



# The Effects of Drought Stress on Mexican Pine-Oak Forests in the Sierra Madre Oriental

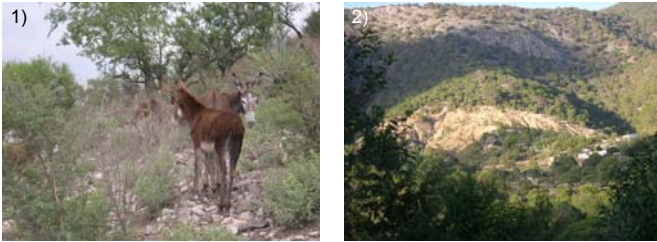


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## INTRODUCTION

Mexican pine-oak forests are exposed to extreme conditions: high temperatures, scarce precipitation distributed irregularly over the year with peaks, and high pressure on tree regeneration caused by intensive silvo-pastoral activities (Fig.1).



The irrational and unsustainable use of natural resources is modifying hydrological cycles, ground water supply, natural habitats of fauna, and contributes plainly to deforestation and soil erosion (Cantú and González 2002, Fig.2).

Sustainable forest management requires detailed knowledge about the characteristics of the forest vegetation and its capacity to respond to environmental changes. Plants reflect as bioindicators its environment, and by measuring the water potential ( $\Psi_w$ ) of trees and shrubs its possible to quantify the actual effects of the site on the forest (Mittlöhner 1997).



## MATERIAL AND METHODS

The study was taken out in two pine-oak forests, north (Fig.3) and south aspect (Fig.4), located at 1500 m in the Experimental Forest (EF) of the Autonomous University of Nuevo Leon in the Sierra Madre Oriental, Nuevo Leon, where silvo-pastoral influences could be ignored for the moment.

Climatic characteristics: 639 mm precipitation and 13°C mean temperature per year. The main part of precipitation occurs from May to October (Cantú and González 2002, CNA 2000, Treviño 1992).



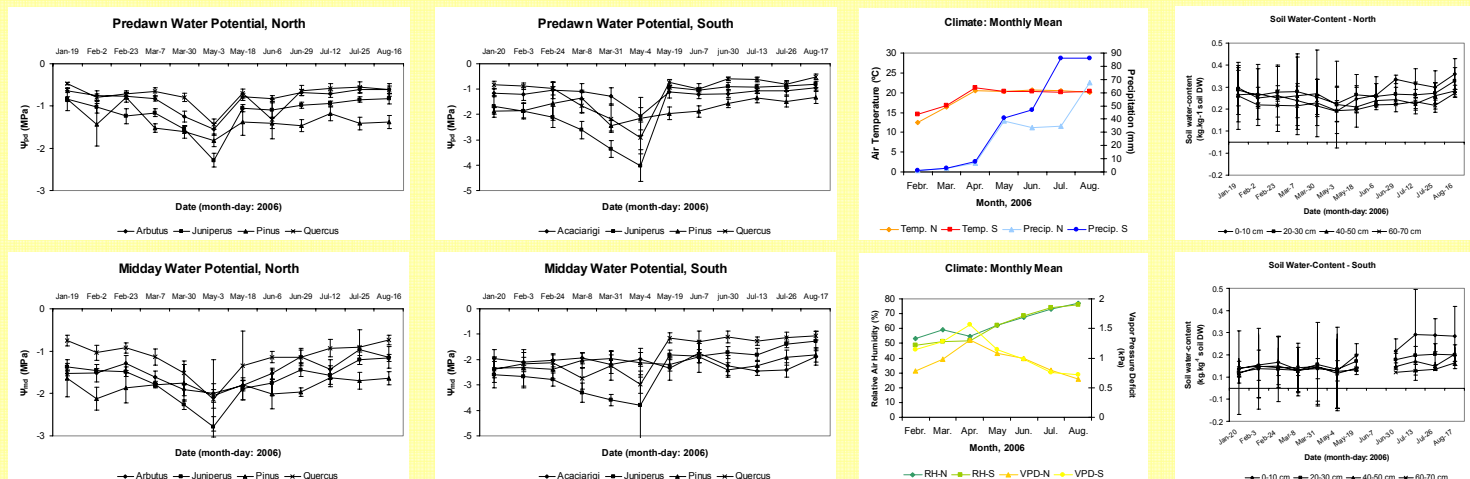
The  $\Psi_w$  of *Quercus canbyi*, *Pinus pseudostrobus*, *Juniperus flaccida* and *Arbutus xalapensis* (N) or rather *Acacia rigidula* (S) were determined twelve times from January until August 2006, using a Scholander pressure bomb (González et al. 2004, Fig.5). Leaves or terminal shoots were measured of six individuals per species forming the regeneration at 06:00 a.m. ( $\Psi_{pd}$ ) and 12:00 p.m. ( $\Psi_{md}$ ).

Environmental variables were taken simultaneously: air temperature (°C), relative humidity (%), vapor pressure deficit (kPa), and soil water-content (kg.kg<sup>-1</sup>) (Fig.6).

## RESULTS AND CONCLUSIONS

All studied specie showed the typical diurnal pattern of variation in  $\Psi_w$ , high values at predawn and lower values at midday. During the dry season (January-March) the  $\Psi_w$  of especially *Quercus* and *Juniperus* showed significant differences comparing the two aspects. In general,  $\Psi_w$  were more negative at the south.

Comparing the environmental data registered at 6:00 a.m. and 12:00 h at each sampling date, highly significant differences were only found for the soil water-content of each layer (between  $p=2.237e-06$  and  $p<2.2e-16$ ) and significant differences for the VPD at midday ( $p=0.04114$ ).



## LITERATURE

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*Quercus* was the less stressed species at the north and *Acacia* at the south. *Pinus* and *Juniperus* seemed to be more stressed at both aspects. The differences between the  $\Psi_w$  measured at both aspects could be explained by the significant differences in soil water-content and the calculated VPD at midday comparing the results of the north and south aspect.

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