## How to Read the South Plains Evapotranspiration Information

Climate and Evapotranspiration (ET) data for the South Plains ET Network are presented in two formats for the convenience of our users. A cumulative data format and a daily output format are easily accessed by "clicking" on the format of choice.

The cumulative file contains daily data since the beginning of the year; this is primarily for users who are applying the data in models (such as irrigation scheduling models) and in various research applications in which the relatively long- term data are preferred. The cumulative file follows the format familiar to users of the Achilleus web site (former home of the South Plains ET Network).

The daily output file provides more detailed information for a 3-7 day period. This format follows the presentation of the North Plains ET Network, and is presented to "stand alone", providing ET information by crop and by planting date. This format essentially eliminates the need for the user to apply crop coefficients and models to estimate irrigation requirements for a given crop, since these steps have been applied in processing the data for the output file.

Data presented in the files include:

Daily Maximum Air Temperature and Daily Minimum Air Temperature
Soil Temperatures at 2 inch depth and 6 inch depths
Heat Unit (Growing Degree Day) accumulation for major crops grown in the region
Precipitation
Average wind speed and direction
Reference Crop Evapotranspiration (ETo, formerly presented as PET*)

The daily output format also presents accumulated Growing Degree Days (GDD) and crop-specific ET for major crops. Crop ET values are presented for 1-day, 3-day, and 7-day averages (expressed in inches per day) for each crop, according to planting date and estimated growth stage. Seasonal cumulative crop water use is also indicated.

** Potential Evapotranspiration (PET) and Reference Evapotranspiration (ETr or ETo) are the same value - an estimate of the (maximum) potential water use for a well-watered reference crop under the given climate conditions. The term, "PET", long used by this Network and others is being replaced with the term, "Reference ET", to conform to standard terminology.*

Some helpful hints and background information for users of the ET Network data:

**What is evapotranspiration (ET)?** Evapotranspiration is a term to describe crop water demand by combining evaporation and transpiration. Evaporation is the process through which water is removed from moist soil and wet surfaces (such as dew on leaves). Transpiration is the process through which water is drawn up through the plant (roots extract water from the soil, and water is eventually removed through stomata on the leaves.)

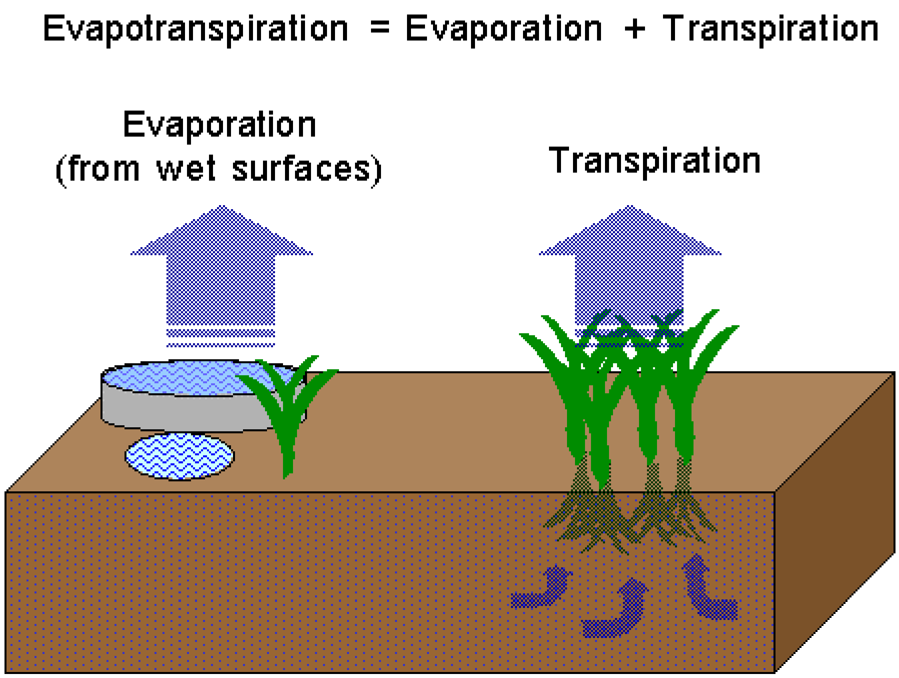



Figure 1. Evapotranspiration

**What is Reference ET (PET)?** Reference crop evapotranspiration, also referred to as Potential Evapotranspiration (PET), is an estimate of water requirement for a well-watered reference crop. The grass reference crop is used for the South Plains ET Network as well as for the North Plains ET Network. This reference crop is essentially an idealized crop used as a basis for the ET model. Reference ET is calculated by applying climate data (temperature, solar radiation, wind, humidity) in a model (equation). It is helpful to note that reference ET is only an <u>estimate</u> of the water demand for this idealized crop, based upon weather station data at a given location.

**How is Crop Evapotranspiration calculated?** Crop-specific ET is estimated by multiplying the Reference ET by a crop coefficient. The crop coefficient takes into account the crop's water use (at a given growth stage) compared to the reference crop. For instance, seedling cotton does not use as much water as the idealized grass reference crop, but during peak bloom cotton could actually use more water than the grass reference crop.  The crop coefficient is understood to follow a pattern ("curve") of the general shape:

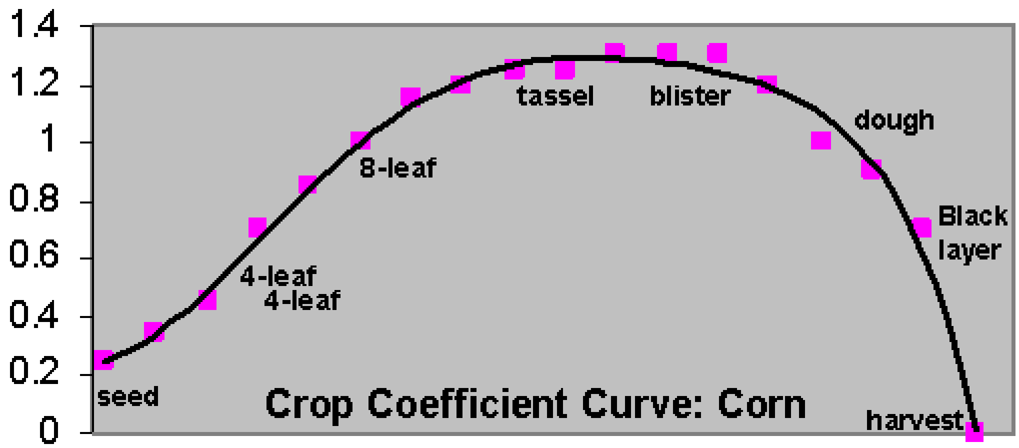



Figure 2.  Crop coefficient curve for corn.

One more item to note is that the reference crop ET model and the crop coefficient curves were developed from long-term research.   Data were compiled from various sources to develop these relationships.   Actual crop water demand can be affected by many factors, including soil moisture available, health of the crop, and likely by plant populations and crop variety traits.   These factors are not taken into account by the models.    Hence, ET data provided by on-line networks are probably best used as guidelines for irrigation scheduling, and (where applicable) integrated pest management and integrated crop management.   The predicted growth stage and estimated water use should be checked with field observations.   The actual crop water use is likely to be somewhat less than the predicted value.

**How is estimated ET used to schedule irrigation?**  There are a variety of irrigation scheduling methods, models and tools available.    Many are essentially based upon a "checkbook" approach:  Water stored in the soil (in the crop's root zone) is withdrawn by evapotranspiration and deposited back into the soil through precipitation and irrigation. When soil moisture storage falls below a given threshold value, irrigation is applied to restore the moisture.

**How should soil conditions be taken into account?**  Soil properties and conditions affect how much water can be retained, and at what rate the water can enter the soil. Some critical soil properties that should affect irrigation management are permeability, soil moisture characteristic, and hydraulic conductivity.

**Permeability** is the ability of the soil to take in water through infiltration. A soil with low permeability cannot take in water as fast as a soil with high permeability; the permeability therefore affects the risk for runoff loss of applied water. Permeability is affected by soil texture, structure, and surface condition. Generally speaking, fine-textured soils (clays, clay loams) have lower permeability than coarse soils (sand). Surface sealing, compaction, and poor structure (particularly at or near the surface) limit permeability.

**Soil moisture characteristic** (sometimes referred to as a soil moisture release curve or soil moisture retention curve) is the relationship of how much water is retained at a given pressure potential (suction). Critical levels of suction are field capacity and permanent wilting point. Plant available water is that which is stored between those two suctions (see the figure below). Some soils can store more water than others. At field capacity, sandy soil may be expected to hold 0.6 to 1.25 inches of available water per foot of soil; a clay loam may hold 1.5 to 2.3 inches of water per foot of soil. Because the soil's moisture holding capacity is limited, excess water applications will be lost through deep percolation and/or runoff.

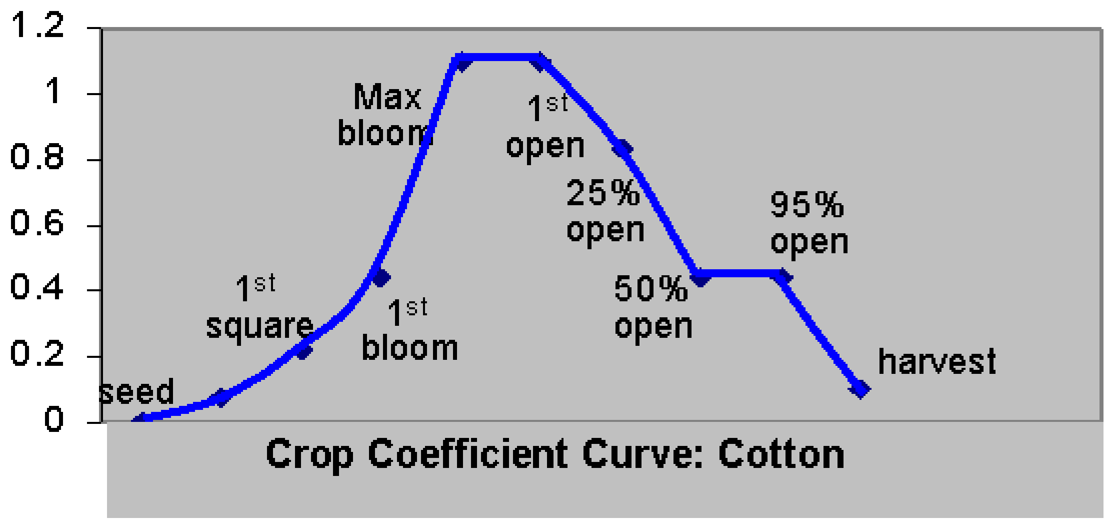



Figure 3. Crop coefficient curve for cotton.

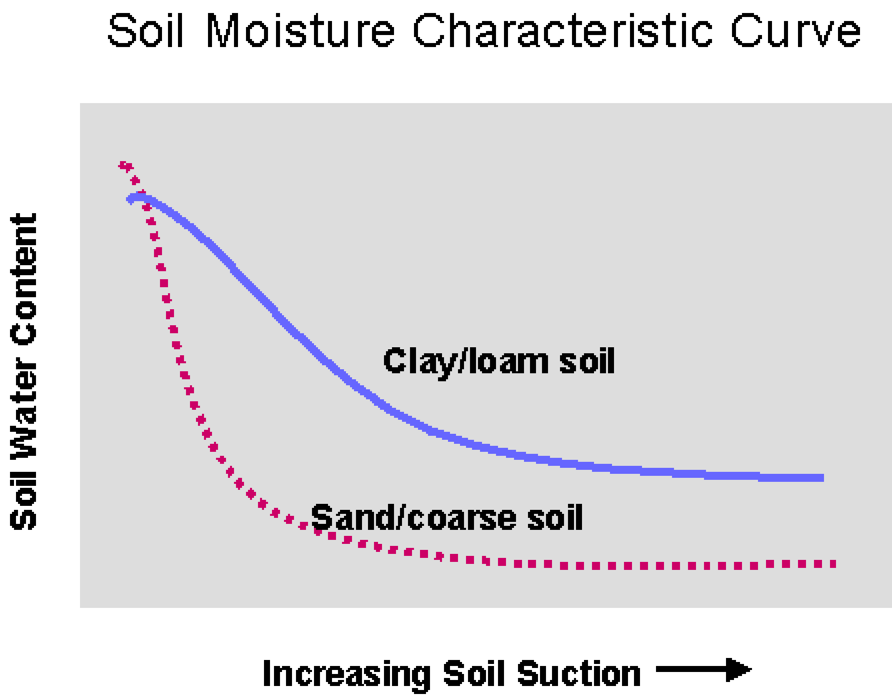



Figure 4. Soil moisture release with increasing suction.

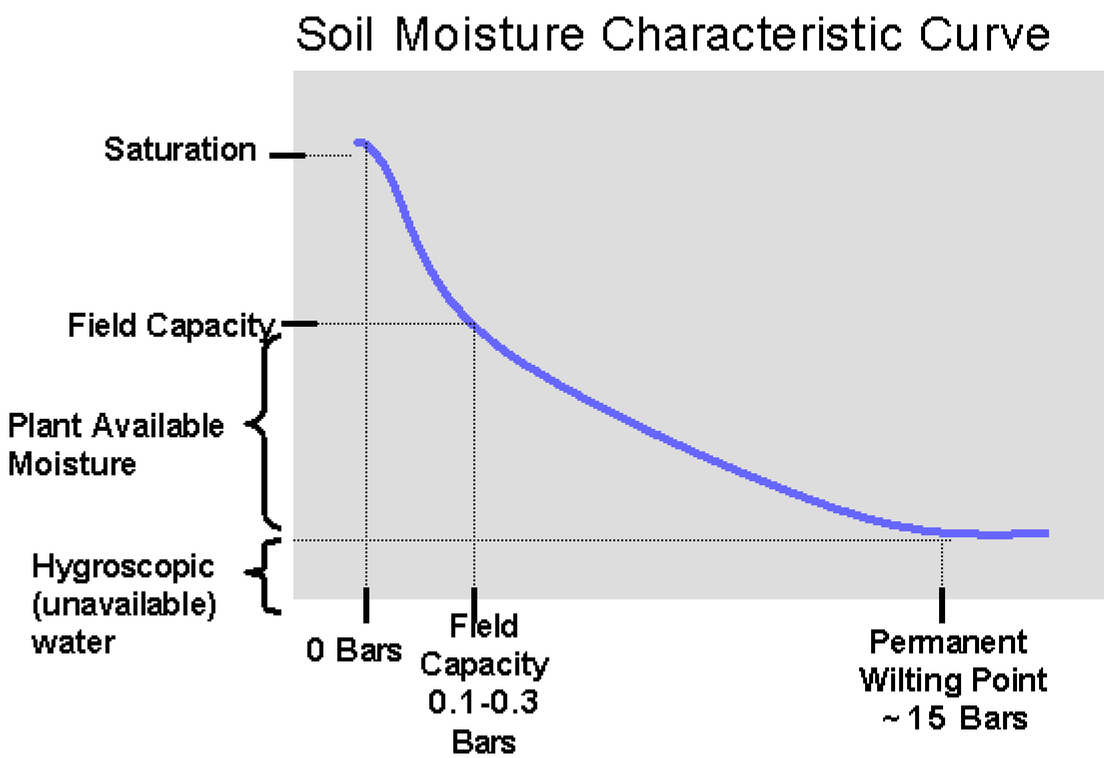



Figure 5. Soil moisture release with increasing suction.

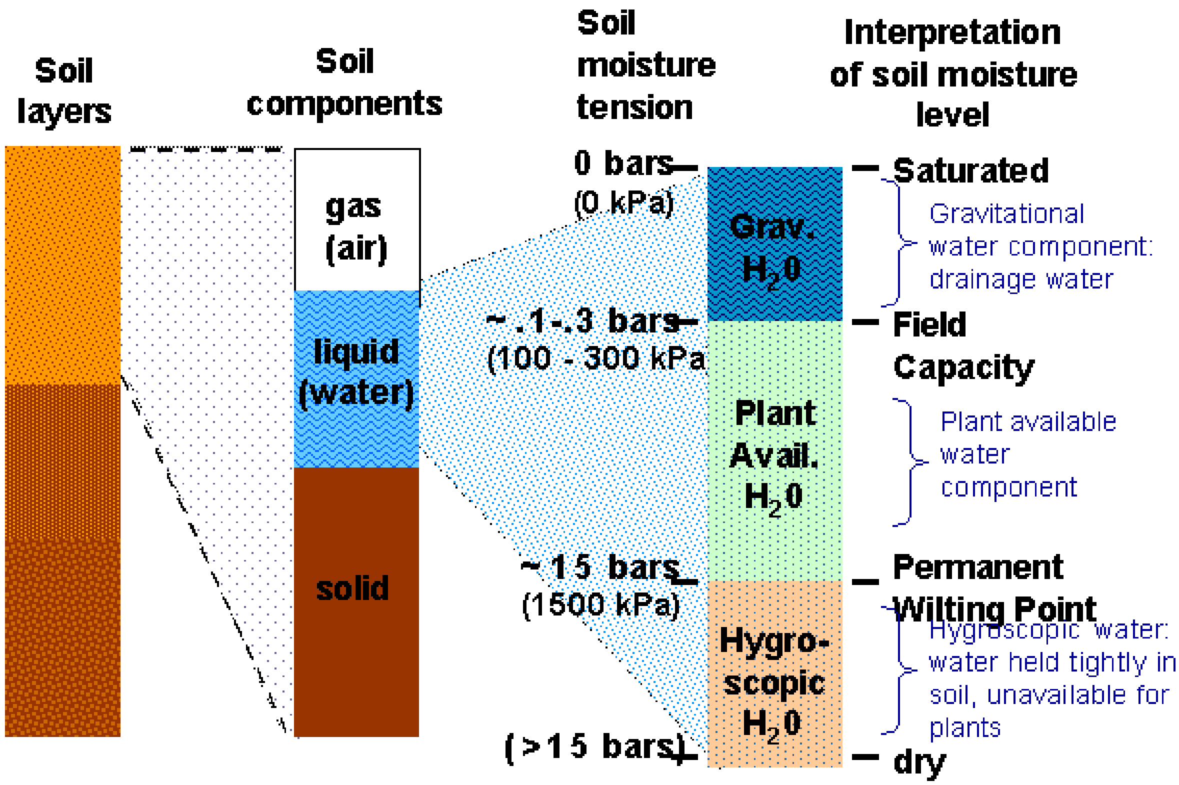



Figure 6. Components of soil and of soil water.

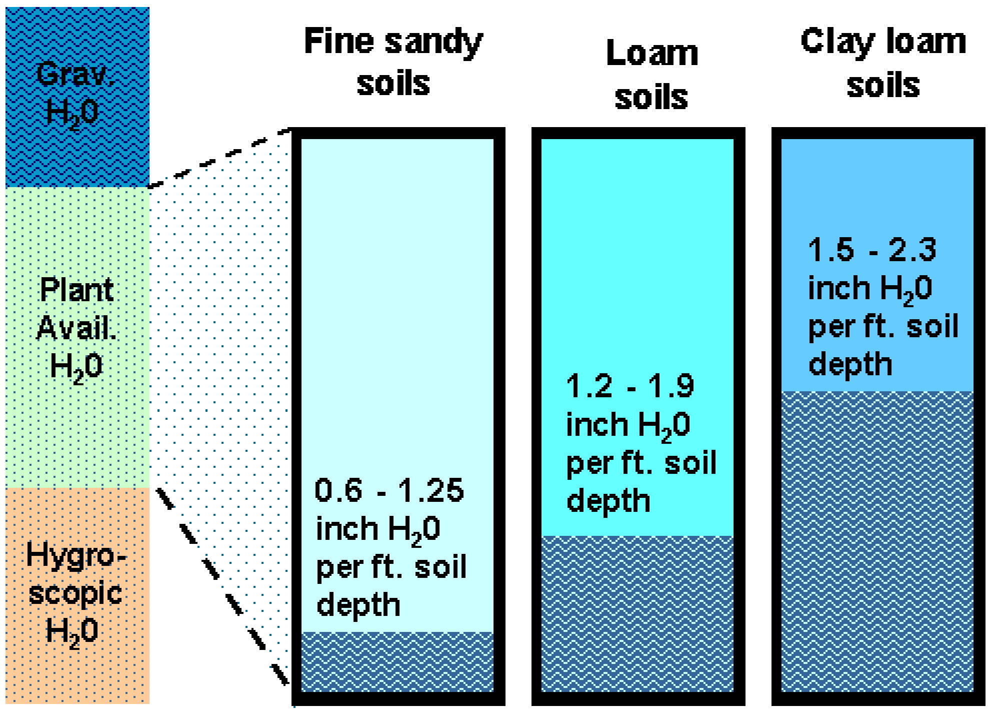
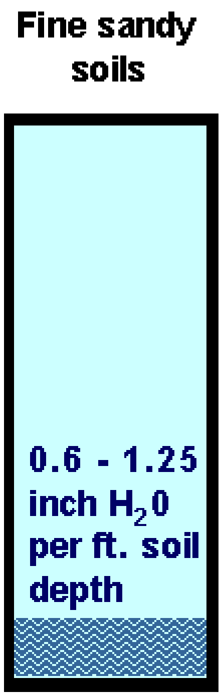



Figure 7. Available water storage by soil type.

## Estimate available water in root zone:




**Example: Amarillo soil**
**(loamy fine sand/fine sandy loam)**

**Available water by soil depth:**

| Soil layer Location | Soil layer depth | Avail. $H_{2}0$ per depth | Avail. $H_{2}0$ Storage |
|---|---|---|---|
| 0-14 in. | 14 in | 0.08 in/in | 1.12 in |
| 14-46 in | 32 in | 0.15 in/in | 4.80 in. |
| 46-80 in | 34 in | 0.13 in/in | 4.42 in |

**If the crop's root zone depth is 4 feet, the water available at field capacity is (14 X 0.08) + (32 X 0.15) + (2 X 0.13) = 1.12 + 4.80 + 0.26 = 6.18 inches.**

Figure 8. Estimating water holding capacity in the root zone.