

LOCATION AGUILITA PR

**Established Series
Rev. JLL: GRB
7/98**

AGUILITA SERIES

The Aguilita series consists of deep, well drained, moderately permeable soils on ridgetops, summits, and side slopes in uplands of the limestone hills and mountains of the Semiarid Mountains and Valley MLRA. They formed in material weathered from soft limestone bedrock. Near the type location, the mean annual precipitation is about 35 inches, and the mean annual temperature is about 79 degrees F. Slopes range from 2 to 60 percent.

TAXONOMIC CLASS: Coarse-loamy, carbonatic, isohyperthermic Aridic Calciustolls

TYPICAL PEDON: Aguilita very gravelly clay loam - in pastureland. (Colors are for moist soil unless otherwise indicated.)

Ap--0 to 8 inches; very dark brown (10YR 2/2) gravelly clay, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; firm, slightly sticky, slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; about 25 percent, by volume, pebbles; moderately alkaline; strongly effervescent; clear smooth boundary. (3 to 8 inches thick).

Bk--8 to 14 inches; dark brown (10YR 4/3) clay, brown (10YR 5/3) dry; weak medium subangular blocky structure; firm; sticky, plastic; many very fine and fine roots; many very fine and fine tubular and vesicular pores; many prominent nodules and soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary. (3 to 6 inches thick).

C1--14 to 21 inches; very pale brown (10YR 8/3) clay loam, white (10YR 8/2) dry; massive; friable; slightly sticky, slightly plastic; many very fine, common fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary.

C2--21 to 33 inches; very pale brown (10YR 8/3) clay loam, white (10YR 8/2) dry; massive; friable; slightly sticky,

slightly plastic; common very fine and fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; gradual smooth boundary.

C3--33 to 43 inches; pale brown (10YR 6/3) clay loam, light gray (10YR 7/2) dry; massive; friable; slightly sticky, slightly plastic; common very fine and fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; gradual smooth boundary.

C4--43 to 54 inches; light olive brown (2.5Y 5/3) loam, light yellowish brown (2.5Y 6/3) dry; massive; friable; slightly sticky, slightly plastic; many very fine, common fine roots; many very fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; moderately alkaline; strongly effervescent; clear smooth boundary.

Cr--54 to 80 inches; 50 percent light olive brown (2.5Y 5/3) and 50 percent very pale brown (10YR 8/3) stratified soft limestone bedrock, 50 percent light yellowish brown (2.5Y 6/3) and 50 percent very pale brown (10YR 8/3) dry; moderate medium and thick platy rock structure; few fine roots in fractures; stratified layers 8 to 12 inches thick; moderately alkaline; strongly effervescent.

TYPE LOCATION: Cabo Rojo Municipio, Puerto Rico. Approximately 3.7 miles northeast of El Combate; southeast from the intersection of P.R. Hwy. 301 and P.R. Hwy. 303, about 0.1 mile south on P.R. Hwy 303, about 200 feet east of highway; USGS Cabo Rojo topographic quadrangle; lat. 17 degrees 59 minutes 24 seconds N. and long. 67 degrees 9 minutes 21 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Depth to soft limestone bedrock ranges from 40 to 60 inches. Reaction is moderately alkaline throughout. Rock fragments include pebbles and cobbles composed of limestone.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is loam, clay loam, or clay in the fine-earth fraction. Content of rock fragments range from 5 to 60 percent, by volume.

The Bk horizon has hue of 7.5YR to 2.5Y, value of 3 to 8, and chroma of 1 to 6. Texture is loam, silt loam, silty clay, clay loam, or clay in the fine-earth fraction. Nodules and soft masses of calcium carbonate concretions and other features such as filaments of calcium carbonate range from common to many. Content of rock fragments range from 0 to 25 percent, by volume.

The BCk horizon, where present, has hue of 7.5YR to 2.5Y, value of 4 to 8, and chroma of 4 or 6. Textures are similar

to the Bk horizon. Nodules and soft masses of calcium carbonate concretions and other features such as filaments of calcium carbonate range from common to many. Content of rock fragments range from 0 to 25 percent, by volume.

The C horizon has hue of 7.5YR to 2.5Y, value of 6 to 8, and chroma of 1 to 6. Texture is loam, silt loam, or clay loam in the fine-earth fraction. Content of rock fragments range from 0 to 15 percent, by volume.

The Cr horizon is composed of soft limestone bedrock. It has hue of 7.5YR to 2.5Y, value of 6 to 8, and chroma of 1 to 6. It can be excavated with difficulty with hand tools, and is rippable by mechanized equipment.

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

GEOGRAPHIC SETTING: Aguilita soils are on ridgetops, summits, and side slopes in uplands and limestone hills and mountains of the Semiarid Mountains and Valleys MLRA. They formed in material weathered from soft limestone bedrock. Slopes range from 2 to 60 percent. The climate is tropical semiarid. The average annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Duey, San German, Tuque, and Yauco soils. Duey and San German soils are on similar positions, but are shallow to soft limestone bedrock. In addition, San German soils do not have a Mollic epipedon. Tuque soils are on similar positions and have a petrocalcic horizon. Yauco soils are on lower positions, and are moderately deep to soft limestone bedrock.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most of the acreage is used for pastureland. Vegetation consists of Mesquite, Huracan, and other xerophytic grasses and shrubs.

DISTRIBUTION AND EXTENT: Uplands of the Semiarid Mountains and Valleys of southern Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS:

The Aguilita soils were correlated as Loamy-skeletal, carbonatic, isohyperthermic Typic Rendolls in the 1970 Soil Survey of the Virgin Islands of the United States. The change from Typic Rendolls to Typic Calciustolls took place when Soil Taxonomy did not allow Rendolls to have an Ustic Soil Moisture Regime.

The type location was moved to Puerto Rico from the U.S. Virgin Islands in 1998 and the series reclassified based on soil lab data and observations in the field.

Diagnostic horizons and features recognized in this pedon are:

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

Calcic horizon - zone from 8 to 14 inches (Bk horizon)

ADDITIONAL DATA: Characterization pedon - Cabo Rojo Municipio, Puerto Rico; S97PR-023-002. Sample by the NSSL, Lincoln NE., 6/97.

MLRA: 271.

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

LOCATION AGUIRRE PR

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

AGUIRRE SERIES

The Aguirre series consists of very deep, somewhat poorly drained, very slowly permeable soils in depressions and on valley floors of the Semiarid Coastal Plain MLRA. They formed in sediments that weathered from limestone and igneous rock. Near the type location, the mean annual precipitation is about 35 inches and the mean annual temperature is about 77 degrees F. Slopes range from 0 to 1 percent.

TAXONOMIC CLASS: Very-fine, smectitic, isohyperthermic Sodic Haplusterts

TYPICAL PEDON: Aguirre clay. (Colors are for moist soil unless otherwise stated.)

A1--0 to 10 inches; very dark gray (N 3/0) clay; moderate fine granular structure; hard, very firm; very sticky, very plastic; common fine roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

A2--10 to 18 inches; very dark gray (N 3/0) clay; moderate fine angular blocky structure; very hard, very firm; very sticky, very plastic; few fine roots along structural faces; common pressure faces on surfaces of peds; slightly effervescent; moderately alkaline. (Combined thickness of the A horizons range from 7 to 19 inches)

Bss1--18 to 26 inches; dark gray (5Y 4/1) clay, moderate medium and coarse angular blocky structure; very hard, very firm; very sticky, very plastic; few fine roots on faces of peds and slickensides faces; many large slickensides having distinct polished and grooved surfaces; about 3 percent, by volume, igneous rock fragments; few black (10YR 2/1) concretions of iron-manganese; strongly effervescent; moderately alkaline; clear irregular boundary.

Bss2--26 to 36 inches; about 50 percent light olive brown (2.5Y 5/4) and about 50 percent dark gray (5Y 4/1) clay; moderate medium and coarse angular blocky structure; common large slickensides having prominent polished and grooved surfaces; few fine black (10YR 2/1) concretions of iron-manganese; slightly effervescent; moderately alkaline; clear irregular boundary.

Bss3--36 to 45 inches; olive gray (5Y 5/2) clay; moderate medium and coarse angular blocky structure; very hard, very firm; very sticky, very plastic; common large slickensides having prominent polished and grooved surfaces; few black (10YR 2/1) concretions of iron-manganese; slightly effervescent; moderately alkaline, gradual wavy boundary.

Bss4--45 to 80 inches; light olive brown (2.5Y 5/4) clay; moderate medium and coarse angular blocky structure; very hard, very firm; very sticky, very plastic; few small and medium slickensides having distinct polished and grooved surfaces; few black (10YR 2/1) concretions of iron-manganese; slightly effervescent; moderately alkaline. (Combined thickness of the Bss horizons range from 51 inches to more than 80 inches.)

TYPE LOCATION: Lajas Municipality, Puerto Rico. Approximately 3.4 miles southeast of the city of Lajas from the intersection of P.R. highway 116 and P.R. highway 117; about 200 feet east of dirt road in pasture. Lat. 18 degrees 00 minutes 33 seconds N.; long. 67 degrees 00 minutes 55 seconds W.; PRD 1940. San German topographic quadrangle.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction ranges from slightly alkaline to moderately alkaline in the A horizons, and moderately alkaline in the Bss horizons. The soil is calcareous throughout.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2; or is neutral with value of 3 or 4.

The upper part of the Bss horizon has hue of 10YR to 5Y, chroma of 4 and value of 1 or 2. The lower part of the Bss horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 2 through 4; or there is no dominant matrix color and is multicolored in shades of brown and gray. Concretions and/or soft masses of iron-manganese ranges from none to common.

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

GEOGRAPHIC SETTING: Aguirre soils are in depressions and on valley floors. They formed in sediments derived from limestone and igneous rock. Slopes range from 0 to 1 percent. The climate is tropical semiarid. The average annual precipitation ranges from 30 to 40 inches and the average annual temperature ranges from 75 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Cartagena, Fe, Fraternidad, and Guanica soils. Cartagena soils have less clay in the control section and have mixed mineralogy. Fe soils have less clay in the control section. The moderately well drained Fraternidad soils have less clay in the subsoil and do not have an exchangeable sodium percentage of 15 or more (SAR of 13 or more). Guanica soils have gypsum accumulation in the subsoil.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; very slow permeability.

USE AND VEGETATION: Aguirre soils are primarily used for sugarcane and native pasture. Native vegetation includes Pajon, Paraguita, and Malojillo along with introduced species.

DISTRIBUTION AND EXTENT: Southern and southwest 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 are:

Mollic epipedon - zone from 0 to 18 inches (A horizons).

Slickensides and vertic features - zone from 18 to 80 inches (Bss horizons).

Exchangeable sodium - more than 15 percent in Bss horizon.

ADDITIONAL DATA: Sampled as S95PR-079-005. Lab. Sample Nos. 4381-4388. Sample by NSSL, Lincoln, NE.; July 1995.

MLRA: 273.

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

LOCATION AMELIA PR

**Established Series
Rev. JLL/GRB
07/2001**

AMELIA SERIES

The Amelia series consists of very deep, well drained, moderately permeable soils on mountain footslopes and alluvial fans. They formed in gravelly sediments that weathered from igneous rock. Near the type location, the mean annual precipitation is about 35 inches and mean annual temperature is about 79 degrees F. Slopes range from 2 to 12 percent.

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

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

Ap--0 to 9 inches; dark brown (7.5YR 3/4) sandy clay loam; moderate fine granular structure; soft, friable; slightly sticky, slightly plastic; common very fine roots; about 5 percent, by volume, pebbles; slightly acid; clear wavy boundary. (5 to 11 inches thick)

Bt1--9 to 15 inches; dark reddish brown (5YR 3/4) clay loam; weak medium subangular blocky structure; slightly hard, friable; sticky, plastic; common very fine roots; common thin clay films on pebbles; about 25 percent, by volume, pebbles; neutral; clear smooth boundary.

Bt2--15 to 29 inches; yellowish red (5YR 4/6) gravelly clay; moderate fine and medium subangular blocky structure; firm; sticky, plastic; few very fine roots, many thin clay films on faces of peds, few thin clay films on gravel; about 15 percent, by volume, pebbles; neutral; gradual smooth boundary.

Bt3--29 to 43 inches; yellowish red (5YR 4/6); very gravelly clay; moderate medium subangular blocky structure; slightly hard, firm; sticky, plastic; few very fine roots; many thin clay films on faces of peds and few thin clay films on pebbles; about 40 percent, by volume, pebbles; about 2 percent, by volume, cobbles; neutral; clear wavy boundary.

Bt4--43 to 56 inches; about 75 percent strong brown (7.5YR 4/6) and about 25 percent yellowish red (5YR 4/6) very

gravelly sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; sticky, plastic; few very fine roots; many thin clay films on faces of peds and on pebbles; about 50 percent, by volume, pebbles; about 5 percent, by volume, cobbles; neutral; gradual wavy boundary.

Bt5--56 to 68 inches; yellowish red (5YR 4/6) extremely gravelly sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; sticky, plastic; common clay films on the vertical and horizontal faces of peds and on pebbles; about 65 percent, by volume, pebbles; about 5 percent, by volume, cobbles; neutral; gradual wavy boundary.

Bt6--68 to 78 inches; yellowish red (5YR 5/6) very gravelly sandy clay loam; weak medium subangular blocky structure; slightly hard, friable; sticky, plastic; common clay films on vertical and horizontal faces of peds and on rock fragments; about 45 percent, by volume, pebbles; about 2 percent, by volume, cobbles; neutral. (Combined thickness of Bt horizon ranges from 60 inches to more than 80 inches thick.)

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 3.3 miles west of P.R. highway 303 from the intersection with P.R. highway 305; about 1.4 miles west of the Maguayo community on dirt road, and about 80 feet south of the dirt road in native pasture. San German topographic quadrangle; lat. 18 degrees 07 minutes 46 seconds N.; long. 67 degrees 07 minutes 13 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 60 to more than 80 inches. Reaction is strongly acid to neutral in the A horizon and slightly acid or neutral in the Bt horizons.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 to 4. Texture is loam, clay loam, gravelly clay loam, or gravelly clay. Content of pebbles and cobbles range from 2 to 20 percent, by volume.

The Bt horizon has hue of 2.5YR to 10YR, value of 3 or 4, and chroma of 4 through 8. Texture in the upper Bt is very gravelly clay loam, very gravelly clay, gravelly clay loam or gravelly clay and in the lower Bt, clay loam, very gravelly clay loam, or extremely gravelly sandy clay loam. Content of pebbles and cobbles range from 20 to 75 percent by volume, averaging 40 to 70 percent in the control section.

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

GEOGRAPHIC SETTING: Amelia soils are on footslopes and alluvial fans. They formed in material that weathered from igneous rock. Slopes range from 2 to 12 percent. The climate is semiarid tropical. The average annual precipitation

ranges from 30 to 40 inches and the average annual temperature ranges from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Descalabrado, Fraternidad, Guayama, Jacana, and Maguayo series. Descalabrado and Guayama soils are shallow to igneous bedrock. Jacana soils are moderately deep to igneous bedrock. In addition, they are on higher adjacent sideslopes of volcanic hills and mountains and have fewer pebbles and cobbles in the control section. The moderately well drained Fraternidad soils have smectitic mineralogy and fewer pebbles in the control section. Maguayo soils are on similar positions, contain secondary carbonates, and have fewer pebbles in the control section.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of Amelia soils are used for pastureland. A few small areas are in cropland, primarily corn and sorghum. Vegetation consists of Guineagrass, Pajon, and other native and introduced grasses and shrubs.

DISTRIBUTION AND EXTENT: Semiarid mountains and valleys of southern 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 are:

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

Argillic horizon - zone from 9 to 78 inches (Bt1, Bt2, Bt3, Bt4, Bt5, and Bt6 horizons)

ADDITIONAL DATA: Sampled as S85PR-079-003, S85PR-007-001 and S57PR-079-007. Samples by NSSL, Lincoln NE.

MLRA: 273.

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

LOCATION MAGUAYO PR

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

MAGUAYO SERIES

The Maguayo series consists of deep, well drained, slowly permeable soils that formed in materials derived from volcanic rocks and limestone. These gently sloping and sloping soils are on alluvial fans and terraces on coastal plains. Slopes range from 2 to 12 percent. Mean annual precipitation is 35 inches. Mean annual temperature is 77 degrees F.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Vertic Haplustalfs

**TYPICAL PEDON: Maguayo gravelly sandy clay loam in pasture.
(Colors are for moist soil unless otherwise stated.)**

Ap--0 to 5 inches; dark brown (10YR 3/3) gravelly clay loam; weak fine granular structure; slightly hard; friable, slightly sticky; 20 percent pebbles; slightly acid; clear smooth boundary. (4 to 7 inches thick)

Bt1--5 to 13 inches; dark yellowish brown (10YR 4/4) clay; weak medium subangular blocky structure, hard, friable, slightly sticky and slightly plastic; many fine roots; many thin clay films on faces of peds; neutral; gradual wavy boundary. (7 to 10 inches thick)

Bt2--13 to 22 inches; dark yellowish brown (10YR 4/4) clay; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; few slickensides; many thin clay films on faces of peds; slightly effervescent; mildly alkaline; gradual wavy boundary. (7 to 10 inches thick)

Bk--22 to 48 inches; yellowish brown (10YR 5/8) clay loam; massive; hard, friable, slightly sticky; 10 percent pebbles; few black concretions; strongly effervescent; common medium distinct very pale brown lime splotches; moderately alkaline; abrupt wavy boundary. (15 to 35 inches thick)

2C--48 to 52 inches; brown (10YR 4/3) very gravelly clay loam; massive; hard, firm in place, friable when removed; 50

percent pebbles; slightly effervescent; mildly alkaline.

TYPE LOCATION: LaJas Valley, Puerto Rico; 0.3 Km. east of Maguayo Branch Post Office, immediately north of Highway 305.

RANGE IN CHARACTERISTICS: Depth to the Bk horizon is 18 to 24 inches. Depth to the 2C horizon is 40 to 60 inches.

The A horizon has value of 2 or 3 and chroma of 2 or 3. It has 15 to 25 percent pebbles. Reaction is medium or slightly acid.

The Bt horizon has hue of 10YR or 7.5YR and value of 4 or 5. It has 0 to 10 percent pebbles.

The Bk horizon has hue of 10YR or 7.5YR and chroma of 4 through 8. It is clay loam or clay and 0 to 10 percent pebbles.

The C horizon is clay loam or clay and 35 to 60 percent pebbles.

COMPETING SERIES: This is the Glynn series. Glynn soils have 2B horizon developed in stratified sediments.

GEOGRAPHIC SETTING: Maguayo soils are on alluvial fans and terraces on coastal plains. Slopes are 2 to 12 percent. These soils formed in materials derived from volcanic rock and limestone. Elevation is near sea level. The climate is tropical semi-arid. The mean annual precipitation is 30 to 35 inches, and the mean annual temperature is 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Amelia soils which have over 35 percent coarse fragments in the particle-size control section.

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

USE AND VEGETATION: These soils are mainly used for pasture.

DISTRIBUTION AND EXTENT: Lajas Valley Area of Puerto Rico. The soils of this series are of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Lajas Valley Area, 1961.

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LOCATION AMERICUS GA+AL FL

**Established Series
Rev. LWF
1/93**

AMERICUS SERIES

The Americus series consists of very deep, somewhat excessively drained, moderately rapidly permeable soils on uplands. These soils have dark reddish brown loamy sand A horizons and dark red loamy sand and sandy loam Bt horizons that extend to depths of more than 6 feet. Slopes range from 0 to 25 percent. Near the type location, mean annual temperature is 66 degrees F., and mean annual precipitation is 50 inches.

TAXONOMIC CLASS: Sandy, siliceous, thermic Rhodic Paleudults

TYPICAL PEDON: Americus loamy sand - cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 7 inches; dark reddish brown (5YR 3/4) loamy sand; weak fine granular structure; very friable; many fine roots; moderately acid; clear wavy boundary. (6 to 9 inches thick)

BA--7 to 11 inches; dark red (2.5YR 3/6) loamy sand; weak fine granular structure; very friable; many fine roots; many fine tongues of A horizon; moderately acid; clear smooth boundary. (0 to 12 inches thick)

Bt1--11 to 31 inches; dark red (2.5YR 3/6) loamy sand, red (2.5YR 4/6) dry; weak medium granular structure; very friable; many fine and few medium roots; thin lenses and small pockets of clean sand grains; most sand grains coated and bridged with clay; strongly acid.

Bt2--31 to 47 inches; dark red (2.5YR 3/6) loamy sand; same color dry; weak medium granular structure; friable; few fine and medium roots; few thin lenses of clean sand grains; most sand grains coated and bridged with clay; very strongly acid; gradual smooth boundary.

Bt3--47 to 72 inches; dark red (2.5YR 3/6) sandy loam; same color dry; weak medium and coarse subangular blocky structure; friable; few fine roots; few scattered clean sand grains and small pockets of clean sand grains; most sand grains

coated and bridged with clay; very strongly acid.
(Combined thickness of the Bt horizon is 66 inches or more)

TYPE LOCATION: Sumter County, Georgia; 45 yards south of Georgia National Guard Armory on Georgia Highway 30.

RANGE IN CHARACTERISTICS: Solum thickness exceeds 72 inches. All horizons are strongly acid or very strongly acid unless limed. The A horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 3, and chroma of 2 through 4. It is loamy sand, loamy fine sand, or sand.

The Bt horizons have hue of 5YR, 2.5YR, or 10R, value of 3, and chroma of 4 or 6. Values of dry soil are 1 unit or less higher than that of moist soil. The Bt1 and Bt2 horizons are loamy sand or loamy fine sand. The Bt3 horizon is sandy loam, fine sandy loam, or loamy sand. The upper 20 inches of the Bt horizon averages between 8 and 14 percent clay and less than 10 percent silt.

COMPETING SERIES: There are no series in the same family. Competing series in other families are the Anniston, Bienville, Blanton, Claiborne, Eustis, Kenansville, Lucedale, Lucy, Molena, Pine Flat, Red Bay, Troup, and Wagram series. Anniston soils have kaolinitic clay mineralogy and average more than 35 percent clay in the control section. Bienville, Blanton, Eustis, Lucy, Troup, and Wagram soils have argillic horizons with dry color values of 5 or more. In addition, Lucy, Troup, and Wagram soils have a kandic horizon and have sandy clay loam Bt horizons. Claiborne soils have mean annual soil temperatures less than 59 degrees F., and have more than 18 percent clay in the upper 20 inches of the Bt. Kenansville soils have sola of less than 40 inches thick. Lucedale and Red Bay soils have more than 18 percent clay in the upper 20 inches of the Bt horizon. Molena soils have sola 40 to 72 inches thick and mixed mineralogy. Pine Flat soils are sandy loam in the upper part of the Bt horizon.

GEOGRAPHIC SETTING: Americus soils are on smooth to dissected parts of the Coastal Plain. Slope gradients are mostly 0 to 12 percent, but the range extends up to 25 percent. Elevation is 150 to 500 feet. The soil formed in unconsolidated sandy sediment. Mean annual air temperature is about 60 to 70 degrees F., and the mean annual precipitation is about 40 to 55 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Eustis, Lucy, Red Bay, Troup, and Wagram series, these are the Faceville, Greenville, Lakeland, and Orangeburg series. Faceville and Greenville soils have more than 35 percent clay in the Bt horizon. Lakeland soils do not have Bt horizons and have sand texture to a depth of

80 inches or more. Orangeburg soils average between 18 to 35 percent clay in the upper 20 inches of the Bt horizon.

DRAINAGE AND PERMEABILITY: Somewhat excessively drained. Runoff is slow. Permeability is moderately rapid to rapid. Available water capacity is low.

USE AND VEGETATION: Most of the soil on gentle slopes has been cleared and is used for general agriculture. The remainder is in forest of pine and blackjack oak.

DISTRIBUTION AND EXTENT: Alabama, Florida, Georgia, and perhaps South Carolina. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: West Florida Experiment Station, Santa Rosa County, Florida; 1949.

REMARKS: Diagnostic horizon and feature recognized in this pedon are:

Argillic horizon - the zone from approximately 11 to 72 inches (Bt1, Bt2, Bt3 horizons).

Rhodic feature - the value three colors throughout the profile.

Revised 1/93

SIR=GA0043

MLRA=133A

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

LOCATION CARTAGENA PR

**Established Series
Rev. LAD-RLV
08/2000**

CARTAGENA SERIES

The Cartagena series consists of very deep, somewhat poorly drained, slowly permeable soils that formed in sediments derived from volcanic rocks and limestone. These nearly level soils are on alluvial fans in valleys. Slopes range from 0 to 2 percent. The mean annual precipitation is about 35 inches and the mean annual temperature is about 77 degrees F.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Sodic Haplusterts

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

Ap--0 to 7 inches; very dark grayish brown (10YR 3/2) clay, weak fine angular blocky structure; firm, slightly sticky, plastic, common fine roots; few fine black concretions; neutral (pH 6.6), clear wavy boundary. (5 to 9 inches thick)

ABss1--7 to 15 inches; very dark grayish brown (10YR 3/2) clay; moderate medium angular blocky structure; firm, slightly sticky, plastic, common fine roots, few fine volcanic fragments; few small slickensides; few fine black concretions; neutral (pH 6.9), clear wavy boundary. (6 to 10 inches thick)

ABss2--15 to 22 inches; very dark gray (10YR 3/1) clay; moderate fine angular blocky structure; firm slightly sticky, plastic; few fine roots; few fine black concretions; few fine volcanic fragments; many slickensides and pressure surfaces; neutral (pH 7.3); wavy boundary. (6 to 9 inches thick)

ABss3--22 to 30 inches; black (10YR 2/1) clay; weak coarse angular blocky structure; firm; slightly sticky; plastic; few fine volcanic fragments; many slickensides and pressure surfaces; mildly alkaline (pH 7.6); clean irregular boundary. (6 to 12 inches thick)

Bss1--30 to 46 inches; dark grayish brown (10YR 4/2) clay; weak coarse angular blocky structure; firm; sticky, plastic; common fine black concretions; many fine subrounded volcanic fragments; common slickensides and pressure surfaces;

moderately alkaline (pH 8.2) gradual wavy boundary. (10 to 20 inches thick)

Bss2--46 to 60 inches; brown (10YR 4/3) clay; weak coarse angular blocky structure; firm; sticky, plastic, common fine black concretions; few fine subrounded volcanic fragments; effervescent; moderately alkaline (pH 8.4).

TYPE LOCATION: Suroeste SCS, Puerto Rico, 2.2 mile southeast of the town of Lajas, 0.6 mile northeast of Hacienda Beatriz Soledad, 5/8 mile south of Highway No. 117, 1.5 miles east of junction of old railroad and Highway No. 116 in northwest corner of farm road intersection.

RANGE IN CHARACTERISTICS: Depth to moderate salinity is 18 to 26 inches.

The A horizon has hue of 10YR or 2.5Y and value of 2 or 3 moist. Texture is clay or silty clay loam.

The ABss horizon has hue of 10YR or 2.5Y and value of 2 or 3 moist. Texture is clay or silty clay loam. This horizon is slightly to moderately saline.

The Bss horizon has hue of 7.5YR, 10YR or 2.5Y, value of 2 through 5, and chroma of 2 through 4. Slickensides are common to many and are close enough to intersect. It is moderately saline. ESP is 15 to 35.

COMPETING SERIES: This is the Fe series in same subgroup. Fe soils have gypsum crystals in the subsoil and have montmorillonitic mineralogy.

GEOGRAPHIC SETTING: Cartagena soils are on alluvial fans in valleys. Slope is 0 to 2 percent. These soils formed in sediments derived from volcanic rocks and limestone. Elevation is near sea level. The climate is tropical semiarid. Mean annual precipitation is 30 to 45 inches, and the mean annual temperature is 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Fe soils, these are the Aguirre, Fraternidad, Guanica, Paso Seco and Santa Isabel soils. Aguirre soils have a very dark gray or black surface layer. Fraternidad soils are moderately well drained. Guanica soils have gypsum crystals at depths of 32 to 50 inches. Paso Seco soils have a lithologic discontinuity of gravelly material at depths of 28 to 35 inches. Santa Isabel soils have a very dark gray or black surface layer and are moderately well drained.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; slow runoff; slow permeability.

USE AND VEGETATION: This soil is mainly used for sugar cane and pasture. The native vegetation consists mainly of Angletongrass, Paraguita and Rayo and Mesquite bushes.

DISTRIBUTION AND EXTENT: Coastal plains of southern Puerto Rico. The soils of this series are of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Lajas Valley Area, Puerto Rico; 1961

REMARKS: The classification was previously updated with the 4/91 draft from Fine, mixed, isohyperthermic Udic Chromusterts to Fine, mixed, isohyperthermic Typic Chromusterts. The previous OSED date was 4/85.

Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - zone from 0 to 30 inches (A and ABss horizons)

Slickensides and vertic features - zone from 7 to 60 inches (ABss and Bss horizons)

ADDITIONAL DATA: Sampled as S57PR-14-5 and S57PR-14-8. NSSL, Lincoln, NE Lab. Sample Nos. 7403-7409 and 7419-7425, Nov. 1966.

National Cooperative Soil Survey
U.S.A.

LOCATION DESCALABRADO PR

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

DESCALABRADO SERIES

The Descalabrado series consists of shallow, well drained, moderately permeable soils on uplands. They formed in material weathered from basic volcanic rock. 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 2 to 60 percent.

TAXONOMIC CLASS: Clayey, mixed, superactive, shallow Typic Haplustolls

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

Ap--0 to 5 inches; dark brown (10YR 3/3) clay loam; weak fine subangular blocky structure parting to moderate medium granular; slightly hard, friable; slightly sticky and slightly plastic; common fine roots; about 10 percent, by volume, angular pebbles of volcanic rock; neutral; clear smooth boundary. (4 to 8 inches thick)

Bw--5 to 12 inches; dark brown (7.5YR 3/2) gravelly clay; weak fine subangular blocky structure; slightly hard, firm; slightly sticky and slightly plastic; few fine roots; about 30 percent, by volume, angular pebbles of volcanic rock; neutral; clear wavy boundary. (6 to 12 inches thick)

R--12 inches; hard basic volcanic rock; few seams of secondary carbonates in cracks in upper part.

TYPE LOCATION: Lajas Valley, Puerto Rico. Approximately 0.3 miles east of km. 13.1, Highway 103 and about 132 feet north of cement marker AFF No. 38 on edge of main irrigation canal.

RANGE IN CHARACTERISTICS: Depth to bedrock ranges from 10 to 20 inches. Rock fragments range from 0 to 30 percent in the A and Bw horizons. Reaction ranges from slightly acid to slightly alkaline.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is clay loam or their gravelly or

cobbly analogs.

The Bw horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is clay loam, clay, or their gravelly or cobbly analogs.

Some pedons have a thin Cr layer composed of highly fractured volcanic rock. Colors are similar to the Bw horizon.

The R layer is hard, basic volcanic rock.

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

GEOGRAPHIC SETTING: Descalabrado soils are on hills and mountains. They formed in material that weathered from basic volcanic rock. The climate is tropical semiarid. Slopes are 2 to 60 percent. The average annual temperature ranges from 77 to 81 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Aguilita, Guayama, Jacana, and Juana Diaz soils. Aguilita soils are generally on lower positions, are deep to limestone bedrock and are carbonatic. Guayama soils are on similar positions, have argillic horizons, and do not have a mollic epipedon. Jacana soils are on slightly lower positions and are moderately deep to volcanic rock. Juana Diaz soils are on similar positions, are shallow to semiconsolidated sandstone, and do not have mollic epipedons.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas are used for pastureland. A few areas are used for crops including corn, tobacco, pigeon peas, avocado, and mangos. Vegetation includes guineagrass, buffelgrass, and other native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid uplands of southern Puerto Rico. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: St. Croix, Virgin Islands, 1932.

REMARKS: The original concept of this series was 15 to 35 inches of residuum over volcanic bedrock as mapped by Dr. James Thorp during the first 1932 soil survey of St. Croix. This soil was correlated as a Lithic Vertic Ustropept in the 1970 Soil Survey of the Virgin Islands. The type location was moved to Lajas Valley, Puerto. This series was not correlated in the USVI soil survey update.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 12 inches (Ap and Bw horizons).

Cambic horizon - zone from 5 to 12 inches (Bw horizons).

Lithic contact - at 12 inches (R layer).

ADDITIONAL DATA: Sampled as S61PR-14-8. Sample by NSSL, Lincoln, NE.

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

LOCATION FE PR

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

FE SERIES

The Fe series consists of very deep, somewhat poorly drained, very slowly permeable soils on alluvial fans in valleys. They formed in clayey sediments that weathered from igneous rocks and limestone. Near the type location, the mean annual precipitation is about 35 inches and the mean annual temperature is about 77 degrees F. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Sodic Haplusterts

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

Ap--0 to 7 inches; dark reddish brown (5YR 3/2) clay; moderate fine angular blocky parting to moderate fine granular structure; very hard; firm; sticky; plastic; common fine roots; calcareous, moderately alkaline; clear wavy boundary.

A--7 to 17 inches; dark reddish brown (5YR 3/2) and (5YR 3/3) clay; moderate medium angular blocky structure; very hard; extremely firm; sticky, plastic; common fine roots along structural faces; many pressure faces on surfaces of peds; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; clear smooth boundary. (Combined thickness of the A and Ap horizons ranges from 11 to 20 inches.)

Bssz1--17 to 28 inches; dark reddish brown (5YR 3/3) clay; moderate medium angular blocky structure; firm; slightly sticky; plastic, few fine roots; common small slickensides having distinct polished and grooved surfaces; common fine salt crystals; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; clear smooth boundary.

Bssz2--28 to 42 inches; dark reddish gray (5YR 4/2) clay; moderate fine and medium angular blocky structure; firm, slightly sticky, plastic, few fine roots; common medium slickensides having distinct polished and grooved surfaces; few fine salt crystals; about 2 percent, by volume, igneous pebbles; strongly effervescent; strongly alkaline; diffuse wavy boundary. (Combined thickness of the Bssz horizons ranges from 16 to 32 inches.)

Bss--42 to 56 inches; dark reddish gray (5YR 4/2) clay; moderate fine and medium angular blocky structure; firm; slightly sticky, plastic, about 5 percent, by volume, igneous pebbles; common medium slickensides having distinct polished and grooved surfaces; strongly effervescent; strongly alkaline.

TYPE LOCATION: Suroeste SCD, Lajas Valley Area, Puerto Rico. Approximately 4.3 miles south of the city of Sabana Grande from the intersection of P.R. Hwy 102 and P.R. Hwy 121; approximately 2.1 miles southwest from the intersection of P.R. Hwy 2 and P.R. Hwy 117; about 1,000 feet west of dirt road (Municipality limits boundary between Lajas and Guanica) in hayfield. Sabana Grande topographic quadrangle; lat. 18 degrees 01 minutes 04 seconds N.; long. 66 degrees 57 minutes 46 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction is moderately alkaline to strongly alkaline in the A horizons and strongly alkaline in the Bss and Bssz horizons. Depth to moderate salinity ranges from 5 to 8 inches.

The A or Ap horizon has hue of 5YR to 10YR, value of 2 or 3, and chroma of 2 or 3.

The Bss and Bssz horizons have hue of 5YR or 7.5YR, value of 3 through 5, and chroma of 2 through 4. The Bssz horizons are moderately saline and the ESP ranges from 25 to 40.

COMPETING SERIES: Hogensborg soils are in the same family. The well drained Hogensborg soils have more sodium within 40 inches of the surface.

GEOGRAPHIC SETTING: Fe soils are on alluvial fans in valleys. They formed in clayey sediments that weathered from igneous rocks and limestone. Slopes range from 0 to 2 percent. The climate is tropical semiarid. The average annual precipitation ranges from 32 to 38 inches and the average annual temperature ranges from 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include Aguirre, Cartagena, Fraternidad, and Guanica soils. Aguirre soils and the moderately well drained Fraternidad soils are nonsaline. Cartagena soils have mixed mineralogy. Guanica soils have more clay in the control section and have gypsum below a depth of 32 inches.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; very slow permeability.

USE AND VEGETATION: Most areas of Fe soil are used for pasture. Some small areas are used for sugarcane. The

vegetation consists of Angletongrass, Paraguita grasses, Rayo, Mesquite, weeds, salt-tolerant plants, other native and introduced species.

DISTRIBUTION AND EXTENT: Coastal plains of southern Puerto Rico. This soil is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico 1936.

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

Mollic epipedon - zone from 0 to 28 inches. (Ap, A, and Bssz1 horizons)

Vertic feature - Slickensides from 17 to 56 inches (Bssz and Bss horizons).

ADDITIONAL DATA: Characterization sample - S61PR121-001. Additonal samples - S61PR-14-1, S61PR-14-2, and S89PR-079-001. Samples by NSSL, Lincoln, NE.

MLRA: 273.

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

LOCATION FRATERNIDAD PR

**Established Series
Rev. GRB
03/2000**

FRATERNIDAD SERIES

The Fraternidad series consists of very deep, moderately well drained, slowly permeable soils on coastal plains. They formed in clayey sediments derived from volcanic rock and limestone. Near the type location, the mean annual temperature is about 77 degrees F., and the mean annual precipitation is about 35 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Typic Haplusterts

TYPICAL PEDON: Fraternidad clay. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 6 inches; very dark grayish brown (10YR 3/2) clay; moderate fine granular structure; firm; slightly sticky and plastic; many fine roots; few siltstone pebbles less than 15 mm in diameter; slightly acid; abrupt smooth boundary. (4 to 7 inches thick)

ABss--6 to 12 inches; very dark grayish brown (10YR 3/2) clay; moderate coarse prismatic structure breaking to very weak coarse angular or wedge-shaped blocks; very hard, firm; plastic, slightly sticky; many fine roots; many large slickensides having polished and grooved surfaces; common siltstone pebbles 2 to 15 mm in diameter; few small soft black (10YR 2/1) bodies; slightly acid; clear wavy boundary. (40 to 50 inches thick)

BAss--12 to 24 inches; brown (10YR 4/3) clay with pockets of very dark grayish brown (10YR 3/2) clay; weak coarse angular or wedge-shaped peds breaking to small and medium angular peds; very hard, firm; plastic, slightly sticky; common fine roots; many large intersecting slickensides having polished and grooved surfaces; few small soft black (10YR 2/1) bodies; slightly effervescent, slightly alkaline; clear wavy boundary. (6 to 23 inches thick)

Bss--24 to 50 inches; brown (10YR 4/3) clay with pockets of sandy clay loam; large angular or wedge shaped intersecting peds; very hard, firm; plastic, slightly sticky; many large slickensides having polished and grooved surfaces;

few to common small soft black (10YR 2/1) bodies; common fine and medium light gray (10YR 7/2) splotches of lime, strongly effervescent; moderately alkaline.

TYPE LOCATION: Lajas Valley, Puerto Rico. Approximately 690 feet north and 150 feet east of junction of road to poultry barns east of Lajas Experiment Station headquarters.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction ranges from slightly acid to slightly alkaline in the A, Ap, and ABss horizons, and from slightly alkaline to moderately alkaline in the Bass and Bss horizons. When dry, this soil has cracks ranging from 0.5 to 3 inches in width extending to depths greater than 20 inches. In pasture this soil has pronounced gilgai relief. The typifying pedon is at the center of a microknoll.

The A, AP, and ABss horizons have moist values of 2 or 3. Texture is clay loam or clay.

The BAss horizon has hue of 10YR or 2.5Y, moist value of 3 through 5, and chroma of 2 through 4. Texture is clay.

The Bss horizon has hue of 10YR or 2.5Y, moist value of 4 or 5, and chroma of 3 through 6. Texture is clay.

COMPETING SERIES: The Santa Isabel series is the only known series in the same family. Santa Isabel soils are on similar positions but are not calcareous in any part.

GEOGRAPHIC SETTING: Fraternidad soils are on coastal plains. They formed in clayey sediments derived from volcanic rocks and limestone. The climate is tropical semiarid. Slopes range from 0 to 12 percent. The average annual temperature ranges from 76 to 78 degrees F., and the average annual precipitation ranges from 30 to 35 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: Aguirre, Cartagena, Fe, Guanica, and Paso Seco soils. Aguirre, Cartagena, Fe, and Guanica soils are somewhat poorly drained. In addition, Aguirre soils are on lower positions, have more clay in the subsoil, and are sodic. Cartagena soils are on similar positions, have mixed mineralogy, and are sodic. Fe soils are on slightly higher positions, and are sodic. Guanica soils are on slightly lower positions and have more clay in the subsoils. The moderately well drained Paso Seco soils have a lithologic discontinuity with very gravelly loamy material below depths of 28 to 35 inches.

DRAINAGE AND PERMEABILITY: Moderately well drained; slow permeability.

USE AND VEGETATION: Fraternidad soils are used for pasture and cultivated crops including sugarcane, rice, fruit, and vegetable crops. The vegetation consists of guineagrass, buffelgrass, and other native and introduced species.

DISTRIBUTION AND EXTENT: Coastal plains of southern Puerto Rico. The soils of this series are moderately extensive.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: The classification was previously updated with the 4/91 draft from Fine, montmorillonitic, isohyperthermic Udic Chromusterts to Fine, montmorillonitic, isohyperthermic Typic Chromusterts. The present definition in Soil Taxonomy for Udic-ustic soil moisture regimes is mutually exclusive. The previous OSED date for this series was 7/84.

A gypsum substratum phase is recognized. Depth to gypsum is 30 to 40 inches. Electrical conductivity is 0 to 2 millimohs per centimeter in the A horizons, 2 to 4 millimohs per centimeter in the BA_{ss} horizon and in the upper part of the B_{ss} horizon, and 8 to 16 millimohs per centimeter in the lower part of the B_{ss} horizon. Depth to moderate salinity is 30 to 40 inches.

A gravelly substratum phase is also recognized. Depth to the gravelly layer is 20 to 36 inches.

Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - zone from 0 to 11 inches (A_p and AB_{ss} horizons).

Slickensides and vertic features - zone from 6 to 50 inches (AB_{ss}, BA_{ss} and B_{ss} horizons).

ADDITIONAL DATA: NSSL S61PR-14-9. Sample by NSSL, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

LOCATION GUANICA PR

**Established Series
Rev. WMS-RLV
06/2002**

GUANICA SERIES

The Guanica series consists of very deep, somewhat poorly drained, slowly permeable soils that formed in clayey sediments derived from limestone and volcanic rocks. These nearly level soils are in old lake beds on valley floors. Slopes range from 0 to 2 percent. Mean annual precipitation is 35 inches. Mean annual temperature is 77 degrees F.

TAXONOMIC CLASS: Very-fine, smectitic, isohyperthermic Sodic Epiaquerts

TYPICAL PEDON: Guanica clay in pasture. (Colors are for moist soil unless otherwise stated.)

A1--0 to 6 inches; black (10YR 2/1) clay; moderate fine granular structure; slightly hard, firm, sticky and plastic; many fine roots; slightly effervescent; moderately alkaline; clear wavy boundary. (5 to 7 inches thick)

A2--6 to 21 inches; black (10YR 2/1) clay; weak coarse subangular blocky structure parting to weak fine angular blocky; hard, firm, sticky and plastic; common fine roots; common pressure faces; slightly effervescent; moderately alkaline; gradual wavy boundary. (8 to 17 inches thick)

ABss--21 to 32 inches; mixed black (10YR 2/1) and dark reddish brown (5YR 3/2) clay; massive; hard, firm, sticky and plastic; few fine roots; many pressure faces; few slickensides; strongly effervescent; moderately alkaline; gradual wavy boundary. (8 to 16 inches thick)

Bss--32 to 47 inches; reddish brown (5YR 4/3) clay; some black (10YR 2/1) soil in cracks; massive; hard, firm, sticky and plastic; few fine roots; many pressure faces; common slickensides; strongly effervescent; moderately alkaline; gradual wavy boundary. (10 to 20 inches thick)

Bssy--47 to 69 inches; reddish brown (5YR 4/3) clay; massive; hard, firm, sticky and plastic; many pressure faces; many

slickensides; many fine gypsum crystals; strongly effervescent; moderately alkaline.

TYPE LOCATION: Lajas Valley, Puerto Rico; about 75 meters north of main drainage canal; 300 meters west of Republican Bridge over canal; which is 1.7 Km north of Hwy. 116 Km 15.5.

RANGE IN CHARACTERISTICS: Depth to the Bssy horizon is 32 to 50 inches.

The A and ABss horizons have hue of 10YR, value of 2 or 3 and chroma of 1 in the upper part and chroma of 1 or 2 in the lower part. Electrical conductivity is 4 to 8 mmhos per cm; and the ESP is 20 to 25.

The Bss and Bssy horizons have hue of 10YR, 7.5YR or 5YR. Electrical conductivity is 8 to 16 mmhos per cm, and the ESP is 25 to 35.

COMPETING SERIES: This is the Aguirre series in the same subgroup. Aguirre soils do not have gypsum accumulation in the subsoil and have mixed mineralogy.

GEOGRAPHIC SETTING: Guanica soils are in old lake beds on valley floors. Slope is 0 to 2 percent. These soils formed in clayey sediments derived from limestone and volcanic rocks. Elevation is near sea level. The climate is tropical semiarid. Mean annual precipitation ranges from 30 to 35 inches, and the mean annual temperature ranges from 76 to 78 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Aguirre soils and the Cartagena, Fe and Fraternidad soils. Cartagena and Fraternidad soils do not have gypsum accumulation in the subsoil. Fe soil are moderately saline at depths of 5 to 8 inches.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; runoff is slow to ponded; very slow permeability.

USE AND VEGETATION: These soils are used for sugarcane and native pasture. Native vegetation consists of Pajon, Paraguita, and Malojillo.

DISTRIBUTION AND EXTENT: Lajas Valley area of Puerto Rico. This series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - zone from 0 to 32 inches (A and ABss horizons)

Slickensides and vertic features - zone from 21 to 69 inches (ABss, Bss and Bssy horizons)

ADDITIONAL DATA: Sampled as S81PR-007-006. NSSL, Lincoln, NE sample Nos. 81 P 1647-1652

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

LOCATION GUAYABO PR

**Established Series
Rev. JLL/GRB
07/2001**

GUAYABO SERIES

The Guayabo series consists of very deep, excessively drained, rapidly permeable soils on coastal plains. They formed in sandy marine deposits. Near the type location, the mean annual temperature is about 77 degrees F. and the mean annual precipitation is about 35 inches. Slope ranges from 0 to 3 percent.

TAXONOMIC CLASS: Mixed, isohyperthermic Psammentic Paleustalfs

TYPICAL PEDON: Guayabo fine sand-cultivated. (Colors are for moist soil unless otherwise stated.)

Ap-0 to 7 inches; brown (10YR 5/3) sand, single grained; loose; nonsticky, nonplastic; neutral; clear smooth boundary.

A1-- 7 to 13 inches; pale brown (10YR 6/3) sand; single grained; loose; nonsticky, nonplastic; neutral; clear smooth boundary.

A2--13 to 18 inches; pale brown (10YR 6/3) fine sand; single grained; loose; nonsticky, nonplastic; common medium faint strong brown (7.5 YR 5/6) stains in root channels; neutral; clear smooth boundary. (Combined thickness of the A and Ap horizons range from 14 to 24 inches.)

E1--18 to 35 inches; very pale brown (10YR 7/3) sand; single grained; loose; nonsticky, nonplastic; few fine faint strong brown (7.5YR 5/6) stains in root channels; neutral; gradual wavy boundary.

E2--35 to 55 inches; very pale brown (10YR 7/3) sand; single grained; loose; nonsticky, nonplastic; neutral; gradual wavy boundary.

E3--55 to 65 inches; very pale brown (10YR 7/4) fine sand; few fine distinct yellowish red (5YR 5/6) masses of iron accumulation; single grained; loose; nonsticky and nonplastic; about 5 percent, by volume, pebbles; neutral; clear smooth

boundary. (Combined thickness of the E horizons range from 42 to 64 inches.)

Bt--65 to 75 inches; about 34 percent strong brown (7.5 YR 5/6), about 33 percent pale brown (10YR 6/3) and about 33 percent red (2.5YR 4/6) loamy fine sand in a variegated pattern; single grained; loose; nonsticky, nonplastic; few faint clay bridges between sand grains; neutral.

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 2.2 miles southwest on P.R. Hwy 303; about 0.6 miles southeast of the intersection of P.R. Hwy 301 and P.R. Hwy 3301, and about 1,200 feet northwest of dirt road on Pole Ojea community. Cabo Rojo topographic quadrangle; lat. 17 degrees 54 minutes 24 seconds N.; long. 67 degrees 11 minutes 00 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction ranges from slightly acid to slightly alkaline throughout.

The A or Ap horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Texture is sand or fine sand.

The E horizon has hue of 7.5YR to 2.5YR, value of 5 to 7, and chroma of 3 or 4. Texture is sand or fine sand.

The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 to 7, and chroma of 3 to 6; or there is no dominant color and is multicolored in shades brown and red. Texture is loamy sand or loamy fine sand.

COMPETING SERIES: Bahia soils are in the same family. Bahia soils have redder subsoils.

GEOGRAPHIC SETTING: Guayabo soils are on coastal plains. They formed in sandy marine deposits. Slopes range from 0 to 3 percent. The climate is tropical semiarid. The average annual precipitation ranges from 30 to 35 inches and the average annual temperature ranges from 75 to 77 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Sosa soils. The well drained Sosa soils have fine particle-size control sections.

DRAINAGE AND PERMEABILITY: Excessively drained; rapid permeability.

USE AND VEGETATION: Guayabo soils are used for pasture and cultivated crops including sorghum, corn, sweet

potatoes, and watermelon. Vegetation consists of native and introduced grasses and shrubs.

DISTRIBUTION AND EXTENT: Southwestern coastal plains of Puerto Rico. This soil is of small 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 65 inches (Ap, A1, A2, E1, E2, and E3 horizons).

Argillic horizon - zone from 65 to 75 inches (Bt horizon).

ADDITIONAL DATA: Pedon No. S81PR007-002. Sample by NSSL, Lincoln, NE.

MLRA: 273.

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

LOCATION GUAYAMA PR

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

GUAYAMA SERIES

The Guayama series consists of shallow, well drained, moderately permeable soils on uplands. They formed in material that weathered from igneous rock. Near the type location, the mean annual precipitation is 35 inches and the mean annual temperature is 79 degrees F. Slopes range from 5 to 60 percent.

TAXONOMIC CLASS: Clayey, mixed, active, isohyperthermic, shallow Typic Haplustalfs

TYPICAL PEDON: Guayama very gravelly clay loam--pasture. (Color are for moist soil unless otherwise stated.)

A--0 to 5 inches; dark reddish brown (5YR 3/4) very gravelly clay loam; weak fine granular structure; friable; slightly sticky, plastic, many fine roots; about 40 percent, by volume, pebbles; neutral; clear smooth boundary. (2 to 8 inches thick)

Bt--5 to 12 inches; reddish brown (5YR 4/4) gravelly clay; moderate fine subangular blocky structure; friable; sticky, plastic; common fine roots; few faint clay films on faces of peds; coarse fragments coated with clay; about 25 percent, by volume, pebbles; neutral; clear smooth boundary. (4 to 9 inches thick)

BC--12 to 18 inches; yellowish red (5YR 4/6) very gravelly clay loam; weak fine subangular blocky structure; firm; slightly sticky, plastic; few fine roots; about 40 percent, by volume, pebbles; neutral; gradual irregular boundary. (2 to 6 inches thick)

R--18 inches; igneous bedrock; common coatings of secondary lime are in cavities and fractures.

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 0.7 miles southeast on P.R. Hwy 303 from the intersection of P.R. Hwy 301 and P.R. Hwy 303 on dirt road; about 200 feet southeast of dirt road. Cabo Rojo topographic quadrangle; lat. 17 degrees 59 minutes 23 seconds N.; long. 67 degrees 08 minutes 55 seconds W.; PRD

1940.

RANGE IN CHARACTERISTICS: Depth to semiconsolidated volcanic rock is 10 to 20 inches. Reaction is slightly acid to slightly alkaline throughout the profile.

The A horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is loam, clay loam, gravelly clay loam, or very gravelly clay loam.

The Bt horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is silty clay loam, clay loam, clay, gravelly clay loam, or gravelly clay.

The BC horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is clay loam, gravelly clay loam, or very gravelly clay loam.

The R layer is igneous bedrock. Coatings of secondary lime in fractures and cavities range from none to many.

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

GEOGRAPHIC SETTING: The Guayama soils are on side slopes and ridges of dissected uplands. They formed in material that weathered from igneous bedrock. Slopes range from 5 to 60 percent. The climate is tropical semiarid. The average annual precipitation ranges from 30 to 40 inches and the average annual temperature ranges from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Aguilita, Amelia, Jacana, and Maguayo soils. Aguilita soils have a mollic epipedon and are shallow to soft limestone bedrock. Amelia soils are very deep and have clayey-skeletal control sections. Jacana soils are moderately deep and have vertic properties. Maguayo soils are very deep and have secondary carbonates in the profile.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of Guayama soils are used as pasture. Vegetation includes Guinea grass, Pajon, Buffel grass, and other native and introduced grasses and shrubs.

DISTRIBUTION AND EXTENT: Semiarid uplands of Puerto Rico. This series is of moderate 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 5 inches (A horizon).

Argillic horizon - zone from 5 to 12 inches (Bt horizon).

Lithic contact - zone at 18 inches (R layer).

MLRA: 271.

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

LOCATION JACANA PR

**Established Series
Rev. BCD
01/2001**

JACANA SERIES

The Jacana series consists of moderately deep, well drained, moderately slowly permeable soils formed in material weathered from volcanic rock. These gently sloping to moderately steep soils are on fans, foot slopes and low hills. Slopes range from 2 to 20 percent. The mean annual precipitation is about 35 inches and the mean annual temperature is about 79 degrees F.

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

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

Ap--0 to 6 inches; very dark brown (10YR 2/2) clay; moderate fine granular structure; hard, friable, slightly sticky, plastic; common fine roots; medium acid; clear smooth boundary. (4 to 8 inches thick)

A--6 to 13 inches; very dark brown (10YR 2/2) clay; weak coarse subangular blocky structure; hard, firm, slightly sticky, plastic; few fine roots; few pressure faces and small slickensides; medium acid; clear wavy boundary. (3 to 9 inches thick)

Bss--13 to 21 inches; dark brown (7.5YR 3/2) clay; streaks of very dark brown (10YR 2/2) from overlying horizon; weak coarse blocky structure; hard, firm, slightly sticky, plastic; few fine roots; many small pressure faces and slickensides; cracks to 21 inches; neutral; clear wavy boundary. (6 to 10 inches thick)

C/B--21 to 28 inches; 80 percent saprolite from volcanic rock and 20 percent by volume dark brown (7.5YR 3/2) clay in pockets and seams; clay loam; massive; friable slightly sticky, slightly plastic; neutral; gradual wavy boundary. (6 to 10 inches thick)

Cr--29 to 40 inches; highly weathered, semi-consolidated bedded, volcanic rock.

TYPE LOCATION: Lajas Valley, Puerto Rico; 60 feet east of kilometer marker 1.7 of Highway 117, and 35 feet south of fence along highway.

RANGE IN CHARACTERISTICS: Depth to semiconsolidated rock ranges from 20 to 40 inches. Reaction ranges from medium acid to mildly alkaline.

The A horizons have hue of 10YR or 7.5YR, and value and chroma of 2 or 3. Texture is clay loam or clay.

The Bss horizon has hue of 10YR or 7.5YR and value and chroma of 2 through 4.

The Cr horizon consists of highly weathered, semi-consolidated bedded volcanic rock. In places, secondary lime occurs as coatings along cleavage planes.

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

GEOGRAPHIC SETTING: The Jacana soils are on fans foot slopes and low hills. Slope is 2 to 20 percent. These soils formed in material weathered from volcanic rock. The climate is tropical semiarid. The mean annual precipitation is 30 to 40 inches and mean annual temperature is 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: There are the Callabo, Coamo, Descalabrado, Fraternidad, Juana Diaz, Llanos, and San German soils. Callabo soils do not have vertic properties. Coamo soils have an argillic horizon and do not have bedrock within a depth of 40 inches. Descalabrado, Juana Diaz, and San German soils have bedrock at depths less than 20 inches. Fraternidad and Llanos soils do not have bedrock within a depth of 40 inches.

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

USE AND VEGETATION: Most areas are used for pasture. The main pasture species are Guineagrass and buffelgrass. Some areas are used for crops including tomatoes, peppers, pigeon peas, and mangos.

DISTRIBUTION AND EXTENT: Semiarid areas of Puerto Rico and the U.S. Virgin Islands. The soils of this series are of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: The classification was updated with the 4/91 draft from Fine, mixed, isohyperthermic Udertic Haplustolls to Fine, mixed, isohyperthermic Vertic Haplustolls. It is presently impossible to have a Udic-ustic soil moisture regime in the tropics. The previous OSED date was 11/84.

Prior to 1984 this soil was classified as a fine, mixed, isohyperthermic Vertic Ustropept.

Diagnostic horizons and features recognized in this soil:

Mollic epipedon - zone from 0 to 13 inches (Ap and A horizons)

Vertic properties - pressure faces and slickensides in A and Bss horizons.

ADDITIONAL DATA: Sampled as S61PR-14-4.

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

LOCATION MARIANA PR

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

MARIANA SERIES

The Mariana series consists of deep or very deep, well drained, moderately permeable soils on side slopes of dissected uplands. They formed in residuum that weathered from acid volcanic rock. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 50 inches. Slopes range from 12 to 20 percent.

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

TYPICAL PEDON: Mariana gravelly clay - Pangola grass (Colors are for moist conditions unless otherwise stated).

Ap--0 to 6 inches; brown (7.5YR 4/2) moist and brown (7.5YR 5/4) dry, gravelly clay; moderate fine granular structure; friable; slightly sticky, slightly plastic; many fine roots; about 20 percent, by volume, pebbles; very strongly acid; clear smooth boundary. (4 to 8 inches thick.)

Bw1--6 to 16 inches; 50 percent red (2.5YR 4/6) and 50 percent brown (7.5YR 4/2) clay having a crushed color that is yellowish red (5YR 4/8); weak fine and medium subangular blocky structure; firm, slightly sticky, plastic; common fine roots; about 5 percent, by volume, pebbles; few clay films in root channels; very strongly acid; clear smooth boundary. (6 to 10 inches thick.)

Bw2--16 to 26 inches; 50 percent red (10R 4/6) and 50 percent reddish yellow (5YR 6/8) clay having a crushed color that is red (2.5YR 4/8); weak medium subangular blocky structure; firm; slightly sticky, plastic; few fine roots; few faint discontinuous clay films in root channels; very strongly acid; gradual wavy boundary. (6 to 10 inches thick)

C--26 to 38 inches plus; 25 percent reddish yellow (5YR 6/8), 25 percent red (10YR 4/6), 25 percent white (5YR 8/1), and 25 percent dark brown (7.5YR 4/2) variegated saprolite with a clay texture and having a crushed color that is reddish yellow (5YR 6/8); massive; firm; slightly sticky, plastic; extremely acid.

TYPE LOCATION: San German Municipality, Puerto Rico. Approximately 1.8 miles southwest of the Sabana Eneas community from the intersection of P.R. Hwy. 102 and P.R. Hwy. 317; about 0.5 mile southwest of P.R. Hwy. 314 on dirt road. San German topographic quadrangle; lat. 18 degrees 03 minutes 58 seconds N.; long. 67 degrees 05 minutes 46 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 16 to 28 inches. Fine and coarse gravel ranges from 20 to 40 percent, by volume, in the A horizon, and from 0 to 10 percent, by volume, in the Bw and C horizons. Reaction ranges from extremely acid to very strongly acid. Base saturation (ammonia acetate) in the epipedon and Cambic horizon is less than 50 percent. Exchange capacity (ammonia acetate) per 100 grams of clay is more than 20 meq.

The A horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. Texture is the gravelly and very gravelly analogs of silt loam or silty clay loam.

The Bw horizon has hue of 10R to 5YR, value of 3 to 5, and chroma of 3 to 6. Texture ranges from clay loam to clay.

The C horizon has hue of 5YR to 10YR value of 4 to 6, and chroma of 3 to 6; or there is no dominant color and is multicolored in shades of red, yellow, white, and brown. Structure of parent rock is evident in C horizons. Texture ranges from clay loam to clay.

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

GEOGRAPHICAL SETTING: Mariana soils are on side slopes of uplands. They formed in residuum that weathered from acid volcanic rock. The climate is tropical semiarid. Slopes range from 12 to 40 percent. The average annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 45 to 55 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Descalabrado, Jacana, and Palmarejo series. Descalabrado and Jacana soils have Mollic epipedons. In addition, Descalabrado soils are shallow to bedrock and Jacana soils are moderately deep to bedrock. The moderately well drained Palmarejo soils have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Most areas of Mariana soils are in native pasture. The vegetation consists of native and introduced grasses and brush.

DISTRIBUTION AND EXTENT: Semiarid uplands 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:

Ochric epipedon - the zone from 0 to 6 inches (A horizon).

Cambic horizon - the zone from 6 to 16 inches (Bw horizon).

MLRA: 271.

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

LOCATION PALMAREJO PR

**Established Series
Rev. JLL/GRB
07/2001**

PALMAREJO SERIES

The Palmarejo series consists of very deep, moderately well drained, moderately permeable soils on fans and benches. They formed in sediments derived from volcanic rocks. 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 2 to 12 percent.

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

TYPICAL PEDON: Palmarejo loam - cultivated (Colors are for moist conditions.)

Ap--0 to 9 inches, dark brown (7.5YR 3/2) loam; weak medium granular structure; friable; sticky, slightly plastic; many fine roots; few fine volcanic rock fragments; very strongly acid; abrupt smooth boundary. (7 to 12 inches thick)

Bt1--9 to 18 inches; yellowish brown (10YR 5/6) clay; few distinct dark brown (7.5YR 3/2) splotches; moderate medium subangular blocky structure; firm; slightly sticky, plastic; common fine roots; few faint clay films on faces of peds; few fine pebbles of volcanic rock; very strongly acid; clear smooth boundary.

Bt2-- 18 to 30 inches; yellowish brown (10YR 5/8) clay loam; moderate medium subangular block structure; firm; slightly sticky, plastic; few fine roots; few faint clay films on faces of peds; many coarse distinct dark yellowish brown (10YR 4/6) masses of iron accumulation; very strongly acid; clear smooth boundary. (Combined thickness of the Bt horizons range from 17 to 25 inches)

BC1--30 to 41 inches, yellowish brown (10YR 5/8) clay loam; massive; firm; sticky, plastic; few fine roots; common fine pebbles of volcanic rock; few fine indurated black (10YR 2/1) concretions; many coarse distinct white (7.5YR 8/0) areas of iron depletions; very strongly acid; clear smooth boundary.

BC2--41 to 60 inches, variegated red (10YR 4/8) and white (7.5YR 8/0) sandy clay loam; massive; firm; slightly sticky,

plastic; many fine pebbles of volcanic rock; few indurated black (10YR 2/1) rounded concretions; the areas in shades of red are iron accumulations and the areas in shades of white are iron depletions; very strongly acid.

TYPE LOCATION: Lajas Municipality, Puerto Rico. Approximately 1.0 mile southwest of the intersection of P.R. Hwy. 306 and P.R. Hwy. 101, about 0.3 miles south of P.R. Hwy. 306 in sugarcane field. San German topographic quadrangle; lat 18 degrees 02 minutes 18 seconds N.; long. 67 degrees 05 minutes 31 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 22 to more than 60 inches. Reaction ranges from very strongly acid to strongly acid throughout the profile.

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

The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 though 8. Texture is clay loam or clay.

The BC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8; or there is no dominant color and is multicolored in shades red, brown, yellow, and gray. Texture is sandy clay loam or clay loam.

COMPETING SERIES: There are other series in the same family.

GEOGRAPHIC SETTING: Palmarejo soils are on fans and benches. They formed in sediments that weathered from volcanic rock. The climate is tropical semiarid. Slopes range from 2 to 12 percent. The average annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Fraternidad and Mariana soils. Fraternidad soils do not have an argillic horizon and are clay throughout. Mariana soils do not have an argillic horizon and have saprolite within a depth of 40 inches.

DRAINAGE AND PERMEABILITY: Moderately well drained; moderate permeability.

USE AND VEGETATION: Palmarejo soils are used for pasture and for cultivated crops including pineapples, corn, pigeon peas, and pumpkins. Vegetation consists of native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid areas of southwestern area of Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Lajas Valley, Puerto Rico; 1959.

REMARKS: Diagnostic horizons and features in this pedon include:

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

Argillic horizon - the zone from 9 to 30 inches (Bt1 and Bt2 horizons).

Aquic feature - perched water table at 30 inches.

ADDITIONAL DATA: Sampled as S57PR-14-2 and S58PRO14-010. Sample by NSSL, Lincoln, NE.

MLRA: 271, 273.

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

LOCATION PONCENA PR

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

PONCENA SERIES

The Poncena series consists of very deep, moderately well drained, slowly permeable soils on terraces and alluvial fans. They formed in material that weathered from volcanic rocks and limestone. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 40 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine, mixed, superactive, isohyperthermic Typic Calciusterts

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

Ap--0 to 11 inches; black (N 2/0) clay; moderate medium granular structure; hard, firm, sticky, plastic; many fine roots; few fine volcanic rock fragments; neutral; gradual wavy boundary. (8 to 14 inches thick)

ABss--11 to 18 inches; mixed black (N 2/0) and very dark grayish brown (10YR 3/2) clay; massive when wet, weak medium subangular blocky structure when dry; firm; sticky, plastic; few fine roots; common distinct slickensides having polished and grooved surfaces; few fine volcanic rock fragments; neutral; gradual wavy boundary. (5 to 8 inches thick)

Bss--18 to 30 inches; dark brown (10YR 3/3) clay; weak coarse subangular blocky structure; firm; sticky, plastic; few fine roots; many distinct intersecting slickensides having polished and grooved surfaces; few fine volcanic rock fragments; neutral; clear irregular boundary. (8 to 12 inches thick.)

Bkss--30 to 38 inches; grayish brown (2.5Y 5/2) clay; weak coarse subangular blocky structure; firm; sticky, plastic; few distinct slickensides having polished and grooved surfaces; few fine weathered volcanic rock fragments; many medium and coarse distinct white (10YR 8/2) soft masses of secondary calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary. (6 to 20 inches thick)

C--38 to 60 inches; about 50 percent dark brown (10YR 4/3) weathered volcanic rock and about 50 percent white (N 8/0) calcareous earth; clay loam; massive; friable; few black (10YR 2/1) pebbles; strongly effervescent; moderately alkaline.

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 0.6 mile east of the intersection of P.R. 101 and P.R. Hwy. 103, about 222 feet south of P.R. Hwy. 101 in pasture. Puerto Real topographic quadrangle; lat. 18 degrees 01 minute 47 seconds N.; long. 67 degrees 07 minutes 48 seconds W. PRD 1940.

RANGE IN CHARACTERISTICS: Depth to the weathered volcanic rock is 30 to 50 inches. Depth to the Bkss horizon is 21 to 34 inches. Reaction is neutral to moderately alkaline in throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or less; or it is neutral with value of 2 or 3. Texture is clay loam or clay.

The Bss horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4.

The Bkss horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 4.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4 for the weathered volcanic rock. The calcareous material has hue of 7.5YR or 10YR, value of 7 or 8, and chroma of 2 or less; or it is neutral with value of 7 or 8.

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

GEOGRAPHIC SETTING: Poncena soils are on terraces and alluvial fans. They formed in material that weathered from volcanic rocks and limestone. The climate is tropical semiarid. Slopes range from 0 to 12 percent. The average annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 35 to 50 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Aguirre, Cartagena, Descalabrado, Guanica, Fraternidad and Jacana soils. None of these soils have a calcic horizon. Aguirre, Cartagena, and Guanica soils are somewhat poorly drained. Descalabrado soils have hard rock at shallow depths. Fraternidad soils have browner colors. Jacana soils have a paralithic contact at moderate depths.

DRAINAGE AND PERMEABILITY: Moderately well drained; slow permeability.

USE AND VEGETATION: Poncena soils are used for sugarcane and for pasture. The main pasture species are guineagrass, stargrass, pangolagrass, and buffelgrass.

DISTRIBUTION AND EXTENT: Semiarid areas of Puerto Rico. The soils are of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1942.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Mollic epipedon - zone from 0 to 30 inches (Ap, ABss and Bss horizons).

Slickensides and vertic features - zone from 18 to 38 inches (Bss and Bkss horizons).

Calcic horizon - zone from 30 to 38 inches (Bkss horizon).

MLRA: 271, 273.

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

LOCATION POZO BLANCO PR

**Established Series
Rev. LRR/GRB
7/98**

POZO BLANCO SERIES

The Pozo Blanco series consists of very deep, well drained, moderately slowly permeable soils on uplands of the Semiarid Coastal Plains MLRA. They formed in clayey and loamy marine sediments. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 30 inches. Slopes range from 0 to 20 percent.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Aridic Calciustolls

TYPICAL PEDON: Pozo Blanco clay - in pastureland. (Colors are for moist soils unless otherwise indicated.)

Ap--0 to 8 inches; dark brown (7.5YR 3/3) clay; dark brown (10YR 3/3) dry; strong medium granular structure; firm, slightly sticky, plastic; many very fine, fine, and medium roots; many very fine interstitial pores; about 5 percent, by volume, pebbles; moderately alkaline; slightly effervescent (HCl, 1N); clear wavy boundary.

Bw--8 to 12 inches; very dark grayish brown (10YR 3/2) clay, dark brown (10YR 3/3) dry; strong medium angular blocky structure; firm; slightly sticky, moderately plastic; many very fine and fine roots; few medium roots; many very fine and few fine tubular and vesicular pores; about 5 percent, by volume, pebbles; moderately alkaline; moderately effervescent (HCl, 1N); clear wavy boundary.

Bk1--12 to 26 inches; dark yellowish brown (10YR 4/4) clay, dark brown (10YR 4/3) dry; moderate medium subangular blocky structure; firm; slightly sticky, moderately plastic; many very fine roots, few fine roots; many very fine, few fine tubular and vesicular pores; few filaments of calcium carbonate; about 10 percent, by volume, pebbles; moderately alkaline; moderately effervescent (HCl, 1N); abrupt wavy boundary.

Bk2--26 to 45 inches; yellowish brown (10YR 5/4) gravelly loam, brown (10YR 5/3) dry; many distinct very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; friable; slightly sticky, slightly plastic; many very fine

roots, common fine roots; many very fine and common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; about 15 percent, by volume, pebbles; strongly alkaline; strongly effervescent (HCl, 1N); clear wavy boundary.

C--45 to 59 inches; dark brown (10YR 4/3) very gravelly loam, brown (10YR 5/3) dry; many distinct very pale brown (10YR 7/3) mottles; massive; friable; slightly sticky, nonplastic; many very fine roots, common fine roots; many very fine, few fine tubular and vesicular pores; common prominent soft masses of calcium carbonate; about 45 percent, by volume, pebbles; about 10 percent, by volume, cobbles; strongly alkaline; strongly effervescent (HCl, 1N); clear wavy boundary.

2C--59 to 76 inches; very pale brown (10YR 7/3) silt, white (10YR 8/2) dry; many distinct very dark grayish brown (10YR 3/2) mottles; massive; friable; slightly sticky, nonplastic; few very fine roots; many very fine, common fine tubular and vesicular pores; many prominent soft masses of calcium carbonate; about 10 percent, by volume, pebbles; strongly alkaline; strongly effervescent (HCl, 1N); abrupt wavy boundary.

3C--76 to 96 inches; very dark grayish brown (10YR 3/2) clay loam, very dark gray (10YR 3/1) dry; many distinct very pale brown (10YR 7/3) mottles; massive; friable; slightly sticky, slightly plastic; few fine and medium roots; few very fine tubular and vesicular pores; common prominent soft masses of calcium carbonate; about 5 percent, by volume, pebbles; moderately alkaline; strongly effervescent (HCl, 1N).

TYPE LOCATION: Lajas Municipio, Puerto Rico. Approximately 2.9 miles southwest of La Parguera and about 2.2 miles southeast of Rancho Cabassa and about 100 feet east of dirt road; USGS Parguera topographic quadrangle; lat. 17 degrees 57 minutes 58 seconds N. and long. 67 degrees 5 minutes 30 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 20 to 60 inches. Reaction is slightly alkaline or moderately alkaline in the A, Ap, and Bw horizons, and moderately alkaline or strongly alkaline in the Bk and C horizons.

The A or Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Texture is loam, clay loam, clay, or their gravelly analogs.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. Texture is clay loam, clay, or their gravelly analogs. Content of pebbles ranges from 0 to 25 percent, by volume.

The Bk horizon has hue of 10YR, value of 4 to 6, and chroma of 4 or 6. Texture is loam, clay loam, clay, or their gravelly analogs. Filaments and soft masses of calcium carbonate range from common to many. Content of pebbles ranges from 5 to 25 percent, by volume.

The C horizon has hue of 10YR to 5Y, value of 3 to 7, and chroma of 2 to 6. Texture ranges from silt to clay loam or their gravelly analogs. Content of pebbles and cobbles ranges from 0 to 60 percent, by volume.

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

GEOGRAPHIC SETTING: Pozo Blanco soils are on uplands of the Semiarid Coastal Plains MLRA. They formed in clayey and loamy marine sediments. Slopes range from 0 to 20 percent. The climate is tropical semiarid. The average annual temperature ranges from 78 to 80 degrees F., and the average annual rainfall ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Aguilita, Duey, Jacana, Montalva, Parguera, and San German soils. All of these soils except Parguera soils are on higher positions. In addition, Aguilita soils are deep to soft limestone bedrock and have coarse-loamy, carbonatic control sections. Duey soils are shallow to soft limestone bedrock. Jacana soils are moderately deep to saprolite of igneous origin. Parguera soils are on similar positions, but have clayey control sections. San German soils are shallow to soft limestone bedrock, have clayey-skeletal control sections, and lack a Mollic epipedon.

DRAINAGE AND PERMEABILITY: Well drained; moderately slowly permeability.

USE AND VEGETATION: Most areas of Pozo Blanco soil are in pastureland. A few areas are in wildlife refuges. Vegetation consists of Yerba huracan, Baboraton, Mesquite, and other xerophytic grasses and shrubs.

DISTRIBUTION AND EXTENT: In the semiarid coastal plains of Puerto Rico. The series is of minor extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico; 1936.

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

Mollic epipedon - zone from 0 to 12 inches.

Calcic horizon - zone from 12 to 45 inches.

Cambic horizon - 20 to 31 inches.

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; S97PR-079-001. Sample by the NSSL, Lincoln, NE., 6/97.

MLRA: 273.

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

LOCATION SAN ANTON PR

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

SAN ANTON SERIES

The San Anton series consists of very deep, well drained, moderately permeable soils on alluvial fans and flood plains. They formed in alluvium that weathered from volcanic rock and limestone. Near the type location, the mean annual temperature about 79 degrees F., and the mean annual precipitation about 37 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, isohyperthermic Cumulic Haplustolls

TYPICAL PEDON: San Anton clay loam--cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 9 inches; very dark brown (10YR 2/2) clay loam; weak fine granular structure; friable; slightly sticky, slightly plastic; many fine roots; many fine pebbles of volcanic rock; moderately alkaline; abrupt smooth boundary.

A1--9 to 22 inches; very dark brown (10YR 2/2) clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; common fine roots; many fine pebbles of volcanic rock; neutral; abrupt smooth boundary.

A2--22 to 27 inches; dark brown (10YR 3/3) loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic, few fine roots; neutral; clear wavy boundary. (Combined thickness of the A and Ap horizons ranges from 22 to 32 inches)

Bw--27 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; neutral; clear wavy boundary. (6 to 10 inches thick)

C1--34 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; slightly sticky, slightly plastic; neutral; abrupt smooth boundary.

C2--40 to 46 inches; dark brown (10YR 3/3) loam, massive; friable; slightly sticky, slightly plastic; neutral; abrupt smooth

boundary.

C3--46 to 52 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; slightly sticky, slightly plastic; slightly alkaline; abrupt smooth boundary.

C4--52 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; massive; friable; slightly sticky, slightly plastic; slightly alkaline.

TYPE LOCATION: Caribe SCD, Puerto Rico. Approximately 30 feet west of kilometer marker 2.35 of Highway No. 506.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 28 to 42 inches. Reaction ranges from neutral to moderately alkaline throughout and is noncalcareous. Rock fragments range from 0 to 25 percent, by volume.

The A horizons have hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Texture is clay loam or silty clay.

The Bw horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. Texture is silt loam, silty clay loam, clay loam, or gravelly clay loam.

The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. Texture is loam, silt loam, or clay loam. In some areas the lower part of the underlying material is sand or loamy sand.

COMPETING SERIES: These include the Cortada, Kawaihapai and Pulehue series. Cortada soils are on slightly lower positions and are calcareous throughout. Kawaihapai and Pulehue soils do not have Bw horizons.

GEOGRAPHIC SETTING: San Anton soils are on alluvial fans and flood plains. They formed in alluvium that weathered from volcanic rock and limestone. The climate is tropical semiarid. Slopes range from 0 to 12 percent. The average annual precipitation ranges from 35 to 40 inches and the average annual temperature ranges from 78 to 80 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the competing Cortada soils and the Aguirre, Cintrona, Constancia, Fraternidad, Machuelo, Santa Isabel, and Vayas soils. The somewhat poorly drained Aguirre, the moderately well drained Fraternidad, and the moderately well drained Santa Isabel soils are on higher positions, have smectitic clay

control sections, and are Vertisols. The very poorly drained Cintrona soils are on lower positions and have clayey control sections. The somewhat poorly drained Constancia soils are on lower positions and have clayey subsoils. The poorly drained Machuelo and Vayas soils are on lower positions, and have clayey control sections. In addition, Machuelo soils do not have Bw horizons.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: San Anton soils are used for pasture and for growing sugar cane, plantains, and truck crops. Vegetation is dominated by guineagrass, buffelgrass, stargrass, pangolagrass, and other native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid areas of southern Puerto Rico. The soils are of moderate extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Puerto Rico, 1936.

REMARKS: The San Anton soil has occasional flooding.

Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon - zone from 0 to 27 inches (Ap, A1, and A2 horizons)

Cambic horizon - zone from 27 to 34 inches (Bw horizon)

**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. Parguera 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 SANTA ISABEL PR

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

SANTA ISABEL SERIES

The Santa Isabel series consists of very deep, moderately well drained, very slowly permeable soils on coastal plains. They formed in material that weathered from volcanic rocks and limestone. Near the type location, the mean annual temperature is about 77 degrees F., and the mean annual precipitation is about 32 inches. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Typic Haplusterts

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

Ap--0 to 10 inches; black (10YR 2/1) clay; weak fine granular structure; firm; sticky and plastic; many fine roots; neutral; clear wavy boundary. (6 to 15 inches thick.)

ABss1--10 to 28 inches; black (10YR 2/1) clay; weak medium angular blocky structure; firm; sticky and plastic; many fine roots; common distinct slickensides having polished and grooved surfaces; neutral; gradual wavy boundary.

ABss2--28 to 39 inches; very dark gray (10YR 3/1) clay; weak medium angular blocky structure; firm; sticky and plastic; common fine roots; many distinct slickensides having polished and grooved surfaces; neutral; gradual wavy boundary.

ABss3--39 to 50 inches; very dark gray (10YR 3/1) clay; weak medium angular blocky structure; firm; sticky and plastic; few fine roots; many distinct slickensides having polished and grooved surfaces; neutral; gradual wavy boundary.

ABss4--50 to 64 inches; black (10YR 2/1) clay; weak medium angular blocky structure; firm; sticky and plastic; few fine roots; many distinct slickensides having polished and grooved surfaces; few fine subrounded volcanic rock fragments; neutral; gradual wavy boundary. (Combined thickness of the ABss horizons range from 10 to 60 inches.)

BC--64 to 69 inches; dark brown (10YR 4/3) clay; massive; firm; sticky and plastic; very dark gray (10YR 3/1) coatings along faces of peds; few fine subrounded volcanic rock fragments; neutral.

TYPE LOCATION: Lajas Municipality, Puerto Rico. Approximately 1.6 miles southwest of the city of Lajas, from the intersection of P.R. Hwy. 315 and P.R. Hwy. 101, about 0.3 miles northeast from the intersection of P.R. Hwy. 303 and P.R. Hwy. 101, about 330 feet south of the Administration Building of the Lajas Agricultural Experiment Station of the University of Puerto Rico-Mayaguez Campus. San German topographic quadrangle; lat. 18 degrees 01 minute 59 seconds N., long. 67 degrees 04 minutes 26 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 60 inches. Reaction is neutral or slightly alkaline throughout the profile.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or less. Texture is clay loam or clay.

The ABss horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or less.

The BC horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3.

COMPETING SERIES: This includes the Fraternidad series in the same family. Fraternidad soils have secondary carbonates in the lower subsoil.

GEOGRAPHIC SETTING: Santa Isabel soils are on coastal plains. They formed in material that weathered from volcanic rocks and limestone. Slopes range from 0 to 2 percent. The climate is tropical semiarid. The average annual temperature ranges from 76 to 78 degrees F., and the average annual precipitation ranges from 30 to 35 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Fraternidad soils, these include the Aguirre and San Anton soils. The somewhat poorly drained Aguirre soils have more clay in the control section and have more than 15 exchangeable sodium. The well drained San Anton soils have less clay in the control section.

DRAINAGE AND PERMEABILITY: Moderately well drained; very slow permeability.

USE AND VEGETATION: Most areas of Santa Isabel soils are used for cultivated crops such as sugarcane. Some areas are used for pasture. Native vegetation consists of Guineagrass and Buffelgrass.

DISTRIBUTION AND EXTENT: Lajas Valley Area 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:

Mollic epipedon - the zone from 0 to 64 inches (A and ABss horizons)

Slickensides and vertic features - the zone from 28 to 64 inches (ABss horizons)

Aquic feature - A seasonal high water table is present at depths of 5 to 6 feet.

ADDITIONAL DATA: Sampled as S81PR-007-004. Sample Nos. 81 P 1635-1640. Sample by NSSL, Lincoln, NE.

MLRA: 273.

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

LOCATION SOSA PR

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

SOSA SERIES

The Sosa series consists of very deep, well drained, moderately slowly permeable soils on marine terraces of the Semiarid Coastal Plains. They formed in clayey and loamy marine sediments. Near the type location, the mean annual temperature is about 76 degrees F., and the mean annual precipitation is about 33 inches. Slopes range from 0 to 12 percent.

TAXONOMIC CLASS: Fine, kaolinitic, isohyperthermic Aridic Paleustalfs

TYPICAL PEDON: Sosa sandy loam--in pasture. (Colors are for moist soil.)

Ap--0 to 5 inches; dark reddish brown (5YR 3/3) sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; many fine roots; slightly acid; clear smooth boundary.

A--5 to 12 inches; dark reddish brown (5YR 3/3) fine sandy loam, weak coarse subangular blocky structure; hard; friable, nonsticky and slightly plastic; many fine roots; about 10 percent, by volume, ironstone nodules; slightly acid; clear smooth boundary. (Combined thickness of the A and Ap horizons ranges from 5 to 19 inches)

B/A--12 to 20 inches; about 70 percent dark red (2.5YR 3/6) and about 30 percent dark reddish brown (5YR 3/3) sandy clay; massive; hard, firm, slightly sticky and plastic; few fine roots; common faint clay films in B portion; about 15 percent, by volume, ironstone nodules; neutral; clear smooth boundary. (0 to 13 inches thick)

Bt1--20 to 33 inches; red (2.5YR 4/6) sandy clay; many medium distinct strong brown (7.5YR 5/8), light gray (10YR 7/1) and dark red (10YR 3/6) reticulate mottles; moderate medium subangular blocky structure; very hard, extremely firm, slightly sticky and slightly plastic; common faint clay films on faces of peds; neutral; gradual wavy boundary. (8 to 18 inches thick)

Bt2--33 to 63 inches; red (2.5YR 4/6) sandy clay loam; many medium distinct strong brown (7.5YR 5/8), light gray

(10YR 7/1) and dark red (10YR 3/6) reticulate mottles; weak medium subangular blocky structure; very hard, extremely firm, slightly sticky and slightly plastic; few faint clay films on faces of peds; neutral.

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 0.25 mile south of Highway 101, Km. 15.5; about 100 feet west of dirt road. Lat. 18 degrees, 01 minutes, 35 seconds N; long. 67 degrees, 08 minutes, 15 seconds west.

RANGE IN CHARACTERISTICS: Combined thickness of A, Ap, and/or B/A horizons is less than 20 inches. Reaction ranges from moderately acid to slightly acid in the A, Ap, and B/A horizons, and from slightly acid to neutral in the Bt horizons.

The A or Ap horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 3 or 4. Colors are for moist values. Texture is loamy fine sand, fine sandy loam, or sandy loam.

The B/A horizon, where present, has hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 3 to 6. Colors are for moist values. Texture is sandy clay loam or sandy clay.

The Bt horizons have hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 6 or 8. Colors are for moist values. Reticulate mottles in shades of red, brown, and gray range from common to many. Texture is sandy clay loam or sandy clay.

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

GEOGRAPHIC SETTING: Sosa soils are on marine terraces of the coastal plain. They formed in clayey and loamy marine sediments. Slopes range from 0 to 12 percent. The climate is tropical semiarid. The average annual temperature ranges from 75 to 77 degrees F., and the average annual precipitation ranges from 30 to 35 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Bahia, Guayabo, and Poncena soils. Bahia and Guayabo soils have sandy, mixed control sections. Poncena soils have mixed mineralogy in the control section.

DRAINAGE AND PERMEABILITY: Well drained; moderately slow permeability.

USE AND VEGETATION: Most areas of Sosa soils are used for pasture. The native vegetation is predominately

Guinea grass and Pajon grass.

DISTRIBUTION AND EXTENT: Southwestern coastal plains of Puerto Rico. These soils are of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Lajas Valley, Puerto Rico. 1962.

REMARKS: Diagnostic horizons and features recognized in this pedon:

Ochric epipedon - zone from 0 to 12 inches (Ap and A horizon).

Argillic horizon - zone from 20 to 63 inches (Bt1 and Bt2 horizons).

ADDITIONAL DATA: NSSL - S81-PR 007-003

MLRA: 273.

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

LOCATION TERESA PR

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

TERESA SERIES

The Teresa series consists of very deep, somewhat poorly drained, very slowly permeable soils on alluvial flats in valley floors of the Semiarid Coastal Plain MLRA. They formed in clayey marine sediments. Near the type location, the mean annual temperature is about 79 degrees F., and the mean annual precipitation is about 35 inches. These soils are saline. Slopes range from 0 to 1 percent.

TAXONOMIC CLASS: Very-fine, smectitic, isohyperthermic Sodic Haplusterts

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

Ap--0 to 10 inches; very dark gray (10YR 3/1) clay; moderate medium subangular blocky structure; hard, firm; very sticky, very plastic; many very fine and fine roots; many very fine interstitial pores; neutral; clear wavy boundary. (4 to 12 inches thick)

Bss1--10 to 26 inches; very dark gray (10YR 3/1) clay; strong coarse prismatic structure; very hard, very firm; very sticky, very plastic; many very fine and fine roots; few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; few distinct soft masses of iron-manganese; slightly alkaline; gradual wavy boundary.

Bss2--26 to 38 inches; very dark grayish brown (10YR 3/2) clay; strong coarse prismatic structure; very hard, very firm; very sticky, very plastic; common very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; few distinct soft masses of iron-manganese; few fine prominent yellowish brown (10YR 5/8) masses of iron accumulation on faces of pedes and slickensides; slightly alkaline; clear smooth boundary. (Combined thickness of the Bss horizons ranges from 10 to 40 inches)

Bssz--38 to 44 inches; very dark grayish brown (10YR 3/2) clay; weak coarse prismatic structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; common large slickensides having distinct polished and grooved surfaces; few distinct soft masses of calcium carbonate; few distinct salt crystals; few distinct soft masses of iron-manganese; few medium prominent yellowish brown (10YR 5/8) masses of iron accumulations on faces of peds and slickensides; slightly alkaline; clear smooth boundary. (8 to 12 inches thick)

Bsszg1--44 to 62 inches; dark brown (10YR 3/3) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; common large slickensides having distinct polished and grooved surfaces; common distinct salt crystals; few distinct soft masses of iron-manganese; common medium distinct olive brown (2.5Y 4/4) masses of iron accumulation; slightly alkaline; gradual wavy boundary.

Bsszg2--62 to 78 inches; brown (10YR 4/3) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine, fine, and medium roots; many very fine, common fine, and few medium tubular and vesicular pores; many large slickensides having distinct polished and grooved surfaces; many distinct salt crystals; many distinct soft masses of iron-manganese; common medium prominent dark gray (2.5Y 4/1) areas of iron depletions; few medium prominent yellowish brown (10YR 5/8) masses of iron accumulation; slightly alkaline; clear wavy boundary. (Combined thickness of the Bsszg horizons ranges from 5 to 8 inches)

Bzg--78 to 85 inches; dark gray (2.5Y 4/1) clay; weak medium subangular blocky structure; very hard, very firm; very sticky, very plastic; few very fine and fine roots; many very fine, common fine, and few medium tubular and vesicular pores; few faint salt crystals; common distinct soft masses of iron-manganese; common prominent yellowish brown (10YR 5/6) masses of iron accumulation; slightly alkaline.

TYPE LOCATION: Cabo Rojo Municipio, Puerto Rico. Approximately 5.4 miles south of Cabo Rojo and about 1.1 miles south of Las Arenas on P.R. Hwy. 301 from the intersection of P.R. Hwy. 101, and about 0.2 miles east in pasture. Puerto Real topographic quadrangle; lat. 18 degrees 0 minutes 33 seconds N.; long. 67 degrees 8 minutes 49 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness is more than 80 inches. Reaction is neutral to strongly alkaline in the A or Ap horizon, and slightly alkaline to strongly alkaline in the rest of the profile.

The A or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3.

The Bss horizons have hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Iron accumulations in shades of brown and yellow range from few to many and are most common on surfaces of peds or slickensides and generally increasing with depth. Soft masses of iron-manganese range from few to many.

The Bssz horizons have hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Iron accumulations in shades of brown range from few to many and are most common on surfaces of peds or slickensides and generally increasing with depth. Some pedons have no dominant color and are multicolored in shades of brown and yellow. Small faint salt crystals range from few to many. Soft masses of calcium carbonate range from none to common. Soft masses of iron-manganese range from few to many.

The Bsszg horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Iron accumulations in shades of brown range from few to many and are most common on surfaces of peds or slickensides. Small faint salt crystals range from few to many. Soft masses of iron-manganese range from few to many.

The Bzg horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Iron accumulations in shade of brown range from few to many and are most common on surfaces of peds or slickensides. Small faint salt crystals range from few to many. Soft masses of iron-manganese range from few to many.

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

GEOGRAPHIC SETTING: Teresa soils are on nearly level valley floors of the Semiarid Coastal Plains MLRA. Slopes range from 0 to 1 percent. They formed in clayey marine sediments. The climate is semiarid tropical. The mean annual temperature ranges from 78 to 80 degrees F., and the average annual precipitation ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Boqueron, Cartagena, Fe, and Fraternidad soils. Boqueron soils are on lower adjacent tidal areas dominated by mangrove trees and have mixed, fine-silty control sections. Cartagena soils are on slightly higher positions, have a clay content ranging from 35 to 60 percent, and have mixed mineralogy. Fe and Fraternidad soils are on slightly higher positions and have a clay content ranging from 35 to 60 percent.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; very slow permeability.

USE AND VEGETATION: Most areas of Teresa soils are used for pastureland. The vegetation consists of lippia, mesquite, desmanthus, and other xerophytic and salt-tolerant plants.

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

MLRA OFFICE RESPONSIBLE: Auburn, Alabama

SERIES ESTABLISHED: Puerto Rico; 1936.

REMARKS: These soils were formerly classified in the Solonetz great soil group.

Diagnostic horizons and feature recognized in this pedon are:

Ochric horizon - 0 to 10 inches (Ap horizon).

Cambic horizon - the zone from about 13 to 80 inches (Bss, Bssz, Bsszg, and Bzg horizons).

Intersecting slickensides beginning about 28 inches and continuing to a depth of about 78 inches (Bss, Bssz, and Bsszg horizons).

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 - Cabo Rojo Municipio, Puerto Rico; S97PR--023-001 sample by SSL, Lincoln, NE. 6/97.

MLRA: 273.

National Cooperative Soil Survey
U.S.A.

LOCATION VAYAS PR

**Established Series
Rev. JLL/GRB
07/2001**

VAYAS SERIES

The Vayas series consists of very deep, poorly drained, slowly permeable on flood plains. They formed in clayey alkaline alluvium of mixed origin. 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 0 to 2 percent.

TAXONOMIC CLASS: Fine, smectitic, isohyperthermic Vertic Endoaquolls

TYPICAL PEDON: Vayas silty clay - pasture. (Colors are for moist conditions.)

A1--0 to 4 inches; very dark grayish brown (10YR 3/2) silty clay; weak fine granular structure; friable; slightly sticky, slightly plastic; many fine roots; neutral; clear wavy boundary. (3 to 8 inches thick)

Bwg1--4 to 11 inches; dark gray (10YR 4/1) silty clay; weak medium subangular blocky structure; friable; slightly sticky, plastic; many fine roots; neutral; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; gradual wavy boundary.

Bwg1--11 to 18 inches; very dark gray (10YR 3/1) silty clay; weak fine subangular blocky structure; firm; slightly sticky, plastic; common fine roots; many medium distinct red (2.5YR 4/8) masses of iron accumulation; many medium distinct gray (N 5/0) areas of iron depletions; slightly alkaline; clear wavy boundary. (Combined thickness of the B horizons ranges from 9 to 22 inches)

Cg1--18 to 22 inches; dark gray (10YR 4/1) clay; massive; firm, sticky, plastic; few fine roots; few fine black (10YR 2/1) concretions; many medium distinct brownish yellow (10YR 6/8) and common medium distinct yellowish red (5YR 5/8) masses of iron accumulation; slightly alkaline; abrupt smooth boundary.

Cg2--22 to 36 inches; very dark gray (10YR 3/1) clay; common medium distinct yellowish brown (10YR 5/6) and few

fine distinct yellowish red (5YR 5/8) masses of iron accumulation; massive; firm, sticky, plastic; few fine roots; few salt crystals; moderately alkaline; clear wavy boundary.

Cg3--36 to 50 inches; black (N 2/0) clay; massive; firm; sticky, plastic; common fine salt crystals; few fine distinct red (2.5YR 4/8) and dark yellowish brown (10YR 4/4) masses of iron accumulation; moderately alkaline.

TYPE LOCATION: Cabo Rojo Municipality, Puerto Rico. Approximately 1.4 miles southeast of the Betances community on dirt road from the intersection of P. R. Hwy. 101 and P.R. Highway 103, about 175 feet east of dirt road. Puerto Real topographic quadrangle; lat. 18 degrees 00 minutes 50 seconds N., long. 67 degrees 07 minutes 34 seconds W.; PRD 1940.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 12 to 30 inches. Reaction ranges from slightly acid to slightly alkaline in the A and Ap horizons, from neutral to slightly alkaline in the Bwg horizons, and from slightly alkaline to moderately alkaline in the BCg and Cg horizons. Organic matter decreases regularly as depth increases.

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

The Bwg horizons have hue of 10YR to 5Y, value of 3 through 5, and chroma of 2 or less. Masses of iron accumulations in shades of red, brown, and yellow range from common to many.

The Cg horizons have hue of 10YR and 5Y, value of 2 through 5, and chroma of 2 or less. Masses of iron accumulations in shades of red, brown, and yellow range from common to many. Salt crystals are fine and range from few to common. Sodium saturation in the upper 20 inches of the solum is less than 15 percent.

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

GEOGRAPHIC SETTING: Vayas soils are on weakly dissected river flood plains. They formed in clayey alkaline alluvium of mixed origin. Slopes range from 0 to 2 percent. The climate is tropical semiarid. The mean annual temperature ranges from 78 to 80 degrees F., and the average annual rainfall ranges from 30 to 40 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Aguirre, and Fraternidad, and San Anton series. The Aguirre and Fraternidad soils are on alluvial fans and valley floors, and have COLE values of 0.09 or more in the sola. The San Anton soils are not mottled.

DRAINAGE AND PERMEABILITY: Poorly drained; slow permeability.

USE AND VEGETATION: Most areas of Vayas soil are planted to sugarcane or used for pasture. The vegetation consists of Para grass and other native and introduced species.

DISTRIBUTION AND EXTENT: Semiarid river flood plains of southern Puerto Rico. The series is of small extent.

MLRA OFFICE RESPONSIBLE: Auburn, Alabama.

SERIES ESTABLISHED: Soil Survey of Puerto Rico; 1942.

MLRA: 273.

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