THE PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF AGRICULTURE

# Agronomy SERIES

# Location and Distribution of Soils of the World, United States, and Pennsylvania

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by

Edward J. Ciolkosz
and
Robert L. Cunningham

Agronomy Series Number 95
June, 1987

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# Location and Distribution of Soils of the World, United States, and Pennsylvania

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Edward J. Ciolkosz and Robert L. Cunningham[1]

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Agronomy Department, The Pennsylvania State University

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June, 1987

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## Introduction

Data on the distribution of various kinds of soils is very useful. This information can be presented in the form of maps or as tabular data. Both forms of information are equally useful, but for different purposes. This publication presents maps and tables of data for soils of the world, United States, and Pennsylvania.

## World

Figure 1 gives a reduced (in size) version of a map prepared by the soil geography unit of the USDA-Soil Conservation Service of the soils of the world (SCS, 1971). The mapping units of this map are named for subdivisions of Soil Taxonomy (Soil Survey Staff, 1975). Soil Taxonomy is the official soil classification system of the United States and it has been in use since 1965. In addition, Table 1 gives the area of soils of the world at the order and suborder levels. These data were derived from the soils map of the world and presently are the best data of this type that are available.

Table 1. Area+ of Soils of the world by soil order and suborder (SCS, 1972a).

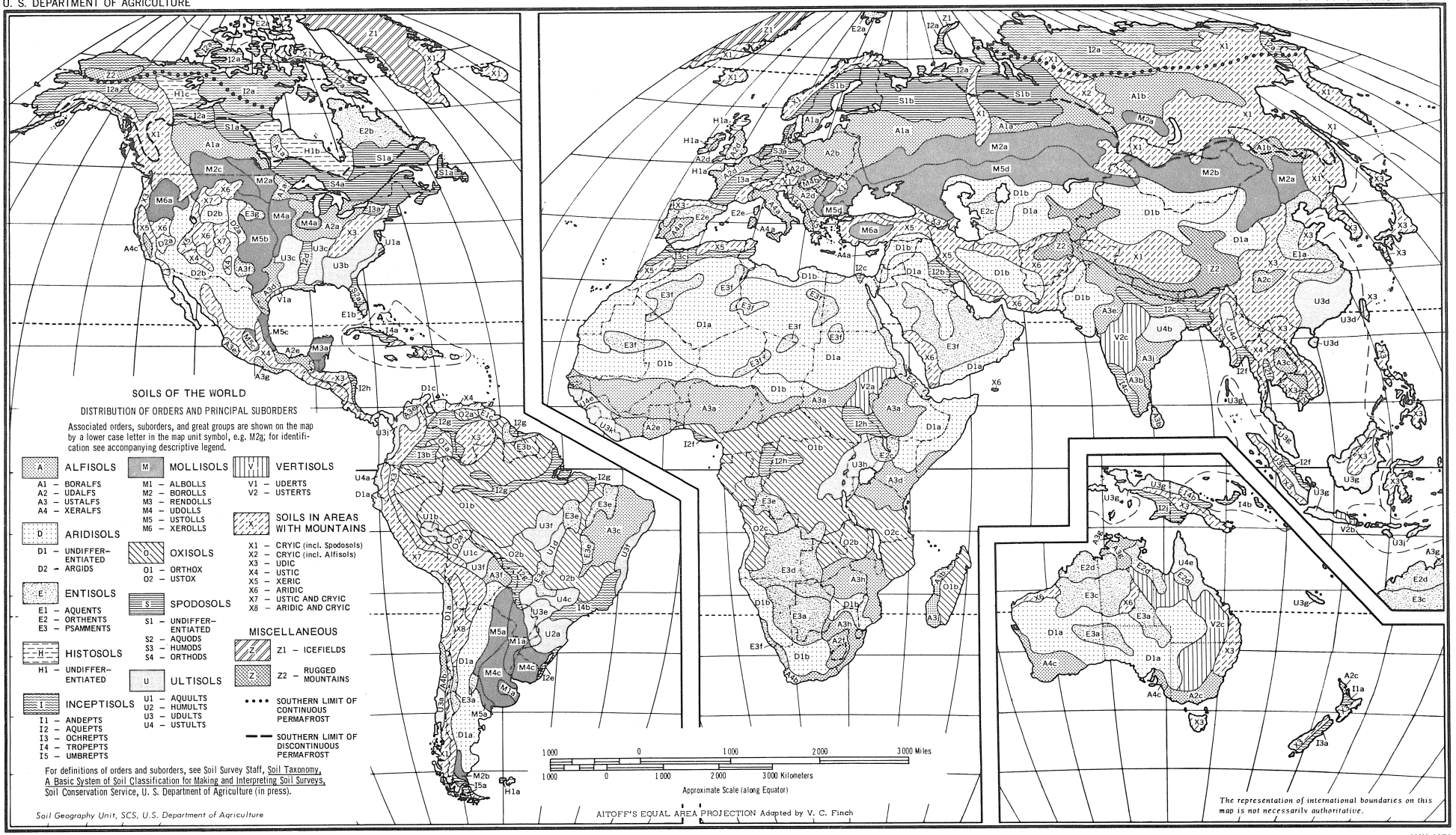
| Soil Order and Suborder | Square Miles Thousands* | Percent of World* | Rank | Soil Order and Suborder | Square Miles Thousands* | Percent of World* | Rank |
|---|---|---|---|---|---|---|---|
| Aridisols | 9,400 | 18.8 | 1 | Entisols | 4,200 | 8.3 | 6 |
| Aridisols** | 8,600 | 17.2 | | Aquents | 300 | 0.6 | |
| Argids | 800 | 1.6 | | Orthents | 1,000 | 2.0 | |
| Alfisols | 6,600 | 13.2 | 2 | Psamments | 2,800 | 5.6 | 7 |
| Boralfs | 1,800 | 3.5 | | Ultisols | 2,800 | 5.6 | |
| Udalfs | 1,200 | 3.2 | | Aquults | 200 | 0.4 | |
| Ustalfs | 3,200 | 6.4 | | Humults | 100 | 0.2 | |
| Xeralfs | 500 | 0.9 | | Udults | 2,000 | 4.0 | |
| Inceptisols | 4,500 | 8.9 | 3 | Ustults | 500 | 0.9 | |
| Andepts | 10 | 0.03 | | Spodosols | 2,200 | 4.3 | 8 |
| Aquepts | 3,800 | 7.5 | | Spodosols** | 1,600 | 3.2 | |
| Ochrepts | 400 | 0.8 | | Aquods | 30 | 0.1 | |
| Tropepts | 300 | 0.6 | | Humods | 50 | 0.1 | |
| Umbrepts | 20 | 0.04 | | Orthods | 500 | 0.9 | |
| Mollisols | 4,300 | 8.6 | 4 | Vertisols | 900 | 1.8 | 9 |
| Albolls | 200 | 0.3 | | Uderts | 10 | 0.03 | |
| Borolls | 2,000 | 4.0 | | Usterts | 890 | 1.8 | |
| Rendolls | 100 | 0.2 | | Histosols** | 500 | 0.9 | 10 |
| Udolls | 400 | 0.9 | | Miscellaneous and Soils in Areas of Mountains | 10,700 | 21.3 | |
| Ustolls | 1,400 | 2.8 | | | | | |
| Xerolls | 200 | 0.4 | | | | | |
| Oxisols | 4,300 | 8.5 | 5 | | | | |
| Orthox | 3,000 | 5.9 | | | | | |
| Ustox | 1,300 | 2.6 | | | | | |

+Ice free land area of world = 51,043,000 $mi^2$, perennial ice and snow = 6,219,000 $mi^2$, and inland water = 765,000 $mi^2$.
*Of Ice free land area.
**Undifferentiated.

# Figure 1. SOILS OF THE WORLD
## Distribution of Orders and Principal Suborders

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE




MAY 1972

USDA-SCS-HYATTSVILLE, MD. 1972

Only the dominant orders and suborders are shown. Each delineation has many inclusions of other kinds of soil. General definitions for the orders and suborders follow. For complete definitions see Soil Survey Staff, Soil Classification, A Comprehensive System, 7th Approximation, Soil Conservation Service, U.S. Department of Agriculture, 1960 (for sale by U.S. Government Printing Office) and the March 1967 supplement (available from Soil Conservation Service, U.S. Department of Agriculture). Approximate equivalents in the modified 1938 soil classification system are indicated for each suborder.

ALFISOLS . . . Soils with gray to brown surface horizons, medium to high base supply, and subsurface horizons of clay accumulation; usually moist but may be dry during warm season

A1 AQUALFS (seasonally saturated with water) gently sloping; general crops if drained, pasture and woodland if undrained (Some Low–Humic Gley soils and Planosols)

A2 BORALFS (cool or cold) gently sloping; mostly woodland, pasture, and some small grain (Gray Wooded soils)

A2S BORALFS steep; mostly woodland

A3 UDALFS (temperate or warm, and moist) gently or moderately sloping; mostly farmed, corn, soybeans, small grain, and pasture (Gray–Brown Podzolic soils)

A4 USTALFS (warm and intermittently dry for long periods) gently or moderately sloping; range, small grain, and irrigated crops (Some Reddish Chestnut and Red–Yellow Podzolic soils)

A5S XERALFS (warm and continuously dry in summer for long periods, moist in winter) gently sloping to steep; mostly range, small grain, and irrigated crops (Noncalcic Brown soils)

ARIDISOLS . . . Soils with pedogenic horizons, low in organic matter, and dry more than 6 months of the year in all horizons

D1 ARGIDS (with horizon of clay accumulation) gently or moderately sloping; mostly range, some irrigated crops (Some Desert, Reddish Desert, Reddish Brown, and Brown soils and associated Solonetz soils)

D1S ARGIDS GENTLY SLOPING TO STEEP

D2 ORTHIDS (without horizon of clay accumulation) gently or moderately sloping; mostly range and some irrigated crops (Some Desert, Reddish Desert, Sierozem, and Brown soils, and some Calcisols and Solonchak soils)

D2S ORTHIDS gently sloping to steep

ENTISOLS . . . Soils without pedogenic horizons

E1 AQUENTS (seasonally saturated with water) gently sloping; some grazing

E2 ORTHENTS (loamy or clayey textures) deep to hard rock; gently to moderately sloping; range or irrigated farming (Regosols)

E3 ORTHENTS shallow to hard rock; gently to moderately sloping; mostly range (Lithosols)

E3S ORTHENTS shallow to rock; steep; mostly range

E4 PSAMMENTS (sand or loamy sand textures) gently to moderately sloping; mostly range in dry climates, woodland or cropland in humid climates (Regosols)

HISTOSOLS . . . Organic soils

H1 FIBRISTS (fibrous or woody peats, largely undecomposed) mostly wooded or idle (Peats)

H2 SAPRISTS (decomposed mucks) truck crops if drained, idle if undrained (Mucks)

INCEPTISOLS . . . Soils that are usually moist, with pedogenic horizons of alteration of parent materials but not of accumulation

I1S ANDEPTS (with amorphous clay or vitric volcanic ash and pumice) gently sloping to steep; mostly woodland; in Hawaii mostly sugar cane, pineapple, and range (Ando soils, some Tundra soils)

I2 AQUEPTS (seasonally saturated with water) gently sloping; if drained, mostly row crops, corn, soybeans, and cotton; if undrained, mostly woodland or pasture (Some Low–Humic Gley soils and Alluvial soils)

I2P AQUEPTS (with continuous or sporadic permafrost) gently sloping to steep; woodland or idle (Tundra soils)

I3 OCHREPTS (with thin or light–colored surface horizons and little organic matter) gently to moderately sloping; mostly pasture, small grain, and hay (Sols Bruns Acides and some Alluvial soils)

I3S OCHREPTS gently sloping to steep; woodland, pasture, small grains

I4S UMBREPTS (with thick dark–colored surface horizons rich in organic matter) moderately sloping to steep; mostly woodland (Some Regosols)

MOLLISOLS . . . Soils with nearly black, organic–rich surface horizons and high base supply

M1 AQUOLLS (seasonally saturated with water) gently sloping; mostly drained and farmed (Humic Gley soils)

M2 BOROLLS (cool or cold) gently or moderately sloping, some steep slopes in Utah; mostly small grain in North Central States, range and woodland in Western States (Some Chernozems)

M3 UDOLLS (temperate or warm, and moist) gently or moderately sloping; mostly corn, soybeans, and small grains (Some Brunizems)

M4 USTOLLS (intermittently dry for long periods during summer) gently to moderately sloping; mostly wheat and range in western part, wheat and corn or sorghum in eastern part, some irrigated crops (Chestnut soils and some Chernozems and Brown soils)

M4S USTOLLS mostly sloping to steep; mostly range or woodland

M5 XEROLLS (continuously dry in summer for long periods, moist in winter) gently to moderately sloping; mostly wheat, range, and irrigated crops (Some Brunizems, Chestnut, and Brown soils)

M5S XEROLLS moderately sloping to steep; mostly range

SPODOSOLS . . . Soils with accumulations of amorphous materials in subsurface horizons

S1 AQUODS (seasonally saturated with water) gently sloping; mostly range or woodland; where drained in Florida, citrus and special crops (Ground–Water Podzols)

S2 ORTHODS (with subsurface accumulations of iron, aluminum, and organic matter) gently to moderately sloping; woodland, pasture, small grains, special crops (Podzols, Brown Podzolic soils)

S2S ORTHODS steep; mostly woodland

ULTISOLS . . . Soils that are usually moist, with horizon of clay accumulation and a low base supply

U1 AQUULTS (seasonally saturated with water) gently sloping; woodland and pasture if undrained, feed and truck crops if drained (Some Low–Humic Gley soils)

U2S HUMULTS (with high or very high organic–matter content) moderately sloping to steep; woodland and pasture if steep, sugar cane and pineapple in Hawaii, truck and seed crops in Western States (Some Reddish–Brown Lateritic soils)

U3 UDULTS (with low organic–matter content; temperate or warm, and moist) gently to moderately sloping; woodland, pasture, feed crops, tobacco, and cotton (Red–Yellow Podzolic soils, some Reddish–Brown Lateritic soils)

U3S UDULTS moderately sloping to steep; woodland, pasture

U4S XERULTS (with low to moderate organic–matter content, continuously dry for long periods in summer) range and woodland (Some Reddish–Brown Lateritic soils)

VERTISOLS . . . Soils with high content of swelling clays and wide deep cracks at some season

V1 UDERTS (cracks open for only short periods, less than 3 months in a year) gently sloping; cotton, corn, pasture, and some rice (Some Grumusols)

V2 USTERTS (cracks open and close twice a year and remain open more than 3 months); general crops, range, and some irrigated crops (Some Grumusols)

AREAS with little soil . . .

X1 Salt flats

X2 Rock land (plus ice fields in Alaska)

## NOMENCLATURE

The nomenclature is systematic. Names of soil orders end in *sol* (L. *solum*, soil), e.g., ALFISOL, and contain a formative element used as the final syllable in names of taxa in suborders, great groups, and subgroups.

Names of suborders consist of two syllables, e.g., AQUALF. Formative elements in the legend for this map and their connotations are as follows:

and – Modified from Ando soils; soils from vitreous parent materials

aqu – L. *aqua*, water; soils that are wet for long periods

arg – Modified from L. *argilla*, clay; soils with a horizon of clay accumulation

bor – Gr. *boreas*, northern; cool

fibr – L. *fibra*, fiber; least decomposed

hum – L. *humus*, earth; presence of organic matter

ochr – Gr. base of ochros, pale; soils with little organic matter

orth – Gr. *orthos*, true; the common or typical

psamm – Gr. *psammos*, sand; sandy soils

sapr – Gr. *sapros*, rotten; most decomposed

ud – L. *udus*, humid; of humid climates

umbr – L. *umbra*, shade; dark colors reflecting much organic matter

ust – L. *ustus*, burnt; of dry climates with summer rains

xer – Gr. *xeros*, dry; of dry climates with winter rains

## United States

Figure 2, which shows the soils of the United States, is also a reduced version of a map prepared by the Soil Conservation Service (SCS, 1970). Table 2 gives the area of these soils at the order and suborder level. Area data for this map at the great group level of classification are also available (SCS, 1972b), but are not presented here. Like the data for the world soils, these data are the best available. In the near future (in about 4 or 5 years) more accurate data will be available when the Soil Conservation Service finishes a new soils map of the United States. This map, at the scale of 1:250,000, will be digitized for computer handling and presentation.

Table 2. Area+ of Soils of the United States by soil order and suborder (SCS, 1972b).

| Soil Order and Suborder | Square Miles | Percentage of U.S. | Rank | Soil Order and Suborder | Square Miles | Percentage of U.S. | Rank |
|---|---|---|---|---|---|---|---|
| Mollisols | 890,200 | 25.1 | 1 | Aridisols | 411,860 | 11.6 | 5 |
| Aquolls | 45,560 | 1.3 | | Argids | 309,230 | 8.7 | |
| Borolls | 175,860 | 5.0 | | Orthids | 102,630 | 2.9 | |
| Udolls | 169,430 | 4.8 | | Entisols | 282,140 | 7.9 | 6 |
| Ustolls | 315,950 | 8.9 | | Aquents | 8,050 | 0.2 | |
| Xerolls | 183,400 | 5.1 | | Fluvents | 10,750 | 0.3 | |
| Inceptisols | 642,050 | 18.2 | 2 | Orthents | 187,060 | 5.2 | |
| Andepts | 64,560 | 1.8 | | Psamments | 76,280 | 2.2 | |
| Aquepts | 402,320 | 11.4 | | Spodosols | 171,620 | 4.8 | 7 |
| Ochrepts | 151,020 | 4.3 | | Aquods | 25,200 | 0.7 | |
| Tropepts | 100 | 0.003 | | Orthods | 146,420 | 4.1 | |
| Umbrepts | 24,050 | 0.7 | | Vertisols | 35,125 | 1.0 | 8 |
| Alfisols | 478,645 | 13.4 | 3 | Uderts | 13,420 | 0.4 | |
| Aqualfs | 36,220 | 1.0 | | Usterts | 21,405 | 0.6 | |
| Boralfs | 106,130 | 3.0 | | Xererts | 300 | 0.008 | |
| Udalfs | 209,390 | 5.9 | | Histosols | 18,600 | 0.5 | 9 |
| Ustalfs | 93,630 | 2.6 | | Fibrists | 7,440 | 0.2 | |
| Xeralfs | 33,275 | 0.9 | | Hemists | 7,440 | 0.2 | |
| Ultisols | 451,620 | 12.8 | 4 | Saprists | 3,720 | 0.1 | |
| Aquults | 40,770 | 1.2 | | Oxisols | 500 | 0.01 | 10 |
| Humults | 27,450 | 0.8 | | Orthox | 200 | 0.005 | |
| Udults | 347,020 | 9.8 | | Ustox | 300 | 0.007 | |
| Xerults | 36,380 | 1.0 | | Miscellaneous | 158,500 | 4.6 | |

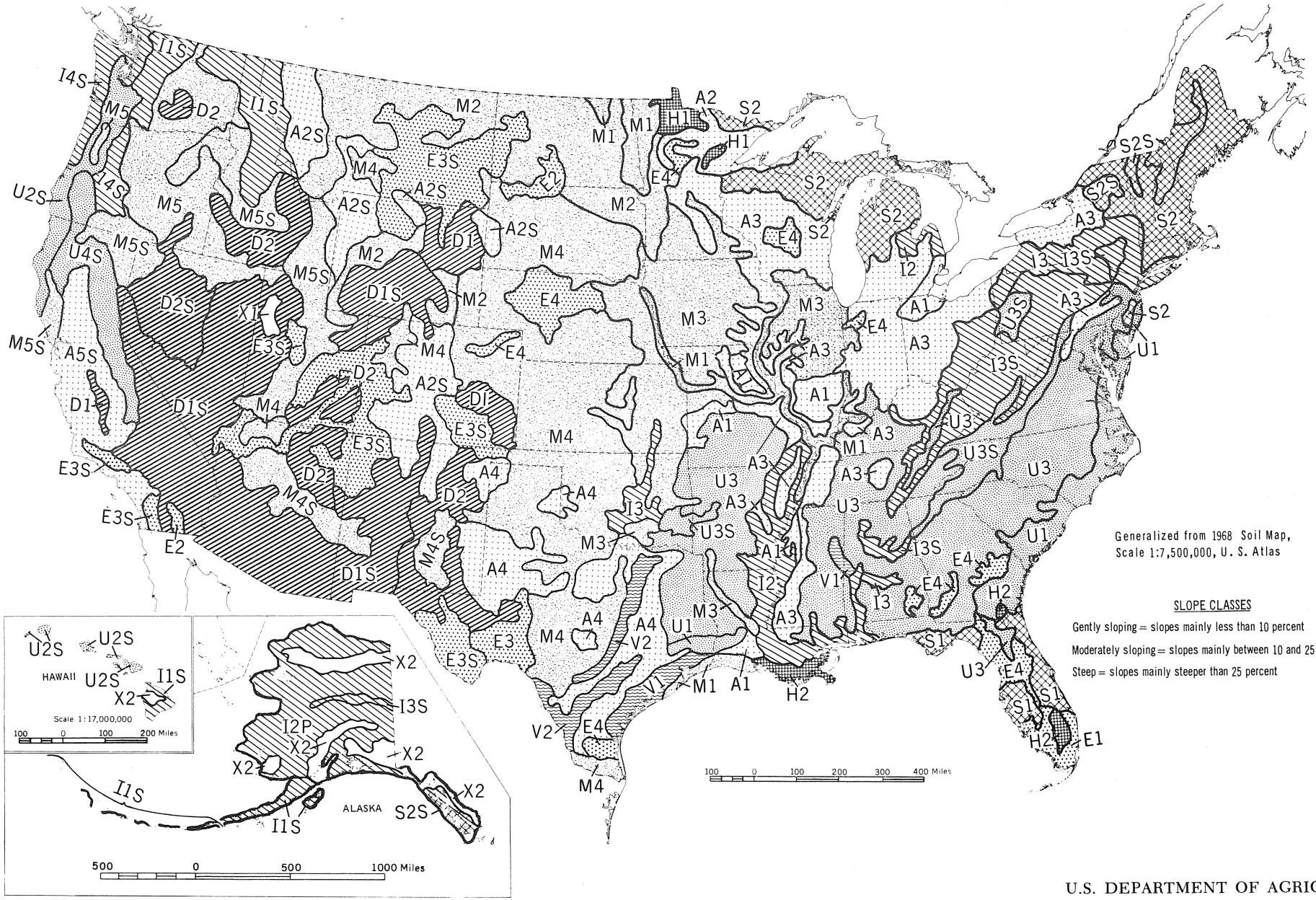
+Land area of the United States = 3,540,920 $mi^2$. This is the land area of the 50 states and the District of Columbia as given in the National Atlas of the United States. (See reference SCS, 1970).

## Pennsylvania

Figure 3 is a map of Pennsylvania soils. The mapping units of this map are not at the same level of classification as the soil maps of the world or United States but are associations of soil series. The series designation is the lowest level of soil classification. Table 3 illustrates the

Figure 2.

# PATTERNS OF SOIL ORDERS AND SUBORDERS OF THE UNITED STATES




U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Only the dominant orders and suborders are shown. Each delineation has many inclusions of other kinds of soil. General definitions for the orders and suborders follow. For complete definitions see Soil Survey Staff, Soil Classification, A Comprehensive System, 7th Approximation, Soil Conservation Service, U.S. Department of Agriculture, 1960 (for sale by U.S. Government Printing Office) and the March 1967 supplement (available from Soil Conservation Service, U.S. Department of Agriculture). Approximate equivalents in the modified 1938 soil classification system are indicated for each suborder.

ALFISOLS . . . Soils with gray to brown surface horizons, medium to high base supply, and subsurface horizons of clay accumulation; usually moist but may be dry during warm season

A1 AQUALFS (seasonally saturated with water) gently sloping; general crops if drained, pasture and woodland if undrained (Some Low-Humic Gley soils and Planosols)

A2 BORALFS (cool or cold) gently sloping; mostly woodland, pasture, and some small grain (Gray Wooded soils)

A2S BORALFS steep; mostly woodland

A3 UDALFS (temperate or warm, and moist) gently or moderately sloping; mostly farmed, corn, soybeans, small grain, and pasture (Gray-Brown Podzolic soils)

A4 USTALFS (warm and intermittently dry for long periods) gently or moderately sloping; range, small grain, and irrigated crops (Some Reddish Chestnut and Red-Yellow Podzolic soils)

A5S XERALFS (warm and continuously dry in summer for long periods, moist in winter) gently sloping to steep; mostly range, small grain, and irrigated crops (Noncalcic Brown soils)

ARIDISOLS . . . Soils with pedogenic horizons, low in organic matter, and dry more than 6 months of the year in all horizons

D1 ARGIDS (with horizon of clay accumulation) gently or moderately sloping; mostly range, some irrigated crops (Some Desert, Reddish Desert, Reddish Brown, and Brown soils and associated Solonetz soils)

D1S ARGIDS GENTLY SLOPING TO STEEP

D2 ORTHIDS (without horizon of clay accumulation) gently or moderately sloping; mostly range and some irrigated crops (Some Desert, Reddish Desert, Sierozem, and Brown soils, and some Calcisols and Solonchak soils)

D2S ORTHIDS gently sloping to steep

ENTISOLS . . . Soils without pedogenic horizons

E1 AQUENTS (seasonally saturated with water) gently sloping; some grazing

E2 ORTHENTS (loamy or clayey textures) deep to hard rock; gently to moderately sloping; range or irrigated farming (Regosols)

E3 ORTHENTS shallow to hard rock; gently to moderately sloping; mostly range (Lithosols)

E3S ORTHENTS shallow to rock; steep; mostly range

E4 PSAMMENTS (sand or loamy sand textures) gently to moderately sloping; mostly range in dry climates, woodland or cropland in humid climates (Regosols)

HISTOSOLS . . . Organic soils

H1 FIBRISTS (fibrous or woody peats, largely undecomposed) mostly wooded or idle (Peats)

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I2P AQUEPTS (with continuous or sporadic permafrost) gently sloping to steep; woodland or idle (Tundra soils)

I3 OCHREPTS (with thin or light-colored surface horizons and little organic matter) gently to moderately sloping; mostly pasture, small grain, and hay (Sols Bruns Acides and some Alluvial soils)

I3S OCHREPTS gently sloping to steep; woodland, pasture, small grains

I4S UMBREPTS (with thick dark-colored surface horizons rich in organic matter) moderately sloping to steep; mostly woodland (Some Regosols)

MOLLISOLS . . . Soils with nearly black, organic-rich surface horizons and high base supply

M1 AQUOLLS (seasonally saturated with water) gently sloping; mostly drained and farmed (Humic Gley soils)

M2 BOROLLS (cool or cold) gently or moderately sloping, some steep slopes in Utah; mostly small grain in North Central States, range and woodland in Western States (Some Chernozems)

M3 UDOLLS (temperate or warm, and moist) gently or moderately sloping; mostly corn, soybeans, and small grains (Some Brunizems)

M4 USTOLLS (intermittently dry for long periods during summer) gently to moderately sloping; mostly wheat and range in western part, wheat and corn or sorghum in eastern part, some irrigated crops (Chestnut soils and some Chernozems and Brown soils)

M4S USTOLLS mostly sloping to steep; mostly range or woodland

M5 XEROLLS (continuously dry in summer for long periods, moist in winter) gently to moderately sloping; mostly wheat, range, and irrigated crops (Some Brunizems, Chestnut, and Brown soils)

M5S XEROLLS moderately sloping to steep; mostly range

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S2S ORTHODS steep; mostly woodland

ULTISOLS . . . Soils that are usually moist, with horizon of clay accumulation and a low base supply

U1 AQUULTS (seasonally saturated with water) gently sloping; woodland and pasture if undrained, feed and truck crops if drained (Some Low-Humic Gley soils)

U2S HUMULTS (with high or very high organic-matter content) moderately sloping to steep; woodland and pasture if steep, sugar cane and pineapple in Hawaii, truck and seed crops in Western States (Some Reddish-Brown Lateritic soils)

U3 UDULTS (with low organic-matter content; temperate or warm, and moist) gently to moderately sloping; woodland, pasture, feed crops, tobacco, and cotton (Red-Yellow Podzolic soils, some Reddish-Brown Lateritic soils)

U3S UDULTS moderately sloping to steep; woodland, pasture

U4S XERULTS (with low to moderate organic-matter content, continuously dry for long periods in summer) range and woodland (Some Reddish-Brown Lateritic soils)

VERTISOLS . . . Soils with high content of swelling clays and wide deep cracks at some season

V1 UDERTS (cracks open for only short periods, less than 3 months in a year) gently sloping; cotton, corn, pasture, and some rice (Some Grumusols)

V2 USTERTS (cracks open and close twice a year and remain open more than 3 months); general crops, range, and some irrigated crops (Some Grumusols)

AREAS with little soil . . .

X1 Salt flats

X2 Rock land (plus ice fields in Alaska)

## NOMENCLATURE

The nomenclature is systematic. Names of soil orders end in *sol* (L. *solum*, soil), e.g., ALFISOL, and contain a formative element used as the final syllable in names of taxa in suborders, great groups, and subgroups.

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arg – Modified from L. *argilla*, clay; soils with a horizon of clay accumulation

bor – Gr. *boreas*, northern; cool

fibr – L. *fibra*, fiber; least decomposed

hum – L. *humus*, earth; presence of organic matter

ochr – Gr. base of ochros, pale; soils with little organic matter

orth – Gr. *orthos*, true; the common or typical

psamm – Gr. *psammos*, sand; sandy soils

sapr – Gr. *sapros*, rotten; most decomposed

ud – L. *udus*, humid; of humid climates

umbr – L. *umbra*, shade; dark colors reflecting much organic matter

ust – L. *ustus*, burnt; of dry climates with summer rains

xer – Gr. *xeros*, dry; of dry climates with winter rains

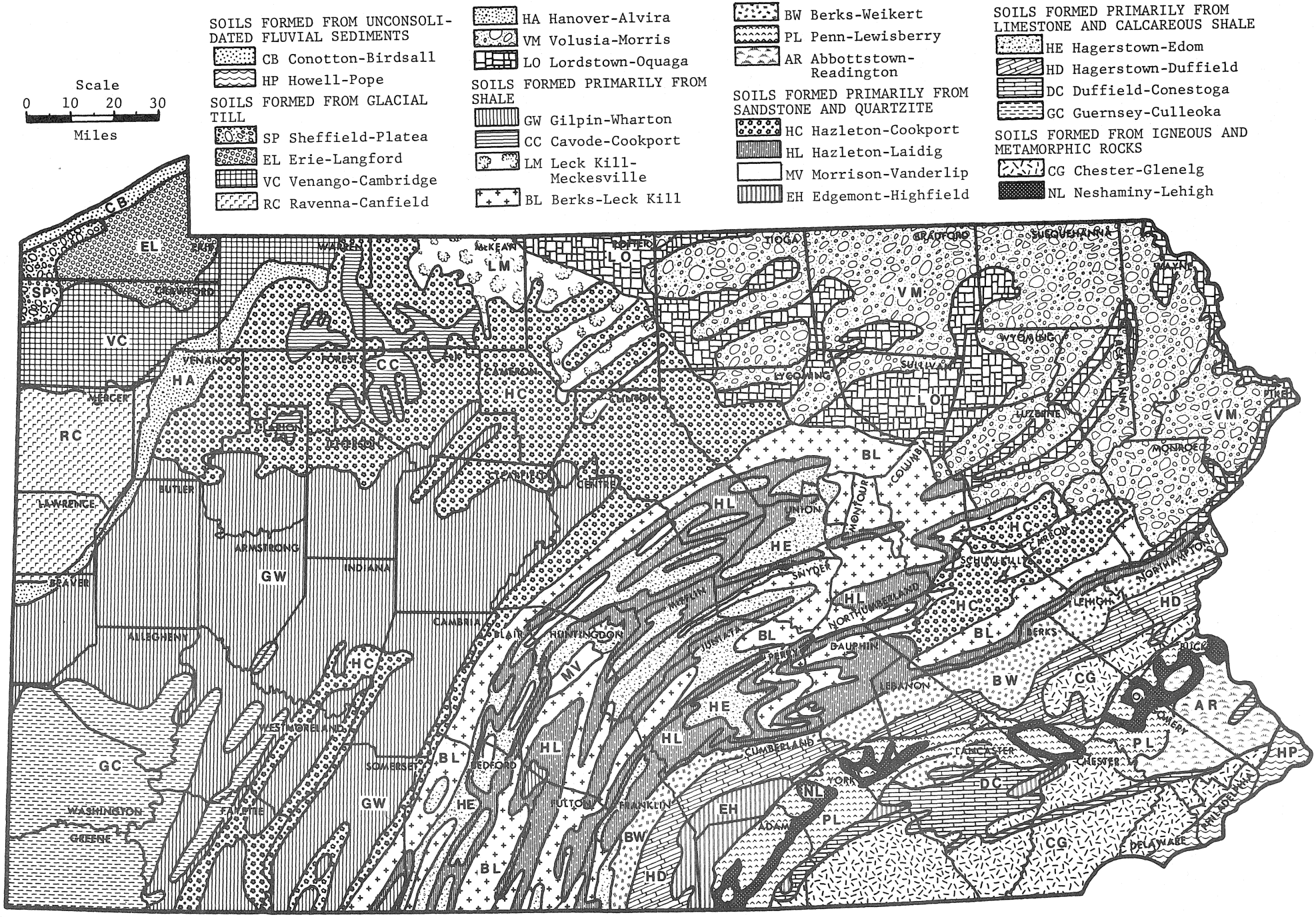


Figure 3. Soil Associations of Pennsylvania

# SOIL ASSOCIATIONS OF PENNSYLVANIA

By

Edward J. Ciolkosz, Robert L. Cunningham, and Gary W. Petersen

Agronomy Series No. 62, The Pennsylvania State University

1980

| Symbol | Soil Series | Depth Class | Drainage Class | Surface Texture | Subsoil Texture | Color | Parent Material | Classification |
|---|---|---|---|---|---|---|---|---|
| AR | Abbottstown | Deep** | Somewhat Poorly | Silt Loam | Silt Loam+ | Grayish Red | Acid Red Shale | Aeric Fragiaqualf |
| | Readington | Deep** | Moderately Well | Silt Loam | Silt Loam+ | Reddish Brown | Acid Red Shale | Typic Fragiudalf |
| BL | Berks | Mod. Deep | Well | Loam+ | Loam++ | Yellowish Brown | Acid Brown Shale | Typic Dystrochrept |
| | Leck Kill | Deep | Well | Silt Loam | Silt Loam+ | Reddish Brown | Acid Red Shale | Typic Hapludult |
| BW | Berks | Mod. Deep | Well | Loam+ | Loam++ | Yellowish Brown | Acid Brown Shale | Typic Dystrochrept |
| | Weikert | Shallow | Well | Loam+ | Loam++ | Yellowish Brown | Acid Brown Shale | Lithic Dystrochrept |
| CB | Conotton | Deep | Well | Sandy Loam+ | Sandy Loam++ | Brown | Sand and Gravel | Typic Hapludult |
| | Birdsall | Deep | Very Poorly | Silt Loam | Silt Loam | Gray | Glacial Silts | Typic Humaquept |
| CC | Cavode | Deep | Somewhat Poorly | Silt Loam | Silty Clay | Grayish Brown | Acid Clay Shale | Aeric Ochraquult |
| | Cookport | Deep** | Moderately Well | Loam | Clay Loam+ | Yellowish Brown | Acid Brown Shale | Aquic Fragiudult |
| CG | Chester | Deep | Well | Silt Loam | Silty Clay Loam | Brown | Gneiss and Schist | Typic Hapludult |
| | Glenelg | Deep | Well | Loam+ | Silt Loam+ | Brown | Gneiss and Schist | Typic Hapludult |
| DC | Duffield | Deep | Well | Silt Loam | Silty Clay Loam | Yellowish Brown | Shaly Limestone | Ultic Hapludalf |
| | Conestoga | Deep | Well | Silt Loam | Silty Clay Loam | Brown | Micaceous Limestone | Typic Hapludalf |
| EH | Edgemont | Deep | Well | Sandy Loam+ | Loam+ | Yellowish Brown | Quartzite | Typic Hapludult |
| | Highfield | Deep | Well | Silt Loam+ | Silt Loam+ | Yellowish Brown | Metarhyolite | Ultic Hapludalf |
| EL | Erie | Deep* | Somewhat Poorly | Silt Loam+ | Loam+ | Grayish Brown | Calcareous Till | Aeric Fragiaqualf |
| | Langford | Deep** | Moderately Well | Silt Loam+ | Loam+ | Yellowish Brown | Calcareous Till | Aqueptic Fragiudalf |
| GC | Guernsey | Deep | Moderately Well | Silt Loam | Clay+ | Yellowish Brown | Limestone and Shale | Aquic Hapludalf |
| | Culleoka | Mod. Deep | Well | Silt Loam | Silt Loam+ | Brown | Limestone and Shale | Ultic Hapludalf |
| GW | Gilpin | Mod. Deep | Well | Silt Loam+ | Silt Loam+ | Yellowish Brown | Shale and Sandstone | Typic Hapludult |
| | Wharton | Deep | Moderately Well | Silt Loam | Silty Clay Loam+ | Brown | Shale and Siltstone | Aquic Hapludult |
| HA | Hanover | Deep** | Well-Mod. Well | Silt Loam+ | Silt Loam+ | Yellowish Brown | Leached Till | Typic Fragiudult |
| | Alvira | Deep** | Somewhat Poorly | Silt Loam+ | Silt Loam+ | Grayish Brown | Leached Till | Aeric Fragiaquult |
| HC | Hazelton | Deep | Well | Sandy Loam | Sandy Loam | Yellowish Brown | Acid Sandstone | Typic Distrochrept |
| | Cookport | Deep** | Moderately Well | Loam | Clay Loam+ | Yellowish Brown | Acid Sandstone | Aquic Fragiudult |
| HD | Hagerstown | Deep | Well | Silt Loam | Clay | Red | Limestone | Typic Hapludalf |
| | Duffield | Deep | Well | Silt Loam | Silty Clay Loam | Yellowish Brown | Shaly Limestone | Ultic Hapludalf |
| HE | Hagerstown | Deep | Well | Silt Loam | Clay | Red | Limestone | Typic Hapludalf |
| | Edom | Deep | Well | Silty Clay Loam | Clay+ | Yellowish Brown | Shaly Limestone | Typic Hapludalf |
| HL | Hazleton | Deep | Well | Sandy Loam | Sandy Loam | Yellowish Brown | Acid Sandstone | Typic Distrochrept |
| | Laidig | Deep** | Well | Loam+ | Loam+ | Brown | Sandstone Colluvium | Typic Fragiudult |
| HP | Howell | Deep | Well | Sandy Loam | Clay | Brown | Sand, Silt and Clay | Typic Hapludult |
| | Pope | Deep | Well | Loam | Loam | Yellowish Brown | Silty Alluvium | Fluventic Dystrochrept |
| LM | Leck Kill | Deep | Well | Silt Loam | Silt Loam+ | Reddish Brown | Acid Red Shale | Typic Hapludult |
| | Meckesville | Deep** | Well | Loam | Clay Loam | Reddish Brown | Red Shale Colluvium | Typic Fragiudult |
| LO | Lordstown | Mod. Deep | Well | Silt Loam+ | Silt Loam+ | Yellowish Brown | Acid Brown Till | Typic Dystrochrept |
| | Oquaqa | Mod. Deep | Well | Loam+ | Loam+ | Reddish Brown | Acid Brown Till | Typic Dystrochrept |
| MV | Morrison | Deep | Well | Sandy Loam | Sandy Clay Loam+ | Brown | Sandy Limestone | Ultic Hapludalf |
| | Vanderlip | Deep | Well | Loamy Sand | Loamy Sand+ | Yellowish Brown | Sandy Limestone | Typic Quartzipsamment |
| NL | Neshaminy | Deep | Well | Silt Loam | Clay Loam+ | Yellowish Red | Diabase | Ultic Hapludalf |
| | Lehigh | Deep | Mod. Well-S.W. Poorly | Silt Loam | Silt Loam+ | Gray | Metamorphosed Shale | Aquic Hapludalf |
| PL | Penn | Mod. Deep | Well | Silt Loam+ | Silt Loam+ | Reddish Brown | Red Shale | Ultic Hapludalf |
| | Lewisberry | Deep | Well | Sandy Loam+ | Sandy Loam+ | Reddish Brown | Red Sandstone | Ultic Hapludalf |
| RC | Ravenna | Deep** | Somewhat Poorly | Silt Loam | Loam+ | Grayish Brown | Neutral Till | Aeric Fragiaqualf |
| | Canfield | Deep** | Moderately Well | Silt Loam | Loam+ | Yellowish Brown | Neutral Till | Aquic Fragiudalf |
| SP | Sheffield | Deep** | Poorly | Silt Loam | Silty Clay Loam | Brownish Gray | Fine Textured Till | Typic Fragiaqualf |
| | Platea | Deep** | Somewhat Poorly | Silt Loam | Silt Loam | Grayish Brown | Fine Textured Till | Aeric Fragiaqualf |
| VC | Venango | Deep** | Somewhat Poorly | Silt Loam | Loam+ | Grayish Brown | Calcareous Till | Aeric Fragiaqualf |
| | Cambridge | Deep** | Moderately Well | Silt Loam | Loam+ | Yellowish Brown | Calcareous Till | Aqueptic Fragiudalf |
| VM | Volusia | Deep* | Somewhat Poorly | Silt Loam+ | Silt Loam+ | Grayish Brown | Acid Brown Till | Aeric Fragiaquept |
| | Morris | Deep* | Somewhat Poorly | Loam+ | Loam+ | Grayish Red | Acid Red Till | Aeric Fragiaquept |

*Fragipan at 10-16 inches from the soil surface; **Fragipan at 16-36 inches from the soil surface;
+Some (15-35%) coarse fragments; ++Many (>35%) coarse fragments.

classification of the Hagerstown soil series in the various levels of the classification system. Spatial data for the map units of Figure 1 are presented in Table 4. These data were derived from a digitization of the map in Figure 3 by the Penn State University Land Analysis laboratory. Area coverage data for Pennsylvania at the order and suborder levels are presented in Table 5.

Table 3. Classification of Hagerstown Soil.

| Level | Taxonomic Name |
|---|---|
| Order | Alfisol |
| Suborder | Udalf |
| Great Group | Hapludalf |
| Subgroup | Typic Hapludalf |
| Family | Clayey, mixed, mesic |
| Series | Hagerstown |

Table 4. Relative amount (percent) of various soil associations in Pennsylvania.

| Soil Association | Square Miles | Percent | Soil Association | Square Miles | Percent |
|---|---|---|---|---|---|
| Abbottstown-Readington | 540 | 1.2 | Hagerstown-Duffield | 940 | 2.2 |
| Berks-Leck Kill | 3,422 | 7.6 | Hagerstown-Edom | 1,936 | 4.3 |
| Berks-Weikert | 990 | 2.2 | Hazelton-Laidig | 3,332 | 7.4 |
| Conotton-Birdsall | 180 | 0.4 | Howell-Pope | 270 | 0.6 |
| Cavode-Cookport | 630 | 1.4 | Leck Hill-Meckesville | 810 | 1.8 |
| Chester-Glenelg | 2,026 | 4.5 | Lordstown-Oquaqa | 2,386 | 5.3 |
| Duffield-Conestoga | 720 | 1.6 | Morrison-Vanderli | 135 | 0.3 |
| Edgemont-Highfield | 450 | 1.0 | Neshaminy-Lehigh | 540 | 1.2 |
| Erie-Langford | 720 | 1.6 | Penn-Lewisberry | 1,081 | 2.4 |
| Guernsey-Culleoka | 2,296 | 5.1 | Ravenna-Canfield | 1,036 | 2.4 |
| Gilpin-Wharton | 7,204 | 16.0 | Sheffield-Platea | 180 | 0.4 |
| Hanover-Alvira | 540 | 1.2 | Venango-Cambridge | 1,036 | 2.3 |
| Hazelton-Cookport | 6,123 | 13.6 | Volusia-Morris | 5,448 | 12.1 |

Table 5. Area+ of Soils of Pennsylvania by order and suborder. Data from Miller and Quandt (1984).

| Soil Order and Suborder | Square Miles | Extent Percent | Rank | Soil Order and Suborder | Square Miles | Extent Percent | Rank |
|---|---|---|---|---|---|---|---|
| Inceptisols | 19,405 | 43.1 | 1 | Entisols | 2,251 | 5.0 | 4 |
| Aquepts | 2,521 | 5.6 | | Aquents | 1,216 | 2.7 | |
| Ochrepts | 16,884 | 37.5 | | Fluvents | 90 | 0.2 | |
| Ultisols | 14,002 | 31.1 | 2 | Orthents | 900 | 2.0 | |
| Aqualts | 1,756 | 3.9 | | Psamments | 45 | 0.1 | |
| Udults | 12,246 | 27.2 | | Spodosols | 225 | 0.5 | 5 |
| Alfisols | 9,095 | 20.2 | 3 | Orthods | 225 | 0.5 | |
| Aqualfs | 2,026 | 4.5 | | Histosols | 45 | 0.1 | 6 |
| Udalfs | 7,069 | 15.7 | | Saprists | 36 | 0.08 | |
| | | | | Hemists | 9 | 0.02 | |

+Land area of Pennsylvania = 45,025 $mi^2$. Water = 308 $mi^2$. Data from National Atlas of the United States (see reference SCS, 1970) p 336.

Additional information on Pennsylvania soils is given in Table 6. These data are keyed to the general soils areas shown in Figure 3. Figure 4 is given to assist in the location of the areas given in Table 6. As with the data for the United States, in the near future more accurate data will be available from the Penn State Land Analysis Laboratory. When these data become available, the information in this publication will be updated.

Table 6. Percentage of the region of the state that has various soil or land characteristics. Data from Ciolkosz et al. (1988).

| Soil or Land Character | Glaciated Northeast | Glaciated Northwest | Southwest Plateau | Central Plateau | Northern Plateau | Ridge and Valley | Triassic-Piedmont | Pennsylvania |
|---|---|---|---|---|---|---|---|---|
| Fragipan | 55 | 63 | 3 | 22 | 37 | 14 | 14 | 30 |
| Argillic horizon | 2 | 66 | 83 | 72 | 42 | 52 | 74 | 51 |
| Aquic moisture regime* | 29 | 51 | 6 | 11 | 9 | 8 | 12 | 16 |
| Stoniness** | 83 | 23 | 1 | 41 | 73 | 65 | 36 | 55 |
| Slope | | | | | | | | |
| 0-3% | 8 | 28 | 7 | 7 | 7 | 10 | 24 | 11 |
| 3-8% | 37 | 43 | 12 | 29 | 32 | 32 | 42 | 33 |
| 8-15% | 17 | 15 | 17 | 21 | 12 | 16 | 20 | 17 |
| 15-25% | 24 | 8 | 30 | 25 | 20 | 22 | 10 | 21 |
| 25+% | 14 | 6 | 34 | 18 | 32 | 20 | 4 | 18 |

*Somewhat poorly and poorly drained. The remainder is well or moderately well drained.
**>15% of the soil surface is covered with rock fragments.

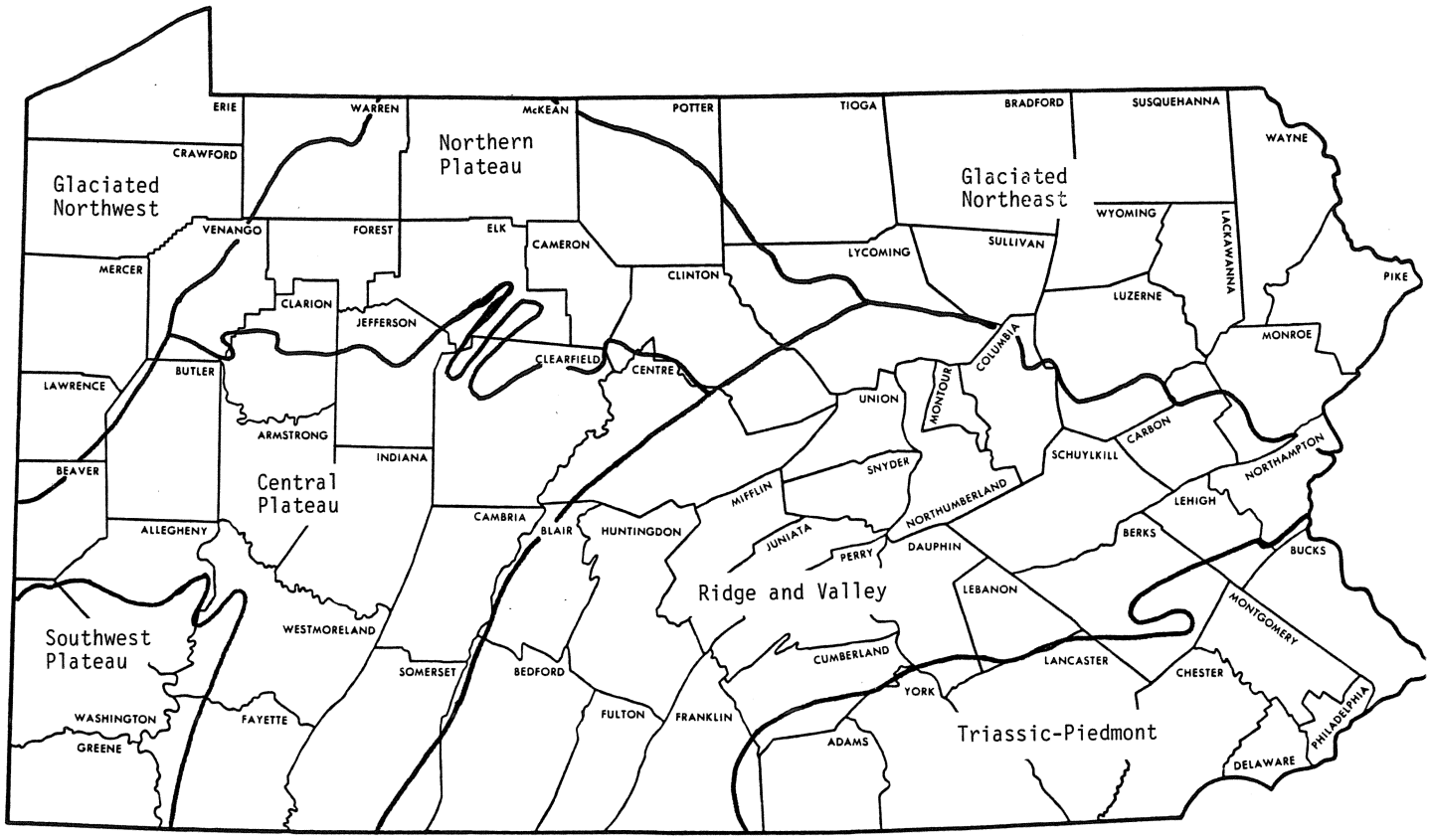


Figure 4. Areas of Pennsylvania Soils. These areas are those given in Table 6.

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