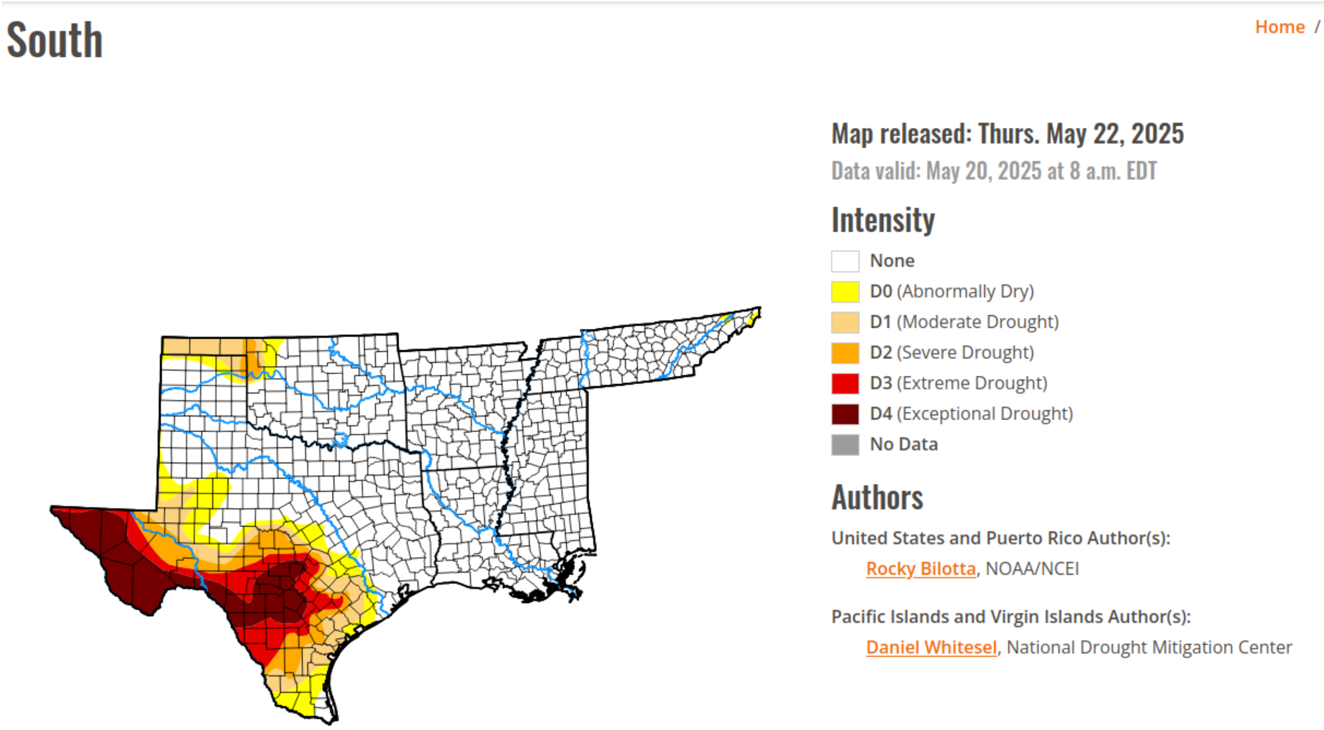
Bi-monthly Educational Topic #10 for CCGCD
by Texas Hill Country Weather Services, LLC
May 27, 2025

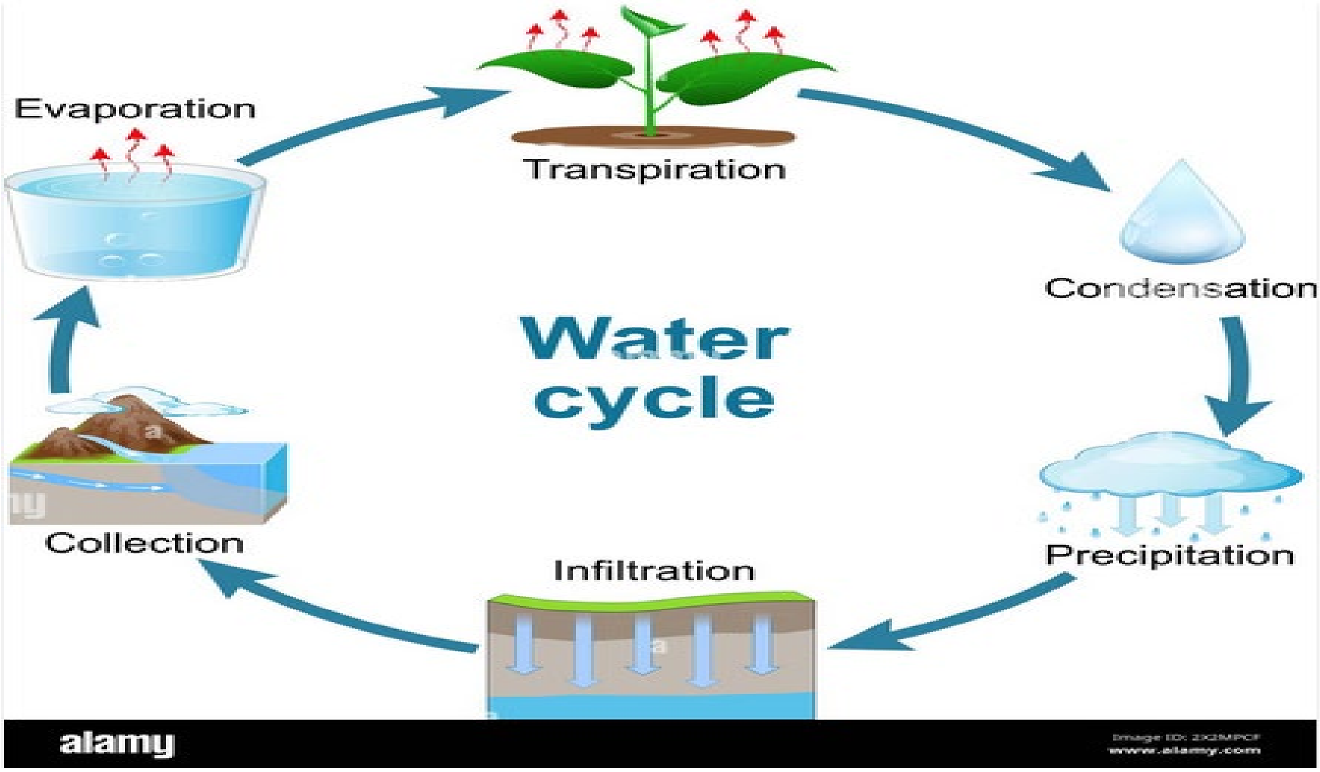
Current conditions:

As of May 20, 2025, Kendall County remains within the D4 exceptional drought category (per the latest available US Drought Monitor map provided below) as the area associated with this drought continues. ENSO-Neutral conditions are in place, and the overall drier than average weather pattern continues. CCGCD remains at a Stage 4 drought restriction within this on-going Drought Emergency.



The previous educational topic we discussed was precipitation data collection and reporting into the CoCoRaHS network. Today we move onto two new topics: evaporation and evapotranspiration.

To understand these two topics, we must first understand the hydrological cycle (see the image below). Weather patterns give us precipitation and that precipitation infiltrates into the ground to our aquifers, and collects in our lakes, ponds, rivers and streams. Incoming solar radiation from our Sun and surface wind causes liquid water to convert into gaseous water through the evaporation process to enter back into the atmosphere. Simultaneously, radiation and wind cause water inside plants, grasses, crops and trees to evaporate and transpire (called evapotranspiration) gaseous water (also known as water vapor) out of them and into the atmosphere. At this point, the water vapor in the atmosphere when dynamically lifted upward creates clouds and unstable weather systems cool and convert that water vapor back into precipitation which falls to the ground restarting the hydrological cycle. This is a continuous cycle, and it varies across distance and time.



So, essentially, when thinking of water only such as open to the air water bodies and soils, evaporation is liquid water converting into gaseous water vapor. Whereas evapotranspiration is the same water evaporation process, but the conversion comes from flora and into the air. Under the same atmospheric conditions, evaporation and evapotranspiration of water into the air are occurring at the same time.

Evaporation and evapotranspiration are dynamic processes that depend on varying conditions such as temperature, surface area, humidity, wind speed, incoming solar radiation and air pressure.

As temperatures rise, the kinetic energy of water molecules bouncing off one another increases, making it easier for those molecules to escape and evaporate.

When thinking of open water bodies like oceans, lakes and ponds or large rivers, a larger surface area provides more opportunity for water molecules to make contact with the air and evaporate. Just think of our planet Earth for a minute. Approximately 71% of our planet's surface is covered by water. This translates to a lot of evaporation. Interesting fact – water vapor is the most abundant natural greenhouse gas in Earth's atmosphere, which accounts for 50% of the total natural greenhouse effect and then add clouds (which is condensed water vapor) into the mix which accounts for an additional 25% of the total natural greenhouse effect. Thus, 75% of the natural greenhouse effect is water. Our planet is truly a water planet!

Humidity is a controlling factor of the evaporation and evapotranspiration rates. As humidity increases (meaning a high amount of water vapor is already in the air), the rates lower since the air is closer to or at saturation. Generally, mornings are more humid than the afternoons; thus, the rates are higher in the afternoons when compared to the morning hours. Additionally, if it is raining, then humidity is high, and the rates are low.

As wind moves along the surface of a water body or plant, it helps remove the evaporated water allowing more water molecules to evaporate. Thus, as wind speeds increase, so do the evaporation and evapotranspiration rates.

Incoming solar radiation from our Sun is the primary driver of evaporation and evapotranspiration. Water absorbs the radiation producing heat, and the increasing heat changes the liquid water into gaseous water vapor.

When air pressure is low, the vapor pressure is low which allows more water molecules to escape, increasing the rates of evaporation and evapotranspiration.

CCGCD is very interested in this topic. They are actively engaged in building a local drought restriction stage decision tool that is expected to include this science of evaporation and evapotranspiration. Other factors that play a role in evaporation and evapotranspiration are the salinity of water, water depth, water currents and wind direction. However, these factors vary greatly and will have little impact on what we are trying to do here in Kendall County.

In the next topic, we will learn about the mathematical equations of evaporation, the available equipment to measure and the interactive tools used to report and display the evaporation and evapotranspiration data and how you could participate.

Stay tuned into CCGCD's website page, as TXHCWS will soon be providing more educational materials.