

# HISTORICAL RECORDS OF DROUGHT IN THE SOUTHWEST

**J. Fessenden, J. Heikoop, M. Ebinger, C. Allen, D. D. Breshears, K. Lepper**

The potential for extended drought threatens the health, productivity, and security of the nation's people and agriculture. Through crop failure, starvation/dehydration on local to regional scales, and grazing effects, impacts on human health are multi-layered. Southwestern regions are highly sensitive to drought especially where ground water tables can drop below sustainable levels for survival (both plant and human). An understanding of past drought is needed to forecast future effects on local ecology, tree species, and agricultural crops in order to address our future safety and livelihood. Tree ring and peat bog chronologies have the power to determine historic drought events throughout the Quaternary. Through stable isotope research, biomarker analysis, and physical evidence of insect-induced pit formation, past droughts and bark beetle infestation can be measured in tree rings. Pollen analysis and stable and radiogenic isotope studies can be used to determine peat age, precipitation source, local temperature, transitions in plant cover, and drought-induced stress levels in historic plant communities found in peat cores. We have the ability to study the cyclicity of drought over 500 years in tree ring chronologies in northern New Mexico localities at (1) Los Alamos National Laboratory, (2) Bandelier National Monument, and (3) the Valles Caldera National Preserve and up to 1.2 million years within peat bogs and lake sediments found in the Valles Caldera N.P. Measurements of ring width,  $\delta^{18}\text{O}$ , and  $\delta^{13}\text{C}$  in tree rings will be made to determine changes in growth, water source, and stress of trees growing in the Los Alamos County. Monoterpene and beta-pinene analysis coupled to physical examination of pit formation will be made on these trees to look for past infestations of bark beetle. Direct dating using  $^{14}\text{C}$ , OSL and  $^{210}\text{Pb}$  will be used to age the peat core sediments.  $\delta^{18}\text{O}$ ,  $\delta\text{D}$ ,  $\delta^{34}\text{S}$  and  $\delta^{13}\text{C}$  in the organic tissues of the peat will be used to determine water source, anaerobic condition, and stress history, and pollen analyses will be used to determine plant species transitions, and productivity related to drought. Results will provide information on drought histories, reasons for the droughts (Monsoon vs. Pacific precipitation strength, i.e. ENSO events), and associated vegetation stress and transitions caused by droughts (e.g. bark beetle outbreaks and changes in the pollen record). The information provided in this study will use past records to understand and forecast future occurrences of drought and help gauge potential ecological changes, and biome transitions caused by drought-induced stress.