Silvopasture Tree Planting case study

Background

This case study was put together to help farmers considering silvopasture think about how to design and establish silvopasture on their farm.

In this example the farmer has roughly 120 acres of land in southwestern Wisconsin and plans to establish a cow-calf operation. The farm has some woods, but the main part of the farm is currently in annual crops and pasture. The farmer is interested in converting the cropland and possibly some of the pasture to silvopasture by planting trees to achieve the following goals:

- Provide shade for livestock
- Harvest timber in about 40 years
- Enhance aesthetics and wildlife habitat

The size, layout, soils, situation, and goals of each farm will be different. This case study is just one example, but all farms will have to answer the questions listed below in order to establish a silvopasture system that works for them.

Case study questions

What financial or technical assistance is available?

Where should the trees be planted? What should the spacing be within the row or patch and between rows or patches?

What species should be planted and where?

What site preparation is needed before planting the trees?

When should the trees be planted?

Where should the trees be sourced?

What forage / pasture species should be planted and when and how?

What management is needed after planting trees and forage?

- Tree protection?
- Weed management?
- Irrigation?
- Fertility management?

Other comments, questions, or suggestions:

A soil map is critical to choosing appropriate species of trees. One of the easiest ways to see which soils you have is a website called SoilWeb:

https://casoilresource.lawr.ucdavis.edu/gmap/

If you enter a street address the website will display that location. If you click on the map the site will show a menu on the left. Click on the menu tabs to find important information including:

- Soil type
- Farmland class
- Flooding frequency
- Drainage class
- Minimum Bedrock Depth
- Water Table Depth

The USDA also hosts a soil map website called Web Soil Survey. This site allows you to organize the information into a convenient packet for printing. You can also run custom reports about your soil's suitability for a number of crops and practices and calculate acreage of fields. It has a bit of a learning curve, but can be worth the effort. https://websoilsurvey.nrcs.usda.gov/

The soil map for this case study was generated on the USDA web soil survey site.

Sample answers for the case study questions follow the soil map. Descriptions of the soil types follow the sample answers.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for La Crosse County, Wisconsin

Tree Planting Case Study

July 9, 2018

Custom Soil Resource Report
Soil Map

Map Scale: 1:5,640 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: La Crosse County, Wisconsin
Survey Area Data: Version 16, Oct 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 15, 2012—Nov 28, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
233C	Boone sand, 6 to 15 percent slopes	3.9	3.3%
434B	Bilson sandy loam, 1 to 6 percent slopes	2.0	1.7%
501A	Finchford loamy sand, 0 to 3 percent slopes	2.9	2.5%
561F	Tarr sand, 15 to 60 percent slopes	23.5	20.1%
562B	Gosil loamy sand, 1 to 6 percent slopes	58.4	50.1%
562C	Gosil loamy sand, 6 to 12 percent slopes	18.7	16.1%
666A	Absco loamy sand, 0 to 3 percent slopes, occasionally flooded	1.3	1.2%
1233F	Boone-Tarr sands, 15 to 50 percent slopes	3.1	2.6%
2030	Udorthents and Udipsamments, cut or fill	2.7	2.3%
Totals for Area of Interest		**116.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different

management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Example case study answers:

What financial or technical assistance is available?

In Wisconsin and Minnesota NRCS offers EQIP financial assistance for a variety of practices that you may use while establishing silvopasture in cropland or pasture, including tree-planting, setting up managed grazing systems, windbreak establishment, and silvopasture. The funds available for specific practices vary by county and year. Work with your local NRCS office to find out what assistance is available in your area and what the application deadlines and requirements are. NRCS can also offer technical advice. Farms that receive NRCS financial assistance have to develop and follow a conservation plan or farm timber management plan.

If your farm qualifies for annual payments under the Conservation Stewardship Program, silvopasture may count as one or more enhancements, boosting the payment level. Check with your local NRCS office for details.

Some states also have grants or cost-share for tree-planting. Check with your state Department of Natural Resources and Department of Agriculture to see what assistance they can provide.

Where should the trees be planted? What should the spacing be within the row and between rows?

- Think about 3 different areas for planting: the crop field, the pasture, and the bays between the fingers of steep, wooded land.
- Don't put the whole farm in silvopasture. Start with an area and amount of trees you are confident you can manage for the first couple of years (irrigation, tree protection, and weed control).
- Usually people plant trees in rows in silvopasture systems because having rows facilitates management of both the young trees and of the forages growing in the alleys between the rows. Trees can be planted in single, double, or triple rows. Single rows take up less space, and open-grown trees in single rows tend to produce more nuts or fruit. It may also be easier to manage weeds in single rows. However, open-grown hardwoods generally have poor form for timber, with too many low branches and short trunks. If timber is an important goal, consider planting trees in patches rather than rows, or triple rows of trees with your timber species in the center row and faster growing species to provide shade and/or fruit or other products on the outer rows. Patches and triple rows will provide more wildlife habitat than single rows.
- On flatter cropland and pasture orient rows running north-south, so you get shade both in morning and afternoon, or southwest-northeast so the trees are less likely to block summer breezes. (If the slopes are steeper (>8% or C slopes) it may make sense to plant trees on contour and give them a keyline swale instead of planting north-south.)
- If winter shelter is a concern, consider an evergreen windbreak and shrubs along the northern boundary, or running in a southwest to northeast direction to slow cold northwesterly winter winds.
- On the fingers between the wooded areas maybe just plant a row along the northeast edge – if the existing trees on the slope don't already provide shade and shade is your primary goal.

- Leave enough space between rows and at row ends for your machinery to facilitate pasture establishment and management.
- Standard within-row spacing for trees is 8 to 12 feet. Some farmers plant trees closer together to allow for tree mortality. That decision depends on the cost of tree seedlings and your assessment of how much protection you will provide for the young trees (tree tubes, livestock exclusion, weed control, irrigation if needed). If you plant closer together you will have more of a buffer against some tree mortality, but you will also probably have to thin your trees sooner. Spacing between multiple rows is also typically 8 to 12 feet. Allow for access of equipment for mowing and irrigation, as well as good grass growth, between tree rows.
- You can use patch tree planting instead of single trees or rows. Patches are better for timber production, provide less shade per tree, and block wind more than single rows. Blocking wind is good for winter shelter but reduces summer cooling effect.

What species should be planted and where?

- It is unrealistic to expect to harvest high timber value trees 40 years after planting in Wisconsin. Time from planting to harvest for black walnut in Wisconsin ranges from 60 to 100 years, depending on the site quality and management of the trees. Other high value timber species such as oak and maple can take even longer to reach harvestable size, again depending on site quality.
- Black walnut is often a good silvopasture species, with diffuse shade and high timber value, but it normally prefers rich soils and this site has sandy soils. Oaks are high timber value species that will grow on sandy soils, but white, black, and bur oak, which tolerate sandy soils, do not grow fast.
- For rapid shade plant a fast-growing species like a white pine or aspen (poplar). Those species currently have no timber value in southern Wisconsin and Minnesota. Poplars cast a light shade and do not live very long, so they can provide shade while you wait for a slower-growing timber tree to grow.
- The Wisconsin DNR catalog has brief notes on site suitability for the tree species they sell, https://dnr.wi.gov/topic/TreePlanting/documents/WisconsinStateNurseryCatalog.pdf
- When thinking about the potential market value of tree species keep in mind that the market for lumber and pulpwood is variable by region and over time. It is possible that trees that have little or no market value now may have a market in 60 years; it is also possible that woods that are currently favored will be less fashionable.
- Fruit-bearing trees or shrubs may provide mast for livestock or wildlife or a marketable crop. Be aware of food safety regulations if you plan to sell fruit or nuts from trees grown in areas with livestock access. http://labs.russell.wisc.edu/farmfoodsafety/food-safety-modernization-act/ https://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm253380.htm#guidance
- Chestnuts (Chinese/American hybrid) produce a high-value nut crop, but not timber. Processing and marketing can be a challenge for unusual crops such as chestnuts.
- Box Elders can be used as fodder and are fast growing, but have shallow roots. Mulberry and poplar leaves can also be used as forage. White mulberry is an invasive species, so avoid planting it in areas where it is not already present. Red mulberry is a native species but may be more difficult to purchase. Sugar maple and silver maple sap has high sugar

content, and these trees can be used for syrup production. The timber value of sugar maples may be reduced by syrup tapping and open growth form.
- Successive tree plantings with different canopy layers; or mixing shrubs, evergreens, and hardwoods may allow you to achieve multiple goals with your tree plantings, but multiple species also require more management, and fast-growing species may shade out slower-growing trees.

What site preparation is needed before planting the trees?

- If there is a compaction layer in the soils use a subsoiler to break up the compaction in the rows to be planted with trees. Do not plant trees in the slot made by the subsoiler – the roots will dry out too quickly.
    - Consider a year of annual cover crops to break up existing compaction layers.
- Know the site's herbicide history, and check that there are not herbicide residuals that will damage tree seedlings.
- Need to control weeds within 3 feet of each tree and erosion in the tree row. Consider using a cover crop to create a mulch that will keep down weeds and erosion. Type of cover crop will depend on timing of tree planting. Oats or other small grains that will winter-kill can be planted the summer before a spring tree planting. Cereal rye can be planted in the fall and crimped at the beginning of anthesis (flowering) in late spring to provide erosion and weed control for fall tree plantings. A smother crop like prostrate birds-foot trefoil planted together with oats may continue to provide weed control after planting. (If planting trees in existing pasture use tillage or herbicide to kill the grass in the row where trees will be planted. If using an herbicide build in an appropriate time before planting trees for the herbicide to break down.)
- Test soils and amend as recommended for pasture establishment https://learningstore.uwex.edu/Assets/pdfs/A4034.pdf

When should the trees be planted?

Plant trees in fall (September until ground freezes) or early to mid spring (April to mid May). Check with your tree source when the trees are available.

Where should the trees be sourced?

- DNR tree nursery – low cost per tree, minimum order size around 250 trees and/or shrubs, may have package orders such as "savanna package" available
- Commercial nursery that works with your area – high cost per tree; usually no minimum order; may have older, bigger trees available
- Savanna Institute bulk-buying program – minimum order size around 25 trees, specialize in agroforestry species that produce edible fruits and nuts
- Your local conservation district may also run a tree sale program

How should trees be planted?

- If you are planting a lot of trees it may be worthwhile to rent a mechanical tree-planter. Check with your local conservation district or forester for availability.
- For hand planting instructions see page 77 of *Perennial Pathways: Planting Tree Crops* http://www.savannainstitute.org/resources.html

What forage / pasture species should be planted and when and how?

- Select the forage species that are suited for your soils, livestock, and management. If you have spaced your rows to allow machinery access it will take at least ten years before the trees provide enough shade to affect forage growth. https://fyi.uwex.edu/grazres/legumes/
- Follow local recommendations for establishing pasture. Check with your local Extension and NRCS office for guidance. https://fyi.uwex.edu/grazres/establishment-improvement/
- Do not plant perennial forages in rows where trees will be planted. Use annual cover crops in those strips until ready to plant trees. https://fyi.uwex.edu/grazres/cover-crops-annual-forages/
- Planting a mix of species, including both grasses and legumes, will provide resilience and reduce the need for nitrogen fertilization.

What management is needed after planting trees and forage?

- Tree protection?

Trees need protection both from livestock and from wildlife until the trunk is sturdy enough to withstand rubbing (2 to 3 inches diameter at breast height depending on livestock) and the canopy is high enough to escape browsing (above 5 feet for cattle and deer).

  - Electric fence provides the best protection for young trees from livestock when trees are planted in rows. Place electric wire far enough from the young trees that livestock cannot browse the leaves.
  - Sturdy 5-foot tree tubes plus stakes can offer protection from deer and smaller livestock such as sheep.
  - Sturdy barriers around individual trees can be used for smaller numbers of trees, but are cost- and labor- prohibitive for large numbers of planted trees.
  - If tree tubes have good soil contact they may provide protection from rodents, but if there is a gap between the soil and bottom of the tree tube it may attract rodent damage.
  - Move grazing livestock frequently.

- Weed management?
  - Remove grass, weeds, and other competing vegetation from tree rows before planting (see discussion of site preparation above).
  - Use a combination of mulch, mowing, and/or herbicide to control competition from weeds in the tree row for at least 2 years after planting. After two years weed control may not be necessary for tree survival but will speed growth.

        - Mulches can be living mulches (low-growing, non-competitive species such as white clover or prostrate birdsfoot trefoil);
        - organic mulches such as wood chips, straw, or hay; or
        - black plastic or landscape fabric. You may be able to re-use black plastic from vegetable farms.
        - Organic mulches may provide cover for rodents, so protecting the base of the tree from rodent damage is especially important if you rely on an organic mulch for weed control.
    - You may be able to place electric fence so that it permits grazing in the tree row but prevents livestock from browsing, trampling, or rubbing young trees.
    - Manage weeds in the pasture by timing, duration, and intensity of grazing and by clipping if needed.

- Irrigation?

Spring and fall times for tree planting are recommended in part to increase the likelihood that there will be sufficient soil moisture for the young tree. However, the weather does not always cooperate, and you should have a plan for irrigating the young trees if necessary. If you get less than an inch of precipitation per week check if the soil near the planted trees feels dry more than 2 inches below the soil surface. If so, water or irrigate. If your soils are very well drained (sandy), like the soils on this site, you should check if you get less than 1.5 inches of precipitation per week.

- Fertility management?

Trees for shade or wood production usually do not receive supplemental fertility. If growing fruit trees or shrubs, follow fertility guidance for those species. Follow recommendations for maintaining pH and fertility in the grass portion of the pasture
https://learningstore.uwex.edu/Assets/pdfs/A4034.pdf

Don't put fertilizer or compost in the hole before planting trees; make trees work for nutrients, don't coddle them at this stage.

For more information check out these resources:

Perennial Pathways: Planting Tree Crops at http://www.savannainstitute.org/resources.html provides more detail on the questions discussed above, including site preparation and management after tree planting.

Silvopasture design overview at http://www.centerforagroforestry.org/academy/2015/chp4-Silvopasture_2015.pdf

Minnesota guide to ***Silvopasture Establishment And Management Principles*** at https://www.lccmr.leg.mn/projects/2013/finals/2013_03j_Silvopasture_BMP.pdf

Economic information on some agroforestry practices is available at the University of Missouri Center for Agroforestry website http://www.centerforagroforestry.org/profit/

From A Pasture to A Silvopasture System at
https://www.fs.usda.gov/nac/documents/agroforestrynotes/an22s04.pdf

General silvopasture information on the National Agroforestry Center website. More oriented toward the southern US https://www.fs.usda.gov/nac/practices/silvopasture.shtml

La Crosse County, Wisconsin

233C—Boone sand, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1lmwx
Elevation: 700 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Boone and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy slope alluvium over siliceous sandy residuum weathered from sandstone

Typical profile

Ap - 0 to 8 inches: sand
Bw - 8 to 21 inches: sand
C - 21 to 35 inches: sand
Cr - 35 to 60 inches: weathered bedrock

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: About 35 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained (G105XY002WI)
Hydric soil rating: No

Minor Components

Tarr

Percent of map unit: 3 percent

Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Elevasil

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

434B—Bilson sandy loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1lmxh
Elevation: 680 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Bilson and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bilson

Setting

Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium over stratified sandy and loamy alluvium

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 32 inches: sandy loam
2C1 - 32 to 38 inches: stratified sand to loamy sand
2C2 - 38 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Forage suitability group: Mod AWC, adequately drained (G105XY005WI)
Hydric soil rating: No

Minor Components

Elevasil

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Bilmod

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Merimod

Percent of map unit: 2 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Gosil

Percent of map unit: 2 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

501A—Finchford loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2v3g8
Elevation: 560 to 790 feet

Mean annual precipitation: 31 to 39 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 120 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Finchford and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finchford

Setting

Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 8 inches: loamy sand
A1 - 8 to 15 inches: loamy sand
A2 - 15 to 19 inches: loamy sand
Bw - 19 to 26 inches: sand
C - 26 to 79 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained (G105XY002WI)
Hydric soil rating: No

Minor Components

Rasset, acid

Percent of map unit: 3 percent
Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Komro, acid

Percent of map unit: 2 percent
Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Prissel

Percent of map unit: 1 percent
Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sparta

Percent of map unit: 1 percent
Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

561F—Tarr sand, 15 to 60 percent slopes

Map Unit Setting

National map unit symbol: 1lmy0
Elevation: 700 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Tarr and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tarr

Setting

Landform: Pediments
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy slope alluvium over sandy residuum

Typical profile

Oe,A - 0 to 6 inches: sand
Bw1, Bw2 - 6 to 34 inches: sand
C - 34 to 62 inches: sand

Properties and qualities

Slope: 15 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained with limitations (G105XY003WI)
Hydric soil rating: No

Minor Components

Boone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Absco

Percent of map unit: 5 percent
Landform: Flats on flood plains, natural levees on flood plains
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

562B—Gosil loamy sand, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1lmy1
Elevation: 680 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Gosil and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gosil

Setting

Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy pedisediment over sandy residuum

Typical profile

Ap - 0 to 9 inches: loamy sand
Bw - 9 to 23 inches: loamy sand
BC - 23 to 27 inches: sand
C - 27 to 60 inches: stratified sand to loamy fine sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained (G105XY002WI)
Hydric soil rating: No

Minor Components

Bilson

Percent of map unit: 3 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Tarr

Percent of map unit: 2 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear

Hydric soil rating: No

562C—Gosil loamy sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 1lmy2
Elevation: 680 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Gosil and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gosil

Setting

Landform: Pediments
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy pedisediment over sandy residuum

Typical profile

Ap - 0 to 9 inches: loamy sand
Bw - 9 to 23 inches: loamy sand
BC - 23 to 27 inches: sand
C - 27 to 60 inches: stratified sand to loamy fine sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained (G105XY002WI)
Hydric soil rating: No

Minor Components

Bilson

Percent of map unit: 3 percent
Landform: Pediments
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Tarr

Percent of map unit: 2 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

666A—Absco loamy sand, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 1lmyj
Elevation: 680 to 1,400 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Absco and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Absco

Setting

Landform: Flats on flood plains, natural levees on flood plains
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Sandy and loamy alluvium

Typical profile

A - 0 to 4 inches: loamy sand
Bw - 4 to 14 inches: sand
C - 14 to 60 inches: stratified sand to loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained (G105XY002WI)
Hydric soil rating: No

Minor Components

Newlang
Percent of map unit: 3 percent
Landform: Depressions on flood plains, drainageways on flood plains
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Northbend
Percent of map unit: 3 percent
Landform: Flats on flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Ettrick, shallow
Percent of map unit: 2 percent
Landform: Depressions, drainageways
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Tarr
Percent of map unit: 2 percent
Landform: Pediments
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

1233F—Boone-Tarr sands, 15 to 50 percent slopes

Map Unit Setting
National map unit symbol: 1lmyt
Elevation: 700 to 1,400 feet
Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Boone and similar soils: 55 percent
Tarr and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy slope alluvium over sandy residuum

Typical profile

Oe,A - 0 to 3 inches: sand
E,Bw - 3 to 21 inches: sand
C - 21 to 35 inches: sand
Cr - 35 to 60 inches: weathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: About 35 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained with limitations (G105XY003WI)
Hydric soil rating: No

Description of Tarr

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy slope alluvium over sandy residuum

Typical profile

Oe,A - 0 to 6 inches: sand
Bw1, Bw2 - 6 to 34 inches: sand

C - 34 to 62 inches: sand

Properties and qualities

Slope: 15 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Forage suitability group: Low AWC, adequately drained with limitations (G105XY003WI)
Hydric soil rating: No

Minor Components

Elevasil

Percent of map unit: 13 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Rock outcrop, sandstone

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

2030—Udorthents and Udipsamments, cut or fill

Map Unit Composition

Udipsamments, cut or fill, and similar soils: 50 percent
Udorthents, cut or fill, and similar soils: 50 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udipsamments, Cut Or Fill

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Udorthents, Cut Or Fill

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None