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Transpiration and water use efficiency in native chilean and exotic species, a usefull tool for catchment management?

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Land-use and forest cover change play important roles in socio-economic processes and have been linked with water supply and other ecosystem services in various regions of the world. Water yield from watersheds is a major ecosystem service for human activities but has been altered by landscape management superimposed on climatic variability and change. Sustaining ecosystem services important to humans, while providing a dependable water supply for agriculture and urban needs is a major challenge faced by managers of human-dominated or increased antropical effect over watersheds. Since water is mostly consumed by vegetation (i.e: transpiration), which strongly depends on trees physiological characteristics (i.e: foliar area, transpiration capacity) are very important. The quantity of water consumed by plantations is influenced mainly by forest characteristics (species physiology, age and management), catchment water retention capacity and meteorological characteristics. Eventhough in Chile, the forest sector accounts for 3.6% of the gross domestic product (GDP) and 12.5% of total exports (INFOR, 2003), afforestation with fast growing exotic species has ended up being socially and politically questionable because of the supposed impact on the environment and water resources.

We present data of trees transpiration and water use efficiency from three headwater catchments: (a) second growth native evergreen forest (Aetoxicon punctatum, Drimys winterii, Gevuina avellana, Laureliopsis philippiana); (b) Eucalyptus globulus plantation, and (c) a mixed native deciduous (Nothofagus obliqua and some evergreen species) forest and Eucalyptus globulus and Acacia melanoxylon plantation located at the Coastal Mountain Range in southern Chile (40ºS).

Annual transpiration rates ranged from 1.24 $\pm$ 0.41 mol•m-2•s-1 (0.022 $\pm$ 0.009 L•m-2•s-1) for E. globulus, while the lowest observed was for L. philippiana 0.44 $\pm$ 0.31 mol•m-2•s-1 (0.008 $\pm$ 0.006 L•m-2•s-1). However water use efficiency for E. globulus, was the lowest observed (6.78 $\pm$ 8.92 μmol•mol-1) compared to native species, 7.45 $\pm$ 4.41 μmol•mol-1 for A. punctatum which showed the lowest value ($p < 0.05$). Preliminary results show, that the E. globulus has the highest transpiration rate, but the lowest water use efficiency values, compared to native evergreen and deciduous species. Nevertheless E. globulus showed the highest photosyntethic rate values, which finally traduces that E. globulus is a fast growing, big water drinker but it's less efficient than most native trees used in this experiment.

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