INTRODUCTION

Plant performance along environmental gradients provides one way to estimate potential plant responses to climate change (Van de Water et al. 2002). In particular, plant leaf carbon isotope composition ($\delta^{13}C$) is an integrated measure of external environmental conditions and internal physiological properties (Dawson et al. 2002). It has been widely used as a means of exploring climate change in terrestrial ecosystems (Hobson and Wassenaar 1999, Hultine and Marshall 2000, Song et al. 2008).

Leaf $\delta^{13}C$ is associated with the ratio of intercellular to the ambient CO$_2$ partial pressures (Ci/CA), which reflects the balance of photosynthesis and stomatal conductance and their coupled response to the environment (Farquhar et al. 1989). Environmental factors (e.g., air temperature, precipitation, barometric pressure, and soil moisture) can modify the carbon isotope composition of plant tissues through their influence on either leaf conductance or photosynthetic rate, or both parameters simultaneously (Ehleringer and Cooper 1988, Ehleringer and Cerling 1995, Panek and Waring 1997, Van de Water et al. 2002). Climate changes markedly with altitude over a short distance, therefore, mountains are ideal sites for studying how leaf $\delta^{13}C$ was affected by environmental factors.

Many studies have indicated that leaf $\delta^{13}C$ increase with altitude both on a global scale and locally in humid climates (Körner et al. 1988, 1991, Marshall and Zhang 1994, Hultine and Marshall 2000), while in arid or semi-arid regions the opposite trend has