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## The Effects of Drought Stress on Mexican Pine-oak Forests in the Eastern Sierra Madre

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### Abstract

Mexican pine-oak forests are exposed to extreme conditions: high temperatures, scarce precipitation distributed irregularly over the year, and intensive silvo-pastoral activities. This and the irrational and unsustainable use of natural resources is modifying hydrological cycles, ground water supply, and contributes plainly to soil erosion. As an approach to understand how natural tree regeneration copes with these stress factors, the water relations in mixed pine-oak forest were studied in the Eastern Sierra Madre. Water potentials ( $\Psi$ ) were related to soil water-content and evaporative demand components in natural pine-oak forest where silvo-pastoral influences could be ignored for the moment. In this way, the exclusive effects of climatic and soil variables on the forest species oak, pine, cedar, arbutus, and acacia were investigated at different aspects (north and southeast) from January 2006 until today. Environmental data (air temperature (Temp), relative humidity (RH), vapour pressure deficit (VPD), precipitation, and soil water-content) were taken simultaneously. The water potentials were measured two times a day, 6:00 a. m. and 12:00 p. m. and possibly twice a month. All studied species showed the typical diurnal pattern of variation in  $\Psi$ , high values at predawn and low values at midday. Comparing the two aspects, all  $\Psi$ , soil water-content, VPD and Temp at midday showed significant differences. In general, the southern site was significantly warmer and dryer, and  $\Psi$  were more negative at the southeast. With increasing temperature, the  $\Psi$  decreased for all species at both sites, while oaks had the highest values and pine and cedar trees the lowest at the north. At the southern site, acacia had highest  $\Psi$  followed by oak, pine, and cedar with more negative values. So, oak was the less stressed species at the north and acacia at the southeast. Pines and cedars seemed to be more stressed at both aspects. The differences between the  $\Psi$  measured at both aspects could be explained by the significant difference in soil water-content, VPD and Temp at midday.

**Keywords:** Climate, drought stress, pine-oak forest, soil water content, water potentials, water relations