Environmental Variables

**Data sources, benefits and problems with each:**

* The Drought Atlas provided by the University of Nebraska-Lincoln: (Station: Morehead City 2 WNW) (<https://droughtatlas.unl.edu/Data/Climate.aspx>). This data is local and the only local source for PDSI, however, **the period covered at this station is 4/15/1948 - 12/31/2017.**
  + **Precipitation and Temperature**
  + **SPI (Standardized Precipitation Index)**
    - 1 – 12, 18, 24, 36, 48, 60, 72, 84 and 96 month timesteps
  + SPEI (Standardized Precipitation-Evapotranspiration Index)
  + **PDSI (Palmer Drought Severity Index)**
  + SC-PDSI (Self-Calibrated Pamler Drought Severity Index)
* NC Climate Office, Climate Division Data: Calculated over the entire NC Central Coastal Plain (<https://climate.ncsu.edu/climate/climdiv>). **The problem with this dataset is that it is not local and is calculated over the entire NC Central Coastal Plain. (Which stretches from Wake County to Carteret County)**
  + **Precipitation and Temperature**
  + **PDSI**
  + PHDI (Palmer Hydrological Drought Index)
  + PZI (Palmer “Z” Index)
  + MPDSI (Modified Palmer Drought Severity Index)
  + **SPI**
    - 1, 2, 3, 6, 9, 12 and 24 month timesteps
* NC Climate Office, High Resolution Drought Index Time Series: calculated on a sub-county level grid resolution (<https://climate.ncsu.edu/drought/map/timeseries?sdate=2006-01-01&edate=2019-11-01&dur=6&latitude=34.750766503907&longitude=-76.801281289063&x_loc=1003&y_loc=439&ts_type=spi>) (this can be changed to different time series by changing the number after “&dur=” (in months)). Complete overlap with study period and very local data. **Does not include PDSI** **data**, however KBDI or SPI could substitute for PDSI.
  + **SPI**
    - 1 – 9, 12, 15, 18, 24 and 36 month timesteps
  + SPI Blend
  + Percent of Normal Precipitation
  + AHPS Precipitation (Advanced Hydrologic Prediction Service)
  + **KBDI (Keetch-Byram Drought Index)**
* GLOBAL HISTORICAL CLIMATOLOGY NETWORK (GHCN-DAILY): Reported daily. For station USW00093765 (Beaufort Michael J Smith Field) **this data is complete and fully overlapping with the study period.** The journal article describing GHCN-Daily is: Menne, M.J., I. Durre, R.S. Vose, B.E. Gleason, and T.G. Houston, 2012: An overview of the Global Historical Climatology Network-Daily Database. Journal of Atmospheric and Oceanic Technology, 29, 897-910, doi:10.1175/JTECH-D-11-00103.1.
  + Precipitation and Temperature

**PDSI (Palmer Drought Severity Index):**

From The Drought Atlas; University Nebraska-Lincoln (<https://droughtatlas.unl.edu/Data/Climate.aspx>)

“The PDSI is a meteorological drought index, and it responds to weather conditions that have been abnormally dry or abnormally wet. When conditions change from dry to normal or wet, for example, the drought measured by the PDSI ends without taking into account streamflow, lake and reservoir levels, and other longer-term hydrologic impacts (Karl and Knight, 1985). PDSI calculations are based on precipitation and temperature data as well as the local available water content (AWC) of the soil. From the inputs, all the basic terms of the water balance equation can be determined, including evapotranspiration, soil recharge, runoff, and moisture loss from the surface layer. Human impacts on the water balance, such as irrigation, are not considered. Complete descriptions of the equations can be found in the original study by Palmer (1965) and the more recent analysis by Alley (1984).

The Palmer Index varies roughly between -6.0 and +6.0. Palmer arbitrarily selected the classification scale of moisture conditions based on his original study areas in central Iowa and western Kansas (Palmer, 1965). The Palmer Index is designed so that, ideally a -4.0 in South Carolina has the same meaning in terms of the moisture departure from a climatological normal as a -4.0 in Idaho (Alley, 1984).”

**SPI (Standardized Precipitation Index):**

From The Drought Atlas; University Nebraska-Lincoln (<https://droughtatlas.unl.edu/Data/Climate.aspx>)

“The Standardized Precipitation Index (SPI) is an index based on the probability of precipitation for any time scale. The underlying assumption is that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow. The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation anomalies on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect the longer-term precipitation anomalies.

The SPI calculation for any location is based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero (Edwards and McKee, 1997). Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI.

A drought event occurs any time the SPI is continuously negative and reaches an intensity of -1.0 or less. The event ends when the SPI becomes positive. Each drought event, therefore, has a duration defined by its beginning and end, and an intensity for each month that the event continues. The positive sum of the SPI for all the months within a drought event can be termed the drought's "magnitude".”

From NC Climate Office, High Resolution Drought Index Time Series (<http://climate.ncsu.edu/products/hirdtt/AboutThisPage.html>)

“The SPI is a precipitation-based drought index that relates the amount of precipitation falling over a given interval of time to its historical probability. SPI has several key advantages for drought monitoring, namely its ability to be calculated on any timescale, provided sufficient data is available, giving it the ability to monitor simultaneously-occurring conditions at different time scales. Additionally, SPI values are normalized to the historical record at a specific location, meaning both wet and dry periods can be monitored and SPI values at different locations can be compared without modification.”

**KBDI (Keetch-Byram Drought Index):**

From NC Climate Office, High Resolution Drought Index Time Series (<http://climate.ncsu.edu/products/hirdtt/AboutThisPage.html>)

“The Keetch-Byram Drought Index is the only drought index with a fixed timescale. KBDI is typically used by foresters to assess the climatological potential for fire. KBDI values are typically lowest in the winter and highest in the summer. Values are based on the previous day's value and are adjusted up or down depending on the current day's temperature and rainfall amounts. KBDI has no timescale, so adjusting the dropdown menu for timescale will not adjust the KBDI map displayed.”

From Drought.gov, U.S. Drought Portal, National integrated Drought Information System <https://www.drought.gov/drought/data-gallery/keetch-byram-drought-index>

“The Keetch-Byram Drought Index assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible.”

