Soil Series and Soil Texture Class

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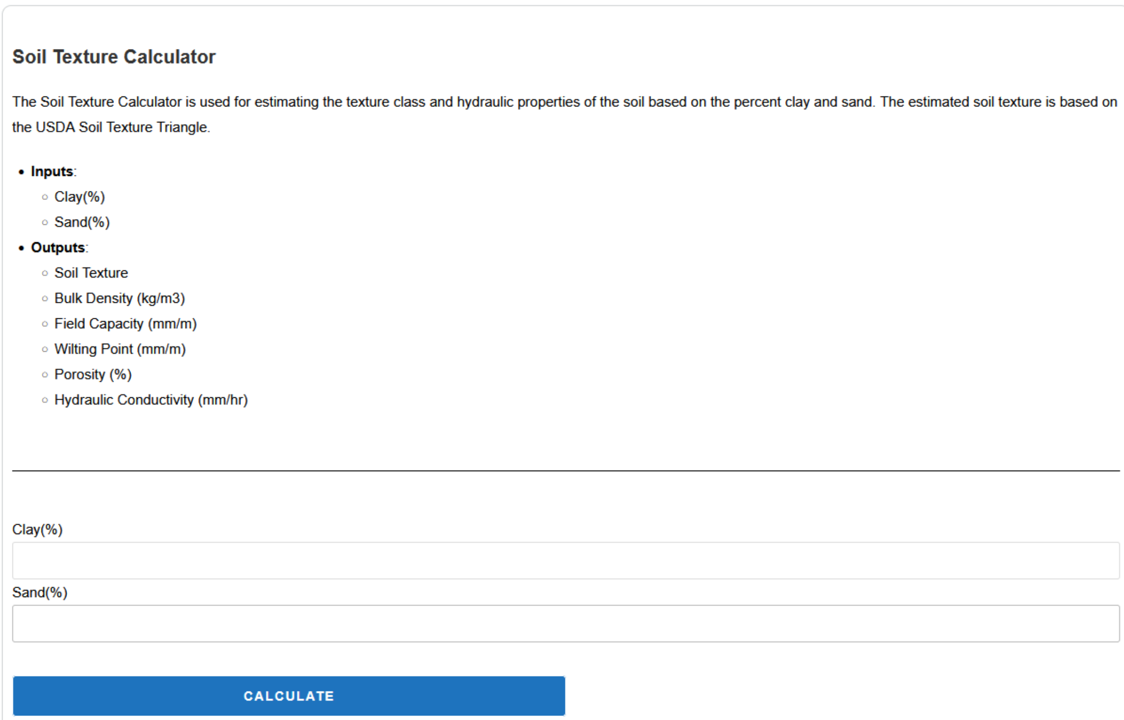
1. Soil Sample

Navigate to the Soil Texture Calculator using the provided link, which can also be found on Canvas.

1.1 Soil Texture Calculator

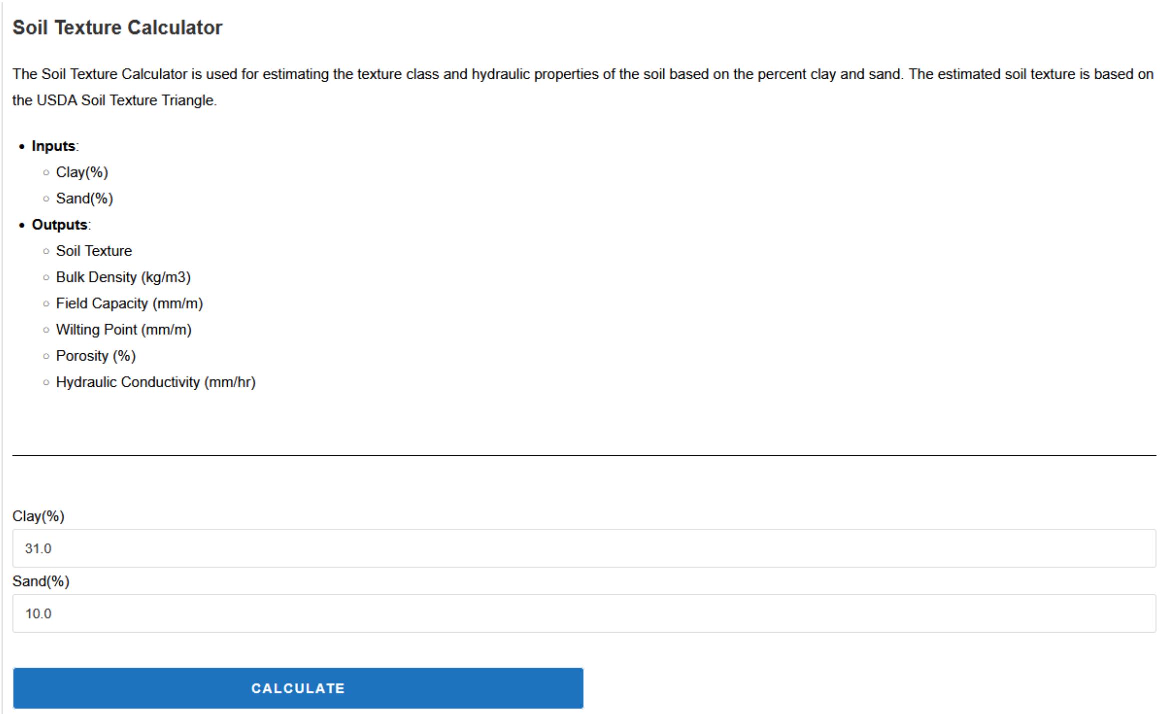


Using a sample provided, input the clay and sand percentage found on the label placed inside the bag into the Soil Texture Calculator and click the blue “CALCULATE” button.

Silty Clay Loam
Sand – Silt – Clay
10 59 31

Figure 1. Example of soil sample label showing measured percent volume for sand, silt, and clay, along with the associated soil texture class for that combination of particle size fractions.

1.2 Input Labeled Percentages



Soil Texture Calculator

The Soil Texture Calculator is used for estimating the texture class and hydraulic properties of the soil based on the percent clay and sand. The estimated soil texture is based on the USDA Soil Texture Triangle.

- **Inputs**:
  - Clay(%)
  - Sand(%)
- **Outputs**:
  - Soil Texture
  - Bulk Density (kg/m3)
  - Field Capacity (mm/m)
  - Wilting Point (mm/m)
  - Porosity (%)
  - Hydraulic Conductivity (mm/hr)

Clay(%)

31.0

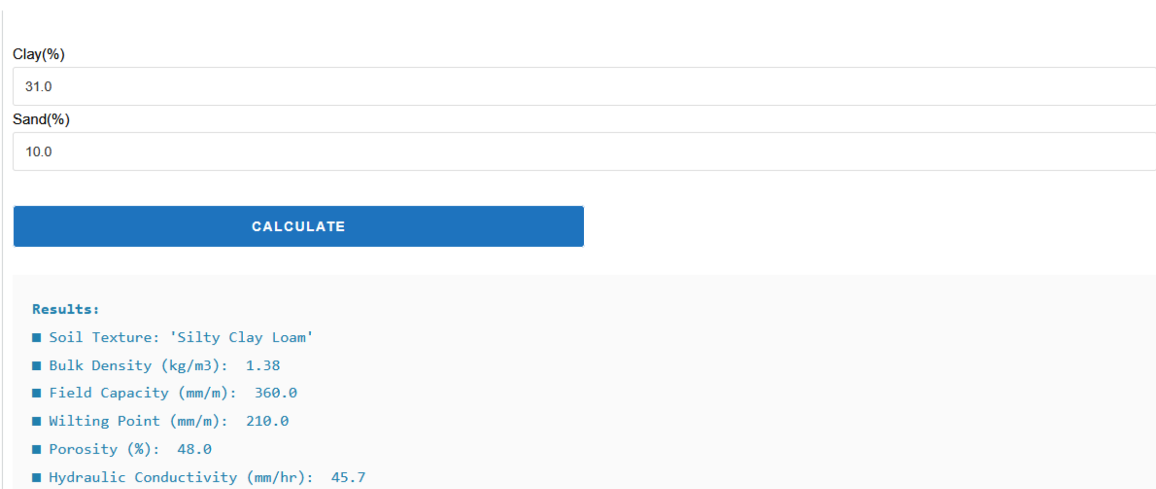
Sand(%)

10.0

CALCULATE

Figure 2. Screenshot of Soil Texture Calculator webpage. You only need to enter the percent volume for clay and silt.

After the calculator processes the information, the output will be shown below the "CALCULATE" button, displaying the Soil Texture Class, Bulk Density, Field Capacity, Wilting Point, Porosity, and Hydraulic Conductivity.



Clay(%)

31.0

Sand(%)

10.0

CALCULATE

```
Results:
■ Soil Texture: 'Silty Clay Loam'
■ Bulk Density (kg/m3):  1.38
■ Field Capacity (mm/m):  360.0
■ Wilting Point (mm/m):  210.0
■ Porosity (%):  48.0
■ Hydraulic Conductivity (mm/hr):  45.7
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Figure 3. Example of Soil Texture Calculator output with soil texture class and pedotransfer functions for dependent soil properties. A pedotransfer function is an equation that calculates a soil property based on measurements that are easier to collect.

2. Soil Survey Data

Using the [SoilWeb KML] file from Activity 1 in Google Earth Pro, find a few different soil profiles you might interact with, either different areas on campus, where you grew up, or just an area of the United States you are curious about.

Look at the information available as you click on different map units by clicking on the delineated polygons (yellow outlines). As you click on different map units, try to think about what the satellite image underneath indicates to you about the landscape position of the soil and the land use. Note how the different soil series vary in texture class (embedded in the map unit description between the soil series name and the percent slope) and in the colors of the representative soil profile diagram.

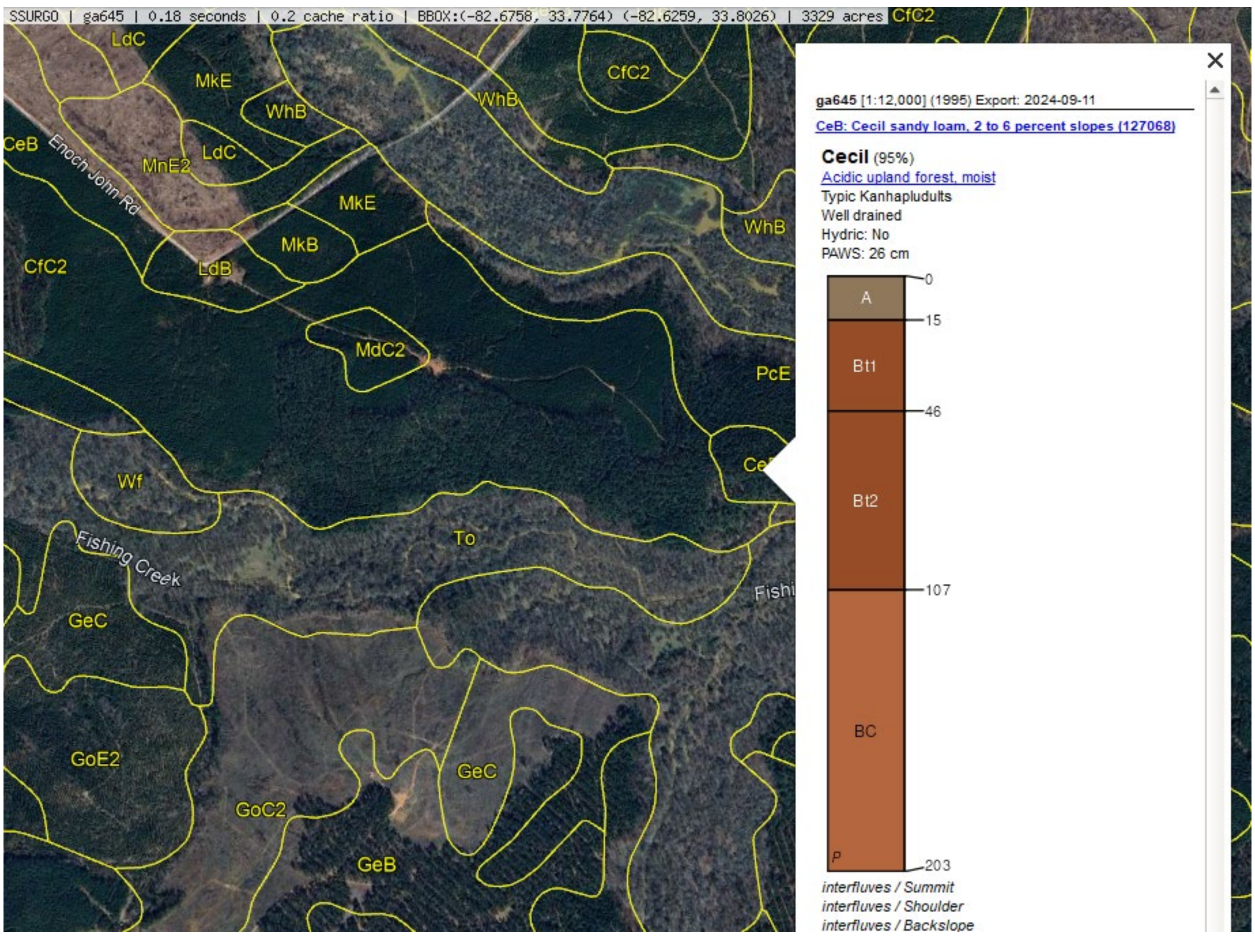


Figure 4. Cecil soil series selected in SoilWeb for Google Earth.

Now, let's pay more attention to the information underneath the soil series name. In the example provided in Fig. 4, we're looking at the information under "Cecil (95%)." "Cecil appears in the map unit name above, but a map unit is known to likely contain other soil series. In the example provided, the Cecil soil series is thought to make up 95% of the map unit called "CeB." Many of the map units in the area you chose to explore may have four or more soil series.

Observe the information underneath the different soil series names.

- Do you recognize the USDA Soil Taxonomy? What soil order is the soil you are looking at? [Hint: In Fig. 4, the Soil Taxonomy description is "Typic Kanhapludults." The suffix "ults" tells us that soil is an Ultisol.]
- Do you recognize the letters on the example soil profile? Do you know what they mean?

Now click on the link (shown in blue) under the soil series name. Note that the top link for the map unit is not currently working. After a few seconds of loading, an information page about that soil series will appear. Explore the tabs on the left to see the connections between your soil series and the combination of climate, ecosystem, topography, and geology.

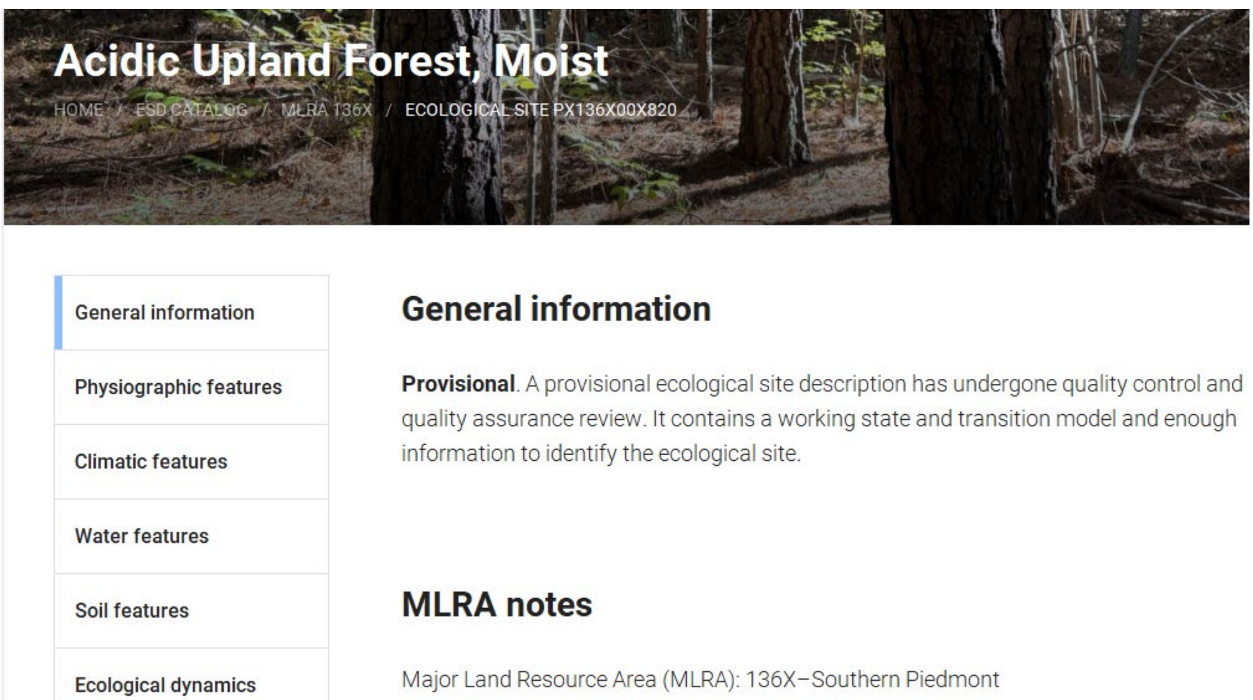


Figure 5. Excerpt from information that pops up when clicking on the description link under the soil series name in SoilWeb for Google Earth. Note the buttons on the left for different information categories.

Go back to Google Earth using the button in the upper right corner of the main pane 

. Then click on your map unit of interest again. This time, click somewhere on the soil profile diagram.

This will pull up the Soil Data Explorer (Fig. 7), which contains the ranges of soil properties measured on instances of the soil series. The pedon graphs show how soil properties change with depth. The dark blue line is the mean of soil properties measured at that depth, and the light blue shading shows the range of that soil property measured at that depth.

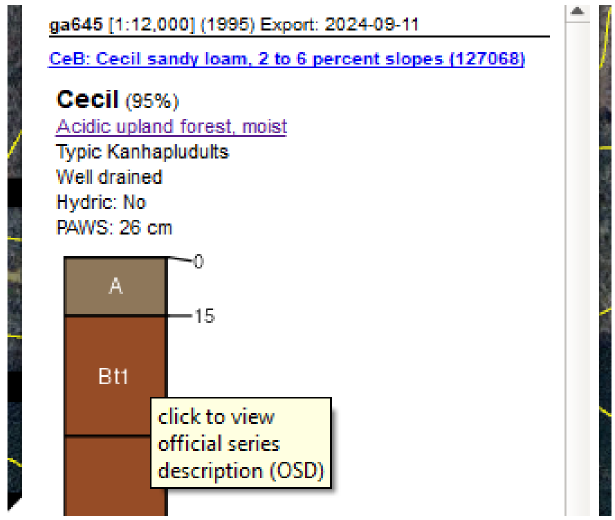
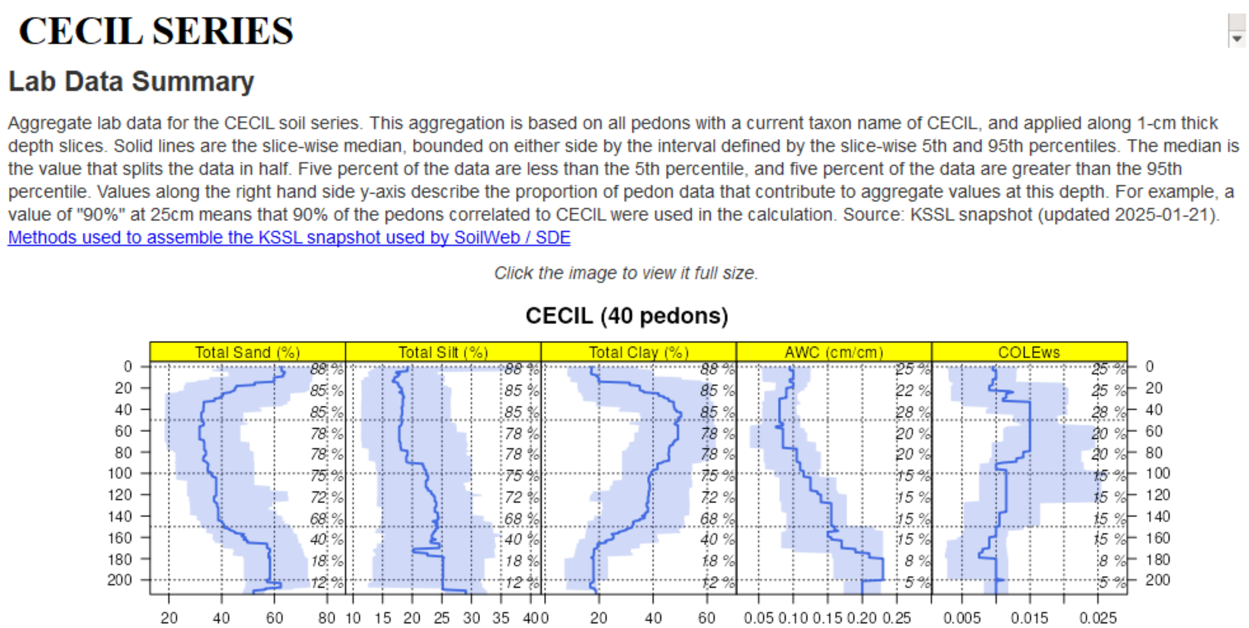


Figure 6. If you hover your cursor over the profile diagram, a pop-up appears telling you to click on it for the official soil series description. Doing this will also pull up the Soil Data Explorer.



CECIL SERIES

Lab Data Summary

Aggregate lab data for the CECIL soil series. This aggregation is based on all pedons with a current taxon name of CECIL, and applied along 1-cm thick depth slices. Solid lines are the slice-wise median, bounded on either side by the interval defined by the slice-wise 5th and 95th percentiles. The median is the value that splits the data in half. Five percent of the data are less than the 5th percentile, and five percent of the data are greater than the 95th percentile. Values along the right hand side y-axis describe the proportion of pedon data that contribute to aggregate values at this depth. For example, a value of "90%" at 25cm means that 90% of the pedons correlated to CECIL were used in the calculation. Source: KSSL snapshot (updated 2025-01-21).
Methods used to assemble the KSSL snapshot used by SoilWeb / SDE

Click the image to view it full size.

Figure 7. Soil Data Explorer screen for the Cecil soil series. Soil properties are highlighted in yellow on the graph headers, the depth in centimeters is marked on the y-axis, and the soil property values are on the x-axis.

Input a few of the volume percent values for particle size fractions (i.e., clay, silt, sand) at matching depths into the Soil Texture Calculator to see the variation in texture class and hydrologic properties as you move vertically along the soil profile. Then try this with other soil series in the area to see how they vary.

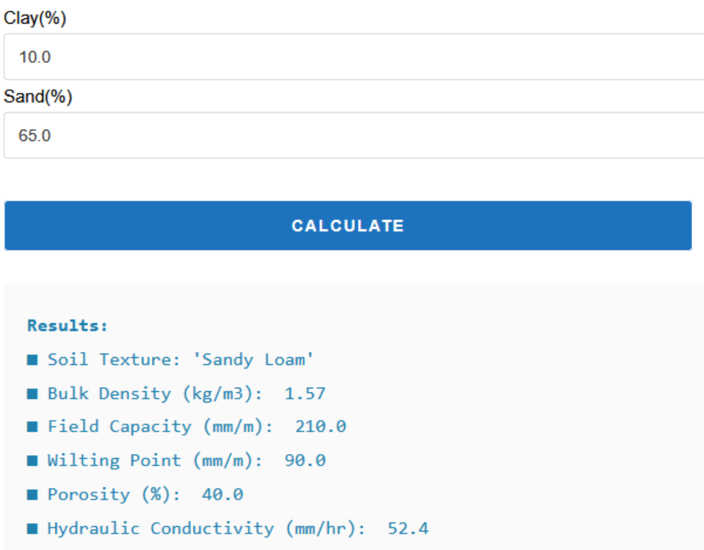


Figure 8. Soil texture class and hydrologic properties calculated from the percent volume values for particle size fractions observed in the Ap horizon of the Cecil soil series.

2.1 Cecil Series Bt1 Horizon Output

Figure 9. For comparison, soil texture class and hydrologic properties calculated from the percent volume values for particle size fractions observed in the Bt1 horizon of the Cecil soil series.

3. Water Availability in Different Ecosystems

Evapotranspiration (ET) can be used as an indirect measure of productivity. ET is driven by plant activity (transpiration) and atmospheric demand (evaporation). ET often correlates with net primary productivity (NPP), a term you may have seen in a biology course. High ET in a vegetated area usually indicates high plant activity and vice versa.

However, note that this is an imperfect relationship, as atmospheric demand is part of ET but is not part of plant productivity. Also, deep-rooted perennials and shallow-rooted annuals may have different ET profiles despite similar productivity. In other words, as we focus on how the soil affects water availability to plants, there are other factors – such as plant adaptations – that interact with the connections between water availability and plant productivity.

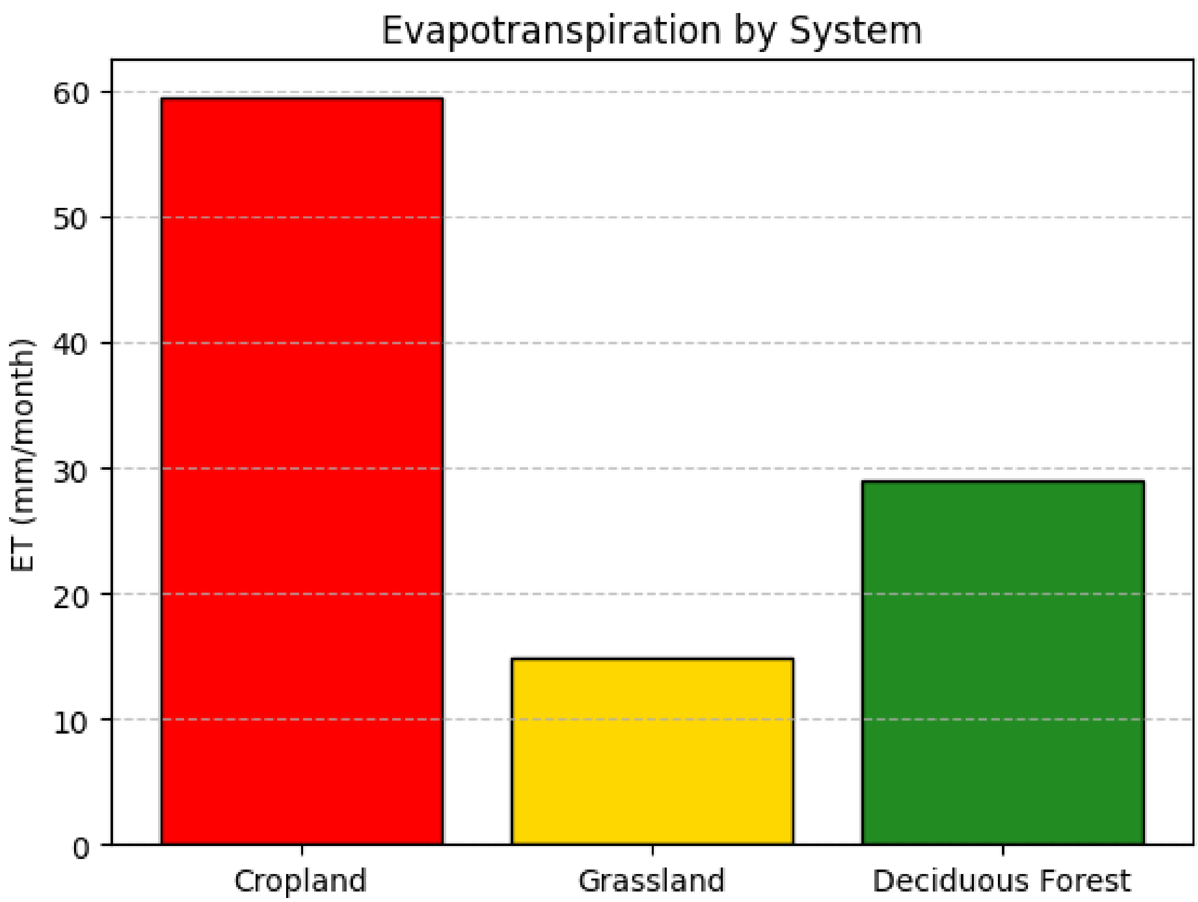


Figure 10. Comparison of evapotranspiration (ET) rates (mm water/month) in different ecosystem types. Showing the speed at which water leaves a system based on the type of plants in the area, assuming average temperatures and precipitation for Ames, Iowa, in July.

In the following graphs, notice that the monthly water balance of the different ecosystems remains the same, but the wilting point threshold shifts between the soil texture classes. Because the wilting point is the minimum soil moisture level at which plants can extract water, plants must go dormant or die when the available water goes below that threshold. In the plots below, the evapotranspiration is subtracted from the monthly precipitation to compare the water left in the system (soil) to the wilting point of each texture class.

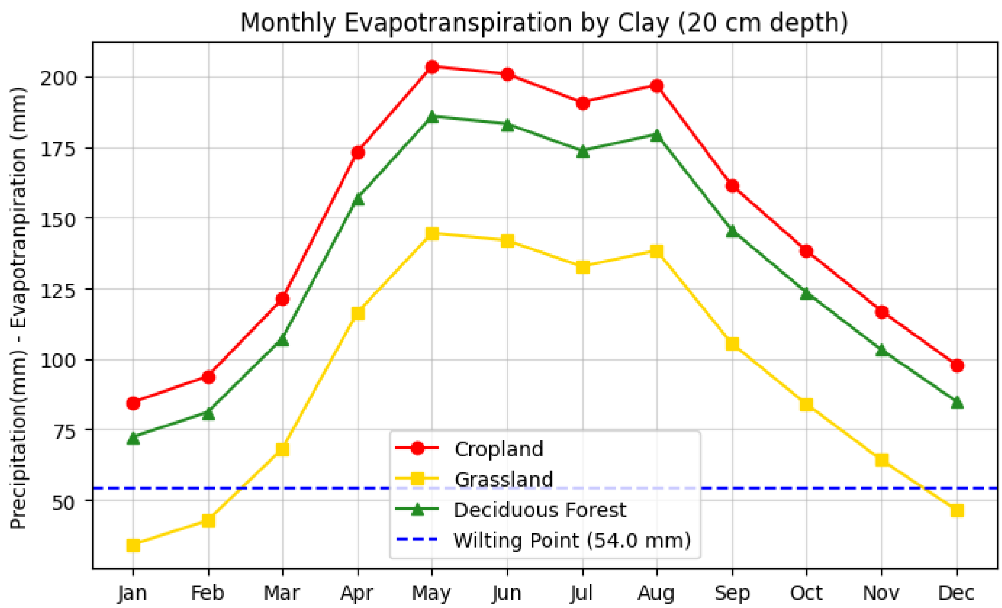


Figure 11. Long-term water balance in a clay-textured soil, plotting the remainder of water in the system (monthly precipitation – monthly evapotranspiration), assuming only water loss is from evapotranspiration and only water gain is from precipitation, using mean temperature and precipitation in Ames, Iowa. The threshold line indicates the wilting point.

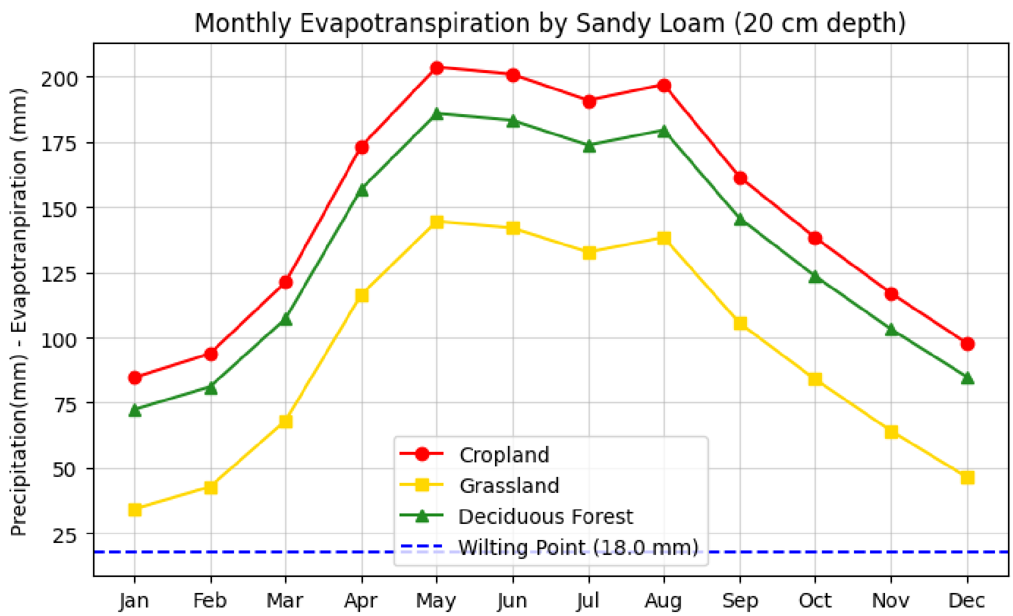


Figure 12. Long-term water balance in a sandy loam-textured soil, plotting the remainder of water in the system (monthly precipitation – monthly evapotranspiration), assuming only water loss is from evapotranspiration and only water gain is from precipitation, using mean temperature and precipitation in Ames, Iowa. The threshold line indicates the wilting point.

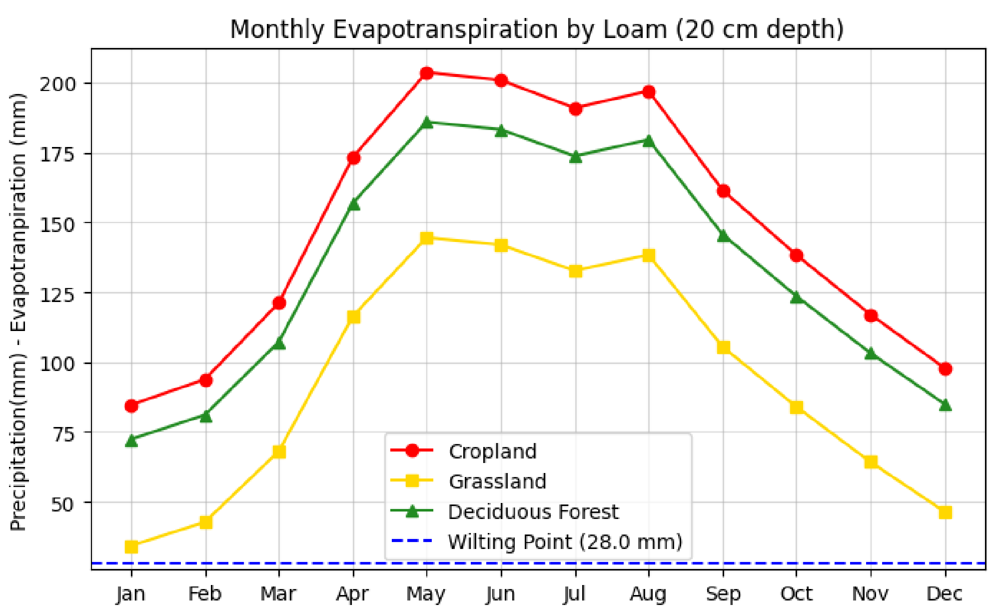


Figure 13. Long-term water balance in a loam-textured soil, plotting the remainder of water in the system (monthly precipitation – monthly evapotranspiration), assuming only water loss is from evapotranspiration and only water gain is from precipitation, using mean temperature and precipitation in Ames, Iowa. The threshold line indicates the wilting point.