EX 4

Analyzing the effects of drought on pinyon pine

This exercise expands the use of the 3-PG model to evaluate year to year variation in climatic conditions and their effects on gross primary production (GPP). Although a general increase in temperature has been recorded across much of the Southwest U.S., bark beetle attacks on pinyon pine have not been uniformly distributed. This exercise demonstrates that bark beetle attacks are mainly concentrated on shallow soils where essentially all available water is extracted during the drought. On deeper soils, most pinyon pine trees were not attacked by bark beetles (see Pub No.117).

Open the spreadsheet "Pinyon Socorro NM Ex 4".

Part I. Determine where 100-year old pinyon pine trees with an LAI =1.0 are unlikely to be attacked by bark beetles during recorded periods of drought.

Note: the met station at Socorro, NM has single years of data from 1985-2005 as well as the mean values for this period. In the first part of the exercise, we use "yearly data" and change only two variables on the green block: "Maximum ASW" and "Fertility rating" to keep the stand leaf area index (LAI) near 1.0 m^2/m^2. You are asked to add values of GPP at stand age 100 years to a table where GPP is listed for every year in the period with your selection of soil fertility ranking (FR) listed at the bottom.

At what ASW value, among those you were asked to simulate, did GPP vary < 2.0 Mg (dry mass)/ha/yr?

What corresponding value did you choose for FR?

Part II. Determine the relative importance of drought, high evaporative demand, and frost on gross photosynthesis under average climatic conditions at monthly intervals.

After changing the designation of the Met station from " yearly data" to mean data" , close the gap after "Output ages" so that each month is listed at year 100. Run model with "Maximum ASW" set at 50 mm.

For each month, the lowest value listed in the last three columns (i.e., fVPD, fFrost, fSW) is most limiting on GPP.

For those interested, there is an additional exercise using the **"Penman-Monteith Equation**" to calculate transpiration for different types of vegetation under varying canopy and boundary-layer conductances.