PLANT ADAPTATIONS TO HOT & DRY CONDITIONS (Xeric Adaptations)

NOTE: Much of the material below comes from presentations of Mary Irish at a series of 4th Saturday August events in Phil Hardberger Park, supplemented by information from Floyd Waller's Grass Walks, and the general literature on plants.

PLANTS ADAPT TO HEAT & DROUGHT (REDUCED SOIL MOISTURE) BY ESCAPING, EVADADING, OR ENDURING THESE CONDITIONS. SOME OF THE SPECIFIC ADAPTATIONS PLANTS USE ARE DETAILED BELOW:

Succulence: Xeric adapted plants have special cells which hold water for photosynthesis when soil moisture is low or even nonexistent. Xeric adapted plants can be 95% water compared to 75% for most plants. All succulents and many xeric adapted plants have mucilaginous interior tissues (actually specialized cells) which store water. Cacti store water in their stems as do most succulent euphorbias. Others like aloes, haworthias and such store water in their leaves, and a very few store water in their roots as either tubers or other swollen membranes.

Reduced(absent) leaf area: By reducing the number of leaves and their surface area the plants lose less water. In some cases, leaves become reduced down to spines (cacti) or very fine leaflets (nearly all legumes(Fabaceae) including acacia). In other cases, like Red Buckeye, Mesquite, or Creosote Bush leaves drop during the summer in response to drought.

Going along with the reduction in leaves is the adaptation of moving the main site of photosynthesis to the stems (chloroplasts in the stems). Prickly Pear pads (actually stems) are a good example of this adaptation.

Stomata, the sites where water vapor during transpiration is released, become fewer and/or in sunken pits below the surface. Some grasses with broad leaves like Indian Grass have cells on the adaxial leaf surface which cause the leaves to fold in response to drought protecting the stomata. Many grass genera found in arid conditions like *Aristida*, *Sporobolus*, and *Muhlenbergia* have very narrow leaves which are not only folded but also longitudinally in-rolled (involute) enclosing the stomata more completely. This condition is often accompanied by very dense basal growth which further contributes a micro-climate which conserves moisture.

Crassulacean acid metabolism (CAM metabolism) works by the plant getting its CO_2 at night and storing malic acid to use during day. This allows photosynthesis to take place such that water loss during the day, when it is hottest, is minimized.

Growth tends toward compact, often spherical or cylindrical forms, which reduce surface area per volume again saving water. Plants also often have a ribbed structure enabling rapid increase in plant volume and decreasing surface area. Furthermore, a ribbed surface also minimizes exposure to the sun. Another form adaptation is a rosette arrangement to the leaves which in agaves, yucca, and aloes direct water to the roots. Some authors even suggest the pads of Prickly Pear orient E/W to escape the direct rays of the sun.

Waxy, hairy, spiny outer surfaces trap air to insulate the plant from heat and cold. In the case of Artemisia, the hair shades the plant. The hair and spines can also scatter light reducing the sun's effect. Also, that waxy impervious covering holds in the water as is evident in our Live Oak leaves. Down pointing spines can direct water from fog and dew to the plant.

Roots near the surface absorb water quickly and can regenerate quickly after a rain.

Restricting germination to optimal times. For example, our bluebonnets germinate and bloom in the cool part of the year. Many xeric species have a short six to eight-week life cycle. Most delay germination until optimal conditions.