# Drought Adaptation of Four Native Shrub Species, Northeastern Mexico

**Humberto González Rodríguez, Israel Cantú Silva, Roque G. Ramírez Lozano and Marisela Pando Moreno**

Universidad Autónoma de Nuevo Leon, Faculty of Forest Sciences

***Apartado Postal 41. Linares, Nuevo Leon 67700 Mexico. E-mail: humberto.gonzalezrd@uanl.edu.mx***

## Introduction.

The main type of vegetation in northeastern Mexico, known as Tamaulipan thornscrub, is distinguished by a wide range of taxonomic groups exhibiting differences in growth patterns, leaf life spans, textures, growth dynamics, and phenological development (Reid *et al*., 1990). Vegetation has been utilized as a forage source for domestic livestock and wildlife, fuelwood, timber for construction, medicine, agroforestry and reforestation practices in disturbed sites. Since water availability is the most limiting factor controlling tree growth, survival and distribution in dry climates, the great diversity of native shrub species in this region reflects the plasticity of how tree species cope with seasonal water stress. Therefore, shrub and tree species have evolved key morphological and physiological traits suited for adaptation to environmental constraints, especially on drought-prone sites. The strategies include early leaf abscission, limited leaf area, an extensive and deeper root system, reduction of water loss by stomatal closure and accumulation of solutes.

## Objetive.

To assess and quantify how seasonal plant water potentials are related to soil water availability and evaporative demand components in four native shrub species.

## Materials and Methods.

***Research site***


***Plant material***

Four native shrub species were randomly selected from a representative and undisturbed thornscrub plot (20 m x 20 m. The shrub species were: *Amyris texana* (Rutaceae), *Bumelia celastrina* (Sapotaceae), *Cordia boissieri* (Boraginaceae) and *Leucophyllum frutescens* (Scrophulariaceae).

***Water potential measurements and sampling procedures***

Determinations of leaf water potential ($\Psi$, MPa) in the four native shrub species were conducted, when possible, at 15-days intervals. At each sampling date, $\Psi$ of five different plants were randomly chosen from the plot. The period of measurement was between January 17 and October 31, 2011. At each sampling date, seasonal $\Psi$ measurements were monitored at 06:00 h (predawn) and 14:00 h (midday) local time by using a Scholander pressure bomb. In addition, diurnal $\Psi$ were also measured during July 3 and August 30 at 2-h intervals between 06:00 and 18:00 hrs. Environmental variables were also registered during sampling times.

***Statistical analyses***

Soil water content and $\Psi$ data were analyzed using the Kruskal-Wallis test because they did not show a normal distribution nor homogeneity of variances. Statistically significant probability (*) were considered at $P<0.05$. Seasonal and diurnal Spearman's correlation analyses were performed between water potential data and environmental variables such as air temperature, relative humidity, rainfall, soil water content at different soil depths, and vapor pressure deficit.

**Table 1. Spearman's correlation coefficient values (n=20) for seasonal predawn leaf water potential in relation to environmental variables in four native shrub species. $^{NS}$=No significant (P>0.05); **P<0.01.**

| Environmental Variable | Native Shrub Species | | | |
|---|---|---|---|---|
| | *A. texana* | *C. boisssieri* | *B. celastrina* | *L. frutescens* |
| Air Temperature | -0.237$^{NS}$ | -0.331$^{NS}$ | -0.354$^{NS}$ | -0.105$^{NS}$ |
| Relative Humidity | 0.417$^{NS}$ | 0.383$^{NS}$ | 0.353$^{NS}$ | 0.241$^{NS}$ |
| Rainfall | 0.424$^{NS}$ | 0.368$^{NS}$ | 0.254$^{NS}$ | -0.143$^{NS}$ |
| Soil Water Content | | | | |
| • depth of 0-10 cm | 0.840** | 0.769** | 0.745** | 0.681** |
| • depth of 10-20 cm | 0.850** | 0.782** | 0.797** | 0.732** |
| • depth of 20-30 cm | 0.842** | 0.754** | 0.792** | 0.707** |
| • depth of 30-40 cm | 0.711** | 0.673** | 0.702** | 0.596** |
| • depth of 40-50 cm | 0.657** | 0.609** | 0.662** | 0.468** |

## Results.

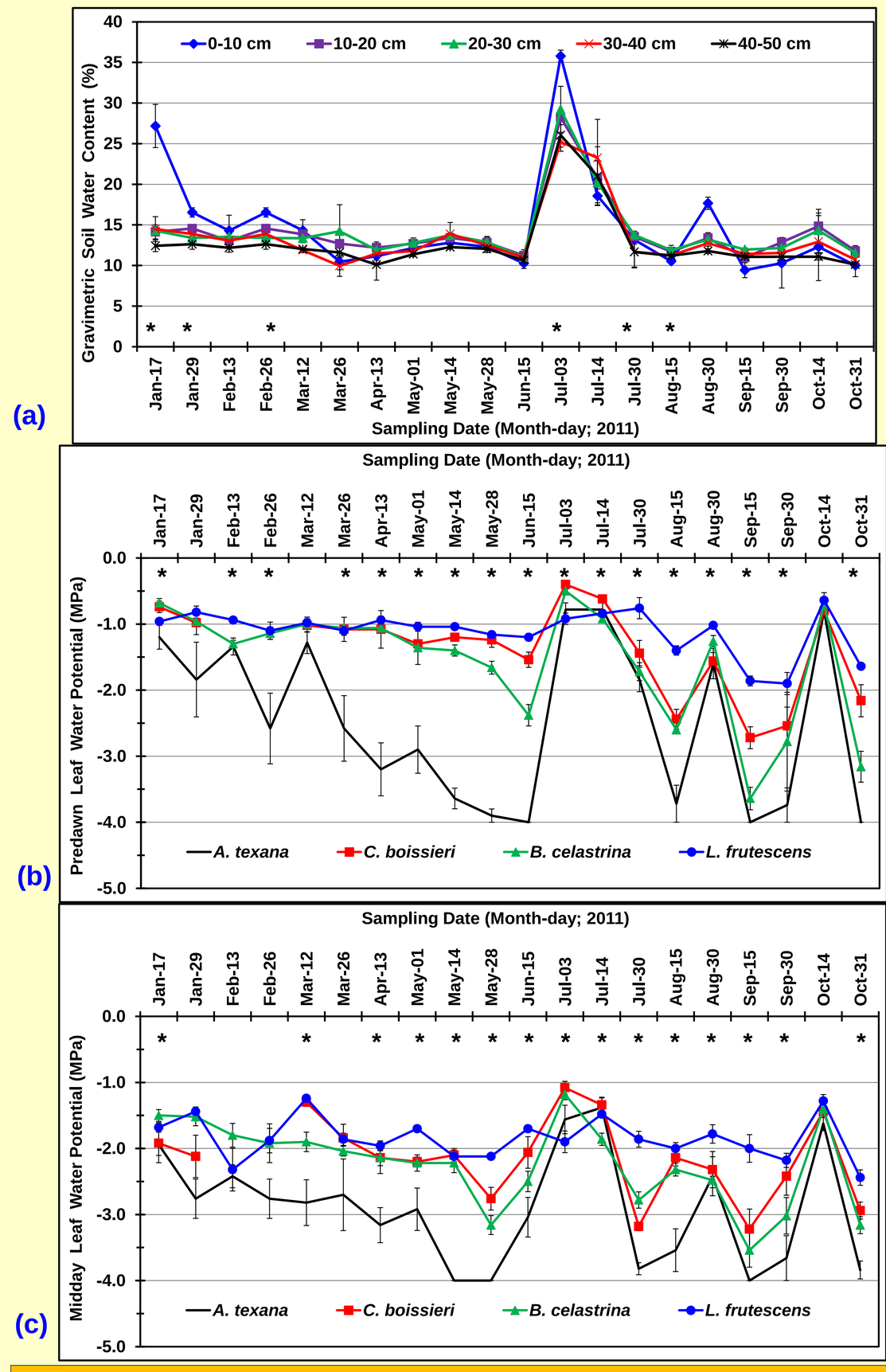


**Figure 1. Seasonal of soil water content (a), predawn (b) and midday (c) leaf water potential in four native shrub species.**

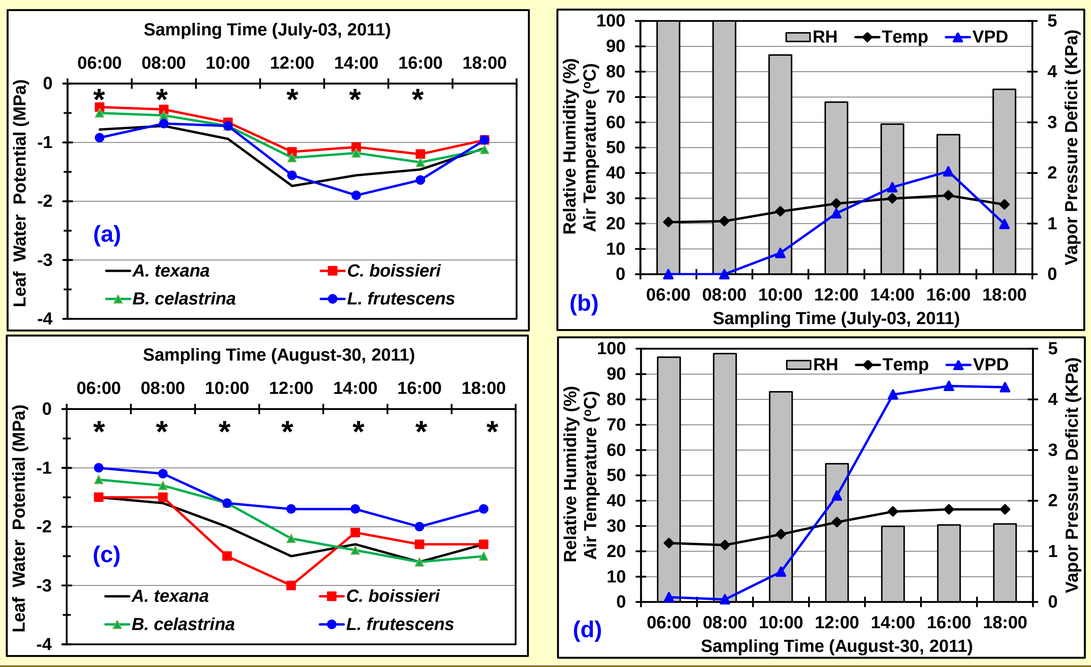


**Figure 2. Diurnal leaf water potentials in four native shrub species and prevailing environmental conditions registered during July-03 (a and b) and August-30, 2011 (c and d), respectively.**

**Table 2. Spearman's correlation coefficient values (n=35) for diurnal leaf water potential in relation to environmental variables in four native shrub species. $^{NS}$=No significant (P>0.05); *P<0.05; **P<0.01.**

| Environmental Variable | Native Shrub Species | | | |
|---|---|---|---|---|
| | *A. texana* | *C. boisssieri* | *B. celastrina* | *L. frutescens* |
| Air Temp. (°C) | -.461** | -.675** | -.392* | -.723** |
| RH (%) | .297$^{NS}$ | .522** | .224$^{NS}$ | .623** |
| VPD (kPa) | -.321$^{NS}$ | -.556** | -.249$^{NS}$ | -.643** |