Nichols Arboretum: Soil Types

- Boyer Sandy Loam 0-6% Slopes
- Fox Sandy Loam 6-12% Slopes
- Miami Loam 2-6% Slopes
- Miami Loam 6-12% Slopes
- Miami Loam 12-18% Slopes
- Miami Loam 18-25% Slopes
- Miami Loam 25-35% Slopes
- Sloan Silt Loam, Wet
- Wasepi Sandy Loam 0-4% Slopes

Data from NRCS Soil Survey
SOIL SERIES DESCRIPTIONS

BOYER SERIES

The Boyer series consists of very deep, well drained soils formed in sandy and loamy drift underlain by sand or gravelly sand outwash at depths of 51 to 102 cm (20 to 40 inches).

GEOGRAPHIC SETTING

Boyer soils are on outwash plains, valley trains, kames, beach ridges, river terraces, lake terraces, deltas, and moraines of Wisconsinan age. The slope gradients are dominantly 0 to 12 percent, but range from 0 to 50 percent. Boyer soils formed in sandy and loamy drift underlain by sand or gravelly sand outwash at depths of 51 to 102 cm (20 to 40 inches). Quartz is the dominant mineral in the 3C horizon, which contains, in addition, varying amounts of material from igneous and metamorphic rocks, limestone, and dolomite. Mean annual precipitation ranges from 711 to 1016 mm (28 to 40 inches). Mean annual temperature ranges from 8.3 to 10.0 degrees C (47 to 50 degrees F).

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY

Well drained. Depth to the seasonal high water table is greater than 163 cm (6 feet). Potential surface runoff is negligible to medium depending upon slope. Saturated hydraulic conductivity is high in the solum and very high in the substratum. Permeability is moderately rapid in the solum and very rapid in the substratum.

USE AND VEGETATION

Soils are cultivated in most areas. Principal crops are corn, small grain, soybeans, field beans, and alfalfa hay. A few areas remain in permanent pasture or forest. The dominant forest trees are oaks, hickories, and maples.

TYPICAL PEDON

Boyer loamy sand, on a 4 percent slope in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap—0 to 18 cm (7 inches); dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary. [15 to 30 cm (6 to 12 inches) thick]

E1—18 to 30 cm (7 to 12 inches); brown (10YR 5/3) loamy sand; weak medium granular structure; very friable; common fine roots; about 2 percent gravel; moderately acid; clear wavy boundary.

E2—30 to 46 cm (12 to 18 inches); yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; about 3 percent gravel; moderately acid; clear wavy
boundary. [Combined thickness of the E horizon is 0 to 56 cm (22 inches).]

2Bt1--46 to 76 cm (18 to 30 inches); brown (7.5YR 4/4) gravelly sandy loam; weak coarse subangular blocky structure; firm; few fine roots; few thin clay films on faces of peds; about 15 percent gravel; slightly acid; gradual wavy boundary.

2Bt2--76 to 86 cm (30 to 34 inches); brown (7.5YR 4/4) gravelly sandy clay loam; weak coarse subangular blocky structure; firm; common thin and medium clay films on faces of peds; about 15 percent gravel; neutral; abrupt irregular boundary. [Combined thickness of the 2Bt horizon is 18 to 66 cm (7 to 26 inches).]

3C--86 to 152 cm (34 to 60 inches); grayish brown (10YR 5/2) stratified gravel and coarse sand; single grain; loose; strong effervescence; moderately alkaline.

RANGE IN CHARACTERISTICS

Thickness of the solum: 51 to 102 cm (20 to 40 inches).
Depth to the sand and gravel: 51 to 102 cm (20 to 40 inches).
Depth to carbonates: 51 to 102 cm (20 to 40 inches).
The Fox series consists of very deep, well drained soils which are moderately deep to stratified calcareous sandy outwash.

**GEOGRAPHIC SETTING**

Fox soils are on outwash plains, stream terraces, valley trains, and kames and in outwash areas on moraines. Slope gradients range from 0 to 35 percent. These soils formed in thin loess and loamy alluvium or just in loamy alluvium overlying stratified calcareous sandy outwash. Mean annual precipitation ranges from 686 to 1120 mm (27 to 44 inches). Mean annual temperature ranges from 7.8 to 13.9 degrees C (46 to 57 degrees F). The frost free period ranges from about 135 to 190 days. Elevation ranges from 177 to 396 meters (580 to 1300 feet).

**DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY**

Well drained. The potential for surface runoff is negligible to high. Saturated hydraulic conductivity is moderately high to high (4.23 to 14.11 micrometer per second) in the silty and loamy mantle and high to very high (42.34 to 141.14 micrometers per second) in the sand and gravelly outwash. Permeability is moderate in the silty and loamy mantle and rapid or very rapid in the sand and gravel outwash.

**USE AND VEGETATION**

Most of the less sloping areas are used for cropland. Common crops are corn, soybeans, small grains, and hay. Some areas are used for pastureland or woodland. Native vegetation is hardwood forest.

Common trees are northern red oak, white oak, sugar maple, black cherry, and white ash.

**TYPICAL PEDON**

Fox silt loam - on a plane 1 percent slope in a cultivated field at an elevation of about 260 meters (850 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

**Ap**--0 to 25 cm (0 to 10 inches); dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; very friable; slightly acid; abrupt smooth boundary. [13 to 25 cm (5 to 10 inches) thick]

**Bt1**--25 to 38 cm (10 to 15 inches); dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; friable; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

**Bt2**--38 to 53 cm (15 to 21 inches); dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; firm; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; clear wavy boundary. [Combined thickness of the Bt horizons in loess ranges from 0 to 48 cm (0 to 19 inches); in loamy outwash it ranges from 25 to 89 cm (10 to 35 inches).]
**2Bt3**—53 to 74 cm (21 to 29 inches); brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common prominent very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear wavy boundary.

**2Bt4**—74 to 84 cm (29 to 33 inches); brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; firm; common distinct dark brown (7.5YR 3/2) clay films on faces of peds; about 5 percent gravel; slightly alkaline; clear wavy boundary. [Combined thickness of the 2Bt horizon [Bt horizon in pedons without a loess mantle] ranges from 10 to 89 cm (10 to 35 inches).]

**3C1**—84 to 114 cm (33 to 45 inches); yellowish brown (10YR 5/4) stratified gravelly sand and very cobbly sand; single grain; loose; about 30 percent gravel and 30 percent cobbles as an average; strongly effervescent; moderately alkaline; clear wavy boundary. [0 to 51 cm (0 to 20 inches) thick]

**3C2**—114 to 152 cm (45 to 60 inches); light yellowish brown (10YR 6/4) stratified very gravelly sand, extremely gravelly sand, and gravel; single grain; loose; about 65 percent gravel as an average; strongly effervescent; moderately alkaline.

**RANGE IN CHARACTERISTICS**

Depth to the base of the argillic horizon: 51 to 102 cm (20 to 40 inches).
Thickness of loess mantle: 0 to 61 cm (0 to 24 inches).
Particle-size control section: averages from 18 to 35 percent clay, 15 to 45 percent fine sand or coarser.
Depth to free carbonates and stratified sandy outwash: 51 to 102 cm (20 to 40 inches).
Volume of gravel: 0 to 35 percent in the loamy mantle, averages 3 to 70 percent in the stratified outwash and ranges from 0 to 95 percent in individual strata.
Volume of cobbles: 0 to 50 percent in individual strata in the outwash.
Reaction: strongly acid to slightly acid in the upper part of the solum, but it ranges to neutral in the upper parts of some pedons where the soil is limed and ranges from moderately acid to slightly alkaline in the in the lower subsoil and is slightly alkaline or moderately alkaline in the outwash.
Free calcium carbonates: in the sand and gravel outwash and in the lower part of the loamy mantle in some pedons.
**MIAMI SERIES**

The Miami series consists of very deep, moderately well drained soils that are moderately deep to dense till.

**GEOGRAPHIC SETTING**

Miami soils are on till plains. Slope gradients are dominantly 0 to 25 percent, but range to 60 percent. Miami soils formed in as much as 46 cm (18 inches) of loess or silty material and in the underlying loamy till. Mean annual precipitation ranges from 762 to 1067 mm (30 to 42 inches). Mean annual temperature ranges from 7.8 to 12.2 degrees C (46 to 54 degrees F). Frost-free period is 140 to 180 days. Elevation is 183 to 366 meters (600 to 1200 feet) above mean sea level.

**DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY**

Moderately well drained. Depth to the top of an intermittent perched high water table ranges from 61 to 91 cm (2.0 to 3.0 feet) between December and April in normal years. Potential for surface water runoff is medium on the gentle slopes and high on the steeper slopes. Saturated hydraulic conductivity is moderately high in the solum and moderately low or low in the underlying dense till. Permeability is moderate in the upper part of the solum, moderately slow in the lower part of the solum, and slow or very slow in the underlying dense till.

**USE AND VEGETATION**

Most areas are used to grow corn, soybeans, small grain, and hay. Much of the more sloping part is in permanent pasture or forest. Native vegetation is deciduous forest.

**TYPICAL PEDON**

Miami silt loam, on a convex, 3 percent slope in a cultivated field at an elevation of about 268 meters (880 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

- **Ap**—0 to 20 cm (0 to 8 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary. [15 to 25 cm (6 to 10 inches) thick]

- **Bt1**—20 to 33 cm (8 to 13 inches); dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; many distinct brown (7.5YR 4/4) clay films on faces of peds and as linings of some pores; 1 percent rock fragments; moderately acid; abrupt wavy boundary. [0 to 20 cm (0 to 8 inches) thick]

- **2Bt2**—33 to 58 cm (13 to 23 inches); dark yellowish brown (10YR 4/4) clay loam; strong coarse subangular blocky structure; firm; many distinct brown (7.5YR 4/4) clay films on faces of peds and as linings of some pores; 2 percent rock fragments; strongly acid; clear wavy boundary.
2Bt3--58 to 79 cm (23 to 31 inches); dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; many distinct brown (7.5YR 4/4) clay films on faces of peds and as linings of some pores; common fine and medium spherical very dark gray (10YR 3/1) iron-manganese masses in the matrix; 5 percent rock fragments; moderately acid; clear wavy boundary. [Combined thickness of the 2Bt horizon is 30 to 51 cm (12 to 20 inches).]

2BCt--79 to 91 cm (31 to 36 inches); brown (10YR 4/3) loam; weak coarse prismatic structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine and medium irregular very dark gray (10YR 3/1) iron-manganese masses in the matrix; common medium faint light brownish gray (10YR 6/2) irregular iron depletions in the matrix; 5 percent rock fragments; slightly effervescent; slightly alkaline; clear irregular boundary. [0 to 25 cm (0 to 10 inches) thick]

2Cd--91 to 203 cm (36 to 80 inches); brown (10YR 5/3) loam; massive; very firm; few fine irregular very dark gray (10YR 3/1) iron-manganese masses in the matrix; common medium faint grayish brown (10YR 5/2) irregular iron depletions in the matrix; 5 percent rock fragments; strongly effervescent; moderately alkaline.

**RANGE IN CHARACTERISTICS**

Thickness of the loess or silty material: 0 to 46 cm (0 to 18 inches).
Depth to the base of the argillic horizon: 61 to 102 cm (24 to 40 inches).
Depth to densic contact: 61 to 102 cm (24 to 40 inches).
Depth to carbonates: 51 to 102 cm (20 to 40 inches).
Depth to bedrock: greater than 203 cm (80 inches).
SLOAN SERIES

The Sloan series consists of very deep, very poorly drained soils formed in loamy alluvium on flood plains.

GEOGRAPHIC SETTING

Sloan soils are on flood plains or in depressions along streams receiving sediment from areas of Wisconsinan age glaciation. Slope ranges from 0 to 2 percent. The soils formed in loamy alluvium washed mainly from soils formed in loamy, calcareous drift. Mean annual precipitation ranges from 787 to 1041 mm (31 to 41 inches). Mean annual temperature ranges from 7 to 13 degrees C (45 to 56 degrees F). Frost-free period is 130 to 200 days. Elevation is 213 to 305 meters (700 to 1000 feet) above mean sea level.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY

Very poorly drained. Depth to the top of an intermittent apparent high water table ranges from 30 cm (1 foot) above the surface to 30 cm (1 foot) below the surface between November and June in normal years. Potential for surface runoff is negligible to medium. These soils are subject to flooding from late fall to spring. Saturated hydraulic conductivity is moderately high; in the sandy substratum phase, it is very high. Permeability is moderate or moderately slow. In the sandy substratum phase, permeability is rapid in the lower part of the series control section.

USE AND VEGETATION

A large part is artificially drained and cultivated. Corn and soybeans are the principal crops with small acreages of hay, oats, and vegetables. Other areas, especially on the flood plains of the smaller streams, are used for permanent pasture or woodland. Native vegetation is deciduous forest, chiefly elm, ash, sycamore, silver maple, and willow.

TYPICAL PEDON

Sloan silty clay loam, on a slope of less than 1 percent in a cultivated field at an elevation of 274 meters (900 feet) above mean sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 23 cm (9 inches); very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) rubbed, and gray (10YR 5/1) dry; moderate fine and medium angular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary. [15 to 28 cm (6 to 11 inches) thick]

A--23 to 38 cm (9 to 15 inches); very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium angular blocky structure; friable; many fine roots; few medium distinct dark yellowish brown (10YR 3/4) masses of oxidized iron-manganese throughout; neutral; gradual wavy boundary. [0 to 33 cm (13 inches) thick]
Bg1--38 to 53 cm (15 to 21 inches); dark gray (10YR 4/1) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; common medium distinct dark yellowish brown (10YR 4/4) masses of oxidized iron-manganese throughout; few dark iron-manganese concretions throughout; neutral; gradual wavy boundary.

Bg2--53 to 86 cm (21 to 34 inches); gray (10YR 5/1) and dark gray (10YR 4/1) silty clay loam; weak medium subangular blocky structure; firm; few fine roots; many medium prominent brown (7.5YR 4/4) masses of oxidized iron-manganese and few fine prominent yellowish brown (10YR 5/6) masses of oxidized iron throughout; few distinct black manganese concretions throughout; neutral; clear smooth boundary. [Combined thickness of the Bg horizon is 20 to 114 cm (8 to 45 inches).]

BCg--86 to 114 cm (34 to 45 inches); gray (10YR 5/1) clay loam; massive; friable; many coarse prominent strong brown (7.5YR 5/6) masses of oxidized iron throughout; slightly alkaline; gradual wavy boundary. [0 to 51 cm (20 inches) thick]

Cg--114 to 152 cm (45 to 60 inches); gray (10YR 5/1) stratified loam, silt loam, silty clay loam, and sandy loam; massive; friable; many coarse distinct yellowish brown (10YR 5/4) and prominent yellowish brown (10YR 5/6) masses of oxidized iron throughout; slightly effervescent; slightly alkaline.

RANGE IN CHARACTERISTICS

Thickness of the solum: 51 to 152 cm (20 to 60 inches). Depth to carbonates: 56 to more than 203 cm (22 to more than 80 inches). Thickness of the mollic epipedon: 25 to 61 cm (10 to 24 inches) and includes the upper part of the B horizon in some pedons. Particle-size control section: averages 22 to 35 percent clay and 15 to 35 percent fine sand or coarser material. Mean annual soil temperature: 9 to 14 degrees C (48 to 57 degrees F).
**WA SEPI SERIES**

The Wasepi series consists of very deep, somewhat poorly drained soils formed in loamy and sandy glaciofluvial deposits underlain by sand and gravel at 51 to 102 cm (20 to 40 inches).

**GEOGRAPHIC SETTING**

Wasepi soils are on outwash plains, deltas, valley trains, glacial drainageways, and lake plains of Wisconsinan Age. Slope gradient is dominantly 0 and 2 percent, but ranges to 6 percent. This soil formed in loamy and sandy glaciofluvial deposits underlain by sand and gravel at 51 to 102 cm (20 to 40 inches). Mean annual precipitation ranges from 737 to 940 mm (29 to 37 inches). Mean annual temperature ranges from 7.8 to 10.0 degrees C (46 to 50 degrees F).

**DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY**

Somewhat poorly drained. Potential for surface runoff is negligible to low. Saturated hydraulic conductivity is high in the solum and high or very high in the underlying sand and gravel. Permeability is moderately rapid in the solum and rapid in underlying sand and gravel.

**USE AND VEGETATION**

Most areas are cultivated. Corn, soybeans, small grain, and grass-legume hay are principal crops. Soils are used for permanent pasture or forest in a few areas. Native vegetation is hardwoods, principally American elm, white ash, hickory, and swamp white oak.

**TYPICAL PEDON**

Wasepi sandy loam, on a 1 percent slope in a cultivated area. (Colors are for moist soil unless otherwise stated.)

**Ap**--0 to 20 cm (8 inches); very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many fine roots; about 5 percent gravel; neutral; abrupt wavy boundary. [15 to 25 cm (6 to 10 inches) thick]

**E1**--20 to 33 cm (8 to 13 inches); brown (10YR 5/3) sandy loam; weak medium granular structure; very friable; many fine roots; about 5 percent gravel; slightly acid; clear wavy boundary.

**E2**--33 to 43 cm (13 to 17 inches); yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; common fine roots; few medium distinct grayish brown (10YR 5/2) iron depletions; about 5 percent gravel; slightly acid; clear wavy boundary. [Combined thickness of the E horizon is 10 to 46 cm (4 to 18 inches).]

**Bt1**--43 to 61 cm (17 to 24 inches); yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; few thin clay films; few fine roots; common medium distinct grayish brown (10YR 5/2) iron depletions; common medium distinct brownish yellow (10YR 6/6) masses of oxidized iron; about 5 percent gravel; slightly acid; gradual wavy boundary.
Bt2--61 to 76 cm (24 to 30 inches); brown (10YR 5/3) sandy clay loam; moderate fine subangular blocky structure; friable; thick clay films and bridging between sand grains; common medium faint light brownish gray (10YR 6/2) iron depletions; common medium distinct yellowish brown (10YR 5/6) masses of oxidized iron; about 10 percent gravel; slightly acid; abrupt wavy boundary. [Combined thickness of the Bt horizon is 20 to 51 cm (8 to 20 inches).]

2Cg--76 to 152 cm (30 to 60 inches); light brownish gray (10YR 6/2) stratified sand and fine gravel; single grain; loose; few coarse prominent brownish yellow (10YR 6/8) masses of oxidized iron; slightly alkaline; slightly effervescent.

RANGE IN CHARACTERISTICS

Thickness of the solum: 51 to 102 cm (20 to 40 inches).
Depth to carbonates: 51 to 102 cm (20 to 40 inches).

The above information was condensed from the Official Soil Series Descriptions available from the USDA Natural Resources Conservation Service: