

Soil and Range Resource Inventory of the

**National Audubon Society
Appleton-Whittell Research Ranch
Santa Cruz County, Arizona**

Special Report

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Natural Resources Conservation Service
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United States Department of Agriculture,
Natural Resources Conservation Service

**National Audubon Society
Appleton-Whittell Research Ranch
Santa Cruz County, Arizona**

Foreward

This inventory is an update of soil and range information and maps of the National Audubon Society Appleton-Whittell Research Ranch that is within the Soil Survey of Santa Cruz and Parts of Cochise and Pima Counties, Arizona. That survey was completed in 1971 and reflects the conditions and needs at that time. The purpose of this report is to provide updated soil and range information and maps for the Audubon Experimental Ranch. The soil information provide in this report are soil maps, soil map unit descriptions, taxonomic unit descriptions, soil map unit legend, soil and range site legend and a soil classification legend.

Due to the time limitations to complete this investigation several soil series and map units were used from soil surveys from the surrounding area. Those soil series and map units used from the surrounding area soil surveys have the same soil range in characteristics and properties that were observed on the Audubon Experimental Ranch. Soil maps in this investigation and soil information may be copied without permission. Enlargements of soil maps, however, could cause misunderstanding of the detail of the map. If enlarged, distortion will occur. Enlarged maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This report is advanced soil survey information and is subject to changes upon the completion, correlation and publication of an update of the Soil Survey of Santa Cruz and parts of Cochise and Pima Counties, Arizona.

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Soil Classification Legend

Soil Series and their Morphology

Blacktail
Brunopeak
Budlamp
Comoro
Contention
Fanno
Guest
Hathaway
Lanque
Lesliecreek
Oversight
Pyeatt
Terrarosa

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**National Audubon Society
Appleton-Whittell Research Ranch
Soil Legend**

- 10 Blacktail – Hathaway - Lesiecreek complex, 1 to 45 percent slopes
- 20 Brunopeak very gravelly fine sandy loam, 5 to 20 percent slopes
- 30 Brunopeak - Hathaway complex, 5 to 45 percent slopes
- 40 Comoro fine sandy loam, 0 to 3 percent slopes
- 50 Contention very gravelly clay loam, 5 to 40 percent slopes
- 60 Fanno - Budlamp complex, 5 to 30 percent slopes
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- 80 Hathaway very gravelly sandy loam, 10 to 60 percent slopes
- 90 Lanque sandy loam, 0 to 3 percent slopes
- 100 Oversight sandy loam, 1 to 10 percent slopes
- 110 Terrarosa complex, 1 to 10 percent slopes
- 120 Terrarosa - Blacktail – Pyeatt complex, 1 to 45 percent slopes

Soil Map Unit Descriptions

10 Blacktail – Hathaway - Lesliecreek complex, 1 to 45 percent slopes

Setting

Landform: fan terraces
Slope range: Blacktail, 1 to 25 percent;
Hathaway, 1 to 45 percent; Lesliecreek,
1 to 3 percent
Hazard of flooding: Lesliecreek none to rare
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62
degrees F.
Frost-free period: 160 to 210 days

Composition

Blacktail and similar soils: 45 percent
Hathaway and similar soils: 40 percent
Lesliescreek and similar soils: 10 percent
Contrasting inclusions: 5 percent

Typical Profile

Blacktail

0 to 3 inches - dark brown gravelly loam
3 to 7 inches - dark reddish brown clay loam
7 to 17 inches - dark reddish brown clay
17 to 23 inches - brown, calcareous, clay
loam
23 to 32 inches - pinkish white, calcareous,
sandy loam
32 to 60 inches - pink and light brown,
calcareous, gravelly sandy loam

Hathaway

0 to 8 inches - dark grayish brown gravelly
loam
8 to 24 inches – pale brown, calcareous,
gravelly loam
24 to 60 inches – light gray and light reddish
brown, calcareous, very gravelly loamy
sand and sand

Lesliecreek

0 to 5 inches - brown fine sandy loam
5 to 25 inches - brown sandy clay loam
25 to 60 inches - brown gravelly sandy clay
loam

Soil Properties and Qualities

Blacktail

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: moderate to high
Potential rooting depth: 60 inches or more
Runoff: low to very high
Hazard of erosion
by water - slight to severe
by wind - slight
Shrink-swell potential: high
Rock fragments: less than 35 percent, but can
range up to 50 percent
Depth to calcic horizon: 15 to 30 inches
Calcium carbonate equivalent: 1 to 60 percent
Corrosivity: steel - moderate; concrete –
moderate

Hathaway

Parent material: mixed calcareous fan
alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderate to moderately rapid
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: medium to rapid
Hazard of erosion
by water - slight to severe
by wind - slight
Shrink - swell potential: low
Rock fragments: greater than 35 percent
Depth to calcic horizon: 5 to 20 inches
Calcium carbonate equivalent: 5 to 40 percent

Corrosivity: steel - moderate; concrete - low

Lesliecreek

Parent material: mixed alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderately slow
Available water capacity: high
Potential rooting depth: 60 inches or more
Runoff: low to medium
Hazard of erosion
by water - slight to moderate
by wind - slight
Shrink-swell potential: moderate
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions

- : Fanno and Budlamp soils that are shallow to moderately deep to bedrock
- : Brunopeak soils that have greater than 35 rock fragments

Similar inclusions

- : Terrarosa soils
- : Soils that are not calcareous in the drainageways
- : Pyeatt soils that have less than 35 percent rock fragment and accumulations of calcium carbonate

Use and Management

Major current uses: wildlife habitat

Soil related factors

- Blacktail - slow permeability, high-shrink swell potential, clayey texture, slope
- Hathaway - slope, hazard of water erosion
- Lesliecreek - hazard of water erosion, flooding

Dominant vegetation on the Blacktail soils

- : in potential plant community - plains lovegrass, sideoats grama, Texas bluestem, cane beardgrass, false mesquite, velvetpod mimosa, crinkleawn, beggartick threeawn, sotol, agave, Emory oak, Mexican blue oak, Arizona white oak, green sprangletop, yerba-de-pasmo
- : in present plant community - plains lovegrass, sideoats grama, Texas bluestem, cane beardgrass, false mesquite, velvetpod mimosa, crinkleawn, beggartick threeawn, sotol, agave, Emory oak, Mexican blue oak, Arizona white oak

Dominant vegetation on the Pyeatt soil

- : in potential plant community - sideoats grama, false mesquite, black grama, New Mexico feathergrass, rough tridens, shortleaf tridens, range ratany, agave, sotol, sacahuista, blue threeawn, crinkleawn
- : in present plant community - sideoats grama, sotol, black grama, New Mexico feathergrass, rough tridens, shortleaf tridens, ratany, agave

Dominant vegetation on the Lesliecreek soil
: in potential and present plant community - Arizona cottontop, sideoats grama, green sprangletop, cane beardgrass, vine mesquite

Special Management Concerns

- : This site responds well to managed natural and prescribed fires.
- : The high content of clay in the Blacktail soil will slow infiltration and permeability.
- : Consider the high shrink-swell potential when designing and building foundations, concrete structures, and paved areas.
- : These soils have a moderate to severe water erosion potential; therefore, special considerations should be given to water management in this area.
- : Steep slopes are a management concern.

Interpretative Groups

Land capability classification

- Blacktail and Hathaway
- Slopes 1 to 30 percent - VI nonirrigated
- Slopes 30 to 45 percent - VIe nonirrigated
- Lesliecreek - VIw nonirrigated

Ecological site

- Blacktail - Loamy Hills 16-20" p.z. 041XA107AZ
- Hathaway - Limy Slopes 16-20 " p.z. 041XA104AZ
- Lesliecreek – Loamy bottom, swales 12-16"p.z. 041XC311AZ

Major land resource area: 41 -Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak – Pine Woodland and Oak Savannah

20 Brunopeak very gravelly fine sandy loam, 5 to 20 percent slopes

Setting

Landform: fan terraces
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Brunopeak and similar soils: 90 percent
Contrasting inclusions: 10 percent

Typical Profile

Brunopeak

0 to 1 inch - brown very gravelly sandy fine loam
1 to 5 inches - reddish brown gravelly sandy clay loam
5 to 26 inches - reddish brown very gravelly clay
26 to 60 inches - reddish brown very gravelly sandy clay loam

Soil Properties and Qualities

Brunopeak

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: high to very high
Hazard of erosion
 by water – slight to moderate
 by wind - slight
Shrink-swell potential: high
Rock fragments: greater than 35 percent gravel and cobbles
Corrosivity: steel - high; concrete – moderate

Inclusions

Contrasting inclusions
: Terrarossa soils that have less than 35 percent rock fragments in the control section

: Soils that are very shallow and shallow to fanglomerate

Similar inclusions

: Blacktail soils that are calcareous at moderate depths

Use and Management

Major current uses: wildlife habitat

Soil related factors: slow permeability, high shrink-swell potential, content of rock fragments, clayey texture, hazard of water erosion, slope

Dominant vegetation:

: in potential and present plant community – plains lovegrass, sideoats grama, Texas bluestem, cane beardgrass, blue grama, palmer agave, oak, juniper, tanglehead, green sprangletop, wait-a-bit mimosa, velvet pod mimosa, false mesquite

Special Management Concerns

: The high content of clay in Brunopeak soil slows infiltration and permeability.
: The high shrink-swell potential of the brunopeak soil should be considered when designing and building foundations, concrete structures, and paved areas.
: These soil has a moderate water erosion potential; therefore, special considerations should be given to water management in this area.
: Excessive rock fragments in the soil interferes with excavations.
: Steep slopes are a management concern

Interpretive Groups

Land capability classification

Slopes 10 to 20 percent - VIs nonirrigated

Ecological site

Brunopeak - - Loamy Upland 16-20" p.z.
041XA108AZ

Major land resource area: 41 - outtheastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak – Pine Woodland and Oak Savannah

30 Brunopeak - Hathaway complex, 5 to 45 percent slopes

Setting

Landform: fan terraces; Brunopeak and Hathaway are on the side slopes of the fan terraces
Slope range: Brunopeak, 5 to 25 percent; Hathaway, 5 to 45 percent slopes
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Brunopeak and similar soils: 60 percent
Hathaway and similar soils: 30 percent
Contrasting inclusions: 10 percent

Typical Profile

Brunopeak

0 to 1 inch - brown very gravelly sandy fine loam
1 to 5 inches - reddish brown gravelly sandy clay loam
5 to 26 inches - reddish brown very gravelly clay
26 to 60 inches - reddish brown very gravelly sandy clay loam

Hathaway

0 to 8 inches - dark grayish brown gravelly loam
8 to 24 inches – pale brown, calcareous, gravelly loam
24 to 60 inches – light gray and light reddish brown, calcareous, very gravelly loamy sand and sand

Soil Properties and Qualities

Brunopeak

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: high to very high
Hazard of erosion

by water - moderate to severe
by wind - slight
Shrink-swell potential: high
Rock fragments: greater than 35 percent gravel and cobbles
Corrosivity: steel - high; concrete – moderate

Hathaway

Parent material: mixed calcareous fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderate to moderately rapid
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: medium to rapid
Hazard of erosion
by water - slight to severe
by wind - slight
Shrink-swell potential: low
Rock fragments: greater than 35 percent
Depth to calcic horizon: 5 to 20 inches,
Calcium carbonate equivalent: 5 to 40 percent
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions
: Soils that contain less than 18 percent clay in the drainageways
: Terrarossa soils that have less than 35 percent rock fragments in the control section
: Soils that are very shallow and shallow to fanglomerate

Similar inclusions

: Pyeatt soils that have less than 35 percent rock fragments and are very deep
: Blacktail soils that are calcareous at moderate depths

Use and Management

Major current uses: wildlife habitat

Soil related factors:

Brunopeak - slow permeability, high shrink-swell potential, content of rock fragments, clayey texture, hazard of water erosion, slope
Hathaway - hazard of water erosion, high content of calcium carbonate, slope

Dominant vegetation on the Brunopeak soil
: in potential and present plant community

Pine Woodland and Oak Savannah

—
plains lovegrass, sideoats grama, Texas
bluestem, green sprangletop, cane
beardgrass, blue grama, palmer agave,
oak, juniper, tangletop, wait-a-bit mimosa,
velvet pod mimosa, false mesquite

Dominant vegetation on the Hathaway soil
: in potential and present plant
community – black grama, sideoats
grama, crinkleawn, wooly bunchgrass,
blue threeawn, hairy grama, New Mexico
feathergrass, slim tridens, shortleaf tridens,
sacahuista, false mesquite, Gregg's dalea

Special Management Concerns

: The high content of clay in the
Brunopeak soil slows infiltration and
permeability.

: The high shrink-swell potential of the
brunopeak soil should be considered
when designing and building foundations,
concrete structures, and paved areas.

: These soils have a severe water erosion
potential; therefore, special onsiderations
should be given to water management in
this area.

: Excessive rock fragments in the soil
interferes with excavations.

: Steep slopes are a management
concern

Interpretive Groups

Land capability classification

Slopes 10 to 30 percent - VI_s
nonirrigated

Slopes 30 to 45 percent - VI_e
nonirrigated

Ecological site

Brunopeak - Loamy Hills 16-20" p.z.
041XA107AZ

Hathaway - Limy Slopes 16-20" p.z.
041XA104AZ

Major land resource area: 41 - Southeastern
Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak
—

40 Comoro fine sandy loam, 0 to 3 percent slopes

Setting

Landform: floodplains, alluvial fans and inset fans
Hazard of flooding: rare
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 60 to 67 degrees F.
Frost-free period: 180 to 230 days

Composition

Comoro and similar soils: 85 percent
Contrasting inclusions: 15 percent

Typical Profile

Comoro

0 to 2 inches - brown fine sandy loam
2 to 25 inches - brown sandy loam
25 to 36 inches - very dark grayish brown fine sandy loam
36 to 40 inches - brown sandy loam

Soil Properties and Qualities

Comoro

Parent material: mixed alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Available water capacity: moderate
Potential rooting depth: 60 inches or more
Runoff: medium
Hazard of erosion
 by water - slight
 by wind – moderately high
Shrink-swell potential: low
Rock fragments: averages less than 35 percent
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions
 : Guest soils that have more than 35 percent clay
 : Soils that have sandy or gravelly sand textures

: Soils that have a seasonal water table at moderate to deep depths
: Riverwash

Similar inclusions

: Soils that are not calcareous throughout
: Comoro soils that have sandy clay loam textures at moderate depths
: Soils that have gravelly subsoils
: Soils that have light colored loamy sand to sand surface textures

Use and Management

Major current uses: wildlife habitat

Soil related factors: hazard of seepage, hazard of flooding, hazard of wind erosion

Dominant vegetation:

: in potential and present plant community – Giant sacaton, sideoats grama, green sprangletop, desert willow, Arizona black walnut

Special Management Concerns

: These soils have moderately high to high wind erosion potential. Care should be taken when vegetation is removed from this site to prevent dust and soil loss.
: This is an important wildlife site; therefore, special consideration in conservation planning should be given to maintaining wildlife habitat and water.
: Structures should be located above the expected flood level.
: Water moving across this site may cause piping.

Interpretive Groups

Land capability classification
 Vlw nonirrigated

Ecological site

Comoro – Loamy bottom, subirrigated 12 to 16" p.z. 041XC312AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-3AZ – Southern Arizona Semidesert Grassland

50 Contention gravelly silt loam, 5 to 60 percent slopes

Setting

Landform: dissected relict lake beds
Elevation: 4,700 to 4,900 feet
Hazard of flooding: none
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Contention and similar soils: 90 percent
Inclusions: 10 percent

Typical Profile

Surface coarse fragments: 10 to 20 percent gravel
0 to 1 inches – brown very gravelly clay loam
1 to 17 inches – brown clay
17 to 45 inches - brown, gypsiferous, clay

Soil Qualities and Potentials

Parent material: mixed alluvium from prehistoric lakes and marshes
Depth class: very deep
Drainage class: well
Permeability: very slow
Available water capacity: moderate
Potential rooting depth: 60 inches or more
Runoff: medium to very rapid
Hazard of erosion:
by water – moderate to very severe
by wind - slight
Shrink-swell potential: high
Soil cracks: When dry, continuous cracks from the surface to a depth 30 or more inches, ranging from .12 to 1.50 inches in width

Calcium carbonate equivalent: 1 to 15 percent
Depth to gypsic horizons: 12 to 20 inches
Gypsum content: .5 to 15 percent
Corrosivity: steel - high concrete - high

Inclusions

Contrasting inclusions
: Soils that contain very dense layers
: Soils that contain less gypsum
: Shallow to moderately deep, sandy loam soils that cap Contention soils

Similar inclusions
: Contention soils that have less surface gravel

Use and Management

Major current uses: wildlife habitat

Soil related factors:
Contention - hazard of water and wind erosion, piping, soil settling, slow permeability, high shrink-swell, cracking, excess gypsum, and clayey texture

Dominant vegetation:
: in potential and present plant community – tobosa, curly mesquite, false mesquite, sideoats grama.

Special Management Concerns

: Gypsum soils can induce electrochemical action that increases the corrosivity rate on concrete.
: Concentrated runoff in drainage ditches can dissolve gypsum in the subsoil layers and cause settling.
: Soil high in gypsum is susceptible to piping, settling and erosion.
: This soil has moderate to severe water erosion potential where piping and gullies occur near deep, unstable stream channels. Therefore special considerations should be given to water management in regards to runoff, diversion, and irrigation.

: This soil has severe limitations for foundations for buildings due to steep slopes, poor bearing strength and high shrink-swell potential.

: This soil is unsuitable for sanitary landfills and septic tank filter fields due to steep slopes. Steep slopes limit the distribution of effluent, and may cause it to surface at points down slope.

Special Management Measures

: For new construction, surface water should be diverted away from building foundations by building the foundation on slightly elevated fill material and grading away from the foundation.

: To reduce the effects of piping and settling, moisture should be diverted from building foundations by rain gutters and downspouts and irrigating the shrubbery around the building no more than needed to sustain growth.

Plant shrubbery as far from the foundation as possible or do not plant shrubbery next to the foundation.

: The effects of shrink-swell potential can be minimized by using proper engineering designs, backfilling with

material that has low shrink-swell potential, and diverting runoff moisture away from the foundation helping to prevent structural damage.

: To compensate for slow permeability which limits septic tank absorption fields, the use of sand and gravel backfill for the trench and increasing the size of the absorption field.

: The steepness of the slope is a concern installing septic tank absorption fields. Absorption lines should be installed on the contour.

Interpretive Group

Land capability Classification
Contention - VIIe nonirrigated

Ecological site
Contention – Clayey Hills 12 to
16" p.z. 041XC303AZ

Major land resource area: 41 -
Southeastern
Arizona Basin and Range

Land resource unit: 41-3AZ – Southern
Arizona
Semidesert Grassland

60 Fanno - Budlamp complex, 5 to 30 percent slopes

Setting

Landform: hills
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Fanno and similar soils: 45 percent
Budlamp and similar soils: 30 percent
Contrasting inclusions: 15 percent

Typical Profile

Fanno

0 to 1 inch - dark reddish gray gravelly clay loam
1 to 25 inches – reddish brown clay
25 to 40 inches – weak red weathered clayey shale

Budlamp

0 to 1 inch - dark brown very gravelly sandy loam
1 to 8 inches – very dark grayish brown extremely gravelly fine sandy loam
8 to 60 inches – metamorphic shale

Soil Properties and Qualities

Fanno

Parent material: residuum from clayey shales and siltstones
Depth class: moderately deep
Drainage class: well drained
Permeability: slow
Available water capacity: low to moderate
Potential rooting depth: 20 to 40 inches
Runoff: medium
Hazard of erosion
 by water - moderate
 by wind - slight
Shrink-swell potential: moderate
Rock fragments: 45 to 65 percent
Corrosivity: steel - high; concrete - moderate

Budlamp

Parent material: mixed alluvium
Depth class: very shallow and shallow
Drainage class: well drained
Permeability: moderately rapid
Available water capacity: very low
Potential rooting depth: 5 to 20 inches
Runoff: very high
Hazard of erosion
 by water - moderate
 by wind - slight
Shrink-swell potential: low
Rock fragments: greater than 35 percent
Corrosivity: steel - high; concrete - moderate

Inclusion

Contrasting inclusions

: Clayey soils that are very deep
: Fanno soils that have greater than 35 percent rock fragments
: Deep soils that have less than 18 percent clay and are in drainageways

Similar inclusions

: Fanno soils that are very shallow and shallow to bedrock

Use and Management

Major current uses wildlife habitat

Soil related factors

Fanno - slow permeability, depth to bedrock, hazard of water erosion, slope
Budlamp - very high, hazard of water erosion, slope

Dominant vegetation on the Fanno soil

: in potential and present plant community – cane beardgrass, sideoats grama, plains lovegrass, Texas bluestem, blue grama, shrubby buckwheat, sacahuista, Emory oak, Arizona white oak, alligator juniper, manzanita

Dominant vegetation on the Budlamp soil

: in potential and present plant community – plains lovegrass, sideoats grama, Texas bluestem, cane beardgrass, blue grama, Schott yucca, Palmers agave,

false mesquite, shrubby buckwheat,
alligator juniper, Emory oak, Arizona
white oak

Special Management Concerns

: The limited depth to bedrock interferes with excavation for installing utilities and does not provide adequate soil depth for septic tank absorption fields.

: These soils have a severe water erosion potential due to steep slopes; therefore, special considerations should be given to water management in this area.

: The high content of clay in the Fanno soil will slow infiltration rate and permeability.

: Steep slopes are a management concern.

Interpretative Groups

Land capability classification

Fanno and Budlamp - Slopes 5 to 30 percent - VIs nonirrigated

Ecological site

Fanno and Budlamp - Shallow Hills
(QUEM, QUAR) 20-23 p.z. 041XA120AZ

Major land resource area: 41 -
Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak
– Pine Woodland and Oak Savannah

70 Guest silty clay loam, 0 to 2 percent slopes

Setting

Landform: flood plains and alluvial fans
Hazard of flooding: occasional
Elevation: 4,700 to 4,900 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 60 to 67 degrees F.
Frost-free period: 180 to 230 days

Composition

Guest and similar soils: 90 percent
Contrasting inclusions: 10 percent

Typical Profile

0 to 2 inches – dark brown clay loam
2 to 40 inches – dark brown clay

Soil Properties and Qualities

Parent material: mixed alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: high
Potential rooting depth: 60 inches or more
Runoff: medium
Hazard of erosion
 by water - slight
 by wind - moderate
Shrink-swell potential: high
Soil cracks: many vertical cracks 0.125 to 1.5 inch wide
Salinity: none to slight
Sodicity: none to slight
Calcium carbonate equivalent: 0 to 10 percent
Gypsum content: 0 to 2 percent
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions
 : Soils that have less than 18 percent clay

Use and Management

Major current uses: wildlife habitat

Soil related factors: hazard of flooding, slow permeability, high shrink-swell potential, hazard of piping, soils cracks

Dominant vegetation
 : in potential and present plant community - tobosa, vine mesquite, sideoats grama, perennial forbs

Special Management Concerns

: This is an important wildlife site; therefore, special consideration in conservation planning should be given to maintaining wildlife habitat and water.
: Structures should be located above the expected flood level.
: Consider the high shrink-swell potential when designing and building foundations, concrete structures, and paved areas.
: The high content of clay in this soil slows infiltration rate and permeability.
: Water moving across this site may cause piping.

Interpretative Groups

Capability classification
 Vlw nonirrigated

Ecological site
 Clayey Bottom, 12 to 16" p.z.
 041XC302AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-3AZ – Southern Arizona Semidesert Grassland

80 Hathaway gravelly loam, 10 to 60 percent slopes

Setting

Landform: fan terraces
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Hathaway and similar soils: 90 percent
Inclusions: 10 percent

Typical Profile

Hathaway

0 to 8 inches - dark grayish brown gravelly loam
8 to 24 inches – pale brown, calcareous, gravelly loam
24 to 60 inches – light gray and light reddish brown, calcareous, very gravelly loamy sand and sand

Soil Properties and Qualities

Hathaway

Parent material: mixed calcareous fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderate to moderately rapid
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: medium to rapid
Hazard of erosion
 by water - slight to severe
 by wind - slight
Shrink-swell potential: low
Rock fragments: greater than 35 percent
Depth to calcic horizon: 5 to 20 inches,
Calcium carbonate equivalent: 5 to 40 percent
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions
 : Blacktail and Terrarossa soils that have greater than 35 percent clay
 : Soils that are very shallow and shallow to fanglomerate
 : Soils that are deep, clayey textured and calcareous

Similar inclusions
 : Pyeatt soils that have less than 35 percent rock fragments and are very deep

Use and Management

Major current uses wildlife habitat

Soil related factors: hazard of water erosion, high content of calcium carbonate, slope

Dominant vegetation on the Hathaway soil
 : in potential and present plant community – black grama, sideoats grama, crinkleawn, wooly bunchgrass, blue threeawn, hairy grama, New Mexico feathergrass, slim tridens, shortleaf tridens, sacahuista, false mesquite, Gregg's dalea

Special Management Concerns

 : These soils have a severe water erosion potential; therefore, special considerations should be given to water management in this area.
 : This site is slow to respond to all forms of management due to the high concentrations of calcium carbonate.
 : Steep slopes are a management concern.

Interpretative Groups

Land capability classification
 Slopes 10 to 30 percent - VIs nonirrigated
 Slopes 30 to 60 percent - VIe nonirrigated

Ecological site: Limy Slopes 16-20" p.z.
041XA104AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak
– Pine Woodland and Oak Savannah

90 Lanque sandy loam, 0 to 3 percent slopes

Setting

Landform: floodplains, alluvial fans and inset fans
Hazard of flooding: rare
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 60 to 67 degrees F.
Frost-free period: 180 to 230 days

Composition

Lanque and similar soils: 85 percent
Contrasting inclusions: 15 percent

Typical Profile

0 to 4 inches - brown sandy loam
2 to 17 inches – dark brown coarse sandy loam
17 to 50 inches - very dark brown coarse sandy loam

Soil Properties and Qualities

Parent material: mixed alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Available water capacity: moderate
Potential rooting depth: 60 inches or more
Runoff: slow to medium
Hazard of erosion
 by water - slight
 by wind – moderately high
Shrink-swell potential: low
Rock fragments: averages less than 35 percent
Corrosivity: steel - high; concrete - low

Inclusions

Contrasting inclusions
 : Lesiecreek soils that have more than 20 percent clay
 : Soils that have sandy or gravelly sand textures
 : Soils that have a seasonal water table at moderate to deep depths
 : Riverwash

Similar inclusions

: Soils that are calcareous throughout
: Lanque soils that have sandy clay loam

textures at moderate depths
: Soils that have gravelly subsoils
: Soils that have light colored subsoils

Use and Management

Major current uses: wildlife habitat

Soil related factors: hazard of seepage, hazard of flooding, hazard of wind erosion

Dominant vegetation:
 : in potential and present plant community – vine mesquite, blue grama, Arizona cottontop, threeawns, dropseeds, giant sacaton, sideoats grama, green sprangletop, mesquite

Special Management Concerns

: These soils have moderately high to high wind erosion potential. Care should be taken when vegetation is removed from this site to prevent dust and soil loss.
: This is an important wildlife site; therefore, special consideration in conservation planning should be given to maintaining wildlife habitat and water.
: Structures should be located above the expected flood level.
: Water moving across this site may cause piping.

Interpretive Groups

Land capability classification
 Vlw nonirrigated

Ecological site
 Lanque – Loamy bottom, swales,
 12 to 16" p.z. 041XC311AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-3AZ – Southern Arizona Semidesert Grassland

100 Oversight sandy loam, 1 to 10 percent slopes

Setting

Landform: fan terraces
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Oversight and similar soils: 90 percent
Contrasting inclusions: 10 percent

Typical Profile

0 to 12 inches - brown sandy loam
12 to 30 inches - brown very gravelly sandy loam
30 to 60 inches - reddish very gravelly sandy clay loam

Soil Properties and Qualities

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid in the upper part and moderately slow in the buried horizons
Available water capacity: low
Potential rooting depth: 60 inches or more
Runoff: slow
Hazard of erosion
by water - slight to moderate
by wind - moderately high
Shrink-swell potential: low
Corrosivity: steel - high; concrete - moderate

Inclusions

Contrasting inclusions
: Soils that have greater than 35 percent clay
: Riverwash

Similar inclusions
: Soils that contain less than 35 percent rock fragments

Use and Management

Major current uses: wildlife habitat

Soil related factors: slope, content of rock fragments

Dominant vegetation
: in potential plant community - sideoats grama, cane beardgrass, plains lovegrass, Arizona cottontop, blue grama, beggartick threeawn, shrubby buckwheat, false mesquite, yerba-de-pasmo
: in present plant community - blue grama, spidergrass, Lehmann lovegrass, cane beardgrass, yerba-de-pasmo, false mesquite, shrubby buckwheat, mesquite

Special Management Concerns

: This is an important wildlife site; therefore, special consideration in conservation planning should be given to maintaining wildlife habitat and water.
: The large rock fragments in the soil interfere with excavations.
: Road building should include water bars and be kept to a minimum.
: Erosion can be a hazard on slopes over 3 percent.

Interpretive Groups

Land capability classification
VIs nonirrigated

Ecological site
Sandy Loam Upland, 16 to 20" p.z.
041XA110AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak - Pine Woodland and Oak Savannah

110 Terrarossa complex, 1 to 10 percent slopes

Setting

Landform: fan terraces
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Terrarossa, fine sandy loam, and similar soils: 50 percent
Terrarossa, gravelly sandy loam, and similar soils: 30 percent
Contrasting inclusions: 20 percent

Typical Profile

Terrarossa fine sandy loam

0 to 3 inches - reddish brown fine sandy loam
3 to 8 inches – reddish brown sandy clay loam
8 to 18 inches - reddish brown gravelly clay
18 to 60 inches - reddish brown to yellowish red clay

Terrarossa gravelly sandy loam

0 to 3 inches - dark brown gravelly sandy loam
3 to 8 inches – reddish brown sandy clay loam
8 to 18 inches - reddish brown gravelly clay
18 to 60 inches - reddish brown to yellowish red clay

Soil Properties and Qualities

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: moderate to high
Potential rooting depth: 60 inches or more
Runoff: medium to very high
Hazard of erosion
by water - slight
by wind - slight to moderately high

Shrink-swell potential: high
Rock fragments: generally less than 35 percent but ranges to 50 percent
Depth to abrupt textural change: 5 to 15 inches
Corrosivity: steel - high; concrete - moderate

Inclusions

Contrasting inclusions
: Soils that have 18 to 35 percent clay
: Soils that are moderately deep to bedrock
: Soils that are calcareous

Similar inclusions
: Soils that have greater than 35 percent gravel in the control section

Use and Management

Major current uses: wildlife habitat

Soil related factors: slow permeability, high shrink-swell potential, slope, clayey texture, hazard of wind erosion

Dominant vegetation
:in potential plant community – plains lovegrass, sideoats grama, threeawn, cane beardgrass, false mesquite, velvetpod mimosa, agave, blue grama, green sprangletop, Arizona cottontop, yerba-de-pasmo
:in present plant community (in places) – Lehmann lovegrass, Boers lovegrass, mesquite, yerba-de-pasmo, burroweed

Special Management Concerns

: This site responds well to managed natural and prescribed fires.
: The high content of clay in this soil will slow infiltration and permeability.
: The high shrink-swell potential should be considered when designing and building foundations, concrete structures, and paved areas.
: These soils have a severe water erosion potential, due to slope; therefore, special considerations should be given to water management in this area.
: Steep slopes will cause management

concerns.

Interpretive Groups

Land capability classification
Slopes 1 to 10 percent - VIs
nonirrigated

Ecological site

Terrarossa; - Loamy Upland 16-20" p.z.
041XA108AZ

Major land resource area: 41 -
Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak
– Pine Woodland and Oak Savannah

120 Terrarossa - Blacktail - Pyeatt complex, 1 to 45 percent slopes

Setting

Landform: fan terraces
Slope range: Terrarossa, 1 to 15 percent;
Blacktail, 3 to 25 percent; Pyeatt, 3 to 45 percent
Elevation: 4,700 to 5,100 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 57 to 62 degrees F.
Frost-free period: 160 to 210 days

Composition

Terrarossa and similar soils: 40 percent
Blacktail and similar soils: 35 percent
Pyeatt and similar soils: 15 percent
Contrasting inclusions: 10 percent

Typical Profile

Terrarossa

0 to 3 inches - reddish brown gravelly fine sandy loam
3 to 8 inches - reddish brown sandy clay loam
8 to 18 inches - reddish brown gravelly clay
18 to 60 inches - reddish brown to yellowish red clay

Blacktail

0 to 3 inches - dark brown gravelly loam
3 to 7 inches - dark reddish brown clay loam
7 to 17 inches - dark reddish brown clay
17 to 23 inches - brown, calcareous, clay loam
23 to 32 inches - pinkish white, calcareous, sandy loam
32 to 60 inches - pink and light brown, calcareous, gravelly sandy loam

Pyeatt

0 to 9 inches - brown gravelly loam
9 to 35 inches - brown, calcareous, gravelly fine sandy loam
35 to 41 inches - light brown, calcareous, fine sandy loam

41 to 60 inches - pink and brown, calcareous, fine sandy loam

Soil Properties and Qualities

Terrarossa

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: high
Potential rooting depth: 60 inches or more
Runoff: low to very high
Hazard of erosion
 by water - slight to severe
 by wind - slight
Shrink-swell potential: high
Rock fragments: less than 35 percent, but can range up to 50 percent
Depth to abrupt textural change: 5 to 15 inches
Corrosivity: steel - high; concrete - moderate

Blacktail

Parent material: mixed fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: slow
Available water capacity: moderate to high
Potential rooting depth: 60 inches or more
Runoff: low to very high
Hazard of erosion
 by water - slight to severe
 by wind - slight
Shrink-swell potential: high
Rock fragments: less than 35 percent, but can range up to 50 percent
Depth to calcic horizon: 15 to 30 inches
Calcium carbonate equivalent: 1 to 60 percent
Corrosivity: steel - moderate; concrete - moderate

Pyeatt

Parent material: mixed calcareous fan alluvium
Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Available water capacity: moderate to high
Potential rooting depth: 60 inches or more

Runoff: low to high
Hazard of erosion
by water - slight to severe
by wind - slight
Shrink - swell potential: low
Rock fragments: less than 35 percent
Depth to calcic horizon: 3 to 20 inches
Calcium carbonate equivalent: 10 to 30 percent below 3 inches
Corrosivity: steel - moderate; concrete - low

Inclusions

Contrasting inclusions
: Loamy soils that are very shallow and shallow to bedrock
: Clayey soils that are moderately deep to bedrock
: Soils that are very shallow and shallow to a hardpan
: Hathaway soils that have greater than 35 percent rock fragment and accumulations of calcium carbonate

Similar inclusions
: Soils that have greater than 35 percent gravel in the control section

Use and Management

Major current uses: wildlife habitat

Soil related factors
Terrarossa and Blacktail - slow permeability, high-shrink swell potential, clayey texture, slope
Pyeatt - slope, hazard of water erosion

Dominant vegetation on the Terrarossa soils
: in potential and present plant community –blue grama, mimosa, threeawn, Palmer agave, false mesquite, sideoats grama, cane beardgrass, plains lovegrass

Dominant vegetation on the Blacktail soils
: in potential and present plant community –plains lovegrass, sideoats grama, Texas bluestem, cane beardgrass, false mesquite, velvetpod mimosa, crinkleawn, beggartick threeawn, sotol, agave, Emory oak, Mexican blue oak,

Arizona white oak, green sprangletop, yerba-de-pasmo

Dominant vegetation on the Pyeatt soil
: in potential and present plant community – sideoats grama, false mesquite, black grama, New Mexico feathergrass, rough tridens, shortleaf tridens, range ratany, agave, alligator juniper, sotol, sacahuista, blue threeawn, crinkleawn

Special Management Concerns

: This site responds well to managed natural and prescribed fires.
: The high content of clay in the Terrarossa and Blacktail soils will slow infiltration and permeability.
: Consider the high shrink-swell potential when designing and building foundations, concrete structures, and paved areas.
: These soils have a severe water erosion potential; therefore, special considerations should be given to water management in this area.
: Steep slopes will cause management concerns.

Interpretative Groups

Land capability classification
Slopes 1 to 30 percent - VI nonirrigated
Slopes 30 to 40 percent - VIe nonirrigated

Ecological site
Terrarossa - Loamy Upland 16-20" p.z.
041XA108AZ
Blacktail - Loamy Hills 16-20" p.z.
041XA107AZ
Pyeatt - Limy Slopes 16-20 " p.z.
041XA104AZ

Major land resource area: 41 - Southeastern Arizona Basin and Range

Land resource unit: 41-1AZ - Mexican Oak – Pine Woodland and Oak Savannah

Soil Classification Legend

Soil name	Family or higher taxonomic class
Blacktail	Fine, mixed, superactive, thermic Aridic Argiustoll
Brunopeak	Clayey-skeletal, mixed, superactive, thermic Aridic Paleustolls
Budlamp	Loamy-skeletal, mixed, superactive, thermic Lithic Haplustolls
Comoro Torrifluvents	Coarse-loamy, mixed, superactive, calcareous, thermic Ustic
*Contention	Fine, smectitic, thermic Typic Gypsite
*Fanno	Fine, illitic, mesic Udic Haplustalfs
Guest Torrifluvents	Fine, mixed, superactive, calcareous, thermic Ustertic
Hathaway	Loamy-skeletal, mixed, superactive, thermic Aridic Calcicustolls
Lesiecreek	Fine-loamy, mixed, superactive, thermic Torrifuventic Haplustolls
Oversight	Loamy-skeletal, mixed, superactive, thermic Aridic Haplustepts
Pyeatt	Coarse-loamy, mixed, superactive, thermic Aridic Calcicustolls
Terrarosa	Fine, mixed, superactive, thermic Aridic Paleustalfs

* Taxadjunct

Soil Series and their Morphology

Blacktail Series

Depth class: very deep
Drainage class: well drained
Permeability: slow
Landform: fan terraces
Parent material: mixed fan alluvium
Slope range: 1 to 25 percent
Elevation: 4,700 to 5,100 feet

Classification: Fine, mixed, superactive,
thermic Aridic Argiustoll

Typical Pedon

The typical pedon description for the Blacktail gravelly loam is from the Soil Survey of Cochise County, Douglas – Tomdstone Part. Blacktail gravelly loam in an area of Terrarossa – Blacktail – Pyeatt complex, 1 to 40 percent slopes, located at latitude of 31 degrees, 34 minutes, 25 seconds North and longitude of 110 degrees, 26 minutes, 30 seconds West.

A--0 to 3 inches; dark brown (7.5YR 3/2) gravelly loam, dark reddish brown (5YR 3/2) moist; weak fine granular structure; soft, very friable, moderately sticky and moderately plastic; common very fine and fine roots; common fine irregular pores; 20 percent gravel; noneffervescent; slightly alkaline (pH 7.6); abrupt smooth boundary.

Bt1--3 to 7 inches; dark reddish brown (5YR 3/2) clay loam, dusky red (2.5YR 3/2) moist; moderate fine subangular blocky structure; soft, friable, moderately sticky and moderately plastic; common very fine and fine roots; common fine irregular pores; common distinct clay films on ped faces and pores; 5 percent gravel; very slightly effervescent; slightly alkaline (pH 7.6); abrupt smooth boundary.

Btk1--7 to 17 inches; dark reddish brown (5YR 3/4) clay, dark reddish brown (5YR 3/3) moist; moderate medium prismatic structure parting to strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; common very fine and fine roots; common fine irregular pores; many distinct clay films on ped faces and in pores and few patchy organic coatings on ped faces; few fine irregular calcium carbonate filaments and few fine irregular soft masses; 5 percent gravel; strongly effervescent; slightly alkaline (pH 7.8); abrupt smooth boundary.

Btk2--17 to 23 inches; brown (7.5YR 5/4) clay loam, brown to dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; soft, very friable, moderately sticky and moderately plastic; common fine and medium roots; common very fine and fine irregular pores; very few distinct clay films on ped faces; common coarse irregular calcium carbonate soft masses; 10 percent gravel; violently effervescent; 28 percent calcium carbonate equivalent; moderately alkaline (pH 8.2); clear wavy boundary.

Btk3--23 to 32 inches; pinkish white (7.5YR 8/2) sandy loam, pink (7.5YR 7/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many distinct clay films on rock fragments; 10 percent gravel; violently effervescent; 60 percent calcium carbonate equivalent; moderately alkaline (pH 8.4); clear wavy boundary.

2Bk—32 to 60 inches; pink (7.5YR 7/4), and light brown (7.5 YR 6/4) gravelly sandy loam, light brown (7.5YR 6/4), and brown (7.5 YR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many distinct calcium carbonate coatings on rock fragments; strongly weathered limestone and conglomerate; 30 percent gravel; violently effervescent; 42 percent calcium carbonate equivalent; moderately alkaline (pH 8.4).

Range in Characteristics

Rock fragments: less than 35 percent but ranges to 50 percent in any one horizon
Reaction: slightly or moderately alkaline
Clay content: averages more than 35 percent in the control section
Organic matter: 1 to 2 percent
Depth to calcic horizon: 15 to 30 inches

A horizon

Hue: 7.5YR, 5YR
Value: 3 or 5 dry, 2 or 3 moist
Chroma: 0 to 4, dry or moist
Texture: sandy loam, loam

Bt horizon

Hue: 2.5YR, 5YR
Value: 3 or 5 dry, 0 to 3 moist
Chroma: 2 to 4 dry, 0 to 4 moist
Texture: clay loam, clay

Btk horizon

Hue: 5YR, 7.5YR
Value: 3 to 8, dry or moist
Chroma: 2 to 6, dry or moist
Texture: clay loam, sandy clay loam
Calcium carbonate equivalent: 15 to 60 percent

Bk horizon

Value: 5 to 8 dry, 5 to 7 moist
Chroma: 2 to 4, dry or moist
Calcium carbonate equivalent: 30 to 45 percent

Brunopeak Series

Depth class: very deep
Drainage class: well drained
Permeability: slow
Landform: fan terraces
Parent material: mixed fan alluvium
Slope range: 5 to 25 percent
Elevation: 4,700 to 5,100 feet

Classification: Clayey-skeletal, mixed, superactive, thermic Aridic Paleustolls

Typical Pedon

The typical pedon description for the Brunopeak very gravelly fine sandy loam is from the Soil Survey of Cochise County, Douglas – Tomdstone Part. Brunopeak very gravelly fine sandy loam, 5 to 20 percent slopes, located at latitude of 31 degrees, 36 minutes, 08 seconds North and longitude of 110 degrees, 31 minutes, 03 seconds West.

A--0 to 1 inches; brown (7.5YR 4/3) very gravelly fine sandy loam, dark brown (7.5YR 3/3) moist; moderate thin platy structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine irregular and tubular pores; 35 to 40 percent gravel; noneffervescent; moderately acid (pH 6.0); abrupt smooth boundary .

A/B—1 to 5 inches; reddish brown (5YR 4/3) gravelly sandy clay loam, dark reddish brown (5YR 3/2) moist; moderate very fine and fine subangular blocky structure; soft, very friable, sticky and plastic; many very fine and fine roots; common fine irregular and tubular pores; 30 to 35 percent gravel; noneffervescent; moderately acid (pH 6.0); abrupt smooth boundary .

Bt1—5 to 11 inches; reddish brown (2.5YR 4/3) very gravelly clay, dark reddish brown (2.5YR 3/3) moist; strong fine angular blocky structure; slightly hard, friable, very sticky and very plastic; common very fine and fine roots; common fine irregular and tubular pores; many distinct clay films on rock fragments and common distinct clay films on faces of peds; 30 to 35 percent gravel; noneffervescent; slightly acid (pH 6.2); clear wavy boundary.

Bt2—11 to 26 inches; reddish brown (2.5YR 3/4) very gravelly clay, dark reddish brown (2.5YR 2.5/4) moist; strong fine angular blocky structure; slightly hard, friable, very sticky and very plastic; common very fine and fine roots; common fine irregular and tubular pores; many distinct clay films on rock fragments and common distinct clay films on faces of peds; 35 to 40 percent gravel; noneffervescent; slightly acid (pH 6.2); clear wavy boundary.

2Bt--26 to 35 inches; reddish brown (5YR 4/4) very gravelly sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate fine angular blocky structure; moderately hard, firm, sticky and plastic, few fine roots; few fine tubular pores; many distinct clay films on rock fragments; common distinct clay films on faces of peds; common distinct organic coatings on faces of peds; 45 to 50 percent gravel and 5 percent cobble; noneffervescent; neutral (pH 6.6); clear wavy boundary.

2B/C—35 to 60 inches; reddish brown (5YR 4/4) very gravelly sandy clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, firm, sticky and plastic; few fine tubular

pores; many distinct clay films on rock fragments; 45 to 50 percent gravel and 5 percent cobble; noneffervescent; neutral (pH 6.6).

Range in Characteristics

Soil Temperature: 59 to 64 degrees F.

Rock fragments: greater than 35 percent gravel and cobbles

Clay content: greater than 35 percent in the control section

Organic matter: 1 to 3 percent

A horizon

Hue: 7.5YR, 5YR

Value: 3 or 4 dry, 2.5 or 3 moist

Chroma: 2 or 3, dry or moist

Texture: fine sandy loam, sandy loam

Reaction: moderately acid to slightly acid

B horizon

Hue: 2.5YR, 5YR

Value: 3 or 4 dry, 2.5 through 4 moist

Chroma: 2 through 4 dry or moist

Texture: sandy clay loam, sandy clay, clay

Reaction: slightly acid to neutral

Budlamp Series

Depth class: very shallow and shallow
Drainage class: well drained
Permeability: moderately rapid
Landform: hills and mountains
Parent material: mixed alluvium
Slope range: 5 to 30 percent
Elevation: 4,700 to 5,100 feet

Classification: Loamy-skeletal, mixed,
superactive, thermic Lithic Haplustolls

Typical Pedon

The typical pedon description for the Budlamp very gravelly sandy loam is located at a latitude of 31 degrees, 34 minutes, 26 seconds North and longitude of 110 degrees, 31 minutes, 29 seconds West

A--0 to 1 inches; dark brown (7.5YR 3/3) very gravelly sandy loam, very dark brown (7.5YR 2.5/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine irregular pores; noneffervescent; 45 to 50 percent gravel; moderately acid (pH 6.0); abrupt smooth boundary.

C--1 to 8 inches; very dark grayish brown (7.5YR 3/2) extremely gravelly fine sandy loam, very dark brown (7.5YR 2.5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine irregular and tubular pores; many distinct organic coatings on rock fragments; noneffervescent; 60 to 65 percent gravel; moderately acid (pH 6.0).

2R--8 to 60 inches; metamorphic shale.

Range in Characteristics

Rock fragments: more than 35 percent
Clay content: 5 to 18 percent
Reaction: moderately acid to neutral
Organic Matter: 1 to 3 percent
Depth to bedrock: 5 to 20 inches
A and C horizon
Hue: 10YR, 7.5YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 through 3, dry or moist

Comoro Series

Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Landform: flood plains, alluvial fans and inset fans
Parent material: mixed alluvium
Slope range: 0 to 3 percent
Elevation: 4,700 to 5,100 feet

Classification: Coarse-loamy, mixed,
superactive, calcareous, thermic Ustic
Torrifluvents

Typical Pedon

The typical pedon description for the Comoro fine sandy loam series in an area of Comoro fine sandy loam, 0 to 3 percent slopes, located at latitude of 31 degrees, 36 minutes, 49 seconds North and longitude of 110 degrees, 28 minutes, 56 seconds West.

A--0 to 2 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine irregular pores; strongly effervescent; moderately alkaline (pH 7.8); clear abrupt boundary.

C1--2 to 25 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 3/3); weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

C2--25 to 36 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0).

C2--36 to 40 inches; brown (10YR 4/3) sandy loam, very dark brown (10YR 2/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0).

Range in Characteristics

Rock Fragments - averages less than 35 percent
Organic matter - more than 1 percent in the surface that decreases irregularly with depth.
Reaction - neutral to moderately alkaline; can range to slightly acid in the upper part

A horizon
Hue: 10YR, 7.5YR
Value: 3 or 4 dry, 2 or 3 moist

Chroma: 2 or 3, dry or moist
Texture: fine sandy loam, sandy loam
Calcium carbonate: none to strongly
effervescent

C horizon

Hue: 10YR, 7.5YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture: Sandy loam, fine sandy loam,
coarse sandy loam
Calcium carbonate: Slightly to violently
effervescent

Contention family

Depth class: very deep
Drainage class: well drained
Permeability: very slow
Landform: dissected relict lake beds
Parent material: mixed alluvium from
prehistoric lakes and marshes
Slope range: 5 to 60 percent
Elevation: 4,700 to 4,900 feet

Classification: Fine, smectitic, thermic Typic Gypsite

Typical Pedon

Contention very gravelly clay loam in an area of Contention very gravelly clay loam, 5 to 60 percent slopes, located at latitude of 31 degrees, 36 minutes, 25 seconds North and longitude of 110 degrees, 29 minutes, 37 seconds West.

10 to 20 percent of the surface is covered with gravel and cobbles

A--0 to 1 inches; brown (7.5YR 5/3) very gravelly clay loam, brown (7.5YR 4/3) moist; weak fine granular structure; loose, sticky and plastic; few very fine and fine roots; many very fine irregular pores; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bky1--1 to 5 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/3) moist; strong medium angular blocky structure; slightly hard, firm, very sticky and very plastic; common very fine and fine roots; few fine tubular pores; few very fine soft calcium carbonate and gypsum masses; few fine gypsum crystals throughout; violently effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bky2—5 to 17 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/3) moist; strong medium angular blocky structure; slightly hard, firm, very sticky and very plastic; common very fine and fine roots; few fine tubular pores; common very fine soft calcium carbonate and gypsum masses; few fine gypsum crystals throughout; violently effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bssky1—17 to 45 inches; brown (7.5YR 5/3) clay, brown (7.5YR 4/3) moist; moderate medium angular blocky structure; hard, very firm, very sticky and very plastic; common very fine and fine roots; few fine tubular pores; common very fine soft calcium carbonate and gypsum masses; few fine gypsum crystals throughout; few distinct manganese coatings on ped faces; common distinct pressure faces and slickensides; violently effervescent; moderately alkaline (pH 8.0).

Range in Characteristics

Soil cracking: When dry, continuous cracks from the surface to 26 inches, ranging from 1/8 to 1/12 inches wide. Pressure faces and slickensides are common in the lower horizons.

Reaction: slightly to strongly alkaline

Clay content: greater than 35 percent in the

control section

Calcium carbonate equivalent: 1 to 15 percent

Depth to gypsic horizon: 3 to 20 inches

Gypsum content: 0.5 to 15 percent

Salinity: none to moderate

Sodicity: none to slight

A horizon

Hue: 7.5YR

Value: 4 or 5 dry or moist

Chroma: 3, dry or moist

Texture: clay loam

Bky horizon

Hue: 7.5YR

Value: 4 or 5 dry or moist

Chroma: 3 or 4 dry or moist

Texture: clay, silty clay

Bssky horizon

Hue: 7.5YR

Value: 4 or 5 dry or moist

Chroma: 3 or 4, dry or moist

Texture: clay, silty clay, silty clay loam

Fanno family

Depth class: moderately deep
Drainage class: well drained
Permeability: slow
Landform: hills
Parent material: residuum from clayey shales
and siltstones
Slope range: 5 to 30 percent
Elevation: 4,700 to 5,100 feet

Classification: Fine, illitic, mesic Udic
Haplustalfs

Typical Pedon

The typical pedon description for the Fanno gravelly clay loam is from the Soil Survey of Santa Cruz and Parts of Cochise and Pima Counties, Arizona. Cochise County, Arizona; near Parker Canyon Lodge, Montezuma Pass road, north side of road, .45 mile east of Lochiel turnoff; approximately 1,100 feet south of N1/4 corner sec. 3, T.24S., R.19E.

A1--0 to 1 inch; dark reddish gray (5YR 4/2) gravelly light clay loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; slightly hard, friable, sticky, plastic; many fine and very fine roots; many fine interstitial pores; 25 percent gravel; slightly acid (pH 6.5); clear wavy boundary.

Bt1--1 to 8 inches; reddish brown (5YR 4/4) light clay, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, friable, sticky, plastic; many fine and very fine and few medium roots; common fine and very fine tubular pores; common thin clay films on faces of peds and in pores; common pressure faces; 5 percent gravel; neutral (pH 7.0); clear wavy boundary.

Bt2--8 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium and coarse angular and subangular blocky structure; hard, friable, sticky, plastic; common fine and very fine and few medium roots; common fine and very fine tubular pores; common pressure faces; few small slickensides in lower part; mildly alkaline (pH 7.5); abrupt wavy boundary.

C--25 to 40 inches; weak red (2.5YR 4/2) weathered clayey shale, fractured in places, weak red (2.5YR 4/2) moist; massive; very hard, firm, slightly sticky, plastic; few fine roots in fractures; few pores; slightly effervescent; strongly effervescent on faces of fractures; moderately alkaline (pH 8.0).

Range in Characteristics

Solum: ranges from 20 to 40 inches thick. Depth to the C horizon: ranges from 20 to 40 inches, but averages 22 to 36 inches.

Reaction: slightly acid to moderately alkaline

A horizon

Hue: 7.5YR, 5 YR, 2.5YR
Value: 2 to 4 dry, 2 or 3 moist
Chroma: 2 to 4, dry or moist

Texture: clay loam, loam
Rock fragments: averages about 25 to 40 percent.

B horizon

Hue: 5YR, 2.5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 3 to 6, dry or moist
Texture: clay, clay loam

Guest Series

Depth class: very deep
Drainage class: well drained
Permeability: slow
Landform: flood plains and alluvial fans
Parent material: mixed alluvium
Slope range: 0 to 2 percent
Elevation: 4,700 to 4,900 feet

Classification: Fine, mixed, superactive,
calcareous, thermic Ustertic Torrifuvents

Typical Pedon

The typical pedon description for the Guest clay loam series in an area of Guest clay loam, 1 to 2 percent slopes, located at latitude of 31 degrees, 36 minutes, 42 seconds North and longitude of 110 degrees, 29 minutes, 17 seconds West.

A1--0 to 2 inches; dark brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2.5/2) moist; weak thin platy structure parting to weak fine granular structure; soft, very friable, sticky and plastic; many very fine and fine roots; common very fine irregular and tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

A2--2 to 8 inches; dark brown (7.5YR 3/2) clay, very dark brown (7.5YR 2.5/2) moist; strong fine angular blocky structure; slightly hard, friable, very sticky and very plastic; common fine and medium roots; common very fine irregular and tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

Ck--8 to 40 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) moist; weak medium angular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; few very fine irregular and tubular pores; strongly effervescent; common fine filaments of calcium carbonate; moderately alkaline (pH 8.2).

Range in Characteristics

Soil cracking: When dry, cracks 1 cm or more wide, extend to depths of 20 inches or more and remain open for 175 to 240 days and are not closed for 60 days.

Rock fragments: ranges from 0 to 20 percent gravel; averages less than 15 percent in the control section

Reaction: Slightly to strongly alkaline

Salinity: none to slight

Sodicity: none to slight

Calcium carbonate: disseminated or occurs as fine filaments

Organic matter: greater than 1 percent
decreasing irregularly with depth

A and C horizons

Hue: 7.5YR, 10YR

Value: 3 to 5 dry, 2 or 3 moist

Chroma: 1 to 3 dry or moist

Texture: silty clay, clay loam, clay

Stratification: less than 2-inch thick strata of coarser material is common

Hathaway Series

Depth class: very deep
Drainage class: well drained
Permeability: moderate to moderately rapid
Landform: fan terraces
Parent material: mixed calcareous alluvium
Slope range: 1 to 60 percent
Elevation: 4,700 to 5,100 feet

Classification: Loamy-skeletal, mixed,
superactive, thermic Aridic Calcicustolls

Typical Pedon

The typical pedon description for the Hathaway series is from the official series description. Santa Cruz County, Arizona; about 6 miles east and 2 1/2 miles north of Sonoita; about 300 feet west of the southeast corner of section 1, T. 20 S., R. 17 E.

A--0 to 8 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure (immediate surface is single grained); soft, friable, slightly sticky and slightly plastic; many fine roots; many fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bk1--8 to 24 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and plastic; few fine roots; few fine tubular pores; few fine irregular calcium carbonate masses; violently effervescent; more than 15 percent calcium carbonate; moderately alkaline (pH 8.2); gradual wavy boundary.

Bk2--24 to 60 inches; light gray (10YR 7/2) pinkish gray (7.5YR 6/2) and light reddish brown (5YR 6/3) stratified very gravelly loamy sand and sand, grayish brown (10YR 5/2), brown (7.5YR 5/2), and reddish brown (5YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common medium irregular calcium carbonate masses; many very fine and fine interstitial pores; violently effervescent; more than 15 percent calcium carbonate; moderately alkaline (pH 8.2).

Range in Characteristics

Rock Fragments: average 35 to 50 percent in the particle-size control section; but can have as much as 85 percent in any one subhorizon.

Organic Matter Content: averages 1 to 3 percent in the upper 7 inches.

Depth to the calcic horizon: 5 to 20 inches.

Reaction: slightly or moderately alkaline. Calcium carbonate equivalent: average 15 to 40 percent; can be as much as 55 percent in any one subhorizon.

A horizon

Hue: 10YR, 7.5YR

Value: 3 through 5 dry, 2 or 3 moist

Chroma: 1 through 3, dry or moist

Texture: loam, sandy loam, fine sandy loam

B horizon

Hue: 10YR, 7.5YR, 5YR

Value: 5 through 7 dry, 4, 5 or 6 moist

Chroma: 2, 3, or 4, dry or moist

Texture: loam, fine sandy loam, sandy loam, loamy sand, sand

Lanque Series

Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Landform: flood plains and alluvial fans
Parent material: mixed alluvium
Slope range: 0 to 3 percent
Elevation: 4,200 to 4,600 feet

Classification: Coarse-loamy, mixed,
superactive, calcareous, thermic Pachic
Haplustolls

Typical Pedon

The typical pedon description for the Lanque sandy loam series in an area of Lanque sandy loam, 0 to 3 percent slopes, located at latitude of 31 degrees, 36 minutes, 25 seconds North and longitude of 110 degrees, 30 minutes, 41 seconds West.

A1--0 to 4 inches; brown (7.5YR 5/3) sandy loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine irregular pores; noneffervescent; neutral (pH 7.0); clear abrupt boundary.

A2--4 to 17 inches; dark brown (7.5YR 3/3) coarse sandy loam, very dark brown (7.5YR 2.5/3); weak medium subangular blocky structure; soft, very friable, nonsticky and non plastic; common very fine and fine roots; many very fine and fine tubular pores; noneffervescent; neutral (pH 7.0); clear wavy boundary.

C1--17 to 50 inches; very dark brown (7.5YR 2.5/3) coarse sandy loam, dark brown (7.5YR 3/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; noneffervescent; neutral (pH 7.0).

Range in Characteristics

Rock fragments: less than 35 percent
Clay content: 3 to 15 percent
Organic Matter: averages 1 to 3 percent in the
control section
Some pedons have a 2Bb or 2Btb horizon

A horizon

Hue: 10YR, 7.5YR
Value: 3 to 5 dry, 3 moist
Chroma: 2 or 3, dry or moist

C horizons

Hue: 10YR, 7.5YR
Value: 2 or 3 or moist

Chroma: 2 or 3, dry or moist

Texture: loamy sand, sandy loam, coarse
sandy loam

Reaction: slightly acid through slightly
alkaline

Lesliecreek Series

Depth class: very deep
Drainage class: well drained
Permeability: moderately slow
Landform: fan terraces
Parent material: mixed alluvium
Slope range: 1 to 3 percent
Elevation: 4,700 to 5,100 feet

Classification: Fine-loamy, mixed, superactive, thermic Torrifuventic
Haplustolls

Typical Pedon

The typical pedon description for the Lesliecreek sandy loam in an area of Blacktail – Hathaway - Lesliecreek complex, 1 to 45 percent slopes, located at a latitude of 31 degrees, 35 minutes, 54 seconds North and longitude of 110 degrees, 28 minutes, 57 seconds West.

A1--0 to 1 inches; brown (7.5YR 4/3) fine sandy loam, dark brown (7.5YR 3/3) moist; moderate thin platy structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; common fine irregular pores; strongly effervescent; moderately alkaline (pH 7.8); abrupt smooth boundary.

A2--1 to 5 inches; brown (7.5YR 4/3) fine sandy loam, very dark brown (7.5YR 2.5/3) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine roots; common fine tubular pores; strongly effervescent; moderately alkaline (pH 7.8); abrupt smooth boundary.

Bk1—5 to 18 inches; brown (7.5YR 4/3) sandy clay loam, dark brown (7.5YR 3/2) moist; weak coarse subangular blocky structure; soft, friable, sticky and plastic; many fine roots; common fine tubular pores; common calcium carbonate filaments; strongly effervescent; moderately alkaline (pH 7.8); abrupt smooth boundary.

Bk1—18 to 25 inches; brown (7.5YR 4/3) sandy clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; soft, friable, sticky and plastic; many fine roots; common fine tubular pores; common calcium carbonate filaments; few distinct calcium carbonate coating on rock fragments; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bk1—25 to 60 inches; brown (7.5YR 4/3) gravelly sandy clay loam, dark brown (7.5YR 3/3) moist; massive; soft, friable, sticky and plastic; few fine roots; common fine tubular pores; common calcium carbonate filaments; few distinct calcium carbonate coating on rock fragments; strongly effervescent; moderately alkaline (pH 8.0).

Range in Characteristics

Reaction: slightly to moderately alkaline
Clay content: 18 to 35 percent in the control
section
Organic matter: 1 to 3 percent

A horizon

Hue: 7.5YR, 10YR

Value: 4 to 5 dry, 2 or 3 moist

Chroma: 1 to 3, dry or moist

Bk horizon

Hue: 7.5YR, 10YR

Value: 3 to 5 dry, 2 to 4 moist

Chroma: 1 to 4 dry or moist

Texture: loam, sandy clay loam

Calcium carbonate equivalent; 0 to 5
percent

Oversight Series

Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid in the upper part and moderately slow in the buried horizons
Landform: fan terraces and alluvial fans
Parent material: mixed fan alluvium
Slope range: 1 to 10 percent
Elevation: 4,700 to 5,100 feet

Classification: Loamy-skeletal, mixed, superactive, thermic Aridic Haplustepts

Typical Pedon

The typical pedon description for the Oversight sandy loam series in an area of Oversight sandy loam, 1 to 10 percent slopes, located at latitude of 31 degrees, 35 minutes, 27 seconds North and longitude of 110 degrees, 29 minutes, 52 seconds West.

A--0 to 5 inch; brown (7.5YR 4/4) sandy loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few fine irregular pores; noneffervescent; neutral (pH 7.2); abrupt smooth boundary.

Bw--5 to 12 inches; brown (7.5YR 4/4) sandy loam, dark brown (7.5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; few fine irregular pores; noneffervescent; neutral (pH 7.0); abrupt wavy boundary.

2Bw--12 to 30 inches; brown (7.5YR 5/4) very gravelly sandy loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine irregular pores; 35 to 40 percent gravel; noneffervescent; neutral (pH 7.0); abrupt wavy boundary.

2Btb--30 to 60 inches; reddish brown (5YR 5/4) very gravelly sandy clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few tubular pores; common distinct clay films on ped faces, in pores and on rock fragments; 35 to 40 percent gravel; noneffervescent; neutral (pH 7.2).

Range in Characteristics

Rock fragments: greater than 35 percent gravel and cobbles
Reaction: slightly acid or neutral

A horizon

Hue: 7.5YR, 5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 through 4, dry or moist

Texture: sandy loam, fine sandy loam

Bw horizon

Hue: 7.5YR, 5YR

Value: 4 or 5 dry, 3 or 4 moist

Chroma: 3 or 4, dry or moist

Texture: sandy loam, sandy clay loam

Btb horizon

Hue: 7.5YR, 5YR

Value: 4 through 6 dry, 3 through 6
moist

Chroma: 3, 4 or 6, dry or moist

Texture: sandy loam, sandy clay loam (10
to 35 percent clay)

Some pedons do not have a buried argillic horizon.

Pyeatt Series

Depth class: very deep
Drainage class: well drained
Permeability: moderately rapid
Landform: fan terraces
Parent material: mixed calcareous fan
alluvium
Slope range: 3 to 45 percent
Elevation: 4,700 to 5,100 feet

Classification: Coarse-loamy, mixed,
superactive, thermic Aridic Calcicustolls

Typical Pedon

The typical pedon description for the Pyeatt gravelly loam is from the Soil Survey of Cochise County, Douglas – Tomdstone Part. Fort Huachuca, Arizona; located at a latitude of 31 degrees, 36 minutes, 30 seconds North and longitude of 110 degrees, 23 minutes, 20 seconds West

A--0 to 3 inches; brown (7.5YR 4/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate thin platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine irregular pores; 20 percent gravel; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

Bk1--3 to 9 inches; brown (7.5YR 4/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; few fine tubular pores; common distinct calcium carbonate coatings on undersides of rocks; few fine calcium carbonate filaments; 20 percent gravel; strongly effervescent, 8 percent calcium carbonate equivalent; moderately alkaline (pH 8.0); clear smooth boundary.

Bk2--9 to 35 inches; brown (7.5YR 5/3) gravelly fine sandy loam, brown (7.5YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; few fine irregular and tubular pores; many distinct calcium carbonate coatings on rock fragments; few fine calcium carbonate filaments; 18 percent gravel; violently effervescent, 20 percent calcium carbonate equivalent; moderately alkaline (pH 8.0); clear smooth boundary.

Bk3--35 to 41 inches; light brown (7.5YR 6/3) fine sandy loam, brown (7.5YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; few fine irregular and tubular pores; common distinct calcium carbonate coatings on rock fragments; common fine and medium calcium carbonate filaments; 10 percent gravel; violently effervescent, 23 percent calcium carbonate equivalent; moderately alkaline (pH 8.2); clear smooth boundary.

Bk4--41 to 60 inches; pink (7.5YR 7/3) and brown (7.5YR 5/3) fine sandy loam, brown (7.5YR4/3) moist; weak medium subangular blocky structure; very soft, very friable, slightly sticky and slightly plastic; few fine roots; few fine irregular pores; few distinct calcium carbonate coatings on rock fragments; common fine and medium calcium

carbonate filaments; 10 percent gravel; violently effervescent, 30 percent calcium carbonate equivalent; moderately alkaline (pH 8.2).

Range in Characteristics

Rock fragments: less than 35 percent
Organic matter content: 1 to 2 percent
Clay content: less than 18 percent
Depth to calcic horizon: 3 to 20 inches
Reaction: slightly or moderately alkaline
Effervescence: strong or violent

A horizon

Hue: 10YR, 7.5YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 or 3, dry or moist
Calcium carbonate equivalent: 0 to 10 percent

Bk horizon

Hue: 10YR, 7.5YR
Value: 4 through 8 dry, 3 through 7 moist
Chroma: 2 or 3, dry or moist
Texture: sandy loam, fine sandy loam, loam
Calcium carbonate equivalent: 10 to 30 percent

Terrarossa Series

Depth class: very deep
Drainage class: well drained
Permeability: slow
Landform: fan terraces
Parent material: mixed fan alluvium
Slope range: 1 to 40 percent
Elevation: 4,700 to 5,100 feet

Classification: Fine, mixed, superactive,
thermic Aridic Paleustalfs

Typical Pedon

The typical pedon description for the Terrarossa fine sandy loam in an area of Terrarossa complex, 1 to 10 percent slopes, located at latitude of 00 degrees, 00 minutes, 00 seconds North and longitude of 110 degrees, minutes, 00 seconds West.

A--0 to 3 inches; reddish brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak thin platy structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine irregular pores; noneffervescent; neutral (pH 7.2); abrupt smooth boundary.

A/B--3 to 8 inches; reddish brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; common fine tubular pores; few faint clay films on ped faces and pores; noneffervescent; neutral (pH 7.2); abrupt smooth boundary.

Bt1--8 to 13 inches; reddish brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) moist; moderate fine angular blocky structure; slightly hard, firm, very sticky and very plastic; common fine roots; common fine tubular pores; common distinct clay films on ped faces and pores; 10 to 15 to 20 percent gravel; noneffervescent; neutral (pH 7.2); clear smooth boundary.

Bt2--13 to 18 inches; reddish brown (5YR 4/4) gravelly clay, dark reddish brown (5YR 3/3) moist; moderate medium prismatic structure parting to strong medium angular blocky; slightly hard, firm, very sticky and very plastic; common very fine and fine roots; few fine tubular pores; common distinct clay films on ped faces and pores; 15 to 20 percent gravel; noneffervescent; neutral (pH 7.2); clear smooth boundary

2Bt1--18 to 27 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/3) moist; moderate medium prismatic structure parting to strong medium angular blocky; slightly hard, firm, very sticky and very plastic; few fine roots; few fine tubular pores; many distinct clay films on ped faces and pores; noneffervescent; neutral (pH 7.2); clear smooth boundary.

2Bt2--27 to 34 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; strong medium angular blocky; slightly hard, firm, very sticky and very plastic; few fine roots; few fine tubular pores; many distinct clay films on ped faces and pores; noneffervescent; neutral (pH 7.2); clear smooth boundary.

2Bt3—43 to 60 inches; reddish brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; moderate medium prismatic structure parting to strong medium angular blocky; slightly hard, firm, very sticky and very plastic; few fine roots; few fine tubular pores; many distinct clay films on ped faces and pores; noneffervescent; neutral (pH 7.2).

Range in Characteristics

Rock fragments: less than 35 percent, but can range to 50 percent in any one horizon

Reaction: moderately acid to neutral

Clay content: averages more than 35 percent

Depth to abrupt textural change: 5 to 15 inches

A and A/B horizon

Hue: 7.5YR, 5YR

Value: 3 to 5 dry, 3 or 4 moist

Chroma: 3 or 4 dry, 2 to 4 moist

Texture: fine sandy loam, loam, sandy clay loam

Bt horizon

Hue: 2.5YR, 5YR

Value: 3 to 5 dry, 3 or 4 moist

Chroma: 3 to 6 dry, 2 to 6 moist

Texture: clay, sandy clay

Research Ranch Ecological Site Legend

Dan Robinett of the Tucson office of the Natural Resources Conservation Service (NRCS) completed an inventory of ecological sites on the Research Ranch with the assistance of Linda Kennedy. This inventory was done during the course of the soil survey update being done by Don Breckenfeld, also of NRCS. Others participating in this effort include Phil Heilman of the Southwest Watershed Research Center of Agricultural Research Service, Joan Scott of the Arizona Game and Fish Department, Dana Backer of the Nature Conservancy and Emilio Carrillo of the NRCS. The work was done from October 16 through 20 and November 14 and 15, 2000 and February 8, 2001. Thirty-two sites were evaluated using NRCS methods for rangeland inventory (see NRCS Nat. Range and Pastureland Handbook, Sept. 1997). Arizona NRCS ecological site guides for MLRA 41-3 and 41-1 were used to compare existing plant communities to potentials (see NRCS Site Guides for 41-3, 1988 and 41-1 1992). This part of the rangeland condition classification is called the "Similarity Index" and refers to the similarity of the existing plant community to the potential plant community. In addition each site was assessed as to the "Trend" of the plant community to or away from the site potential and finally each site was assessed a rangeland health. This is a new technique developed by the NRCS and the Bureau of Land Management (BLM) which evaluates 17 attributes of the ecosystem in relating the condition of the site to; soil and site stability, biotic integrity and watershed function (see BLM and NRCS Tech. Ref 1734-6, Interpreting Indicators of Rangeland Health).

Twelve different ecological sites were identified and mapped on the Research Ranch. Four of these were assessed using the Ecological Site Descriptions for MLRA 41-3 and the other eight were assessed using the descriptions for MLRA 41-1. The following legend briefly describes these sites and their present day condition and trend.

Clayey Bottom 41-3 (12-16pz)

This site occurs in one area as a small floodplain in the northwest end of O'Donnell canyon. Soils are deep and clayey and have high shrink-swell potentials. Slopes are less than one percent. The site receives extra water in the form of runoff from adjacent uplands. The present day and potential plant communities are similar being dominated by tobosa and vine mesquite grasses. Similarity index is high and the site is healthy.

Loamy Bottom, subirrigated 41-3 (12-16pz)

This site occurs as the major floodplains of O'Donnell, Post and Turkey Creek canyons. Soils are deep and silty-clayloam in texture. Slopes are less than one percent. The soils benefit from extra water received as both, flooding of the stream channels and high water tables (1 to 10 meters). The present day and potential plant communities are similar both being dominated by giant sacaton. One area of this site was assessed and had a very high similarity index and was healthy.

Loamy Bottom, swales 41-3 (12-16pz)

This site occurs as small floodplains of the tributaries of major streams throughout the area. Soils are deep and range in texture from sandyloam to clayloams. Slopes are from one to two percent. They benefit from extra water received as runoff from adjacent uplands. The present day and potential plant communities are similar and the two areas of this site that were assessed both had high similarity indices and were healthy. Historic severe gully erosion dating from the 1920's and 1930's has healed extremely well in all of these bottoms. Native grasses like blue and sideoats grammas, cane beardgrass, vine mesquite, mat muhly and Arizona cottontop dominate the plant community.

Clayey Hills 41-3 (12-16pz)

This site occurs as small areas of steep hillslopes in the breaks along the north end of O'Donnell canyon. Soils are deep and clayey and developed in lacustrine (lakebed) deposits. They have

high amounts of gypsum causing them to be highly erodible. Slopes are from 15 to 45 percent. The present day and potential plant communities are both dominated by tobosa grass but historic accelerated erosion caused by cattle trails have put areas of this site in an “unhealthy” classification. This erosion is probably proceeding at geologic rates at present and should not be cause for alarm.

Sandy Loam Upland 41-1 (16-20pz)

This site occurs as fan terraces and inset fans alongside the bottomlands of Post Canyon. Soils are deep, reddish colored and loamy. Slopes are from one to five percent. The surface soil is sandy loam six to twelve inches thick over clayey subsoils. Soils are neutral to slightly acid pH. The thick, coarse textured surface takes summer rainfall very well and lets it slowly infiltrate the heavy textured subsoils. This is the most productive upland site in the plains grassland. The one area of this site evaluated had a high similarity index but rated as “at risk” as it had been burned in May of 2000 and had not yet recovered from the effects of the fire. Native grasses dominate the plant community including blue, black and sideoats grammas, cane beardgrass, Arizona cottontop, plains lovegrass, fall witchgrass and threeawns.

Loamy Upland 41-1 (16-20pz)

This site is the most common upland ecological site on the Research Ranch. It occurs as fan terraces and mesa tops. Soils are deep, reddish colored and loamy. Slopes are from one to ten percent. Soils are neutral to slightly acid pH. Soils surfaces are very gravelly sandy loams one to three inches thick over a clay loam horizon about six inches thick. Dense, red, clayey subsoils underlie this surface. The thin coarse textured surfaces do not take summer rainfall very well and when the native grass cover is depleted this site can easily produce runoff and erosion at accelerated rates. Eight areas of this site were evaluated. Three of these areas were either dominated by non-native lovegrasses or being invaded by them and were rated as “at risk” with low similarity indices. One area had historic heavy soil erosion and may not have enough soil surface left to ever recover to the sites potential. It also rated as “at risk” and other areas between Post Canyon and O’Donnell Canyon appeared to be in the same condition. Five areas had high similarity indices and rated as “healthy”. Native grasses dominate this plant community and include blue, sideoats and sprucetop grammas, cane beardgrass, plains lovegrass, wolftail and threeawns. One area where herbaceous production was actually determined by clipping and weighing had 1500 pounds per acre dry weight yield.

Limy Slopes 41-1 (16-20pz)

This site occurs on moderate to steep slopes in the canyons around Bald Hill and the breaks into O’Donnell, Turkey and Post canyons. Soils are deep, gravelly and/or cobbly, and very calcareous. Soil textures range from very gravelly sandy loams to loams. The surface six to ten inches is dark colored over light colored subsoils. Soil reaction is alkaline with pH of about 8. Slopes are from 10 to 45 percent. Seven areas of this site were evaluated. The present day and potential plant communities are very similar with indices of 72 to 95 and all sites ranked as “healthy”. Native grasses dominate the plant community including black and sideoats grammas, slender, shortleaf and rough tridens, wooly bunchgrass, crinkleawn, blue threeawn and New Mexico stipa. Numerous perennial forbs are unique to these calcareous soils. The dominant shrubs are beargrass, sotol, Greggs dalea, spreading ratany, false mesquite and mimosa. On some north aspects this site has an overstory of Emory and Arizona white oaks resembling the same site in a higher precipitation zone that is oak woodland.

Loamy Hills 41-1 (16-20pz)

This site occurs in complex with the Limy Slopes described above. Soils are deep and gravelly to cobbly loams to clay loams. Soil reaction is neutral to slightly acid pH. Slopes are from 10 to 45 percent. The soil surface is typically a very dark colored cobbly and/or gravelly loam two to eight inches thick over reddish clay subsoils. Seven areas of this site were evaluated. Similarity indices ranged from 56 to 90. In two areas non-native lovegrasses are increasing resulting in low indices and “at risk” ratings for range health. In three other areas the present day and potential plant communities were very similar and the sites were “healthy”. Native grasses dominate the plant

community. On southern aspects the main species are sideoats grama, cane beardgrass, tanglehead, plains lovegrass and green sprangletop. On northern aspects the dominant grasses include these plus bullgrass, Texas bluestem and beggartick threeawn. Important native shrubs on this site are wait-a-bit and velvet-pod mimosas, false mesquite, Palmers agave, yerba-de-pasmo and rainbow cactus. This site appears to be the most important site for Palmer agave within its range in southern Arizona. Two areas (#14 and 25) of this site were inventoried on steep north aspects where the plant communities are more characteristic of the same site in a higher precipitation zone. These areas had an oak woodland community dominated by Emory and Arizona white oak. The tree canopy at both sites was from 20 to 25 percent and understory production was about 1000 pounds per acre per year, which is normal for the site. These two areas had very high similarity indices and rated as "healthy".

Limestone Hills 41-1 (16-20pz)

A few small areas of this site occur on steep slopes in Post and O'Donnell Canyons. Soils are shallow to calcareous conglomerate parent materials. Slopes are from 15 to 60 percent. Soil reaction is alkaline with pH of about 8. Soil textures are very gravelly loams to clay loams and light colored or pinkish. One area of this site was evaluated and the present day and potential plant communities are very similar except that shrubby species have thickened in the absence of natural fires. Historic erosion has put this site in an "at risk" classification and present day erosion is probably occurring at geologic rates. Dominant plants of this site are shrubs like desert ceanothus, mountain mahogany, cliffrose, silktassle, sotol, beargrass and skunkbush sumac. Common grasses are black, purple and sideoats grammas, purple muhly, bullgrass, New Mexico stipa, wolly bunchgrass and crinkleawn. Trees like alligator juniper, Mexican pinyon, Emory and Arizona white oaks dominate on cool north aspects.

Sandy Bottom, subirrigated 41-1 (16-20pz)

This site occurs along stream channels and on low stream terraces. It is the sandy bottoms of Turkey Creek and Post and O'Donnell Canyons. Soils are deep and sandy and gravelly. Slopes are less than one percent. This site benefits both from extra water received as flooding of stream channels and periodic high water tables. One area of this site was evaluated in Post Canyon and the present day and potential plant communities are very similar. This is a woodland site and the dominant tree species include cottonwood, black willow, Arizona ash, Arizona black walnut, and desert willow. The main shrubs and vines are canyon grape, virgins bower, coyote willow, batamote and rabbitbrush. Deergrass, sedges, rushes and horsetail dominate the grasslike component of the understory

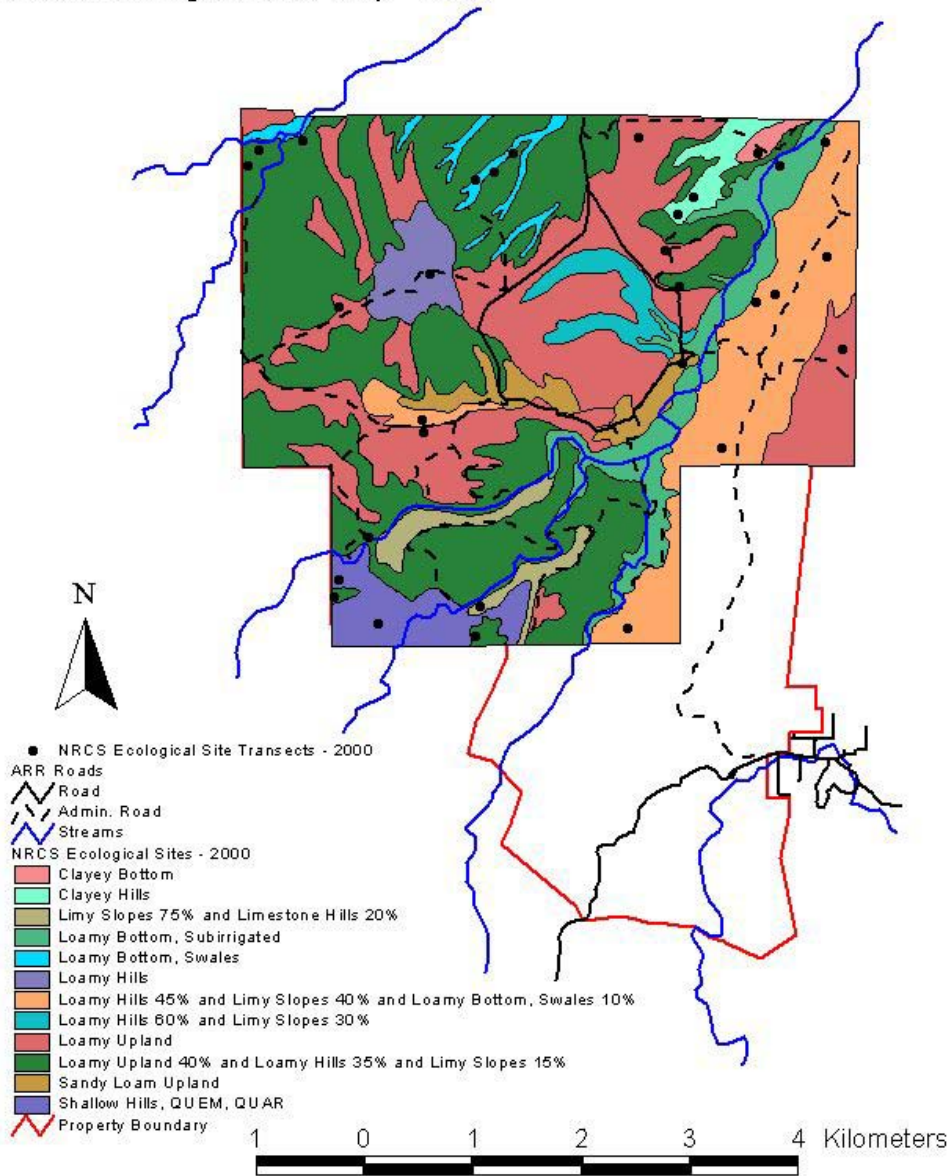
Shallow Hills 41-1 (20-23pz)

This site occurs as moderate to steep slopes in the upper drainages of Post and O'Donnell Canyons. Slopes are from 15 to 55 percent. Soils are shallow very gravelly loams to clay loams over parent materials of granite, rhyolite, quartzite and other metamorphic rocks. Soil reaction is slightly acidic. Two areas of this site were evaluated and the present day and potential plant communities are similar with indices of 60 and both were assessed as "healthy". Shrubby species have thickened on this site in the absence of historic fires and reduces the similarity indices. The plant community is open woodland of Emory and Arizona White oaks with lesser amounts of Mexican pinyon and alligator juniper. Canopy cover averages 15 to 25 percent. Common understory grasses are sideoats, purple and hairy grammas, bullgrass, plains lovegrass, Texas bluestem, cane beardgrass and beggartick threeawn. Common shrubs include the mimosas, agave species, Schott yucca, sotol, beargrass, manzanita, skunkbush sumac, brickellia, yerba-de-pasmo, shrubby buckwheat and cane cholla. Forbs are primarily shade tolerant species like herbaceous sage, ferns and stolon daisy.

Audubon Research Ranch Ecological Site Map Legend

Symbol	Ecological Site
1	Loamyhills 16 – 20 p.z. Limy slopes 16 – 20 p.z.. Loamy bottom, swales 12 – 16 p.z.
2	Loamy hills 16 – 20 p.z
3	Loamy hills 16 – 20 p.z. Limy slopes 16 – 20 p.z.
4	Loamy bottom, subirrigated 16 – 20 p.z.
5	Clayey hills 12 – 16 p.z.
6	Shallow hills QUEM, QUAR 20 – 23 p.z.
7	Cleyey bottom 12 – 16 p.z.
8	Limy slopes 16 – 20 p.z. Limestone hills 16 – 20 p.z.
9	Loamy bottom, swales 16 – 20 p.z.
10	Sandyloam upland 16 – 20 p.z.
11	Loamy upland 16 – 20 p.z
12	Loamy upland 16 20 p.z. Loamy hills 16 – 20 p.z. Limy slopes 16 – 20 p.z

NRCS Ecological Site Map - 2000



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Summary of Ecological Site Inventory of The Research Ranch, Oct. - Nov. 2000

No	Ecological Site	MLR A	Date	Trend	Similarity	Health	Notes
1	loamy upland	41-1	10/16/2000	static	65	H	
2	limy slopes	41-1	10/16/2000	sl up	85	H	
3	loamy hills	41-1	10/16/2000	sl up	85	H	
4	loamy upland	41-1	10/16/2000	up	97	H	
5	loamy bottom, swales	41-3	10/17/2000	sl up	70	H	
6	limy slopes	41-1	10/17/2000	static	72	H	
7	loamy upland	41-1	10/17/2000	sl down	50	AR	Severe drought mortality
8	loamy upland	41-1	10/17/2000	sl up	52	AR	Lehmann and Boers lovegrass
9	clayey bottom	41-3	10/17/2000	sl up	60	H	
10	loamy bottom, subirrigated	41-3	10/17/2000	static	95	H	
11	loamy upland	41-1	10/17/2000	static	8	AR	Boers lovegrass dominance
12	limy slopes	41-1	10/17/2000	static	95	H	
13	clayey hills	41-3	10/17/2000	sl down	67	UH	Historic accelerated erosion
14	loamy hills	41-1	10/18/2000	static	100	H	North aspect - oak woodland
15	loamy hills	41-1	10/18/2000	sl down	56	AR	Severe drought mortality
16	limy slopes	41-1	10/18/2000	sl up	75	H	
18	loamy hills	41-1	10/18/2000	sl up	90	H	
19	loamy bottom, swales	41-3	10/18/2000	static	80	H	
20	Sandyloam upland	41-1	10/19/2000	static	82	AR	Burned in May of 2000
21	loamy upland	41-1	10/19/2000	static	57	AR	Lehmann and Boers lovegrass
22	limy slopes	41-1	10/19/2000	static	80	H	
23	loamy upland	41-1	10/20/2000	up	90	H	Clipped plot at soil pit
24	loamy hills	41-1	11/14/2000	static	67	H	
25	loamy hills	41-1	11/14/2000	up	97	H	North aspect - oak woodland
26	sandy bottom, subirrigated	41-1	11/14/2000	sl up	NA	NA	
27	shallow hills	41-1	11/15/2000	sl up	60	H	20 to 23 inch pz, oak woodland
28	loamy hills	41-1	11/15/2000	sl down	59	AR	Lehmann lovegrass invading
29	shallow hills	41-1	11/15/2000	sl up	60	H	20 to 23 inch pz, oak woodland
30	loamy upland	41-1	11/15/2000	sl up	79	H	
31	limestone hills	41-1	11/15/2000	static	80	AR	Historic accelerated erosion
32	limy slopes	41-1	2/8/2001	sl up	77	H	

H = Healthy
AR = At Risk
UH = Unhealthy

Plant List from NRCS Ecological Site and Soils Inventory, Nov.2000

Genus	Specific epithet	Variety	Family	Common name(s)
<i>Dyschoriste</i>	<i>decumbens</i>		Acanthaceae	Dychoriste
<i>Agave</i>	<i>parryi</i>	<i>huachucensis</i>	Agavaceae	Parry agave
<i>Agave</i>	<i>palmeri</i>		Agavaceae	palmer agave
<i>Yucca</i>	<i>elata</i>	<i>elata</i>	Agavaceae	soaptree yucca
<i>Yucca</i>	<i>schottii</i>		Agavaceae	Schott yucca
<i>Amaranthus</i>	<i>palmeri</i>		Amaranthaceae	Careless Weed; Pigweed
<i>Froelichia</i>	<i>arizonica</i>		Amaranthaceae	Snake cotton
<i>Gomphrena</i>	<i>nitida</i>		Amaranthaceae	gomphrena; globe amaranth
<i>Guilleminea</i>	<i>densa</i>		Amaranthaceae	Small mat weed
<i>Rhus</i>	<i>microphylla</i>		Anacardiaceae	littleleaf sumac
<i>Rhus</i>	<i>trilobata</i>		Anacardiaceae	Skunk bush; skunkbush sumac
<i>Rhus</i>	<i>virens</i>	<i>choriophylla</i>	Anacardiaceae	Mearns sumac
<i>Macrosiphonia</i>	<i>brachysiphon</i>		Apocynaceae	Macrosiphonia
<i>Sarcostemma</i>	<i>crispum</i>		Asclepiadaceae	climbing milkweed
<i>Acourtia</i>	<i>wrightii</i>		Asteraceae	pink perezia
<i>Acourtia</i>	<i>nana</i>		Asteraceae	desert holly
<i>Ambrosia</i>	<i>confertiflora</i>		Asteraceae	western ragweed
<i>Ambrosia</i>	<i>psilostachya</i>		Asteraceae	ragweed
<i>Artemisia</i>	<i>dracunculus</i>		Asteraceae	false tarragon
<i>Artemisia</i>	<i>ludoviciana</i>	<i>sulcata</i>	Asteraceae	herbaceous sage
<i>Artemisia</i>	<i>ludoviciana</i>	<i>albula</i>	Asteraceae	herbaceous sage
<i>Baccharis</i>	<i>bigelovii</i>		Asteraceae	Bigelow baccharis
<i>Baccharis</i>	<i>pteronioides</i>		Asteraceae	yerba de pasmo
<i>Baccharis</i>	<i>salicifolia</i>		Asteraceae	seep willow, betamote
<i>Baccharis</i>	<i>sarothroides</i>		Asteraceae	Desert broom
<i>Bahia</i>	<i>absinthifolia</i>	<i>absinthifolia</i>	Asteraceae	Bahia
<i>Belandiera</i>	<i>lyrata</i>		Asteraceae	green eyes; chocolate flower
<i>Bidens</i>	<i>aurea</i>		Asteraceae	water marigold
<i>Bidens</i>	<i>leptocephala</i>		Asteraceae	stick seed
<i>Brickellia</i>	<i>californica</i>		Asteraceae	California brickelbush
<i>Brickellia</i>	<i>eupatorioide</i>		Asteraceae	
<i>Brickellia</i>	<i>s</i>	<i>chlorolepis</i>	Asteraceae	eupatorium
<i>Carphochaete</i>	<i>bigelovii</i>		Asteraceae	Bigelow bush
<i>Chaetopappa</i>	<i>ericoides</i>		Asteraceae	wire daisy
<i>Chrysothamnus</i>	<i>nauseosus</i>		Asteraceae	Rabbitbrush; SW rabbitbrush
<i>Cirsium</i>	<i>neomexicanum</i>		Asteraceae	New Mexico thistle
<i>Cirsium</i>	<i>ochrocentrum</i>		Asteraceae	red thistle
<i>Conyza</i>	<i>canadensis</i>		Asteraceae	mares tail
<i>Erigeron</i>	<i>divergens</i>		Asteraceae	Fleabane or Wild daisy
<i>Erigeron</i>	<i>flagellaris</i>		Asteraceae	stolon daisy
<i>Erigeron</i>	<i>neomexicanus</i>		Asteraceae	wild daisy
<i>Gaillardia</i>	<i>pinnatifida</i>		Asteraceae	blanket flower
<i>Gnaphalium</i>	<i>canescens</i>		Asteraceae	gordo lobo, cudweed
<i>Gutierrezia</i>	<i>microcephala</i>		Asteraceae	snakeweed

<i>Helianthus</i>	<i>annuus</i>		Asteraceae	Sunflower
<i>Helianthus</i>	<i>petiolaris</i>		Asteraceae	little sunflower
<i>Heliomeris</i>	<i>longifolia</i>	<i>annua</i>	Asteraceae	annual goldeneye
<i>Heliomeris</i>	<i>multiflora</i>		Asteraceae	shrubby goldeneye
<i>Heterotheca</i>	<i>subaxillaris</i>		Asteraceae	camphor weed
<i>Hymenoclea</i>	<i>monogyra</i>		Asteraceae	burrobush
<i>Hymenothrix</i>	<i>wislizenii</i>		Asteraceae	Hymenothrix
<i>Isocoma</i>	<i>tenuisecta</i>		Asteraceae	Burro weed
<i>Lactuca</i>	<i>serriola</i>		Asteraceae	prickley lettuce
<i>Laennecia</i>	<i>coulteri</i>		Asteraceae	Coulter's conzya
<i>Machaeranthera</i>	<i>gracilis</i>		Asteraceae	slender golden head
<i>Machaeranthera</i>	<i>pinatifida</i>		Asteraceae	spiny golden head
<i>Machaeranthera</i>	<i>tanacetifolia</i>		Asteraceae	purple aster
<i>Melampodium</i>	<i>sericeum</i>		Asteraceae	plains blackfoot
<i>Pectis</i>	<i>longipes</i>		Asteraceae	perennial chinchweed
<i>Sanvitalia</i>	<i>abertii</i>		Asteraceae	sanvitalia
<i>Senecio</i>	<i>flaccidus</i>	<i>flaccidus</i>	Asteraceae	senecio
<i>Solidago</i>	<i>velutina</i>		Asteraceae	goldenrod
<i>Stephanomeria</i>	<i>pauciflora</i>		Asteraceae	Stephanomeria; wire lettuce
<i>Thelesperma</i>	<i>longipes</i>		Asteraceae	green threads
<i>Tragopogon</i>	<i>dubius</i>		Asteraceae	goats beard
<i>Verbesina</i>	<i>encelioides</i>		Asteraceae	crown beard
<i>Xanthium</i>	<i>strumarium</i>	<i>canadense</i>	Asteraceae	Cockle-bur
<i>Zinnia</i>	<i>acerosa</i>		Asteraceae	desert zinnia
<i>Zinnia</i>	<i>grandiflora</i>		Asteraceae	Zinnia; Texas zinnia
<i>Chilopsis</i>	<i>linearis</i>	<i>linearis</i>	Bignoniaceae	Desert willow
<i>Lithospermum</i>	<i>incisum</i>		Boraginaceae	puccoon
<i>Plagiobathrys</i>	<i>arizonicus</i>		Boraginaceae	lipstick weed
<i>Descurainia</i>	<i>pinnata</i>		Brassicaceae (Cruciferae)	tansy mustard
<i>Lepidium</i>	<i>lasiocarpum</i>		Brassicaceae (Cruciferae)	desert pepperweed
<i>Lepidium</i>	<i>thurberi</i>		Brassicaceae (Cruciferae)	white pepperweed
<i>Lesquerella</i>	<i>fendleri</i>		Brassicaceae (Cruciferae)	bladderpod
<i>Rorippa</i>	<i>nasturtium-aquaticum</i>		Brassicaceae (Cruciferae)	water cress
<i>Sisymbrium</i>	<i>irio</i>		Brassicaceae (Cruciferae)	London rocket
<i>Cylindropuntia</i>	<i>spinosior</i>		Cactaceae	cane cholla
<i>Echinocereus</i>	<i>rigidissimus</i>		Cactaceae	rainbow cactus
<i>Opuntia</i>	<i>englemannii</i>		Cactaceae	prickley pear
<i>Opuntia</i>	<i>macrocentra</i>		Cactaceae	plains prickley pear
<i>Sambucus</i>	<i>mexicanus</i>		Caprifoliaceae	Mexican elderberry
<i>Silene</i>	<i>antirrhina</i>		Caryophyllaceae	catch fly
<i>Atriplex</i>	<i>elegans</i>	<i>fasciculata</i>	Chenopodiaceae	wheelscale
<i>Chenopodium</i>	<i>berlandieri</i>	<i>sinuatum</i>	Chenopodiaceae	Goose foot
<i>Salsola</i>	<i>kali</i>		Chenopodiaceae	Russian thistle; tumbleweed
<i>Commelina</i>	<i>dianthifolia</i>		Commelinaceae	dayflower
<i>Tradescantia</i>	<i>pinetorum</i>		Commelinaceae	spiderwort
<i>Convolvulus</i>	<i>equitans</i>		Convolvulaceae	Bindweed, tanglevine
<i>Evolvulus</i>	<i>arizonicus</i>		Convolvulaceae	hairy evolvulus
<i>Ipomoea</i>	<i>cristulata</i>		Convolvulaceae	Star-glory; red morning glory

<i>Cucurbitata</i>	<i>digitata</i>		Cucurbitaceae	fingerleaf melon
<i>Cucurbitata</i>	<i>foetidissima</i>		Cucurbitaceae	buffalo gourd
<i>Cucurbitata</i>	<i>palmata</i>		Cucurbitaceae	coyote melon
<i>Carex</i>	<i>lanuginosa</i>		Cyperaceae	sedge
<i>Cyperus</i>	<i>esculentus</i>		Cyperaceae	yellow nut sedge
<i>Cyperus</i>	<i>sphaerolepis</i>		Cyperaceae	Flat-sedge, cyperus
<i>Scirpus</i>	<i>acutus</i>		Cyperaceae	bull rush
<i>Scirpus</i>	<i>maritimus</i>		Cyperaceae	bull rush
<i>Arctostaphylos</i>	<i>pungens</i>		Ericaceae	manzanita
<i>Acalypha</i>	<i>lindheimeri</i>		Euphorbiaceae	three-seeded mercury
<i>Acalypha</i>	<i>neomexicana</i>		Euphorbiaceae	New Mexico copperleaf
<i>Chamaesyce</i>	<i>albomarginata</i>		Euphorbiaceae	perennial spurge
<i>Chamaesyce</i>	<i>hyssopifolia</i>		Euphorbiaceae	hyssop spurge
<i>Croton</i>	<i>pottsii</i>	<i>pottsii</i>	Euphorbiaceae	doveseed croton
<i>Jatropha</i>	<i>macrorhiza</i>	<i>Septemfida</i>	Euphorbiaceae	jatropha
<i>Poinsettia</i>	<i>heterophylla</i>		Euphorbiaceae	Mexican poinsettia
<i>Poinsettia</i>	<i>radians</i>		Euphorbiaceae	desert poinsettia
<i>Tragia</i>	<i>ramosa</i>		Euphorbiaceae	noseburn
<i>Acacia</i>	<i>angustissima</i>		Fabaceae (Leguminosae)	whiteball acacia
<i>Amorpha</i>	<i>fruticosa</i>		Fabaceae (Leguminosae)	lead plant
<i>Astragalus</i>	<i>nuttallianus</i>	<i>nuttallianus</i>	Fabaceae (Leguminosae)	spectacle pod locoweed
<i>Calliandra</i>	<i>eriphylla</i>		Fabaceae (Leguminosae)	false mesquite
<i>Calliandra</i>	<i>humilis</i>	<i>reticulata</i>	Fabaceae (Leguminosae)	mountain calliandra
<i>Dalea</i>	<i>formosa</i>		Fabaceae (Leguminosae)	false indigo bush
<i>Dalea</i>	<i>jamesii</i>		Fabaceae (Leguminosae)	James dalea
<i>Desmanthus</i>	<i>cooleyi</i>		Fabaceae (Leguminosae)	bundleflower
<i>Desmodium</i>	<i>neomexicanum</i>		Fabaceae (Leguminosae)	tick clover
<i>Indigofera</i>	<i>sphaerocarpa</i>		Fabaceae (Leguminosae)	indigo bush
<i>Lotus</i>	<i>wrightii</i>		Fabaceae	Wright's lotus
<i>Lotus</i>	<i>greenei</i>		Fabaceae (Leguminosae)	hill lotus; Green's lotus
<i>Lotus</i>	<i>humistratus</i>		Fabaceae (Leguminosae)	mares fat
<i>Macroptilium</i>	<i>gibbosifolium</i>		Fabaceae (Leguminosae)	wild bean
<i>Melilotus</i>	<i>albus</i>		Fabaceae (Leguminosae)	white sweet clover
<i>Melilotus</i>	<i>officinalis</i>		Fabaceae (Leguminosae)	yellow sweet clover
<i>Mimosa</i>	<i>aculeaticarpa</i>	<i>biuncifera</i>	Fabaceae (Leguminosae)	wait-a-bit mimosa
<i>Mimosa</i>	<i>dysocarpa</i>		Fabaceae (Leguminosae)	Mimosa; velvet pod momosa
<i>Phaseolus</i>	<i>acutifolius</i>	<i>tenuifolius</i>	Fabaceae (Leguminosae)	wild bean
<i>Prosopis</i>	<i>velutina</i>		Fabaceae (Leguminosae)	velvet mesquite
<i>Prosopis</i>	<i>glandulosa</i>	<i>torreyana</i>	Fabaceae	western honey mesquite
<i>Psoralidium</i>	<i>tenuiflorum</i>		Fabaceae (Leguminosae)	Scurf pea
<i>Rynchosia</i>	<i>senna</i>	<i>texana</i>	Fabaceae (Leguminosae)	rosary bean
<i>Senna</i>	<i>bauhinoides</i>		Fabaceae (Leguminosae)	twin leaf senna
<i>Quercus</i>	<i>turbinella</i>		Fagaceae	Turbinella oak
<i>Quercus</i>	<i>emoryi</i>		Fagaceae	Emory oak
<i>Quercus</i>	<i>arizonicus</i>		Fagaceae	Arizona white oak
<i>Quercus</i>	<i>oblongifolia</i>		Fagaceae	Mexican blue oak
<i>Fouquieria</i>	<i>splendens</i>		Fouquieriaceae	ocotillo
<i>Corydalis</i>	<i>aurea</i>		Fumariaceae	golden corydalis
<i>Garrya</i>	<i>wrightii</i>		Garryaceae	Silk-tassel
<i>Erodium</i>	<i>cicutarium</i>	<i>cicutarium</i>	Geraniaceae	filaree

<i>Phacelia</i>	<i>arizonicus</i>		Hydrophyllaceae	scorpion weed
<i>Sisyrinchium</i>	<i>demissum</i>		Iridaceae	blue-eyed-grass
<i>Juglans</i>	<i>major</i>		Juglandaceae	Arizona black walnut
<i>Juncus</i>	<i>Balticus</i>		Juncaceae	Baltic rush
<i>Juncus</i>	<i>interior</i>	<i>arizonicus</i>	Juncaceae	rush
<i>Juncus</i>	<i>mexicanus</i>		Juncaceae	rush
<i>Krameria</i>	<i>erecta</i>		Krameriaceae	range ratany
<i>Krameria</i>	<i>lanceolata</i>		Krameriaceae	spreading ratany
<i>Marrubium</i>	<i>vulgare</i>		Lamiaceae (Labiatae)	horehound
		<i>austromontan</i>		
<i>Monarda</i>	<i>citriodora</i>	<i>a</i>	Lamiaceae (Labiatae)	oregano
<i>Salvia</i>	<i>subincisa</i>		Lamiaceae (Labiatae)	Salvia
<i>Trichostema</i>	<i>arizonicum</i>		Lamiaceae (Labiatae)	bluecurls; Arizona blue curls
<i>Calochortus</i>	<i>ambiguus</i>		Liliaceae	sego lily
<i>Calochortus</i>	<i>kennedyi</i>		Liliaceae	mariposa lily
<i>Dichelostemma</i>	<i>pulchellum</i>		Liliaceae	blue dicks, covena
<i>Linum</i>	<i>puberulum</i>		Linaceae	orange flax
<i>Mentzelia</i>	<i>albicaulis</i>		Loasaceae	annual stickleaf
<i>Aspicarpa</i>	<i>hirtella</i>		Malpighiaceae	aspicarpa
<i>Anoda</i>	<i>cristata</i>		Malvaceae	cristate anoda
<i>Rhynchosida</i>	<i>physocalyx</i>		Malvaceae	tuberous side
<i>Sida</i>	<i>abutifolia</i>		Malvaceae	sida
<i>Sida</i>	<i>neomexicana</i>		Malvaceae	sida
<i>Sphaeralcea</i>	<i>angustifolia</i>	<i>cuspidata</i>	Malvaceae	globe mallow
<i>Mollugo</i>	<i>verticillata</i>		Molluginaceae	carpetweed
<i>Dasyilirion</i>	<i>wheeleri</i>		Nolinaceae	sotol
<i>Nolina</i>	<i>microcarpa</i>		Nolinaceae	beargrass
<i>Allionia</i>	<i>incarnata</i>		Nyctaginaceae	trailing 4 o'clock
<i>Boerhaavia</i>	<i>coccinea</i>		Nyctaginaceae	red spiderling
<i>Boerhaavia</i>	<i>coulteri</i>		Nyctaginaceae	Coulter spiderling
<i>Mirabilis</i>	<i>longiflora</i>		Nyctaginaceae	longtube 4 o'clock
<i>Fraxinus</i>	<i>velutina</i>		Oleaceae	Ash; Arizona ash
<i>Gaura</i>	<i>coccinea</i>		Onagraceae	scarlet gaura
<i>Gaura</i>	<i>parviflora</i>		Onagraceae	Gaura; smallflower gaura
<i>Oenothera</i>	<i>caespitosa</i>	<i>marginata</i>	Onagraceae	evening primrose
<i>Oenothera</i>	<i>rosea</i>		Onagraceae	evening primrose
<i>Oxalis</i>	<i>albicans</i>	<i>albicans</i>	Oxalidaceae	wood sorrel
<i>Argemone</i>	<i>pleiacantha</i>	<i>pleiacantha</i>	Papaveraceae	prickle poppy
<i>Proboscidea</i>	<i>parviflora</i>		Pedaliaceae	devil's claw; Unicorn plant
<i>Plantago</i>	<i>patagonica</i>		Plantaginaceae	Indian wheat
<i>Platanus</i>	<i>wrightii</i>		Platanaceae	Arizona sycamore
<i>Aristida</i>	<i>adscensionis</i>		Poaceae (Gramineae)	Sixweeks threeawn
<i>Aristida</i>	<i>divaricata</i>		Poaceae (Gramineae)	Poverty threeawn
<i>Aristida</i>	<i>orcuttiana</i>		Poaceae (Gramineae)	beggar tick threeawn
<i>Aristida</i>	<i>purpurea</i>	<i>longiseta</i>	Poaceae (Gramineae)	red threeawn
<i>Aristida</i>	<i>purpurea</i>	<i>nealleyi</i>	Poaceae (Gramineae)	blue threeawn
<i>Aristida</i>	<i>purpurea</i>	<i>parishii</i>	Poaceae (Gramineae)	Parish threeawn
<i>Aristida</i>	<i>purpurea</i>	<i>perplexa</i>	Poaceae	purple threeawn
<i>Aristida</i>	<i>ternipes</i>	<i>hamulosa</i>	Poaceae (Gramineae)	mesa threeawn
<i>Aristida</i>	<i>ternipes</i>		Poaceae (Gramineae)	Spider grass

<i>Bothriochloa</i>	<i>barbinodis</i>		Poaceae (Gramineae)	Cane beardgrass
<i>Bouteloua</i>	<i>aristoides</i>	<i>aristoides</i>	Poaceae (Gramineae)	Needle grama
<i>Bouteloua</i>	<i>barbata</i>		Poaceae	Six week grama
<i>Bouteloua</i>	<i>chondrosioides</i>		Poaceae (Gramineae)	Sprucetop grama
<i>Bouteloua</i>	<i>curtipendula</i>	<i>curtipendula</i>	Poaceae (Gramineae)	Sideoats grama
<i>Bouteloua</i>	<i>eludens</i>		Poaceae (Gramineae)	Santa Rita grama
<i>Bouteloua</i>	<i>eriopoda</i>		Poaceae (Gramineae)	black grama
<i>Bouteloua</i>	<i>gracilis</i>		Poaceae (Gramineae)	blue grama
<i>Bouteloua</i>	<i>hirsuta</i>	<i>hirsuta</i>	Poaceae (Gramineae)	hairy grama
<i>Bouteloua</i>	<i>radicosa</i>		Poaceae (Gramineae)	purple grama
<i>Bouteloua</i>	<i>repens</i>		Poaceae (Gramineae)	slender grama
<i>Bouteloua</i>	<i>rothrockii</i>		Poaceae	Rothrock grama
<i>Brachiaria</i>	<i>arizonica</i>		Poaceae (Gramineae)	Arizona panic
<i>Bromus</i>	<i>catharticus</i>		Poaceae (Gramineae)	rescue brome
<i>Cenchrus</i>	<i>caloinianus</i>		Poaceae (Gramineae)	field sandbur
<i>Chloris</i>	<i>virgata</i>		Poaceae (Gramineae)	feather fingergrass
<i>Cynodon</i>	<i>dactylon</i>		Poaceae (Gramineae)	Bermuda grass
<i>Digitaria</i>	<i>californica</i>		Poaceae (Gramineae)	Arizona cottontop
<i>Digitaria</i>	<i>cognata</i>	<i>pubiflora</i>	Poaceae (Gramineae)	Falls witchgrass
<i>Echinochloa</i>	<i>crus-galli</i>	<i>crus-galli</i>	Poaceae (Gramineae)	barnyard grass
<i>Elymus</i>	<i>canadensis</i>		Poaceae (Gramineae)	wild rye
<i>Elymus</i>	<i>elymoides</i>		Poaceae (Gramineae)	Squirreltail
<i>Elyonurus</i>	<i>barbiculmis</i>		Poaceae (Gramineae)	wooly bunchgrass
<i>Enneapogon</i>	<i>desvauxii</i>		Poaceae (Gramineae)	spike pappus grass
<i>Eragrostis</i>	<i>cilianensis</i>		Poaceae (Gramineae)	Stink grass
<i>Eragrostis</i>	<i>curvula</i>	<i>conferta</i>	Poaceae (Gramineae)	Boer lovegrass
<i>Eragrostis</i>	<i>intermedia</i>		Poaceae (Gramineae)	Plains lovegrass
<i>Eragrostis</i>	<i>lehmanniana</i>		Poaceae (Gramineae)	Lehmann lovegrass
<i>Eragrostis</i>	<i>pectinacea</i>	<i>miserrima</i>	Poaceae (Gramineae)	annual lovegrass
<i>Eragrostis</i>	<i>superba</i>		Poaceae	Wilman lovegrass
<i>Eriochloa</i>	<i>acuminata</i>		Poaceae (Gramineae)	Cup grass; SW cupgrass
<i>Erioneuron</i>	<i>pulchellum</i>		Poaceae (Gramineae)	fluffgrass
<i>Hackelochloa</i>	<i>granularis</i>		Poaceae (Gramineae)	hackelochloa
<i>Heteropogon</i>	<i>contortus</i>		Poaceae (Gramineae)	Tangle head
<i>Hilaria</i>	<i>belangeri</i>		Poaceae (Gramineae)	Curly mesquite
<i>Hilaria</i>	<i>mutica</i>		Poaceae (Gramineae)	tobosa
<i>Hordeum</i>	<i>arizonicum</i>		Poaceae (Gramineae)	little barley
<i>Hordeum</i>	<i>jubatum</i>	<i>jubatum</i>	Poaceae (Gramineae)	fox tail barley
<i>Leptochloa</i>	<i>dubia</i>		Poaceae (Gramineae)	Green sprangletop
<i>Leptochloa</i>	<i>fasicularis</i>		Poaceae	red sprangletop
<i>Leptochloa</i>	<i>uninervia</i>		Poaceae	Mexican sprangletop
<i>Lycurus</i>	<i>setosus</i>		Poaceae (Gramineae)	Wolftail
<i>Muhlenbergia</i>	<i>arizonica</i>		Poaceae (Gramineae)	Arizona muhly
<i>Muhlenbergia</i>	<i>emersleyi</i>		Poaceae (Gramineae)	bullgrass
<i>Muhlenbergia</i>	<i>fragilis</i>		Poaceae (Gramineae)	pull up muhly
<i>Muhlenbergia</i>	<i>repens</i>		Poaceae	mat muhly
<i>Muhlenbergia</i>	<i>rigens</i>		Poaceae (Gramineae)	deergrass
<i>Muhlenbergia</i>	<i>rigida</i>		Poaceae (Gramineae)	purple muhly
<i>Panicum</i>	<i>antidotale</i>		Poaceae (Gramineae)	Blue panicgrass; blue panic
<i>Panicum</i>	<i>bulbosum</i>		Poaceae (Gramineae)	bulb panic

<i>Panicum</i>	<i>hallii</i>		Poaceae (Gramineae)	Halls panic
<i>Panicum</i>	<i>hirticaule</i>		Poaceae (Gramineae)	witchgrass
<i>Panicum</i>	<i>obtusum</i>		Poaceae (Gramineae)	Vine mesquite
<i>Paspalum</i>	<i>dilatatum</i>		Poaceae (Gramineae)	dallis grass
<i>Paspalum</i>	<i>distichum</i>		Poaceae (Gramineae)	knotroot paspalum
<i>Phalaris</i>	<i>canariensis</i>		Poaceae (Gramineae)	Carolina canary grass
<i>Piptochaetium</i>	<i>fimbriatum</i>		Poaceae (Gramineae)	Pinyon ricegrass
<i>Polypogon</i>	<i>monspeliensis</i>		Poaceae (Gramineae)	rabbitfoot grass
<i>Schizachyrium</i>	<i>cirratum</i>		Poaceae (Gramineae)	Texas bluestem
				Yellow bristlegrass; annual
<i>Setaria</i>	<i>grisebachii</i>		Poaceae (Gramineae)	bristlegrass
<i>Setaria</i>	<i>leucopila</i>		Poaceae (Gramineae)	Plains bristlegrass
<i>Sorghum</i>	<i>halepense</i>		Poaceae (Gramineae)	Johnson grass
<i>Sporobolus</i>	<i>contractus</i>		Poaceae (Gramineae)	spike dropseed
<i>Sporobolus</i>	<i>cryptandrus</i>		Poaceae (Gramineae)	sand dropseed
<i>Sporobolus</i>	<i>wrightii</i>		Poaceae	sacaton; big sacaton; giant sacaton
<i>Stipa</i>	<i>neomexicana</i>		Poaceae (Gramineae)	New Mexico feather grass
<i>Trachypogon</i>	<i>secundus</i>		Poaceae (Gramineae)	crinkleawn
<i>Tridens</i>	<i>elongatus</i>		Poaceae	rough tridens
<i>Tridens</i>	<i>grandiflorus</i>		Poaceae	shortleaf tridens
<i>Tridens</i>	<i>muticus</i>	<i>muticus</i>	Poaceae (Gramineae)	slim tridens
<i>Vulpia</i>	<i>octoflora</i>		Poaceae (Gramineae)	six weeks fescue
<i>Eriastrum</i>	<i>diffusum</i>		Polemoniaceae	eriastrum
<i>Polygala</i>	<i>alba</i>		Polygalaceae	white milkwort
<i>Eriogonum</i>	<i>abertianum</i>		Polygonaceae	annual buckwheat
<i>Eriogonum</i>	<i>polycladon</i>		Polygonaceae	sorrel buckwheat
<i>Eriogonum</i>	<i>wrightii</i>		Polygonaceae	Shrubby buckwheat
<i>Polygonum</i>	<i>amphibium</i>	<i>emersum</i>	Polygonaceae	pond smartweed
<i>Rumex</i>	<i>crispus</i>		Polygonaceae	curly dock
<i>Portulaca</i>	<i>suffrutescens</i>		Portulacaceae	Portulaca
<i>Portulaca</i>	<i>umbraticola</i>		Portulacaceae	verdolaga
<i>Talinum</i>	<i>aurantiacum</i>		Portulacaceae	flame flower
<i>Talinum</i>	<i>paniculatum</i>		Portulacaceae	big talinum
<i>Androsace</i>	<i>occidentalis</i>		Primulaceae	rock jasmine
<i>Anemone</i>	<i>tuberosa</i>		Ranunculaceae	desert windflower
<i>Clematis</i>	<i>drummondii</i>		Ranunculaceae	virgin's bower
<i>Ceanothus</i>	<i>gregii</i>		Rhamnaceae	desert ceanothus
<i>Cerocarpus</i>	<i>montanus</i>		Rosaceae	mountain mahogany
<i>Purshia</i>	<i>stansburiana</i>		Rosaceae	cliffrose
<i>Galium</i>	<i>wrightii</i>		Rubiaceae	bedstraw
<i>Populus</i>	<i>fremontii</i>		Salicaceae	cottonwood
<i>Salix</i>	<i>exigua</i>		Salicaceae	coyote willow
<i>Salix</i>	<i>gooddingii</i>		Salicaceae	black willow
<i>Salix</i>	<i>taxifolia</i>		Salicaceae	yewleaf willow
<i>Sapindus</i>	<i>saponaria</i>	<i>drummondii</i>	Sapindaceae	western soapberry
<i>Castilleja</i>	<i>integra</i>		Scrophulariaceae	Indian paintbrush
<i>Datura</i>	<i>fexox</i>		Solanaceae	jimson weed
<i>Datura</i>	<i>wrightii</i>		Solanaceae	Thorn apple; sacred datura
<i>Physalis</i>	<i>hederaefolia</i>	<i>hederaefolia</i>	Solanaceae	ground cherry
<i>Solanum</i>	<i>elaeagnifolium</i>		Solanaceae	silverleaf nightshade

<i>Typha</i>	<i>latifolia</i>		Typhaceae	cattail
<i>Celtis</i>	<i>laevigata</i>	<i>reticulata</i>	<i>Ulmaceae</i>	netleaf hackberry
<i>Tetradlea</i>	<i>coulteri</i>		Verbenaceae	tetradlea
<i>Verbena</i>	<i>gracilis</i>		Verbenaceae	verbena
<i>Phoradendron</i>	<i>villosum</i>	<i>coryae</i>	Viscaceae	mistletoe
<i>Vitis</i>	<i>arizonica</i>		Vitaceae	canyon grape
<i>Kallestroemia</i>	<i>grandiflora</i>		Zygophyllaceae	summer poppy
<i>Kallestroemia</i>	<i>parviflora</i>		Zygophyllaceae	small flower summer poppy
<i>Juniperus</i>	<i>depeana</i>		Cupressaceae	Alligator Juniper;
<i>Ephedra</i>	<i>trifurca</i>		Ephedraceae	Mormon tea
<i>Pinus</i>	<i>cembroides</i>		Pinaceae	Mexican Pinyon
<i>Equisetum</i>	<i>laevigatum</i>		Equisetaceae	horsetail
<i>Astrolepis</i>	<i>cochisensis</i>		Pteridaceae	Jimmy fern
<i>Cheilanthes</i>	<i>fendleri</i>		Pteridaceae	lip fern
<i>Pellaea</i>	<i>atropurpurea</i>		Pteridaceae	cliff brake

Glossary

Alluvial fan. A low, outspread, relatively flat to gently sloping mass of alluvium, shaped like an open fan or a segment of a cone, deposited by a stream at the place where it issues from a narrow mountain valley upon a plain or broad valley, or where a tributary stream is near or at its junction with the main stream, or wherever a constriction in a valley abruptly ceases or the gradient of the stream suddenly decreases; it is steeper near the mouth of the valley where its apex points upstream, and it slopes gently and convexity outward with gradually decreasing gradient.

Argillic horizon. A subsurface horizon into which clay has moved. It has at about a third more clay than the horizons above. The presence's of clay films on ped faces and in the soil pores is evidences of clay movement.

Available water capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

The capacity, in a 60-inch profile or to a limiting layer is expressed as:

very low	0 to 3
low	3 to 6
moderate	6 to 9
high	9 to 12
very high	more than 12

Basin Floor. A general term for the nearly level to gently sloping, bottom surface of an intermountain basin (bolson). Component landforms include playas, broad alluvial flats containing ephemeral drainageways and relict alluvial and lacustrine surfaces that rarely if ever are subject to flooding. Where drainage systems are well-developed alluvial plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountain ward to distal parts of the piedmont slopes.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, diluted hydrochloric acid.

Calcic horizon. This is a horizon of calcium carbonate or calcium and magnesium carbonate accumulation. If the texture of the soil is greater than 18 percent clay the calcic horizon will be more than six inches thick and have more than 15 percent calcium carbonate equivalent and at least 5 percent calcium carbonate equivalent is required.

Calcium carbonate. Is used interchangeable with lime or limy.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil texture class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay films. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round mineral or rock particle 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobble. A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such intricate pattern or so small in area that it is not practical to map them separately at the select scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. The terms commonly used to describe consistence are:

- Loose - Noncoherent when dry or moist; does not hold together in a mass.
- Friable - When moist, crushes easily under gentle pressure between the thumb and forefinger and can be pressed together into a lump.
- Firm - When moist, crushes under moderate pressure between the thumb and forefinger, but resistance is distinctly noticeable.
- Plastic - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between the thumb and forefinger.
- Sticky - When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
- Hard - When dry, moderately resistant to pressure; can be broken with difficulty between the thumb and forefinger.
- Soft - when dry, breaks into powder or individual grains under very slight pressure.
- Cemented - Hard, little affect by moistening.

Depth classes. The depth to which the soil is classified.

Very deep	greater than 150 centimeters
Deep	100 to 150 centimeters
Moderately deep	50 to 100 centimeters
Shallow	25 to 50 centimeters
Very shallow	less to 25 centimeters

Drainage class. The relative wetness of the soil under natural conditions as it pertains to wetness due to a water table.

Excessively drained. Water is removed very rapidly. The occurrence of internally free water commonly is very rare or very deep. The soils are commonly coarse-textured.

Somewhat excessively drained. Water is removed from the soil rapidly. Internal free water occurrence commonly is very rare or very deep. The soils are commonly coarse-textured.

Well drained. Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep; annual duration is not specified. Water is available to plants throughout most of the growing season in humid regions.

Wetness does not inhibit growth of roots for significant periods during most growing seasons. The soils are mainly free of the deep to redoximorphic features that are related to wetness.

Moderately well drained. Water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory through permanent.

The soils are wet for only a short period of time within the rooting depth during the growing season,

but long enough that most mesophytic crops are affected.

Somewhat poorly drained. Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. The occurrence of internal free water commonly is

shallow to moderately deep and transitory to permanent. Wetness markedly restricts the growth of mesophytic crops, unless artificial drainage is provided.

Poorly drained. Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of

internal free water is shallow or very shallow and common or persistent. Freewater is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth.

Freewater at shallow depth is usually present.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or near the ground surface during much of the growing season. The occurrence of internal free water is very

shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops

cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is

high or nearly continuous, slope gradients may be greater.

Effervescence. In the field, cold 10 percent hydrochloric acid is used to test for carbonates. The amount and expression of effervescence is affected by size distribution and mineralogy as well as the amount of carbonates. Consequently, effervescence cannot be used to estimate the amount of carbonate. Four classes of effervescence are used:

noneffervescent- few to none bubbles seen

slightly effervescent -bubbles readily seen

strongly effervescent -bubbles form low foam

violently effervescent- thick foam forms quickly

Eluviation. The movement of materials in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fan Alluvium. Unconsolidated clastic materials deposited on alluvial fans and fan terraces by running water, including gravel, sand, silt, clay and various mixtures of these.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured soil. Sandy clay, silty clay, and clay.

Flooding Frequency Classes, None-No reasonable possibility of flooding (near 0 percent chance of flooding in any year). Rare-Flooding unlikely but possible under unusual weather conditions (from near 0 to 5 percent chance or near 0 to 5 times in 100 years). Occasional-Flooding is expected infrequently under usual weather conditions (5 to 50 percent chance of flooding or 5 to 50 times in 100 years). Frequent-Flooding is likely to occur often under usual weather conditions (more than a 50 percent chance of flooding or more than 50 times in 100 years). Common-Occasional and frequent classes can be grouped for certain purposes and called common flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon. An organic layer of fresh and decaying plant residue.

A horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon. The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon. The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky

structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon.

The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon. Soft, consolidated bedrock beneath the soil.

R layer. Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or B horizon.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Inclusions. Soil components or miscellaneous areas that are not identified in the named map unit. Many areas of these components are too small to be delineated separately or cannot be identified by practical field methods or are deliberately placed in map units to avoid excessive detail on the map or legends. These are two types of inclusions. Similar inclusions are the named components in characteristics and properties and have the same major interpretations. Contrasting inclusions differ appreciably in one or more properties and the differences generally are great enough to affect major interpretations.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Large stones. Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lime. Chemically, lime is calcium oxide but as the term is commonly used it is also calcium carbonate (CaCO_3) and calcium hydroxide ($\text{Ca}(\text{OH})_2$).

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Medium textured soil, Very fine sandy loam, loam, silt loam, or silt.

Moderately coarse textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Paleosols. Soils formed in past environments.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

	Inches per hour
Very slow	less than 0.06
Slow	0.06 to 0.2
Moderately slow	0.2 to 0.6
Moderate	0.6 inch to 2.0
Moderately rapid	2.0 to 6.0
Rapid	6.0 to 20
Very rapid	more than 20

Petrocalcic Horizon. A continuous or fractured, cemented or indurated calcic horizon cemented by carbonates and some silica. This is the same as a lime cemented hardpan or a cemented calcium carbonate hardpan.

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Potential rooting depth (effective rooting depth). The depth roots could penetrate or grow if the moisture in the soil were adequate. The soil has not properties restricting the penetration of roots to this depth.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.3 to 7.8
Moderately alkaline	7.8 to 8.4
Strongly alkaline	8.4 to 9.0
Very strongly alkaline	9.0 and higher

Relief. The elevations or inequalities of a land surface considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more, for example, gravel, cobble, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. Runoff of water from a soil is determined by the percent slopes and the hydrologic group.

Hydrologic group	Percent slope			
	0 - 3	3 - 15	15 - 30	30+
A	v. slow	v. slow	slow	slow
B	slow	medium	rapid	rapid

C	slow	medium	rapid	rapid
D	medium	med/rapid	v.rapid	v.rapid

Sand. A soil separate, individual rock or mineral fragments from 0.05 millimeters to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that has 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of rock are conglomerate, sandstone, limestone, and shale.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, building foundations, dams, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil texture class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal.

	Percent
Nearly level	0 to 3
Gently sloping or undulating	3 to 7
Strongly sloping or rolling	7 to 15
Moderately steep or hilly	15 to 25
Steep	25 to 55
Very steep	55+

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Stream alluvium. Unconsolidated clastic material deposited on stream terraces by running water, including gravel, sand, silt, clay and various mixtures of these.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former stage of erosion or deposition.

Structure, soil. The arrangement of primary soil particles into compounds or aggregates. The principal forms of soil structure are: platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (particles adhering with out any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, is the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, sandy clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse", "fine", or "very fine".

Water erosion classes. Water erosion is determined by the soil erodibility factor (K factor) of the soil's surface texture and percent slope. The K factor is a measure of the susceptibility of a soil to particle detachment and transport by rainfall. It is a quantitative value, experimentally determined.

K Factor	Percent slope			
	0-3	3-15	15-30	30+
0.02-0.20	slight	slight	moderate	severe
0.24-0.37	slight	moderate	severe	severe
0.43-0.69	moderate	severe	severe	v.severe

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes results in the disintegration and decomposition of the material.

Wind Erodibility Group. A wind erodibility group (WEG) is a collection of soils that have similar properties affecting their resistance to soil blowing. The groups indicate the susceptibility to blowing. The lower the number the more susceptible the soil is to wind erosion.

Erosion	WEG
very high	1
high	2
moderately high	3
moderate	4, 4L
slightly	5-7
very slightly	8