS PR

**Established Series
BCD-HRM. Rev. GRB
07/2001**

LOS GUINEOS SERIES

The Los Guineos series consists of very deep, well drained soils on side slopes of mountains. They formed in residuum from sandstone material. The mean annual precipitation is about 120 inches and the mean annual temperature is about 68 degrees F. Slopes range from 5 to 60 percent.

TAXONOMIC CLASS: Very-fine, kaolinitic, isothermic Humic Hapludox

TYPICAL PEDON: Los Guineos clay - forest. (Colors are for moist conditions.)

A--0 to 1 inch; dark yellowish brown (10YR 4/4) clay; moderate medium granular structure parting to moderate fine granular; firm; sticky, plastic; common very fine roots, many fine roots; few fine discontinuous tubular pores; many faint organic coats on vertical and horizontal faces of peds; extremely acid; clear smooth boundary. (1 to 5 inches thick).

Bt1--1 to 3 inches; yellowish brown (10YR 5/4) clay; moderate fine subangular blocky structure; firm; very sticky, very plastic; very few coarse, common fine and medium roots throughout; common very fine discontinuous tubular pores; few faint clay films on vertical and horizontal faces of peds; few worm casts; extremely acid; clear smooth boundary.

Bt2--3 to 9 inches; yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure parting to moderate coarse subangular blocky; firm; very sticky, very plastic; common fine and medium roots; common fine and medium discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; extremely acid; clear smooth boundary.

Bt3--9 to 18 inches; brownish yellow (10YR 6/6) clay; moderate coarse subangular blocky structure; firm; very sticky, very plastic; common fine and medium roots; few fine discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; common fine distinct red (2.5YR 4/6) masses of iron accumulation; extremely acid; clear wavy boundary.

Bt4--18 to 31 inches; red (2.5YR 4/6) clay; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; very sticky, very plastic; few fine roots; few medium discontinuous tubular pores; many distinct clay films on vertical and horizontal faces of peds; few worm casts; many coarse distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; gradual smooth boundary. (Combined thickness of the Bt horizons range from 25 to 50 inches)

Bw1--31 to 43 inches; red (2.5YR 4/6) clay; weak coarse subangular blocky structure; firm; very sticky; very plastic; few fine roots; few medium discontinuous tubular pores; common distinct films on vertical faces of peds; common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; gradual smooth boundary.

Bw2--43 to 61 inches; strong brown (7.5YR 5/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few fine roots; few medium discontinuous tubular pores; common faint films on vertical faces of peds; many medium distinct yellowish red (5YR 4/6) and few medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Bw3--61 to 74 inches; strong brown (7.5YR 5/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few medium discontinuous tubular pores; common distinct coatings in root channels and/or pores; about 10 percent, by volume, saprolite; many medium distinct yellowish red (5YR 4/6) masses of iron accumulation; very strongly acid; gradual smooth boundary.

Bw4--74 to 93 inches; yellowish red (5YR 4/6) clay; weak very coarse subangular blocky structure; firm; sticky, plastic; few medium discontinuous tubular pores; about 10 percent, by volume, saprolite; very strongly acid. (Thickness of the Bw horizon is 50 to 80 inches).

TYPE LOCATION: Rio Grande Municipio, Noreste SWCD; Caribbean National Forest, Puerto Rico. Approximately 150 feet southwest of bridge on Road 911. El Yunque topographic quadrangle; lat. 18 degrees 18 minutes 47 seconds N.; long. 65 degrees 49 minutes 27 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness and depth to bedrock is more than 80 inches. Rock fragments range from 0 to 10 percent, by volume, throughout the profile. Reaction ranges from extremely acid to strongly acid throughout the profile. The lower depth of the Oxic horizon is above 50 inches. Stones and cobbles range from 0 to 15 percent on the surface.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is clay loam or clay.

The Bt horizon has hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is clay loam or clay.

The Bo horizon, where present, has hue of 2.5YR to 10YR, value of 4 or 5 and chroma of 6 or 8. Texture is clay.

The Bw horizon has hue of 2.5YR to 7.5YR, value of 4 to 6 and chroma of 6 to 8. Texture is clay (using either 2.5 or 3 times the 15 bar water). Because of poor dispersion, the measured clay content ranges from 15 to 45 percent. Saprolite ranges from 0 to 20 percent, by volume, in the lower part.

COMPETING SERIES: There are no competing series in the same family.

GEOGRAPHIC SETTING: These soils are mountain sides or deeply dissected plateaus of uplands. They formed in residuum from sandstone material. The climate is humid tropical. Slopes range from 5 to 60 percent. The annual precipitation ranges from 100 to 140 inches and the average annual temperature ranges from 65 to 72 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Moteado, Yunque, and Zarzal soils. The poorly drained Moteado soils are deep to bedrock. The moderately well drained Yunque soils have less clay in the control section. The moderately well drained Zarzal soils have a kaolinitic control section.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Watershed protection, recreation, research, and wildlife habitat. Most of the areas are now forested.

DISTRIBUTION AND EXTENT: Upland areas of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1936.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 1 inch (A horizon).

Oxic horizon - zone from 1 to 31 inches (Bt horizons).

Cambic horizon - zone from 31 to 93 inches (Bw horizons).

LABORATORY DATA: Characterization data - Caribbean National Forest, Puerto Rico. Pedon No. 86P303 and Soil Survey No. S86PR-3-10. Sample by NSSL, Lincoln NE., February, 1986.

MLRA: 270.

**National Cooperative Soil Survey
U.S.A.**

LOCATION MARAGUEZ PR

**Established Series
Rev. REG: LHR
08/2000**

MARAGUEZ SERIES

The Maraguez series is well drained, moderately permeable soils formed in loamy materials weathered from volcanic rocks. They are steep and very steep soils on side slopes and ridges of the humid uplands. These soils are silty clay loam slightly acid in the A horizon; clay loam slightly acid in the cambic horizon and loam or silt loam in the C horizon.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Typic Eutrudepts

**TYPICAL PEDON: Maraguez silty clay loam - shade grown coffee.
(Colors are for moist soils.)**

Ap--0 to 6 inches; dark brown (10YR 3/3) silty clay loam; moderate fine and medium granular structure; firm, slightly sticky, slightly plastic; many fine and medium roots; few wormholes; fine and medium gravel 5 percent from 1/2 to 1 inch in diameter; slightly acid; clear wavy boundary. (5 to 7 inches thick)

B2--6 to 12 inches; brown (10YR 4/3) 60 percent and dark brown (10YR 3/3) 40 percent, clay loam; weak fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; few fine and medium roots; few wormholes; fine volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; slightly acid; clear wavy boundary. (4 to 7 inches thick)

B3--12 to 21 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; fine subangular volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; common fine quartz grains; slightly acid; clear wavy boundary. (7 to 10 inches thick)

C--21 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable, slightly sticky, slightly plastic; few fine and medium roots; fine and medium volcanic fragments 5 to 10 percent from 1/2 to 1 inch in diameter; many fine quartz grains; medium acid.

TYPE LOCATION: Sur SCD, Puerto Rico, 50 feet east of kilometer marker 16.1 on Highway 139.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 16 to 24 inches. Depth to the semi-consolidated volcanic rock is over 60 inches. Consistence is slightly sticky and slightly plastic in the whole profile. Reaction is medium or slightly acid. Fine rock fragments range from 2 to 10 percent throughout. Organic carbon decreases regularly with depth. The mean annual soil temperature is 76 degrees F.

The A horizon has hue of 10YR, values of 3 or 4, and chroma of 2 and 3. Texture is silty clay loam. Structure is weak or moderate, fine or medium granular.

The B2 horizons have matrix colors in hues of 10YR, values of 4 or 5, and chroma of 3 and 4. Texture of the B2 horizon is clay loam, silty clay loam, or loam. Texture of the B3 horizon is loam or silt loam. Structure of the B horizons is weak fine or medium subangular blocky.

The C horizon is loam or silt loam.

COMPETING SERIES: This is the Morado series in the same family. The Caguabo, Juncos, Junquitos, Mabi, Malaya, Maresua, Montegrande, Mucara, Pandura, Plata and Quebrada series are similar soils in related families. The Marado soils are pinkish and are shallower to the semi-consolidated rock. The Caguabo and Malaya soils are shallower to the volcanic rock. The Juncos, Mabi, Montegrande and Mucara soils all have finer textured and have higher COLE values. The Junquitos soils have finer texture and low chroma mottles. The Maresua soils have finer texture and are gravelly throughout. The Pandura are coarser textured and shallow to the weathered rock. The Plata soils have more than 35 percent by volume of gravel. The Quebrada soils are finer texture throughout.

GEOGRAPHIC SETTING: The Maraguez soils are steep and very steep soils on side slopes and ridges of strongly dissected volcanic uplands with slope gradients of 20 to 60 percent. The soil formed in moderately medium textured residuum weathered from basic volcanic rocks. The climate is humid tropical. The average annual precipitation ranges from 60 to 70 inches and the mean annual temperature ranges from 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Morado, Mucara, Quebrada, and Caguabo soils. The Caguabo soils are underlain by hard rock at 20 inches or less.

DRAINAGE AND PERMEABILITY: Well drained; very rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in native pasture and shade grown coffee.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent with about 13,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

**National Cooperative Soil Survey
U. S. A.**

LOCATION MARICAO PR

**Established Series
Rev. BCD
06/2002**

MARICAO SERIES

The Maricao series consists of very deep, well drained, moderately permeable soils formed in material weathered from volcanic rocks. They are steep and very steep soils on strongly dissected uplands. Slopes range from 20 to 60 percent. The mean annual precipitation is about 110 inches and the mean annual temperature is about 72 degrees F.

TAXONOMIC CLASS: Fine, mixed, subactive, isohyperthermic Inceptic Hapludults

TYPICAL PEDON: Maricao clay -- native pasture. (Colors are for moist soil.)

Ap--0 to 5 inches; reddish brown (5YR 4/4) clay, some mixture of red (2.5YR 5/8) from underlying horizon; weak fine and medium subangular blocky parting to moderate medium granular structure; firm, slightly sticky, plastic; many fine roots; few worm channels; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bt--5 to 14 inches, red (2.5YR 5/8) clay, coatings of light red (2.5YR 6/8) and yellowish red (5YR 5/8); weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few faint clay films; 10 percent of horizon is saprolite; 2 percent firm weathered rock fragments; very strongly acid; clear wavy boundary. (6 to 9 inches thick)

BC--14 to 20 inches; red (2.5YR 5/8) clay, and mixed colors from the saprolite; weak fine subangular blocky structure; friable, slightly sticky, plastic; few fine roots; 40 percent of horizon is saprolite; very strongly acid; clear wavy boundary. (5 to 12 inches thick)

C--20 to 60 inches; crushed color red (2.5YR 5/8) silty clay loam, variegated colors of saprolite; massive, saprolite; friable, nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: Oeste SCD, Puerto Rico; 7.0 miles southeast of the town of Maricao; 2.3 kilometers on dirt road south of kilometer marker 44.5 of Highway 105; 25 meters west of dirt road.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 15 to 25 inches. Thickness of the argillic horizon ranges from 6 to 16 inches. Depth to semi-consolidated tuffs, mudstone or lava is more than 5 feet. The soil is extremely acid or very strongly acid. The mean annual soil temperature ranges from 68 to 72 degrees F.

The A horizons have hues of 2.5YR or 5YR, values of 4 or 5, and chroma of 3 to 6. They are clay.

The Bt horizons have hues of 2.5YR or 5YR, values of 4 or 5, and chroma of 6 or 8. They are clay. Structure is weak fine or medium subangular blocky. The Bt horizon has 5 to 20 percent saprolite and the BC horizon has 20 to 60 percent saprolite.

The C horizon has crushed hues of 2.5YR or 5YR, values of 4 to 6, and chroma of 4 to 8. They are silty clay or silty clay loam.

COMPETING SERIES: These are no other known series in the same family.

The Ciales, Consumo, Corozal, Ingenio, Moca, Patillas, and Vega Alta series and similar soils in related families. All of these soils except Ciales soils have isohyperthermic temperature regimes. Ciales soils have argillic horizons thicker than 16 inches and have gray mottles.

GEOGRAPHIC SETTING: The Maricao soils are steep and very steep soils on strongly dissected uplands at elevations above 550 meters, with slope gradients of 20 to 60 percent. The soils formed in highly weathered residuum from basic volcanic rocks. The climate is humid tropical with annual precipitation that ranges from 90 to 120 inches and mean annual temperature of 70 to 74 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Ciales series and the Cuchillas, Los Guineos, Picacho, and Yunque soils. Cuchillas soils have a cambic horizon. Los Guineos and Yunque soils have hue of 10YR and mottles in the upper part of the B horizon. Picacho soils have low chroma mottles in the argillic horizon.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Most of the acreage is in brushland or abandoned coffee plantations. Small acreage is used for growing native pasture, tame pasture, and coffee.

DISTRIBUTION AND EXTENT: Humid and high elevation areas of Puerto Rico. The series is of moderate extent with about 36,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, (Ponce Survey Area), 1971.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isothermic Dystropeptic Tropudults to Clayey, mixed, isothermic Ochreptic Hapludults with this draft. The previous OSED date was 5/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 5 inches (Ap horizon)

Argillic horizon - zone from 5 to 14 inches (Bt horizon)

Ochreptic feature - Bt horizon less than 10 inches thick.

National Cooperative Soil Survey
U.S.A.

LOCATION MATANZAS PR

**Established Series
Rev. BCD
06/2002**

MATANZAS SERIES

The Matanzas series consists of deep, well drained soils formed in sediments derived from limestone. They are nearly level and gently sloping soils on foot slopes and small valleys between limestone hills. Slopes range from 0 to 5 percent. The mean annual precipitation is about 64 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Clayey, kaolinitic, isohyperthermic Lithic Kandistox

TYPICAL PEDON: Matanzas clay--native pasture. (Colors are for moist soil.)

Ap--0 to 14 inches; dark reddish brown (2.5YR 3/4) clay; moderate coarse granular structure; firm, slightly sticky, slightly plastic; common fine roots; few sand-size black aggregates; neutral; gradual smooth boundary. (10 to 16 inches thick)

Bo1--14 to 27 inches; dusky red (10R 3/4) clay; weak medium subangular blocky structure parting to moderate fine granular; friable, slightly sticky, plastic; many medium pores; common fine roots; very fine granules in micro channels; neutral; gradual smooth boundary. (10 to 16 inches thick)

Bo2--27 to 44 inches; dark red (2.5YR 3/6) clay; weak coarse subangular blocky structure parting to moderate fine granular; friable, slightly sticky, plastic; many medium pores; common fine roots; very fine granules in micro channels; neutral; gradual smooth boundary. (10 to 16 inches thick)

R--44 to 46 inches; white hard limestone with fractures stained dark red.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 125 feet east of kilometer marker 125 of highway 2; on south side of highway.

RANGE IN CHARACTERISTICS: Solum thickness and depth to limestone bedrock ranges from 40 to 50 inches. The

soil ranges from medium acid to neutral. Base saturation of the oxic horizon ranges from 65 to 100 percent and cation retention ranges from 7.5 to 10 meg/100 g of clay. They are clay throughout with clay content ranging from 60 to 90 percent. The mean annual soil temperature ranges from 76 to 80 degrees F.

The A horizons have hues of 2.5YR and 5YR, value of 3, and chroma of 2 to 4.

The Bo horizons have hues of 10R and 2.5YR, values of 3 and 4, and chroma of 4 to 8. They have weak coarse to medium subangular blocky structure. They have slightly sticky and plastic consistence.

COMPETING SERIES: The Puhi series is in the same family. Puhi soils have less than 60 percent clay in the particle-size control section. The Bayamon, Catalina, Cotito, Coto, Delicias, Hanamaula, Lawai, Makapili, and Rosario series are similar soils in related families. Bayamon and Delicias soils have oxic horizons that extend to depths of more than 60 inches. Catalina, Coto, and Rosario soils have base saturation of less than 35 percent. Cotito soils have bedrock within a depth of 40 inches. Hanamaula, Lawai, and Makapili soils have umbric epipedons.

GEOGRAPHIC SETTING: The Matanzas soils are nearly level and gently sloping soils on foot slopes and small valleys between the limestone hills on slope gradients of 0 to 5 percent. The soils formed in fine textured sediments derived from limestone. Limestone outcrops are common in some areas. The climate is humid tropical. The average annual precipitation is 64 inches and the mean annual temperature 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bayamon, Cotito, and Coto series and the Aceitunas and Tanama series. The Aceitunas soils are more acid and deeper than 60 inches to the hard limestone. The Tanama soils are yellower, have stronger structure in the B horizons and are shallower than 20 inches to the limestone.

DRAINAGE AND PERMEABILITY: Well drained, slow runoff and moderate permeability.

USE AND VEGETATION: Mostly used for growing food crops but a small acreage is in tame grasses and native pasture.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. The series is of minor extent, about 3,200 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, oxidic, isohyperthermic Tropeptic Eutrorthox to Very-fine, kaolinitic, isohyperthermic Lithic Eustrustox. The previous OSED date was 5/75.

Diagnostic horizons and features recognized in this pedon:

Umbric epipedon - zone from 0 to 14 inches (Ap horizon)

Oxic horizon - zone from 14 to 44 inches (Bo horizons)

Lithic contact - zone at 44 inches (R layer)

ADDITIONAL DATA: Characterization data are available for the typical pedon S61PR6-2 and pedon S63PR7-1 both of which are published in SSIR No. 12.

**National Cooperative Soil Survey
U.S.A.**

LOCATION MOCA PR

**Established Series
Rev. BCD
07/2001**

MOCA SERIES

The Moca series consists of very, deep moderately well drained, moderately slowly permeable soils formed in clayey materials overlaying a basal conglomerate of clay, gravel and cobbles. They are sloping and steep soils on foot slopes and side slopes of low hills in the humid uplands. Slopes range from 5 to 40 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Very-fine, mixed, semiactive, isohyperthermic Vertic Paleudults

TYPICAL PEDON: Moca clay - sugarcane. (Colors are for moist soil.)

Ap--0 to 6 inches; brown (7.5YR 4/2) clay; weak medium subangular blocky structure; very hard, firm, slightly sticky, plastic; small amount of Bt mixed with this horizon; many fine roots; fine and medium volcanic rock fragments; extremely acid; clear smooth boundary. (4 to 8 inches thick)

Bt1--6 to 10 inches; red (7.5R 4/8) clay with common fine distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; very hard, firm, slightly sticky, plastic; common fine roots; few faint clay films; common krotovinas 2 mm in diameter; very strongly acid; clear smooth boundary. (4 to 7 inches thick)

Bt2--10 to 18 inches; red (7.5R 4/8) and brown (10YR 5/3) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; few fine roots; common distinct clay films; cracks to 20 inches; organic staining along root channels; few pressure faces and slickensides; very strongly acid; gradual smooth boundary. (7 to 12 inches thick)

Bt3--18 to 32 inches; grayish brown (10YR 5/2) with approximately 30 percent red (7.5R 4/8) clay; weak medium and coarse subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few faint clay films; organic staining along root channels; few pressure faces and slickensides; very strongly acid, abrupt smooth boundary. (12 to 16 inches thick)

C1--32 to 48 inches; light gray (2.5Y 7/2) clay with many medium distinct red (7.5R 4/8) mottles; massive; firm, slightly sticky, slightly plastic; very strongly acid; abrupt smooth boundary. (12 to 18 inches thick)

C2--48 to 64 inches; red (7.5R 4/8), light gray (2.5Y 7/2) and reddish yellow (7.5YR 6/8) clay; massive; firm slightly sticky and slightly plastic; very strongly acid; gradual smooth boundary. (12 to 18 inches thick)

C3--64 inches plus; stratified mottled red and gray clays with varying amount of gravel. Fracture plains in gray clay lenses appear as pressure faces or slickensides and are light gray (5Y 7/1).

TYPE LOCATION: Culebrinas SCD, Puerto Rico; 2.5 miles southeast of the town of Moca; 0.6 kilometer north and 50 feet east of junction of Highways 111 and 110.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 27 to 43 inches. Thickness of the argillic horizon varies from 23 to 35 inches. Texture is clay throughout the profile. Consistence in the solum is slightly sticky or sticky and plastic. Reaction ranges from strongly to extremely acid in the whole profile. Cracks occur throughout the B horizon. The mean annual soil temperature ranges from 75 to 80 degrees F.

The A horizon has hues of 5YR or 7.5YR, values of 3 or 4, and chroma of 2 to 4. Structure is weak, fine or medium subangular blocky. Rock fragments range from 0 to 10 percent.

The Bt horizons have red, brown, and grayish brown colors in varying proportions. Structure is weak or moderate, medium or coarse subangular blocky. Clay films range from few faint to many prominent. Pressure faces may occur in any portion of the argillic horizon. Slickensides may or may not be present.

The C horizons have gray colors with varying proportions of red and reddish yellow. Varying amounts of gravel may be present in this horizon.

COMPETING SERIES: There are no other known series in the same family. The Consejo, Consumo, Corozal, Corozo, Ingenio, Jagueyes, Lirios, Maricao, Patillas and Rio Piedras series are similar soils in related families. The Consejo, Lirios and Rio Piedras all lack horizons with COLE value of 0.09 or more. The Consumo and Maricao soils have thinner argillic horizons. The Corozal soils have low chroma mottles in the upper part of the argillic horizon. The Corozo soils have sandy surface layers. The Ingenio and Jagueyes soils have lower CEC values, less than 24 meq/100 grams of clay. The Patillas soils are coarser textured.

GEOGRAPHIC SETTING: The Moca soils are sloping to steep soils on foot slopes and side slopes of low hills on slope gradients of 5 to 40 percent. They formed in fine textured materials over clays, gravels, and cobbles geologically referred to as the San Sebastian Formation, a basal conglomerate. The climate is humid tropical. The average annual precipitation ranges from 70 to 90 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Voladora, Plata, and Perchas series. The Voladora soils are redder, have thinner B horizons, and friable, coarser textured C horizons. The Plata soils are browner, and lack argillic horizons. The Perchas soils have cambic horizons, are browner, and have low chroma mottles.

DRAINAGE AND PERMEABILITY: Moderately well drained, medium to rapid runoff and moderately slow permeability.

USE AND VEGETATION: Gentler slopes in sugarcane. Steeper slopes in native pasture.

DISTRIBUTION AND EXTENT: Humid uplands of northwestern Puerto Rico. The series is of minor extent with about 8,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Vertic Tropudults to Clayey, mixed, isohyperthermic Aquic Paleudults. Although this soil contains vertic features such as slickensides, there is no evidence of cracking to the surface or the base of the Ap horizon in the description. This needs to be tested. The previous OSED date was 11/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 6 inches

Argillic horizon - zone from 6 to 32 inches

Pale clay curve - Less than 20 percent clay cutback in Bt and C horizons.

Aquic feature - 2 chroma mottles in Bt3 horizon

**National Cooperative Soil Survey
U.S.A.**

LOCATION MORADO PR

**Established Series
Rev. REG: LHR
06/2002**

MORADO SERIES

The Morado series consists of moderately deep, well drained soils formed in materials weathered from volcanic rocks. They are moderately steep to very steep soils on side slopes and ridgetops of the dissected uplands. They are friable clay loam in the A and B horizons over loam saprolite of variegated colors. Semi-consolidated volcanic rock is at 33 inches.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Dystric Eutrudepts

**TYPICAL PEDON: Morado clay loam - pigeon peas.
(Colors are for moist soil.)**

Ap--0 to 7 inches; dark reddish gray (10YR 4/1) clay loam; weak fine subangular blocky structure; friable, slightly sticky, plastic; common fine roots; neutral; clear smooth boundary. (4 to 7 inches thick)

B2--7 to 17 inches; reddish gray (5YR 5/2) clay loam with few fine faint weak red (2.5YR 4/2), yellowish red (5YR 4/6) and reddish brown (5YR 4/3) mottles; weak fine subangular blocky structure breaking to weak fine granular; friable, slightly sticky, plastic; common fine roots; slightly acid; gradual wavy boundary. (6 to 11 inches thick)

B3--17 to 24 inches; variegated colors, brown, dark brown (7.5YR 4/2), dark reddish gray (5YR 4/2) and dark gray (5YR 4/1) clay loam; weak fine subangular blocky structure; friable, slightly sticky, plastic; few fine roots; slightly acid; clear wavy boundary. (6 to 12 inches thick)

C--24 to 33 inches; variegated colors; brown, dark brown (7.5YR 4/2), dark reddish gray (5YR 4/2) and dark gray (5YR 5/1) loam; massive; friable, slightly sticky, slightly plastic; slightly acid. (6 to 12 inches thick)

R--33 plus inches ; reddish gray, semi-consolidated volcanic rock.

TYPE LOCATION: Oeste SCD, Puerto Rico; 6.5 miles northwest of the city of Mayaguez; 500 meters on dirt road from kilometer marker 3.85 on Highway 406 and 100 feet north of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 16 to 30 inches. Depth to the semi-consolidated volcanic rock varies from 22 to 42 inches. These soils are slightly sticky and plastic or slightly plastic throughout. The mean annual soil temperature ranges from 74 to 76 degrees F.

The A horizon has hues of 5YR to 10R, values of 4 or 5, and chroma of 1 or 3. It is clay loam or silty clay loam. Consistence is slightly sticky and plastic or slightly plastic. Reaction is neutral or slightly acid.

The B2 horizon has hues of 5YR to 2.5YR, values of 4 or 5, and chromas of 2 to 4. Some pedons have weak red, yellowish red and reddish brown mottles. Texture varies from clay loam to silty clay loam. Structure of the B2 horizon when present has 40 to 50 percent saprolite. Reaction varies from medium acid to neutral.

The C horizon is loam or clay loam.

COMPETING SERIES: The Maraguez series is in the same family. The Maraguez soils are deeper in the semi-consolidated rock and have yellower colors in hue of 10YR. The Caguabo, Juncos, Junquitos, Mabi, Malaya, Maresua, Montegrande, Mucara, Pandura, Plata and Quebrada are the soils in similar families. Caguabo and Malaya soils are shallower to the volcanic rocks. The Juncos, Mabi, Montegrande, and Mucara soils are all finer textured and have higher COLE value. The Junquitos soils are finer textured and have low chroma mottles. The Maresua soils are finer textured and are gravelly throughout. The Pandura soils are coarser textured throughout. The Plata soils have more than 35 percent by volume of gravel. The Quebrada soils have finer soil texture throughout.

GEOGRAPHIC SETTING: The Morado soils are strongly sloping to very steep soils on side slopes and ridgetops of dissected uplands with slope gradients of 12 to 60 percent. The soil formed in moderately fine and medium textured residuum weathered from volcanic rocks. The climate is humid tropical. The average annual precipitation is 88 inches and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Caguabo, Maraguez, Mucara, and the Quebrada series. All of these soils occur in similar positions.

DRAINAGE AND PERMEABILITY: Well drained; rapid runoff; moderate permeability.

USE AND VEGETATION: Coffee, pasture and brush.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of moderate extent about 34,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

ADDITIONAL DATA: Characterization data are available of the typical pedon. S61PR-8-2.

**National Cooperative Soil Survey
U. S. A.**

LOCATION MUCARA PR

**Established Series
Rev. GRB
06/2002**

MUCARA SERIES

The Mucara series consists of moderately deep, well drained soils on side slopes of strongly dissected uplands. They formed in material that weathered from igneous rocks. Near the type location, the mean annual precipitation is about 78 inches and the mean annual temperature is about 76 degrees F. Slopes range from 15 to 70 percent.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Dystric Eutrudepts

TYPICAL PEDON: Mucara clay - pasture. (Colors are for moist soil)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay; weak medium granular structure; firm, slightly sticky, plastic; few fine black (10YR 2/1) concretions; many fine roots; moderately acid; clear smooth boundary. (4 to 8 inches thick)

Bw--6 to 12 inches; about 50 percent very dark grayish brown (10YR 3/2) and about 50 percent brown (10YR 5/3) clay; weak medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots along structural faces; few distinct pressure faces on surfaces of peds; slightly acid; abrupt irregular boundary. (6 to 12 inches thick)

C--12 to 22 inches; brown (10YR 4/3) loam; massive; friable; slightly sticky, slightly plastic; few fine roots; about 30 percent, by volume, saprolite; few distinct tongues of B material; neutral; gradual wavy boundary. (10 to 16 inches thick)

R--22+ inches; semi-consolidated igneous rock.

TYPE LOCATION: Suroeste SCD, Puerto Rico. Approximately 1.5 miles east of bridge of Highway 2 over the Rosario River and about 100 feet north of the highway.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 10 to 20 inches. Rock fragments range from 0 to 15 percent, by volume. Depth to semi-consolidated rock ranges from 20 to 40 inches. Reaction ranges from moderately acid to

neutral in the A and Bw horizons and slightly acid or neutral in the C horizon.

The A horizon has hue of 5YR to 2.5Y, value of 2 to 5, and chroma of 2 to 4. Texture is silty clay loam, silty clay, or clay.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 2 to 6. Texture is clay loam, silty clay, or clay.

The BC horizon, where present, has colors and textures similar to the Bw horizon.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4; or there is no dominant color and is multicolored in shades of brown, yellow, and gray. Texture is loam or clay loam.

The R layer is semi-consolidated igneous rock.

COMPETING SERIES: There no competing series in the same family.

GEOGRAPHIC SETTING: Mucara soils are on side slopes of strongly dissected uplands. They formed in fine-textured residuum weathered from basic igneous rock. The climate is humid tropical. Slopes range from 15 to 70 percent. The average annual precipitation ranges from 75 to 80 inches and the average annual temperature ranges from 75 to 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Caguabo, Maraguez, Morado, and Quebrada series. These soils are on similar landscape positions. In addition, Caguabo soils are shallow to bedrock, Maraguez soils are very deep and have less clay in the subsoil, Morado soils have less clay in the subsoil, and Quebrada soils are very deep and have mixed mineralogy in the control section.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Many areas of Mucara soils are used for growing sugarcane, food crops, coffee, and pastureland. Some areas are in woodland. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of major extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - the zone from 0 to 6 inches (Ap horizon).

Cambic horizon - the zone from 6 to 12 inches (Bw horizon).

MLRA: 270.

**National Cooperative Soil Survey
U.S.A.**

LOCATION NARANJO PR

**Established Series
Rev. REG:LHR
07/2001**

NARANJO SERIES

The Naranjo series consists of deep, well drained soils formed in materials weathered from limestone. They are sloping to very steep soils on side slopes, foot slopes, and hilltops of the humid uplands. These soils are very dark grayish brown clay, calcareous in the A horizon, lighter colored, calcareous B and C horizons.

TAXONOMIC CLASS: Fine, carbonatic, isohyperthermic Inceptic Haprendolls

**TYPICAL PEDON: Naranjo clay-native pasture.
(Colors are for moist soil.)**

Ap--0 to 9 inches; very dark grayish brown (10YR 3/2) clay; weak fine granular structure; firm, slightly sticky; plastic; many fine roots; volcanic fragments 1/2 to 1 inch in diameter; common fine shell fragments; fine and medium limestone fragments; strong effervescence; abrupt smooth boundary. (8 to 12 inches thick)

B2--9 to 17 inches; brownish yellow (10YR 6/6) clay; weak fine subangular blocky structure; firm, slightly sticky, plastic; common fine roots; fine shell fragments; fine and medium limestone fragments, 5 to 10 percent from 1/2 to 1 inch in diameter; strong effervescence; clear smooth boundary. (6 to 10 inches thick)

B3--17 to 25 inches; yellow (10YR 7/6) clay; weak fine subangular blocky structure; friable, slightly sticky, plastic; common fine roots; common lime splotches; fine and medium limestone fragments, 5 to 10 percent from 1/2 to 1 inch in diameter; strong effervescence; gradual smooth boundary. (6 to 10 inches thick)

C1--25 to 36 inches; yellow (10YR 7/6) clay; with common medium prominent light gray (7.5YR 7/0) and few fine faint brownish yellow (10YR 6/6) mottles; massive; firm, sticky, plastic; few fine roots; common lime splotches; fine and medium limestone fragments 5 to 10 percent from 1/2 to 1 inch in diameter; violent effervescence; gradual wavy boundary. (8 to 12 inches thick)

C2--36 to 60 inches; mixed colors, yellow (10YR 7/6) brownish yellow (10YR 6/6) and light gray (7.5YR 7/0), crushed color, yellow (10YR 7/8) clay; massive; firm, slightly sticky, plastic; many lime splotches; violent effervescence.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 1.5 miles southeast of the town of Aguadilla; 100 meters south of kilometer marker 1.2 on Highway 111.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 18 to 30 inches. Depth to the soft limestone is over 60 inches. Texture is clay in the whole profile. Consistence is slightly sticky or sticky and plastic. Gravel fragments range from 0 to 10 percent. These soils are calcareous throughout and effervescence increases with depth. Pressure faces may or may not be present. The mean annual soil temperature ranges from 74 to 76 degrees F.

The A horizon has hues of 10YR to 2.5Y, and values and chromas of 2 or 3.

The B horizons have hues of 10YR or 7.5YR, values of 5 to 7, and chromas of 6 to 8.

The C horizons have yellow, brownish yellow, very pale brown, and light gray colors in varying proportions. Effervescence is violent.

COMPETING SERIES: The Santa Clara series is in the same family. The Aguilita, Coamo, Colinas, Ensenada, Guanabano, Pozo Blanco, Sion, Soller and Yauco series are similar soils in related families. The Santa Clara soils are shallower with hard rock within 40 inches. The Aguilita soils have more than 35 percent coarse fragments in their profiles and lack cambic horizons. The Coamo, Guanabano and Ensenada, have argillic horizons. The Colinas have coarser textured profiles. The Pozo Blanco, Sion and Yauco soils are coarser textured and have ustic moisture regimes. The Soller soils are shallow to the hard limestone.

GEOGRAPHIC SETTING: The Naranjo soils are sloping to very steep soils on foot slopes, side slopes and hilltops with slopes ranging from 5 to 60 percent. They formed in fine textured, calcareous residuum from soft limestone. The climate is humid tropical. The average annual precipitation is 70 to 90 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Colinas and Santa Clara, Camaguey and Juncal series. The Camaguey soils have thicker and darker A horizons and slickensides close enough to intersect at 12 to 16 inches of the surface. The Juncal soils have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained, medium and rapid runoff and moderate permeability.

USE AND VEGETATION: Some acreage is planted to sugarcane. Some acres are in native pasture or brush.

DISTRIBUTION AND EXTENT: Humid uplands of northern Puerto Rico. The series is of minor extent with about 5000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Noroeste SCD, Puerto Rico; 1979.

**National Cooperative Soil Survey
U. S. A.**

LOCATION PALMAR PR

**Established Series
Rev. LAD
04/2000**

PALMAR SERIES

The Palmar series consists of deep, poorly drained, moderately permeable soils formed in decomposed plant material. These nearly level soils are on coastal plains and flood plains and are subject to frequent flooding. Slopes ranges from 0 to 2 percent. Mean annual precipitation is 54 inches. Mean annual temperature is 78 degrees F.

TAXONOMIC CLASS: Euic, isohyperthermic Typic Haplosaprists

**TYPICAL PEDON: Palmar muck
(Colors are for moist soil unless otherwise noted.)**

Op--0 to 8 inches; black (N 2/0) broken face and rubbed; about 5 percent fibers; less than 5 percent rubbed, moderate fine granular structure, friable, slightly sticky, slightly plastic; many fine roots; low mineral content; neutral; clear smooth boundary. (6 to 10 inches thick.)

Oa1--8 to 15 inches; black (N 2/0) broken face and rubbed; about 10 percent fibers; less than 5 percent rubbed; weak medium subangular blocky structure, firm, slightly sticky, slightly plastic; common fine roots; low mineral content; neutral; clear smooth boundary. (5 to 9 inches thick.)

Oa2--15 to 23 inches; very dark brown (10YR 2/2) broken face and black (10YR 2/1) rubbed; about 35 percent fiber, 5 percent rubbed; massive; slightly sticky, slightly plastic; low mineral content; neutral, gradual smooth boundary (6 to 12 inches thick.)

Oa3--23 to 37 inches; dark yellowish brown (10YR 3/4) broken face and very dark brown rubbed and pressed; about 60 percent fiber; 15 percent fiber rubbed; massive, slightly sticky, slightly plastic; low mineral content; neutral; gradual smooth boundary. (10 to 16 inches thick.)

Oa4--37 to 45 inches; black (10YR 2/1) broken face and rubbed color; 35 percent fiber; 5 percent rubbed; slightly sticky and slightly plastic; low mineral content; neutral.

TYPE LOCATION: Atlantico SCD, Puerto Rico, 2 miles east of curve of dirt road, 2.1 kilometers north of kilometer marker 10.7 of Highway 682.

RANGE IN CHARACTERISTICS: The reaction of the profile ranges from slightly acid to neutral.

The sapric layers have color in hues of 2.5Y, values of 2 and chromas of 1 or less. The unrubbed fiber content varies from 5 to 60 percent. Rubbed fiber content 5 to 15 percent.

COMPETING SERIES: This is the Tiburones series in the same family. Tiburones soils are more acid in the upper tier.

GEOGRAPHICALLY SETTING: Palmar soils are on coastal plains and flood plains. Slope is 0 to 2 percent. These soils formed in residuum of decomposed plant material. Elevation is near sea level. The climate is tropical humid. The mean annual precipitation ranges from 50 to 58 inches, and the mean annual temperature ranges from 77 to 79 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Garrochales and Vigia soils and the competing Tiburones soils. Garrochales soils have a marl layer. Vigia soils have mineral layers.

DRAINAGE AND PERMEABILITY: Poorly drained; slow runoff; moderate permeability. A seasonal high water table is at depths of 0 to 2.5 feet.

USE AND VEGETATION: Most areas are in native vegetation consisting of sedges, ferns, cattails, and other aquatic plants. Small areas are abandoned sugarcane fields. These soils are used mainly for pasture.

DISTRIBUTION AND EXTENT: Northern coastal plains of Puerto Rico. These soils are of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, 1942.

REMARKS: Formerly Palmas Altas series.

National Cooperative Soil Survey
U. S. A.

LOCATION PELLEJAS PR

**Established Series
Rev. REG
06/2002**

PELLEJAS SERIES

The Pellejas series have dark grayish brown, granular, clay loam A horizons and dark brown, clay loam B horizons over thick, light brownish gray, loamy sand C horizons.

TAXONOMIC CLASS: Fine-loamy over sandy or sandy-skeletal, mixed, subactive, isohyperthermic Typic Dystrudepts

TYPICAL PEDON: Pellejas clay loam - native pasture.
(Colors are for moist soil unless otherwise stated.)

Ap--0-5 inches; Dark grayish brown (10YR 4/2) clay loam; moderate fine granular structure; firm, slightly sticky, slightly plastic, many fine roots, many fine quartz grains; strongly acid; clear smooth boundary. (4 to 6 inches thick)

B2--5-11 inches; Dark brown (10YR 4/3) clay loam; weak medium subangular blocky structure; firm, slightly sticky, plastic, many fine roots; common fine and few medium quartz grains; strongly acid; clear wavy boundary. (4 to 9 inches thick)

B3--11-15 inches; Pale brown (10YR 6/3) 60 percent, dark yellowish brown (10YR 4/4) 20 percent rubbed color light brownish gray (2.5Y 6/2) sandy loam; weak fine and medium subangular blocky structure; friable, nonsticky, slightly plastic, common fine roots; many fine quartz grains; many fine black and white specks; strongly acid; clear wavy boundary. (3 to 5 inches thick)

C--15-60 inches; Light brownish gray (2.5 6/2) loamy sand; single grained; very friable, nonsticky, nonplastic, strongly acid.

TYPE LOCATION: Sur SCD, Puerto Rico; 100 meters north of kilometer marker 44.5 of Highway No. 10.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 11 to 20 inches. These soils are strongly or very strongly acid. Mean annual soil temperature ranges from 75 to 78 degrees F.

The A horizons are dark grayish brown (10YR 4/2), or dark brown (10YR 4/3). Clay loam is the dominant type.

The B horizons become lighter with depth and range from dark brown (10YR 4/3), to dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4), pale brown (10YR 6/3), or light yellowish brown (10YR 6/4). The upper B horizons are loam or clay loam. The lower B horizons are sandy loam or loamy sand. Structure of the B horizons ranges from weak fine to weak medium subangular blocky inclusive. These soils have slightly sticky and slightly plastic A horizons and slightly sticky and plastic upper B horizons.

COMPETING SERIES: These are the Anones, Mayo, Pandura, Santa Marta, Utuado, Vieques, and Yunes series. The Anones and Santa Marta soils have oxidic mineralogy and fine texture. The Mayo soils are coarser textured throughout the solum. The Pandura soils are shallow to partially weathered plutonic rocks and are less acid. The Utuado soils have cooler soil temperatures and occur in higher elevations. The Vieques soils are drier having ustic soil moisture regimes. The Yunes soils are shallow to shaly sedimentary rocks and have 60 to 80 percent by volume of shaly fragments in the cambic horizon.

GEOGRAPHIC SETTING: The Pellejas soils occur on moderately steep and steep sideslopes and narrow ridges with slope gradients of 40 to 60 percent. The soil formed in coarse textured residuum weathered from plutonic rocks. The climate is humid tropical. The average annual precipitation ranges from 70 to 90 inches and the mean annual temperature is 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Lirios soils which occur in the sideslopes of the humid uplands. The Lirios soils have formed in the same kind of material, but are red, deeper to saprolite, and have argillic horizons.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained; very rapid runoff; rapid permeability.

USE AND VEGETATION: Mostly used for coffee and pasture.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Ponce Survey Area, Puerto Rico; 1971.

REMARKS: The Pellejas soils were formerly classified in the Gray Brown Podzolic great soil group.

**National Cooperative Soil Survey
U.S.A.**

LOCATION PERCHAS PR

**Established Series
Rev. REG:LHR
07/2001**

PERCHAS SERIES

The Perchas series consists of deep, poorly drained soils formed in materials over Tertiary clays. They are gently sloping to moderately steep soils on foot slopes and rolling hills of the tropical uplands. These soils are dark grayish brown clay in the A horizon, light gray, gley in the cambic and C horizons.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Chromic Dystraquerts

**TYPICAL PEDON: Perchas clay - native pasture.
(Colors are for moist soil.)**

Ap--0 to 5 inches; dark grayish brown (10YR 4/2) clay with few medium distinct gray (10YR 5/1) few fine prominent greenish gray (5GY 6/1) and few fine prominent dark greenish gray (5BG 4/1) mottles; weak medium and coarse subangular blocky structure; firm, slightly sticky, plastic; many fine roots; rust color due to root decay; very strongly acid; abrupt smooth boundary. (4 to 6 inches thick)

B2g--5 to 12 inches; light gray (5Y 7/2), light brownish gray (10YR 6/2), and light yellowish brown (10YR 6/4) clay with few fine prominent greenish gray (5GY 6/1) mottles; weak medium and coarse subangular blocky structure; firm, slightly sticky, plastic; common fine roots; very strongly acid; clear wavy boundary. (5 to 9 inches thick)

B3g--12 to 19 inches; light gray (10YR 7/2) and greenish gray (5GY 5/1) clay with common fine strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm, slightly sticky, plastic; few fine roots; very strongly acid; clear wavy boundary. (5 to 11 inches thick)

C1g--19 to 28 inches; light gray (10YR 7/2) clay with many fine prominent strong brown (7.5YR 5/6) mottles; massive, firm, slightly sticky, plastic; very strongly acid; clear wavy boundary. (7 to 10 inches thick)

C2g--28 to 40 inches; light gray (10YR 7/2) clay with few medium prominent greenish gray (5BG 5/1) and common fine prominent strong brown (7.5YR 5/6) mottles; massive; firm, slightly sticky, plastic; very strongly acid.

TYPE LOCATION: Culebrinas SCD, Puerto Rico, 3 miles west of the town of Lares. 350 meters south of kilometer marker 32.9 on Highway 111, on paved, unnumbered road, 25 meters west of road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 14 to 26 inches. Texture is clay in the whole profile. Consistence is slightly sticky or sticky and plastic. Structure is weak, fine to coarse subangular blocky in the cambic horizon. Reaction is strongly to extremely acid throughout. Organic matter content decreases regularly with depth. The mean annual soil temperature is 75 degrees F.

The A horizon has hues of 7.5YR or 10YR, values of 4 or 5, and chromas of 1 to 2. Mottles are gray, greenish gray or dark greenish gray. Structure is weak or medium subangular blocky.

The B horizons are gleyed with 60 percent or more by volume of the matrix as low chroma. Hues are 5Y, 10YR, or 2.5Y, values of 5 to 7, and chroma of 2 or less. Structure is weak, fine to coarse subangular blocky.

The C horizon is also gley with hues of 2.5Y, 5Y, or 10YR, chroma of 2 or less in more than 60 percent by volume of the matrix.

COMPETING SERIES: The Maunabo series is in the same family. The Bajura, Coloso, Corcega, Fortuna, Guayabota, Igualdad, Jareales, Pinones, Reparada, Santoni, Talante, Vayas and Vigia series are similar soils in related families. Maunabo soils have coarser textured lower horizons. The Bajura and Santoni soils have horizons with COLE values of more than 0.09 in their profiles. The Coloso, Corcega and Talante soils are better drained and have less than 60 percent by volume of the upper 30 inches with low chroma mottles. The Corcega and Talante soils have coarser textured profiles. The Fortuna and Vayas soils have organic matter content that does not decrease regularly with depth. The Guayabota soils are shallow to the rock and have colder mean annual soil temperatures. The Igualdad are coarser textured in the lower horizons and are less acid. The Jareales, Pinones, Reparada and Vigia soils all have organic layer with their profiles.

GEOGRAPHIC SETTING: The Perchas soils are gently sloping and moderately steep soils on foot slopes and low rolling hills on slopes ranging from 2 to 20 percent. The regolith formed in fine textured sediments over Tertiary clays. The climate is humid tropical. The average annual precipitation ranges from 80 to 90 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Moca, Voladora and Plata series. The Moca and Voladora soils are redder and better drained. The Plata soils are coarser textured and have a conglomerate of cobbles, sands and clays in the substrata.

DRAINAGE AND PERMEABILITY: Poorly drained, runoff is medium and permeability is slow.

USE AND VEGETATION: Most of the acreage is in native pasture. Small acreage is in sugarcane and coffee.

DISTRIBUTION AND EXTENT: Humid northern uplands of Puerto Rico. The series is of minor extent, with about 5,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Culebrinas SCD, Puerto Rico; 1979.

National Cooperative Soil Survey
U. S. A.

LOCATION REILLY PR

**Established Series
Rev. JLL/GRB
08/1999**

REILLY SERIES

The Reilly series consists of very deep, excessively drained, rapid permeable soils on flood plains adjacent to streams. They formed in stratified sediments of gravel and sand. Near the type location, the mean annual temperature is about 78 degrees F., and the mean annual precipitation is about 70 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Sandy-skeletal, mixed, isohyperthermic Mollic Udifluvents

TYPICAL PEDON: Reilly gravelly loam - sugarcane. (Colors are for moist soil.)

Ap--0 to 9 inches; dark brown (10YR 3/3) gravelly silt loam; weak fine granular structure; friable; slightly sticky, nonplastic; many fine roots; moderately acid; abrupt smooth boundary. (7 to 16 inches thick)

C1--9 to 16 inches; dark grayish brown (10YR 4/2) very gravelly sand; massive; very friable; few fine roots; moderately acid, about 60 percent, by volume, pebbles; few thin silty and clayey layers; abrupt smooth boundary.

C2--16 to 48 inches; clean, coarse sand and gravel; about 70 percent, by volume, coarse gravel, 2 to 3 inches in diameter.

TYPE LOCATION: Suroeste SCD, San German Municipality, Puerto Rico. Approximately 1.0 miles northwest of the city of San German; from the intersection of P.R. Hwy. 102 and P.R. Hwy 347, about 490 feet north of P.R. Hwy. 347 on farm road, about 165 feet west of road in sugarcane field. San German topographic quadrangle; lat. 18 degrees 05 minutes 52 seconds N.; long. 67 degrees 02 minutes 43 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Thickness of the A horizon and depth to the sand and gravel ranges from 7 to 16 inches. Reaction ranges from very strongly acid to slightly acid throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 and 3. Texture is loam, silt loam, or their gravelly analogs.

Content of pebbles ranges from 25 to 35 percent, by volume.

The C horizon has hue of 10YR, value of 3 or 4, and value of 3 to 6. Texture is very gravelly sand or extremely gravelly sand. Content of pebbles ranges from 50 to 75 percent, by volume.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: The Reilly soils are on flood plains adjacent to streams. They formed in medium and moderately coarse-textured sediments stratified with gravel and sands in dominant proportions. Slope range from 0 to 2 percent. The climate is humid tropical. The average annual temperature ranges from 76 to 80 degrees F., and the average annual rainfall ranges from 65 to 75 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Bajura, Coloso, Dique, and Toa series. All of these soils are in flood plains. The poorly drained Bajura soils have more clay in the substratum. The somewhat poorly drained Coloso soils have more clay in the subsoil. The well drained Dique soils have more clay in the subsoil. The well drained Toa soils have more clay in the control section and have Mollic epipedons.

DRAINAGE AND PERMEABILITY: Excessively drained; rapid permeability.

USE AND VEGETATION: Most areas of Reilly soils are in pasture. A few small acreage are in vegetable crops or sugarcane. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Humacao Soil Survey Area, Puerto Rico; 1968.

MLRA: 272.

**National Cooperative Soil Survey
U.S.A.**

LOCATION RIO LAJAS PR

**Established Series
Rev. BCD
06/2002**

RIO LAJAS SERIES

The Rio Lajas series consists of very deep, somewhat excessively drained, rapidly permeable soils formed in sandy coastal plains sediments. This nearly level to sloping soils is in the coastal plains. Slopes range from 2 to 12 percent. The mean annual precipitation is about 67 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Mixed, isohyperthermic Psammentic Paleudalfs

TYPICAL PEDON: Rio Lajas sand - cultivated. (Colors are for moist soil.)

A1--0 to 8 inches; dark reddish brown (5YR 3/4) sand; single grain; loose; few fine roots; slightly acid; gradual smooth boundary. (6 to 10 inches thick)

A2--8 to 24 inches; dark reddish brown (5YR 3/3) loamy sand; single grain; loose; nonsticky, nonplastic; very few fine roots; slightly acid; gradual smooth boundary. (12 to 18 inches thick)

A3--24 to 32 inches; dark reddish brown (5YR 3/4) loamy sand; single grain; loose; nonsticky and nonplastic; slightly acid; gradual smooth boundary. (8 to 12 inches thick)

Bt--32 to 60 inches; dark reddish brown (2.5YR 3/4) loamy fine sand; weak coarse subangular blocky structure parting to single grain; loose, nonsticky, nonplastic; slightly acid.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 5.5 miles west of the town of Isabela; 125 yards south of junction of roads to Punta Jacinto and east-west dirt road along the beach; 50 feet west of highway and 300 yards south of the sea.

RANGE IN CHARACTERISTICS: Thickness of the solum is over 60 inches. Thickness of the argillic is more than 50 inches. These soils are loose, nonsticky and nonplastic throughout. Reaction ranges from medium acid to neutral throughout

the profile. The mean annual soil temperature is 75 degrees F.

The A1 horizon has hues of 5YR, values of 3, and chroma of 3 and 4. Texture is dominantly sand. The A2 and A3 is sand or loamy sand. Thickness of the A horizons is 26 to 40 inches.

The Bt horizon has hues of 5YR or 2.5YR, values of 3 or 4, and chroma of 4 to 6. Texture is loamy fine sand.

COMPETING SERIES: There are no other know series in the same family. The Candelerero, Cayagua, Fajardo, Islote, Juncal, Rio Arriba, San Sebastian, Tanama, Vega Baja and Via series are similar soils in related families. The Candelerero, Cayagua and Vega Baja soils are finer textured and all have low chroma mottles in their profiles. The Fajardo and Rio Arriba soils have COLE value higher than 0.09 in their horizons. The Islote, Juncal, San Sebastian and Via soils all are finer textured. The Tanama soils are finer textured and shallower to the hard limestone.

GEOGRAPHIC SETTING: The Rio Lajas soils are gently sloping and sloping coastal plains. Slightly above sea level on slope gradients of 2 to 12. They formed in reworked sandy sediments of the coastal plains. The climate is sub-humid tropical. The average annual precipitation ranges from 60 to 70 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Malaze, Jabos, Bajucos, Guerrero and Guanajibo series and the Carrizales, Coto, Cotito and Matanzas series. The Carrizales soils are sandy throughout and do not have argillic horizon.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained, slow runoff, and rapid permeability.

USE AND VEGETATION: Mostly in pasture and food crops.

DISTRIBUTION AND EXTENT: Northwestern Puerto Rico. This series is of minor extent, with about 2,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Loamy, mixed, isohyperthermic Typic Tropudalfs to Sandy, mixed, isohyperthermic Psammentic Paleudalfs. The previous OSED date was 4/67.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 32 inches (A horizons)

Argillic horizon - zone from 32 to 60 inches (Bt horizon)

LABORATORY DATA: Available for the Type Location.

**National Cooperative Soil Survey
U.S.A.**

LOCATION SABANA SECA PR

**Established Series
Rev. LHR:REG
07/2001**

SABANA SECA SERIES

The Sabana Seca series consists of deep, poorly drained soils formed in iron rich sediments. They are gently sloping and sloping soils in the coastal plain. These soils are clay, plastic in the A horizon, clay, plastic, gleyed in the upper B horizon and are plinthic, gleyed in the lower B horizon.

TAXONOMIC CLASS: Very-fine, kaolinitic, isohyperthermic Plinthic Haplaquox

**TYPICAL PEDON: Sabana Seca clay - pasture.
(Colors are for moist soil.)**

Ap--0 to 10 inches; very dark grayish brown (10YR 3/2) clay; weak fine subangular blocky structure parting to weak fine granular; firm, slightly sticky, plastic; many fine roots; extremely acid; abrupt smooth boundary. (8 to 12 inches thick)

B1--10 to 13 inches; dark grayish brown (2.5Y 4/2) clay with many medium and coarse prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular and angular blocky structure; firm, slightly sticky, plastic, common fine roots; thin patchy clay films on ped faces; dark gray coloration (10YR 4/1) on old root channels and cracks; about 5 percent of Ap horizon; extremely acid; clear wavy boundary. (2 to 5 inches thick)

B21g--13 to 23 inches; light gray (5Y 6/1) clay with many coarse prominent yellowish brown (10YR 5/6) and few fine prominent red (10YR 4/6) mottles (1:1 ratio of matrix to mottles); very weak coarse prismatic structure parting to moderate medium subangular and angular blocky; firm, slightly sticky, plastic; common fine roots; thin patchy clay films on ped faces; dark gray (10YR 4/1) coloration on old root channels and ped faces; extremely acid; gradual smooth boundary. (7 to 13 inches thick)

B22g--23 to 36 inches; light gray (5Y 6/1, 7/1) clay with many fine to coarse strong brown (7.5YR 5/6) and common medium and coarse prominent dark red (10R 3/6) mottles, and a few specks of red (2.5YR 4/6); very weak coarse

prismatic structure parting to moderate medium subangular and angular blocky; firm, slightly sticky, plastic; few fine roots, common fine perdigons (concretions); about 20 percent plinthite; thin patchy clay films on ped faces; extremely acid; gradual smooth boundary. (9 to 15 inches thick)

B23g--36 to 48 inches; white (5Y 8/1, 8/2) clay with many fine medium and coarse prominent dusky red (10R 3/4) and strong brown (7.5YR 5/6) mottles and concretions; weak coarse prismatic structure parting to weak medium subangular and angular blocky; firm, slightly sticky, plastic; about 25 percent plinthite; thin patchy clay films on vertical and horizontal ped faces; extremely acid; clear smooth boundary. (8 to 16 inches thick)

B24g--48 to 56 inches; white (5Y 8/1) clay with many coarse prominent dusky red (10R 3/4) and common fine to coarse prominent strong brown (7.5YR 5/8) mottles and concretions; weak coarse prismatic structure; firm, slightly sticky, plastic; about 20 percent plinthite; thin patchy clay films in vertical ped faces; extremely acid; clear smooth boundary. (8 to 16 inches thick)

**B25g--56 to 70 inches; white (5Y 8/1) clay with many coarse prominent dusky red (10R 3/4) and dark red (7.5R 3/6) and few fine prominent red (10R 4/8) and strong brown (7.5YR 5/8) mottles and concretions; weak coarse prismatic structure; firm, slightly sticky, plastic; very few patchy clay films in vertical faces; about 25 percent plinthite; extremely acid.
TYPE LOCATION: San Juan, SCD, Puerto Rico, 400 meters east of kilometer marker 8.5 on highway 866, municipality of Toa Baja, San Juan Soil Survey Area.**

RANGE IN CHARACTERISTICS: Thickness of the solum is over 60 inches. Thickness of the argillic is over 50 inches. Texture is clay throughout. Consistence is slightly sticky or sticky and plastic. Reaction is very strongly or extremely acid in the whole profile. Perdigons may or may not be present. Clay films are few or very few and patchy in the B horizon. Depth to water table ranges from 24 to 36 inches. CEC per 100 grams of clay ranges from 16 to 22 mc. Cation retention from NH₄CC ranges from 9 to 12 mc. The mean annual soil temperature is 76 degrees F.

The A horizon has hues of 10YR and 2.5Y, values of 2 or 3 and chroma of 1 to 3. Structure is weak, fine or medium subangular blocky.

The B2g horizon has hues of 2.5Y and 5Y, values of 4 to 8, and chromas of 1 and 2. Yellow, brown, strong brown, dusky red and dark red mottles are present in varying proportions. Low chromas occupies more than 60 percent of the matrix. Structure is weak, medium or coarse prismatic. Plinthite ranges from 15 to 30 percent in the lower B2g.

COMPETING SERIES: These are no other series in the same family. The Almirante, Guanajibo, Guerrero, Jobos, Sosa,

Torres and Vega Alta series are similar soils in related families. The Almirante, Guanajibo, Jobos and Vega Alta soils are better drained. The Guerrero soils are better drained and have sandy surface layers. The Sosa soils have ustic moisture regimes. The Torres soils have sandy surface layers and higher organic content.

GEOGRAPHIC SETTING: The Sabana Seca soils are gently sloping and sloping soils in the coastal plains with slope gradients of 2 to 12 percent. The soil formed in fine textured, iron rich sediments of the coastal plains. The climate is humid tropical. The average annual precipitation ranges from 65 to 75 inches, and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Almirante, Martin Pena, Vega Alta, and Vega Baja series. The Almirante and Vega Alta soils are better drained and occupy slightly higher positions in the coastal plains. The Martin Pena soils are darker in color, lack plinthite and have organic surface layers. The Vega Baja soils are less acid and lack plinthite.

DRAINAGE AND PERMEABILITY: Poorly drained; slow runoff and very slow permeability.

USE AND VEGETATION: Native pasture and weeds used for pasture. Some of the acreage has been used for housing developments.

DISTRIBUTION AND EXTENT: Humid northern coastal plains of Puerto Rico. The series is of minor extent, with about 7,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1942.

REMARKS:

ADDITIONAL DATA: Laboratory data are available for the typical pedon S58PR-9-1.

**National Cooperative Soil Survey
U. S. A.**

LOCATION SAN GERMAN PR

**Established Series
Rev. LRR/GRB
06/2002**

SAN GERMAN SERIES

The San German series consists of shallow, well drained, very slowly permeable soils on ridgetops, summits and side slopes in uplands of limestone hills and mountains of the Semiarid Mountains and Valleys MLRA. They formed in material weathered from limestone bedrock. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 35 inches. Slopes range from 5 to 90 percent.

TAXONOMIC CLASS: Clayey-skeletal, mixed, superactive, nonacid, isohyperthermic, shallow Typic Ustorthents

TYPICAL PEDON: San German gravelly loam-pasture. (Colors are for moist soil unless otherwise indicated.)

Ap--0 to 2 inches; dark brown (10YR 3/3) gravelly clay, brown (10YR 4/3) dry; strong medium granular structure; slightly hard, firm; slightly sticky, slightly plastic; many very fine and fine roots; many very fine and common fine interstitial pores; about 15 percent, by volume pebbles, about 2 percent, by volume, cobbles; moderately alkaline; strongly effervescent (HCl, 1N); clear wavy boundary. (1 to 4 inches thick)

AC--2 to 11 inches; brown (10YR 4/3) extremely gravelly clay; brown (10YR 5/3) dry; slightly hard, firm; massive; slightly sticky, slightly plastic; many very fine and fine roots; many very fine and common fine tubular and vesicular pores; about 70 percent, by volume, pebbles; moderately alkaline; strongly effervescent (HCl, 1N); abrupt wavy boundary. (4 to 10 inches thick)

Cr1--11 to 21 inches; very pale brown (10YR 7/4) hard semi-consolidated fractured limestone; white (10YR 8/2) dry; strong medium and thick platy rock structure; many very fine roots, common fine and medium roots in fracture planes; moderately alkaline; violently effervescent (HCl, 1N); clear wavy boundary.

Cr2--21 to 27 inches; very pale brown (10YR 7/4) hard semi-consolidated fractured limestone, white (10YR 8/2) dry; strong medium and thick platy rock structure; few very fine roots in fracture planes; moderately alkaline; violently

effervescent (HCl, 1N); abrupt wavy boundary. (Combined thickness of the Cr horizons is from 5 to 26 inches.)

R--27 to 80 inches; very pale brown (10YR 7/4) hard consolidated limestone bedrock, white (10YR 8/2) dry; moderately alkaline; violently effervescent (HCl, 1N).

TYPE LOCATION: Lajas Municipio, Puerto Rico; approximately 3.0 miles west of La Parguera, about 1.7 miles southeast of Rancho Cabassa, and about 20 feet east of gravel road. Parguara topographic quadrangle; lat. 17 degrees 58 minutes 56 seconds N., long. 67 degrees 5 minutes 32 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Depth to hard semi-consolidated limestone ranges from 5 to 20 inches. Depth to hard unweathered limestone bedrock ranges from 25 to 40 inches. Reaction is moderately alkaline throughout.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 to 4. Texture is clay loam or clay in the fine-earth fraction.

The AC horizon, where present, has hue of 7.5R or 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is clay loam or clay in the fine-earth fraction.

The C horizon, where present, has hue of 7.5YR or 10YR, value of 4 or 5 and chroma of 1 to 4. Texture is clay loam or clay in the fine-earth fraction.

The Cr horizons are composed of hard semi-consolidated fractured limestone. It has hue of 7.5YR to 2.5Y, value of 6 to 8, and chroma of 2 to 6. It can be excavated with difficulty with hand tools, and is rippable by mechanical equipment.

The R layer is composed of hard consolidated limestone bedrock.

COMPETING SERIES: There are no competing series in the same family.

GEOGRAPHIC SETTING: San German soils are on ridge tops, summits, and side slopes in uplands of limestone hills and mountains of the Semiarid Mountains and Valleys MLRA of southern Puerto Rico. Slopes range from 5 to 90 percent. They formed in material weathered from limestone bedrock. The climate is semiarid tropical. The mean annual temperature ranges from 78 to 80 degrees F., and the mean annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Aguilita, Descalabrado, Duey, Pozo Blanco, Seboruco,

and Tuque soils. Aguilita, Duey, and Tuque soils are on similar positions, In addition, Aguilita soils have a Mollic epipedon and coarse-loamy, carbonatic subsoils. Descalabrado soils formed in igneous bedrock. Duey soils have fine-loamy carbonatic control sections. Tuque soils have a Mollic epipedon. Pozo Blanco are on lower adjacent positions, are very deep, and have a Mollic epipedon. Seboruco soils are on slightly lower positions and have red, fine-silty control sections.

DRAINAGE AND PERMEABILITY: Well drained; very slow permeability.

USE AND VEGETATION: Most areas of San German soils are used for pasture and rangeland. Vegetation consists of buffellgrass, huracan grass, and other xerophytic grasses, shrubs, and trees.

DISTRIBUTION AND EXTENT: In the semiarid limestone hills and mountains of southern Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico, 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 2 inches (Ap horizon).

Paralithic contact - zone at 11 inches (Cr layer).

Lithic contact - zone at 27 inches (R layer).

The type location was moved to its present location in 1998 and the series reclassified based on soil lab data and observations in the field.

ADDITIONAL DATA: Characterization pedon - Lajas Municipio, Puerto Rico; SPR97-079-003. Sample by the NSSL, Lincoln, NE. 6/97.

MLRA: 271.

**National Cooperative Soil Survey
U.S.A.**

LOCATION SAN SEBASTIAN PR

**Established Series
Rev. BCD
06/2002**

SAN SEBASTIAN SERIES

The San Sebastian series consists of very deep, well drained, moderately permeable soils on dissected uplands. They formed in limestone residuum. Slopes range from 20 to 60 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Clayey-skeletal, carbonatic, isohyperthermic Calcic Argiudolls

TYPICAL PEDON: San Sebastian gravelly clay-weeds. (Colors are for moist soil)

Ap--0 to 4 inches; dark brown (10YR 3/3) gravelly clay, moderate fine and medium granular structure; friable, slightly sticky, plastic; many fine roots; slight effervescence; clear wavy boundary. 3 to 6 inches thick.

Bk1--4 to 9 inches; strong brown (7.5YR 5/6) very gravelly clay; weak medium subangular blocky structure; firm, sticky, plastic; few fine roots; few faint clay films; clay coatings on gravel faces; slight effervescence; from 50 to 60 percent by volume of gravel; clear smooth boundary. 4 to 7 inches thick.

Bk2--9 to 14 inches; strong brown (7.5YR 5/6) extremely gravelly clay; weak medium subangular blocky structure; firm, sticky, plastic; few fine roots; few faint clay films; clay coatings on gravel faces; strong effervescence; more than 60 percent by volume of gravel; clear smooth boundary 4 to 8 inches thick.

BC--14 to 22 inches; reddish yellow (7.5YR 6/8) extremely gravelly clay; weak fine subangular blocky structure; firm, sticky, plastic; clay coatings on gravel faces; strong effervescence; more than 60 percent by volume of grave; gradual wavy boundary. 7 to 11 inches thick.

C1--22 to 33 inches; reddish yellow (7.5YR 7/6) very gravelly clay; massive; friable; sticky and plastic; strong effervescence; from 50 to 60 percent by volume of gravel; gradual wavy boundary. 9 to 13 inches thick.

C2--33 to 41 inches plus; reddish yellow (7.5YR 7/6) gravelly clay; massive; friable; slightly sticky, plastic; from 25 to 60 percent by volume of gravel; strong effervescence.

TYPE LOCATION: Culebrinas SCD, Puerto Rico, 5 miles northwest of the town of San Sebastian; 250 meters east of kilometers marker 9.2 of Highway 112.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 29 to 32 inches. These soils are calcareous throughout. Fine to medium gravel is present throughout the profile. These soils have slightly sticky and plastic A horizons and sticky and plastic Bk and C horizons. Base saturation (by sum of cations) is more than 60 percent at 50 inches below the top of the argillic horizon. CEC is more than 24 meq/100 grams of clay in the major part of the argillic horizon. Coarse fragments exceeds 35 percent, by volume, throughout the major part of the control section.

The A horizons have colors in hues of 7.5YR and 10YR, values of 3 and 4, and chromas of 2, 3 and 4.

The Bk horizons range in hues of 7.5YR to 10YR, values of 4 to 5, and chromas of 4 to 8. Texture of the soil is gravelly clay throughout. Structure ranges from weak fine to medium subangular blocky.

COMPETING SERIES: These are the Juncal and Machete series in the same Subgroup and the Tanama and Rio Arriba series in the same Great Group. The Juncal and Machete soils lack the coarse fragments in their profiles and are not calcareous. The Tanama soils have hard rock within 20 inches of the surface. The Rio Arriba soils have horizons with COLE values greater than 0.09 and crack when dry.

GEOGRAPHIC SETTING: The San Sebastian series are on moderately steep to steep sideslopes with slope gradients from 20 to 60 percent. The regolith consists of fine textured gravelly residuum from limestone. The climate is humid tropical.

The average annual precipitation is 85 inches and the mean annual temperature 77 degrees F. The mean annual soil temperature at 20 inches is more than 72 degrees F. and the difference between mean summer and winter temperatures is less than 9 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: This is the competing Juncal in addition to Colinas and Cidral series. The Colinas soils are shallower, darker, and lack argillic horizons. The Cidral soils are redder, acid, and free of gravel

throughout.

DRAINAGE AND PERMEABILITY: Well drained, rapid runoff and moderate permeability.

USE AND VEGETATION: Most of the acreage is in brush. Small areas are in sugar cane and native pasture.

DISTRIBUTION AND EXTENT: Humid limestone uplands of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Culebrinas SCD, Puerto Rico. Name is from a town where the series was first recognized.

REMARKS: The classification was updated with the 4/91 draft from CLayey-skeletal, carbonatic, isohyperthermic Typic Tropudalfs to Clayey-skeletal, carbonatic, isohyperthermic Eutropeptic Rendolls based on lab data from the Type Location. The previous OSED date was 4/67.

This soil was formerly included in the Tanama series.

Diagnostic horizons and features recognized in the pedon:

Mollic epipedon - zone from 0 to 9 inches (Ap and Bk1 horizons)

Calcic horizon - zone from 4 to 22 inches (Bk horizons)

**National Cooperative Soil Survey
U.S.A.**

LOCATION SANTA CLARA PR

**Established Series
Rev. REG:LHR
06/2002**

SANTA CLARA SERIES

The Santa Clara series consists of moderately deep, well drained soils formed in materials weathered from limestone. They are gently sloping to moderately steep soils in foot slopes and rounded hills. These soils are silty clay loam or clay, neutral in the A horizon, silty clay, calcareous in the cambic horizon over a C horizon that is mainly soft limestone.

TAXONOMIC CLASS: Fine, mixed, active, isohyperthermic Typic Eutrudepts

**TYPICAL PEDON: Santa Clara silty clay loam - native pasture.
(Colors are for moist soil.)**

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, strong medium and coarse granular structure; slightly hard, firm, slightly sticky, plastic; many fine roots; neutral; clear smooth boundary. (5 to 10 inches thick)

B--6 to 23 inches; dark yellowish brown (10YR 4/4) silty clay; weak medium and coarse subangular blocky structure; slightly hard, firm slightly sticky, plastic; common fine roots; worm channels; slight effervescence; clear smooth boundary. (15 to 20 inches thick)

C--23 to 30 inches; yellow (10YR 7/6) with few faint very pale brown (10YR 8/3) mottles; massive; friable, slightly sticky, slightly plastic; very few fine roots; violent effervescence with dilute HCL; clear smooth boundary. This horizon is mainly soft limestone. (6 to 10 inches thick)

R--30 plus inches; hard fragmental limestone.

TYPE LOCATION: Norceste SCD, Puerto Rico; one mile south of the town of Isabela; one kilometer on dirt road east of kilometer marker 1.7 on Highway 112; 50 meters south of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 20 to 30 inches. Depth to the hard fragmental limestone varies from 26 to 40 inches. Base saturation (by NH₄OAC) is 80 to 90 percent throughout the profile. The mean annual soil temperature is 75 degrees F.

The A horizon has hues of 10YR or 7.5YR, values and chromas of 2 or 3. Texture is silty clay loam or clay. Structure is moderate or strong, medium or coarse granular. Consistence is slightly sticky or sticky and plastic. Reaction is slightly acid to mildly alkaline.

The B horizon has hues of 7.5YR or 10YR, values of 4 or 5, and chromas of 4 to 6. Texture is silty clay or clay. Structure is moderate weak, fine to coarse subangular blocky. Consistence is slightly sticky or sticky and plastic. Reaction is neutral to moderately alkaline. May have from 5 to 10 percent fine limestone fragments.

The C horizon is a mixture of clay and soft limestone. Consistence is slightly sticky and slightly plastic or plastic.

COMPETING SERIES: The Naranjo series is in the same family level. The Aguilita, Colinas, Fredensborg, Pozo Blanco, Sion, Soller and Yauco series are similar soils in related families. The Naranjo soils are deeper and lack the hard fragmental limestone. The Aguilita soils are coarser textured and have more than 35 percent coarse fragments in their profiles. The Colinas soils are calcareous and are coarser texture over soft limestone. The Fredensborg, Pozo Blanco, Sion and Yauco soils are coarser textured and have ustic moisture regimes. The Soller soils are shallower to hard rock and have thinner sola.

GEOGRAPHIC SETTING: The Santa Clara soils are gently sloping to moderately steep soils on foot slopes and rounded limestone hills with slope gradients of 2 to 25 percent. They formed in moderately fine and fine textured residuum derived from limestone. The climate is humid tropical. The average annual precipitation ranges from 75 to 80 inches and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Camaguey, Colinas, Naranjo, San German, Soller, and Tanama. The Camaguey soils have thicker and darker A horizons, lack cambic horizons, have many slickensides and pressure phases, and are deeper. The Tanama soils are redder and have argillic horizons. The San German soils are coarser textured and lack B horizons.

DRAINAGE AND PERMEABILITY: Well drained, medium runoff, and moderate permeability.

USE AND VEGETATION: Sugarcane and pasture.

DISTRIBUTION AND EXTENT: Humid limestone areas of Puerto Rico. The series is of minor extent, with about 2,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

National Cooperative Soil Survey
U. S. A.

LOCATION SOLLER PR

**Established Series
Rev. LHR:REG
06/2002**

SOLLER SERIES

The Soller series consists of moderately, deep, well drained soils formed in materials weathered from limestone. They are gently sloping to very steep soils on side slopes and hilltops in the humid limestone area. They are clay or clay loam, dark colored, calcareous in the A and B horizons over partially weathered limestone. Hard, fragmental limestone is at 26 inches.

TAXONOMIC CLASS: Clayey, mixed, active, isohyperthermic, shallow Typic Haprendolls

**TYPICAL PEDON: Soller clay - pasture.
(Colors are for moist soil.)**

Ap--0 to 5 inches; very dark gray (10YR 3/1) clay; weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; moderately alkaline; clear smooth boundary. (4 to 6 inches thick)

B--5 to 12 inches; very dark grayish brown (10YR 3/2) clay; moderate coarse subangular blocky structure; firm, slightly sticky, plastic; few fine roots; moderately alkaline; clear smooth boundary. (6 to 12 inches thick)

C--12 to 26 inches; white (10YR 8/1) partially weathered limestone that can be penetrated with the spade. (10 to 16 inches thick)

R--26 plus inches; hard fragmental limestone.

TYPE LOCATION: Culebrinas SCD, Puerto Rico; 4 miles west of the town of Laras; 350 meters north of kilometer marker 28.45 on Highway 111.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 10 to 20 inches. Depth to the hard fragmental limestone varies from 20 to 34 inches. Some pedons have up to 30 percent cobbles in the surface. Reaction of the solum is

neutral to moderately acid. It is slightly sticky or sticky and plastic. Calcium carbonate equivalent in the solum is more than 40 percent. The mean annual soil temperature ranges from 76 to 78 degrees F.

The A horizon has hues of 10YR, values of 2 or 3, and chromas of 1 or 2. Structure is weak fine or medium granular of subangular blocky.

The B horizon has hues of 10YR, values of 3 or 4, and chromas of 2 to 4. Structure ranges from weak medium to moderate coarse subangular blocky.

COMPETING SERIES: There are no other known series in the same family. The Aguilita, Binnsville, Castalia, Colinas, Fredensborg, Hesselberg, Otaway, Pedlar, Pozo Blanco, Redmanson, Sheege, Sion, Snowy, Tumbez, Tugur, Urtah, and Yauco. The Aguilita, Fredensborg, Hesselberg, Pozo Blanco, Sion, Tugur, and Yauco soils do not have cambic horizons and have ustic moisture regimes. The Binnsville, Castalia, Otaway, Redmanson, Sheege, Snowy, Tumbez and Urtah soils have colder soil temperatures and do not occur in the tropics. The Colinas soils have coarser textured sola and carbonatic mineralogy. The Pedlar soils have colder soil temperatures and have hard rock within 20 inches.

GEOGRAPHIC SETTING: The Soller soils occur on gently sloping to very steep hilltops and side slopes of limestone hills with slope gradients of 2 to 60 percent. The regolith consists of fine textured residuum derived from limestone. The climate is humid tropical. The average annual precipitation ranges from 80 to 90 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Santa Clara, Naranjo, and Colinas series in addition to the Canaguey series and the land type Limestone Outcrop. The Canaguey soils have thick A horizons, lack cambic horizons, and have slickensides and pressure phases. The land type Limestone Outcrops have 75 percent or more of the surface area covered by rock outcrops.

DRAINAGE AND PERMEABILITY: Well drained, runoff is medium to rapid and permeability is moderate.

USE AND VEGETATION: Native pasture and brushes.

DISTRIBUTION AND EXTENT: Humid limestone areas in the northern coastal plains of Puerto Rico. The series is of moderate extent, about 65,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

**National Cooperative Soil Survey
U. S. A.**

LOCATION TANAMA PR

**Established Series
Rev. BCD
08/2000**

TANAMA SERIES

The Tanama series consists of shallow, well drained, moderately permeable soils formed in materials weathered from limestone. They are gently sloping to very steep soils on foot slopes and side slopes of limestone hills. Slopes range from 2 to 60 percent. The mean annual precipitation is about 70 inches and the mean annual temperature is about 76 degrees F.

TAXONOMIC CLASS: Clayey, mixed, active, isohyperthermic Lithic Hapludalfs

TYPICAL PEDON: Tanama clay - sugarcane. (Colors are for moist soil.)

Ap--0 to 4 inches; dark reddish brown (5YR 3/4) clay; moderate fine and medium granular structure; firm, slightly sticky, plastic; many fine roots; common fine and medium limestone fragments; slightly acid; clear smooth boundary. (3 to 5 inches thick)

Bt1--4 to 11 inches; reddish brown (5YR 4/4) clay; moderate medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few faint clay films; slightly acid; abrupt wavy boundary. (5 to 9 inches thick)

Bt2--11 to 16 inches; reddish brown (5YR 5/4) clay with reddish brown (5YR 4/4) coatings in exterior of peds; moderate medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; few faint clay films; slightly acid. (4 to 6 inches thick)

R--16 inches; hard limestone.

TYPE LOCATION: Noroeste SCD, Puerto Rico; 2 miles southwest of the town of Aguada. 1.2 miles on dirt road west of kilometer marker 24.9 on Highway 115 (old Highway 2).

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the hard limestone ranges from 12 to 20

inches. Texture is clay in the whole profile. Consistence is slightly sticky and plastic throughout. Reaction ranges from slightly acid to neutral. The mean annual soil temperature is 75 degrees F.

The A horizon has hues of 5YR or 7.5YR, values and chromas of 3 or 4. Structure is weak or moderate, fine and medium granular.

The Bt horizon has hues of 5YR or 2.5YR, values of 3 or 5, and chromas of 4 to 6. Structure is moderate fine or medium subangular blocky. Clay films range from few faint to many distinct.

COMPETING SERIES: There are no other known series in the same family. The Caracoles, Islote, Juncal, Rio Lajas, San German, San Sebastian and Teja series are similar soils in related families. The Caracoles, San German, and Teja soils lack B horizons. The Islote soils are deeper to the calcareous sandstone. The Juncal soils have thicker argillic horizons. The Rio Lajas soils are sandy throughout. The San Sebastian are calcareous and have more than 35 percent coarse fragments in their profiles.

GEOGRAPHIC SETTING: The Tanama soils are gently sloping to very steep soils on foot slopes and side slopes of limestone hills with slope gradients of 2 to 60 percent. They formed in fine textured residuum derived from limestone. The climate is humid tropical. The average annual precipitation is 70 inches and the mean annual temperature is 76 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing San Sebastian and the San German series. The San Sebastian soils are deeper, very gravelly and calcarous. The San German soils are shallower, calcareous, and lack argillic horizon.

DRAINAGE AND PERMEABILITY: Well drained, medium to rapid runoff, and moderate permeability.

USE AND VEGETATION: Gentler slopes are in sugarcane. Steeper slopes are in pasture and brush. Small areas are in food crops.

DISTRIBUTION AND EXTENT: Along the north coastal plains of Puerto Rico. The series is of moderate extent, with about 75,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Lithic Tropudalfs to Clayey, mixed, isohyperthermic Lithic Hapludalfs. The previous OSED date was 11/75.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 4 inches (Ap horizon)

Argillic horizon - zone from 4 to 16 inches (Bt horizons)

Lithic contact - zone at 16 inches (R layer)

**National Cooperative Soil Survey
U.S.A.**

LOCATION TIBURONES PR

**Established Series
Rev. GA
04/2000**

TIBURONES SERIES

The Tiburones series consists of deep, poorly drained organic soils formed from sediments of highly decomposed plant tissues. Tiburones soils occur on nearly level bottom land and in depressional areas. Typically, Tiburones soils have a black, granular muck surface layers, are extremely acid and very strongly acid between 9 and 31 inches, and are slightly acid to neutral below 31 inches.

TAXONOMIC CLASS: Euic, isohyperthermic Typic Haplosaprists

**TYPICAL PEDON: Tiburones Muck - abandoned sugarcane field.
(Colors are for moist soil.)**

Oap--0 to 9 inches; black (N 2/0) broken face and rubbed colors; less than 5 percent fiber content; moderate medium granular; friable, slightly sticky, slightly plastic; many fine and common medium roots; low mineral content; medium acid (pH 5.8 CaCl₂); clear wavy boundary. (7 to 11 inches thick)

Oa2--9 to 15 inches; Black (N 2/0) broken face and rubbed colors; some root channels have white fungi; less than 5 percent fiber; weak coarse prismatic and moderate medium platy structure; friable, slightly sticky, slightly plastic; common fine and medium roots; low mineral content; extremely acid (pH 4.3 CaCl₂); gradual wavy boundary. (4 to 8 inches thick)

Oa3--15 to 31 inches; Black (N 2/0) broken face and rubbed colors; less than 5 percent fibers; massive; friable, slightly sticky, slightly plastic; common fine roots; low mineral content; very strongly acid (pH 4.6 in CaCl₂); clear smooth boundary. (14 to 18 inches thick)

Oa4--31 to 42 inches; Black (N 2/0) 90 percent with very dark brown (10YR 2/2) 10 percent; less than 5 percent fibers; massive; friable, slightly sticky, slightly plastic; low mineral content; slightly acid (pH 6.4 in CaCl₂); gradual smooth boundary. (9 to 13 inches thick)

Oa5--42 to 84 inches; very dark brown (10YR 2/2) broken face and rubbed; less than 5 percent fibers, massive; friable, slightly sticky, slightly plastic; low mineral content; neutral (pH 6.9 in CaCl₂).

TYPE LOCATION: Atlantico SCD, Puerto Rico, Cano Tiburones Area. 0.2 kilometers east of curve of dirt road, 2.1 kilometers east of kilometer marker 10.7 on Highway 682.

RANGE IN CHARACTERISTICS: Thickness of the sapric materials is over 7 feet. Reaction is medium acid to extremely acid in the upper part and slightly acid to neutral in the lower part. They are friable, slightly sticky and plastic throughout. Fiber content is less than 5 percent throughout. Soluble salts may or may not be present.

The Oap horizon is black (N 2/0). Structure ranges from weak to moderate granular.

The Oa2 horizon ranges from weak coarse to moderate coarse prismatic. Roots vary from common fine to medium.

The lower part of the Oa horizon ranges to hue of 10YR, with value of 2 and chroma of 2 or less.

COMPETING SERIES: The Palmas Altas series is in the same family. The Garrochales and Saladar series are in a related family. The Palmas Altas soils are slightly acid to neutral throughout. The Garrochales soils have a limnic layer within the control section that is 5 cm. or more thick. The Saladar soils have hemic materials in the bottom tier.

GEOGRAPHIC SETTING: The Tiburones muck are nearly level soils on bottomland and depressional areas. Slopes range from 0 to 2 percent. They have formed from the sediments of organic decomposition under natural wet conditions. The climate is humid tropical. Average annual rainfall is 60 inches and the average annual temperature is 78 degrees F.

GEOGRPAHICALLY ASSOCIATED SOILS: These are the competing Garrochales and Palmas Altas soils and the Vigia and Reparada soils. The Vigia soils are underlain by fine textured material. The Reparada soils have mineral fine textured material in the surface layers.

DRAINAGE AND PERMEABILITY: Poorly drained, slow runoff and moderate permeability. Depth to water table varies from 0 to 30 inches.

USE AND VEGETATION: Most of the acreage is in pasture. Sugarcane was cultivated for many years.

DISTRIBUTION AND EXTENT: Northern humid coastal plain of Puerto Rico. The series is of minor extent, with about 3,300 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

ADDITIONAL DATA: Characterization data is available on the typical pedon; sample Nos. S73-PR-01-3, lab. Nos. 74B 161 - 74B 165.

**National Cooperative Soil Survey
U. S. A.**

LOCATION TOA PR

**Established Series
Rev. JLL/GRB
06/2002**

TOA SERIES

The Toa series consists of very deep, well drained, moderately permeable soils are on river flood plains. They formed in stratified alluvial sediments of mixed origin. Near the type location, the mean annual temperature is about 78 degrees F., and the mean annual precipitation is about 70 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, mixed, active, isohyperthermic Fluvaquentic Hapludolls

TYPICAL PEDON: Toa silty clay loam - sugarcane. (Colors are for moist conditions.)

Ap--0 to 8 inches; dark brown (10YR 3/3) silty clay loam; weak fine granular structure; friable; slightly sticky, slightly plastic; common fine roots; many fine sand grains; about 3 percent, by volume, volcanic fragments 1/4 to 1/2 inch in diameter; strongly acid; clear smooth boundary.

A--8 to 17 inches; dark brown (10YR 3/3) silty clay loam; weak medium subangular blocky structure, parting to weak fine granular; friable; slightly sticky, slightly plastic; few fine roots; common fine black (10YR 2/1) nodules; neutral; clear smooth boundary. (Combined thickness of the Ap and A horizons ranges from 12 to 20 inches)

Bw--17 to 29 inches; dark yellowish brown (10YR 3/4) silty clay loam; weak medium and coarse subangular blocky parting to weak fine subangular blocky; friable; slightly sticky, slightly plastic; few fine roots, few fine vesicular pores, common fine black (10YR 2/1) nodules; few fine distinct dark brown (7.5YR 4/4) masses of iron accumulation; slightly alkaline; clear smooth boundary. (8 to 15 inches thick)

BC--29 to 43 inches; dark brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; few brick fragments found at the top of this horizon; few fine distinct reddish brown (5YR 5/3) masses of iron accumulation; slightly alkaline; clear smooth boundary. (0 to 15 inches thick)

C--43 to 64 inches; dark yellowish brown (10YR 4/4) clay loam; massive; friable; slightly sticky, slightly plastic; few fine black (10YR 2/1) nodules; few fine faint yellowish brown (10YR 5/6) masses of iron accumulation; few fine faint light gray (10YR 7/1) areas of iron depletions; slightly alkaline.

TYPE LOCATION: Suroeste SCD, Puerto Rico. Approximately 0.9 mile southwest of the Lavadero community from the intersection of P.R. Hwy. 2 and P.R. Hwy. 345, about 2,300 feet south of P.R. Hwy. 345 on dirt road from the intersection of the highway at the kilometer marker 2.5, and about 650 feet east of road in sugarcane field. Rosario topographic quadrangle; lat. 18 degrees 07 minutes 31 seconds N., long. 67 degrees 06 minutes 47 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 20 to 35 inches. Thickness of the mollic epipedon ranges from 12 to 20 inches. Reaction ranges from strongly acid to neutral in the Ap and A horizons, and from neutral to slightly alkaline in the Bw, BC, and C horizons. Organic carbon does not decrease regularly with depth. Fragments of volcanic rock ranges from 0 to 5 percent, by volume, throughout the profile.

The Ap or A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is silty clay loam or silty clay. Fine volcanic fragments range from 0 to 5 percent, by volume.

The Bw horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is silty clay loam or clay loam. Redoximorphic features in shades of brown range from none to common.

The BC horizon, where present, has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. Texture is silty clay loam or clay loam. Redoximorphic features in shades of brown range from none to common.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. Texture is silty clay loam or clay loam. Redoximorphic features in shades of brown and gray range from few to many. Texture is silty clay loam or clay loam. Lenses of sand may be present.

COMPETING SERIES: There are no other known series in the same family.

GEOGRAPHIC SETTING: Toa soils are on river flood plains. They formed in sediments of mixed origin. Slopes range from 0 to 2 percent. The climate is humid tropical. The average annual air temperature ranges from 77 to 79 degrees F., and the average annual precipitation ranges from 60 to 82 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Bajura, Coloso, Dique, Reilly, and Vivi series. All of

these soils are in flood plain positions. Bajura, Coloso, and Dique soils lack mollic epipedons. In addition, Bajura soils are poorly drained, Coloso soils are somewhat poorly drained, and Dique soils have fine-loamy control sections. The excessively drained Reilly soils have sandy-skeletal control sections. The somewhat excessively drained Vivi soils have coarse-loamy control sections.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of Toa soils are used for the production of sugarcane. Some areas are in tame grasses and used for pasture. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

MLRA: 272, 273.

**National Cooperative Soil Survey
U.S.A.**

LOCATION VEGA ALTA PR

**Established Series
Rev. BCD
06/2002**

VEGA ALTA SERIES

The Vega Alta series consists of very deep, well drained, moderately permeable soils on coastal plains and terraces. They formed in clayey, iron-rich coastal plain sediments. Slopes range from 2 to 12 percent. The mean annual precipitation is about 76 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Typic Hapludults

TYPICAL PEDON: Vega Alta clay loam - marker grass. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; dark yellowish brown (10YR 3/4) clay loam; moderate fine granular structure; friable, slightly sticky, slightly plastic; many fine black concretions; common fine roots; strongly acid; abrupt wavy boundary. (6 to 10 inches thick)

Bt1--8 to 14 inches; reddish yellow (7.5YR 6/8) and yellowish red (5YR 4/6) clay; weak medium and coarse subangular blocky breaking to moderate fine granular structure with few faint clay films on surfaces of peds and root channels; firm, slightly sticky, slightly plastic; many fine black concretions; few fine roots; strongly acid; clear wavy boundary. (5 to 10 inches thick)

Bt2--14 to 25 inches; red (2.5YR 4/8) and strong brown (7.5YR 5/8) clay; moderate medium and coarse subangular blocky breaking to weak medium blocky structure with common prominent clay films on faces of peds; firm, slightly sticky, slightly plastic; few fine black concretions; few fine roots; strongly acid; gradual wavy boundary. (9 to 13 inches thick)

Bt3--25 to 36 inches; red (2.5YR 4/8) brownish yellow (10YR 6/8), and red (7.5R 4/8) clay; weak medium and coarse subangular blocky structure with brownish yellow clay films in root channels; firm, nonsticky, slightly plastic; few fine quartz grains; very strongly acid; gradual wavy boundary. (9 to 14 inches thick)

Bt4--36 to 52 inches; dark red (10R 3/6), strong brown (7.5R 5/8), and light gray (5Y 7/1) clay; weak coarse subangular

blocky structure with few faint clay films; friable, nonsticky, slightly plastic; very strongly acid; gradual wavy boundary. (14 to 18 inches thick)

C--52 to 84 inches dark red (10YR 3/6), brownish yellow (10YR 6/8), light gray (5Y 7/1) clay; massive; friable, nonsticky, slightly plastic; very strongly acid.

TYPE LOCATION: San Juan SCD, Puerto Rico, Rio Piedras Experiment Station, section of farm north of Highway 1 to Caguas, 150 feet north of radio station, 50 feet south of trail, east of Rum Pilot Plant.

RANGE IN CHARACTERISTICS: Thickness of solum ranges from 43 to 65 inches and that of the Bt horizons from 37 to 55. Base saturation (by sum of cations) is less than 35 percent at 50 inches below the top of the argillic horizon.

Exchange capacity in the major part of the argillic is less than 24 meq. per 100 grams of clay. Organic matter content is 1.5 percent or less in the upper 6 inches of the argillic horizon. Plinthite in the C horizon occupies more than 10 percent by volume of the soil mass.

The A horizon is clay loam or silty clay. Colors of the A horizon are in hues of 10YR or 7.5YR, values and chromas of 3 or 4.

The Bt horizons are dominantly clayey. They range from weak coarse to moderate medium subangular blocky and clay films range from few faint to many prominent. Black concretions in the profile range from few to many.

COMPETING SERIES: These are the Alonso, Consumo, Corozal, Ingenio, Jagueyes, Moca, and Rio Piedras series, none of which contain plinthite. The Alonso soils are reddish brown throughout. The Consumo soils have thinner argillic horizons. The Corozal soils have low chroma mottles in the upper B horizon. The Ingenio soils have many quartz sand size grains and have uniform red colors throughout. The Jagueyes soils are coarser textured. The Moca soils are underlain by clays with high shrink-swell behavior. The Rio Piedras soils have more developed argillic horizons and higher exchange capacity.

GEOGRAPHIC SETTING: The Vega Alta soils occur on nearly level to moderately sloping coastal plains and terraces with slope gradients which range from 2 to 12 percent. The soil formed in fine textured, iron rich, red, brown, and gray coastal plains sediments. The climate is humid tropical. The mean annual precipitation is 76 inches and the mean annual temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bajura, Coloso, Toa, and Vega Baja, in addition to the

competing Rio Piedras soils. The Bajura, Coloso, and Toa soils also occur at lower positions in the river flood plains. Bajura and Coloso soils are poorly drained and are dark grayish brown. Toa soils are well drained and are coarser textured. The Vega Baja soils are poorly drained and occur at slightly lower geomorphic terrace positions.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: Used largely for production of sugar cane and for pasture.

DISTRIBUTION AND EXTENT: Humid northern coastal plains of Puerto Rico. This series is of limited extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: The classification was updated with the 4/91 draft from Clayey, mixed, isohyperthermic Plinthic Tropudults to Clayey, mixed, isohyperthermic Plinthic Paleudults. The previous OSED date was 7/73.

Laboratory data show that these soils have 10 percent or more weatherable minerals in the 20 to 200 micron fraction of the upper 40 inches.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 8 inches (Ap horizon)

Argillic horizon - zone from 8 to 52 inches (Bt horizons)

National Cooperative Soil Survey
U.S.A.

LOCATION VEGA BAJA PR

**Established Series
Rev. RLV
06/2002**

VEGA BAJA SERIES

The Vega Baja series consists of very deep, somewhat poorly drained, slowly permeable soils on alluvial fans and coastal plains. They formed in alluvial sediments and the underlying coastal plain sediments. Slopes range from 0 to 35 percent.

TAXONOMIC CLASS: Fine, mixed, active, isohyperthermic Aquic Hapludalfs

TYPICAL PEDON: Vega Baja silty clay - Merker grass. (Colors are for moist soil.)

Ap--0 to 7 inches; dark brown (10YR 4/3) silty clay; weak fine granular structure; firm, slightly sticky, plastic; many fine roots; few fine black concretions; strongly acid; gradual wavy boundary. (4 to 12 inches thick)

A--7 to 12 inches; mixed dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/8) silty clay; weak fine granular structure; firm, slightly sticky, plastic; many fine roots; few fine black concretions; strongly acid; abrupt wavy boundary. (4 to 12 inches thick)

Bt1--12 to 17 inches; dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/8) clay; weak coarse subangular blocky structure; firm, slightly sticky, plastic; few fine roots; few fine black concretions; black coatings on ped faces and root channels; very strongly acid; abrupt wavy boundary. (4 to 10 inches thick)

Bt2--17 to 32 inches; mixed strong brown (7.5YR 5/8) and gray (5Y 6/1) clay; weak medium subangular blocky structure; firm, slightly sticky, plastic; seams between peds and root channels filled with gray clay; few fine black concretions; very strongly acid; gradual wavy boundary. (8 to 16 inches thick)

BC--32 to 50 inches; brownish yellow (10YR 6/8) and light gray (N 7/0) silty clay with pockets of yellowish brown clay loam materials; weak coarse subangular blocky structure; slightly sticky, slightly plastic; few peds and fracture planes coated with black; root channels and worm burrows filled with gray clay; strongly acid; abrupt wavy boundary. (12 to 20

inches thick)

C1--50 to 55 inches; light gray (N 7/0) clay with many fine distinct strong brown (7.5YR 5/8) mottles; massive; sticky, plastic; moderately acid; abrupt wavy boundary. (4 to 12 inches thick)

C2--55 to 60 inches; light gray (N 7/0) and strong brown (7.5YR 5/8) silty clay; massive; sticky, plastic; medium acid.

TYPE LOCATION: San Juan SCD, Puerto Rico, Rio Piedras Experiment Station 200 feet north on road to Food Technology Laboratory, and 200 feet to the east of road. (Section of farm north of Highway 1 to Caguas)

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 32 to 70 inches. Thickness of the argillic horizon varies from 24 to 46 inches. These soils are slightly sticky or sticky and plastic. Base saturation ranges from 40 to 80 percent at 50 inches below the top of the argillic horizon.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 8. It is clay, silty clay or silty clay loam. Reaction ranges from neutral to very strongly acid.

The Bt horizon has hue of 7.5YR, 10YR, or 5Y, value of 4 to 6, and chroma of 1 to 8. They are clay or silty clay. Consistence is slightly sticky or sticky and plastic. Reaction is neutral or very strongly acid.

The C horizons are silty clay or clay; sticky and plastic. Reaction varies from moderately acid to strongly acid.

COMPETING SERIES: There are no series in this family. The Candelerio, Cayagua, Coloso, Corcega and Talante series are similar soils in related families. The Candelerio soils have coarser textured profiles with less than 35 percent clay. The Cayagua soils are underlain by coarse textured saprolite of granitic rocks within 40 inches of the soil surface. The Coloso soils lack argillic horizons and have organic matter that does not decrease regularly with depth. The Corcega and Talante are coarser textured.

GEOGRAPHIC SETTING: The Vega Baja soils are nearly level soils on fine textured coastal plains and alluvial fans with slope gradients from 0 to 35 percent. They formed in coastal plains sediments overlain by alluvial sediments. The climate is humid tropical. The mean annual precipitation ranges from 76 to 80 inches, and the mean annual air temperature is 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Vega Alta, Sabana Seca, Coloso, Bajura and Toa series. The Vega Alta soils occur at higher elevations in the coastal plain, are well drained and have more than 5 percent plinthite in the B horizon. The Sabana Seca soils are poorly drained and have plinthite. The Coloso, Bajura, and Toa soils occur at lower geomorphic positions in the river flood plain. The Toa and Coloso soils have organic matter that does not decrease regularly with depth and the Bajura soils have horizons with COLE values of more than 0.09.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow runoff; slow permeability.

USE AND VEGETATION: Most of the acreage of this soil is used for the production of sugarcane, and tame grasses and used as pasture.

DISTRIBUTION AND EXTENT: Humid northern coastal plains of Puerto Rico. The series is of minor extent, about 2,100 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

REMARKS: This revision updates the classification to Aeric Endoaqualfs.

Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 12 inches (Ap and A horizon)

Argillic horizon - zone from 12 to 37 inches (Bt horizon)

ADDITIONAL DATA: Characterization data are available for the typical pedon S61-PR-9-1.

MLRA = 272

SIR = PR0059

**National Cooperative Soil Survey
U.S.A.**

LOCATION VIGIA PR

Established Series

Rev.

06/2002

VIGIA SERIES

The Vigia series consists of deep, poorly drained soils formed from the residuum of highly decomposed plant tissues over fine textured sediments. They are nearly level soils on low and depressional area. The Vigia soils have black, granular organic surface layers over clay.

TAXONOMIC CLASS: Clayey, mixed, euic, isohyperthermic Terric Haplosaprists

TYPICAL PEDON: Vigia muck - native pasture and Aquatic Plants. (Colors are for moist soil.)

Oap--o to 14 inches; black (N 2/0) broken face and rubbed colors, about 5 percent fiber; moderate fine granular; friable, slightly sticky, slightly plastic, many fine roots; low mineral content; strongly acid, clear smooth boundary. (10 to 14 inches thick.)

Oa2--14 to 18 inches; black (N 2/0) 50 percent and very dark brown (10YR 2/2) 50 percent; moderate fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic, common fine roots, about 10 percent mineral content; medium acid, abrupt smooth boundary. (4 to 6 inches thick.)

C1--18 to 27 inches; gray (10YR 5/1) clay rust mottles due to root decay; massive; firm, sticky, plastic; medium acid; clear smooth boundary. (7 to 11 inches thick.)

C2--27 to 39 inches; yellowish brown (10YR 5/6) clay; few fine distinct yellowish red (5YR 4/6) and common medium distinct light brownish gray mottles; massive; firm, sticky, plastic; strongly acid; gradual wavy boundary. (10 to 14 inches thick.)

C3--39 to 60 inches; reddish brown (5YR 5/4) clay, few fine distinct brownish yellow (10YR 6/8) and greenish gray (5BG

6/1) massive; firm, sticky, plastic; slightly acid.

TYPE LOCATION: Norte SCD, Puerto Rico, 0.5 miles east of kilometer marker 3.6 on Highway 690.

RANGE IN CHARACTERISTICS: Depth to the mineral layers varies from 14 to 20 inches. Reaction of the profile varies from strongly to slightly acid.

The Oa layers vary in hues of 2.5Y, values of 2 and chromas of 1 or less. They are friable, slightly sticky and slightly plastic. Roots vary from many fine to common fine. Fiber content is less than 5 percent.

The C horizons are firm, sticky, plastic and of clay texture. The upper part of the C horizon has hues of 10YR, values of 5 and 6 and chromas of 1 or 2. The lower part of the C horizon has colors in hues of 10YR to 5YR, values and chromas of 4 to 6 with mottles of light brownish gray, bluish gray, yellowish red and brownish yellow.

COMPETING SERIES: There are no other known series in the same family. The Bayside, Colos, Corcega, Elvers, Pinones, Reparada, Snohomist, Talante and Wallkill series are similar soils in related families. The Elvers, Pinones, Reparada, Snohomist and Wallkill soils are underlain by histic layers. The Coloso, Corcega and Talante soils lack histic layers throughout the profile.

GEOGRAPHIC SETTING: The Vigia soils are nearly level soils on bottomland and depressional areas. Slope varies from 0 to 2 percent. The soils formed in the residuum of partially and completely decomposed plant tissue over fine textured coastal plain material. The climate is humid tropical. The average annual rainfall is 60 inches and the annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Reparada series and Garrochales and Tiburones series. The Reparada soils are underlain by marl. The Tiburones soils lack mineral layers.

DRAINAGE AND PERMEABILITY: Poorly drained, slow runoff and slow permeability. Water table varies from 30 to 40 inches.

USE AND VEGETATION: Most of the acreage is on native grasses and used as pasture.

DISTRIBUTION AND EXTENT: Humid northern coastal plains of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Arecibo Soil Survey Area, Puerto Rico. Vigia is the name of a "barrio" or ward close to where this soil was first recognized.

REMARKS: This soil has perched water table and has bright colors in the lower C horizons, so it qualifies for an Aeric-Histic Subgroup.

**National Cooperative Soil Survey
U.S.A.**

LOCATION VIVI PR

**Established Series
Rev. RAB-LHR-JEW
06/2002**

VIVI SERIES

The Vivi series consists of deep, somewhat excessively drained soils formed in sediments derived from volcanic rocks. They are nearly level soils on river flood plains. These soils typically have very dark grayish brown loam A horizons and dark grayish brown loam B horizons over stratified very fine sandy loam to coarse sand C horizons. TAXONOMIC

CLASS: Coarse-loamy, mixed, isohyperthermic Fluventic Hapludolls

**TYPICAL PEDON: Vivi loam - cultivated sugar cane
(Colors are for moist soil.)**

Ap--0 to 7 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable, nonsticky, nonplastic; many fine roots; many fine quartz grains; strongly acid; clear smooth boundary. (5 to 10 inches thick)

B--7 to 14 inches; dark grayish brown (10YR 4/2) loam; weak coarse subangular blocky structure; friable, nonsticky, nonplastic; common fine roots; many fine quartz grains; medium acid; clear smooth boundary. (5 to 10 inches thick)

C1--14 to 20 inches; dark brown (10YR 3/3) very fine sandy loam; massive; friable; few fine roots; medium acid; clear smooth boundary. (6 to 12 inches thick)

C2--20 to 30 inches; very dark grayish brown (10YR 3/2) loam; massive; friable, nonsticky, nonplastic; many fine quartz grains; medium acid; clear smooth boundary. (8 to 14 inches thick)

C3--30 to 36 inches; dark grayish brown (10YR 4/2) coarse sand; single grain; loose; medium acid; clear smooth boundary. (5 to 10 inches thick)

C4--36 to 60 inches; dark grayish brown (10YR 4/2) sandy loam; common medium distinct brown (7.5YR 4/4) mottles;

massive; very friable; medium acid.

TYPE LOCATION: Este SCD, Yabucoa, Puerto Rico; 1,000 feet north of kilometer marker 4.3 of Highway 901.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 10 to 20 inches. The soil ranges from strongly acid to slightly acid. Coarse fragment content ranges from 0 to 10 percent in subhorizons. The mean annual soil temperature ranges from 76 to 80 degrees F.

The A horizons have hues of 10YR or 2.5Y, values of 2 or 3, and chroma of 2 or 3. They are loam or sandy loam and have weak granular or subangular blocky structure.

The B horizons have hues of 10YR or 2.5Y, values of 3 to 6, and chroma of 2 to 4. They are loam or very fine sandy loam to sandy loam.

The C horizons have hues of 7.5YR to 2.5Y, values of 3 to 5, and chroma of 2 to 4. They are stratified loam or very fine sandy loam to coarse sand.

COMPETING SERIES: There are no other known series in the same family.

The Cornhill, Dique, Limani, Maraquez, Morado, Plata, and Vives series are similar soils in related families. Cornhill and Vives soils have ustic moisture regimes. Dique soils have fine-loamy particle-size control sections. Limani soils have base saturation of less than 50 percent. Maraquez, Morado, and Plata soils have regular decrease in organic matter with depth.

GEOGRAPHIC SETTING: The Vivi soils are nearly level on river flood plains. Slope gradients are 0 to 2 percent. The soils formed in coarse to medium textured stratified sediments from plutonic rocks. The climate is humid tropical. The average annual rainfall ranges from 80 to 90 inches. The mean annual temperature ranges from 77 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coloso, Maunabo, Mayo, Pandura, and Talante soils. Coloso, Maunabo, and Talante soils are somewhat poorly drained or poorly drained and have more than 18 percent clay in the particle-size control sections. Mayo soils have base saturation of less than 50 percent and are on terraces or alluvial fans above the flood plain. Pandura soils are shallow soils on uplands.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained. Runoff is medium to slow. Permeability is moderately rapid.

USE AND VEGETATION: Vivi soils are used for the production of sugar cane and minor crops. Some areas are used for growing pasture. Native vegetation consists of grasses and brush.

DISTRIBUTION AND EXTENT: Humid river flood plains of Puerto Rico. The series is of small extent with about 1600 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1942.

REMARKS:

National Cooperative Soil Survey
U.S.A.

LOCATION VOLADORA PR

**Established Series
Rev. REG: LHR
06/2002**

VOLADORA SERIES

The Voladora series is well drained moderately permeable on terraces and alluvial fans. These soils have dark reddish brown or dark red extremely acid fine textured A and B horizons over moderately fine textured conglomerate of varying colors.

TAXONOMIC CLASS: Very-fine, mixed, active, isohyperthermic Typic Palehumults

**TYPICAL PEDON: Voladora clay - sugarcane.
(Colors are for moist soil.)**

Ap--0 to 8 inches; dark reddish brown (5YR 3/4) clay; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; volcanic rock fragments; numerous krotovinas; extremely acid; clear smooth boundary. (6 to 10 inches thick)

B2t--8 to 16 inches; dark reddish brown (2.5YR 3.4) moist, red (2.5YR 4/6) dry clay with organic staining along root channels; moderate medium subangular blocky structure; friable, slightly sticky, plastic; thin patchy clay films; common fine roots; extremely acid; clear smooth boundary. (6 to 12 inches thick)

B3--16 to 26 inches; dark red (2.5YR 3/6) moist, red (2.5YR 4/8) dry clay loam; weak medium subangular blocky structure; friable, slightly sticky, plastic; thin patchy clay films; few fine roots; many fine weathered yellow sand grains; extremely acid; gradual wavy boundary. (12 to 18 inches thick)

C--26 to 48 inches; mixed colors, red (2.5YR 4/8), very pale brown (10YR 7/4), and brownish yellow (10YR 6/6) highly weathered conglomerate; clay loam with original rock structure visible; massive; friable, slightly sticky, plastic; extremely acid.

TYPE LOCATION: Culebrinas SCD, Puerto Rico; 3 miles east of the town of Moca; 0.2 kilometers west on dirt road from kilometer marker 1.1 on Highway 420; 300 feet south of dirt road.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 24 to 40 inches. Thickness of the argillic horizon varies from 18 to 30 inches. Reaction is strongly to extremely acid throughout. Consistence is slightly sticky, slightly plastic or plastic. Base saturation (by sum of cations) is 20 to 30 percent below the upper part of the argillic horizon. Organic carbon ranges from 0.6 to 0.8 in the upper 6 inches of the argillic horizon. The mean annual soil temperature is 70 degrees F.

The A horizon has hue of 5YR or 2.5YR, value of 3 and chroma of 3 or 4. It is clay. Structure is weak or moderate, fine or medium granular. Fine volcanic fragments range from 2 to 5 percent.

The B horizons have hues of 2.5YR or 10R, values of 3 or 4, and chromas of 4 to 8. Texture is clay. Structure is weak or more moderate, fine or medium subangular blocky.

The C horizons consists of clay loam or silty clay loam, weathered conglomerate of variegated colors.

COMPETING SERIES: There are no other known series in the same family. The Almirante, Bejucos, Cabo Rojo, Cidral, Consejo, Consumo, Corozal, Corozo, Espinosa, Guanajibo, Guerrero, Ingenio, Jagueyes, Jobos, Lirios, Maleza, Maricao, Patillas, Rio Piedras, and Vega Alta series are similar soils in related families. The Almirante, Guanajibo, Guerrero, Jobos, and Vega Alta soils have plinthite in their profiles. The Bejucos, Cidral, Consejo, Corozo, Espinosa, Ingenio, Jagueyes, Lirios, Maleza, and Rio Piedras soils all have dry color values of 5 or more in the argillic horizon and change more than 1 unit of value from dry to moist colors. The Cabo Rojo soils have thicker argillic horizons. The Consumo, Maricao and Patillas soils have thinner argillic horizons. The Corozal soils have low chroma mottles in their profile.

GEOGRAPHIC SETTING: The Voladora soils are sloping to steep soils on dissected terraces and alluvial fans on slope gradients of 5 to 40 percent. They formed in fine and moderately fine textured residuum of highly weathered conglomerate. The climate is humid tropical. The average annual precipitation is 80 inches and the mean annual temperature is 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Moca, Perchas and Plata series. The Moca soils are deeper, more plastic throughout and lack the weathered conglomerate. The Perchas soils are poorly drained. The Plata soils are lighter colored, shallower, and lack argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; runoff is medium; permeability is moderate.

USE AND VEGETATION: Sugarcane in gentler slopes, pasture in the steeper ones.

DISTRIBUTION AND EXTENT: Humid uplands of Puerto Rico. The series is of minor extent, with about 16,000 acres.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Culebrinas SCD, Puerto Rico; 1979.

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