Southern Forests: a Journal of Forest Science, vol. 79(1): 1-9

Single-tree water use and water-use efficiencies of selected indigenous and introduced species in the Southern Cape region of South Africa

Mapeto P
Gush, MB
Louw J

ABSTRACT:

In South Africa, the development of a plantation tree industry using fast-growing introduced species was accelerated by the limited extent of indigenous forests. However, concerns about the impacts of plantations on the country's limited water resources has initiated forest hydrology research and subsequent regulation of the industry since 1972. The forestry industry's continued efforts to sustainably meet fibre and timber demands for the country's growing economy have prompted questions whether indigenous tree species can provide an additional low water-use form of forestry. Single-tree water use and water-use efficiencies of three indigenous species (Ilex mitis, Ocotea bullata and Podocarpus latifolius) and one introduced species (Pinus radiata) in the Southern Cape region of South Africa were quantified. The heat-pulse velocity method was used to collect hourly sap flow data over a 12-month period. Hourly weather and soil-water data were concurrently recorded and tree growth rates were determined for the year. Biophysical water-use efficiency was calculated as the ratio of utilisable biomass gained per volume of water transpired. Patterns of water use through the year were different for the different species. Pinus radiata had higher transpiration volumes and water-use efficiency levels than the indigenous species. The most transpiring Pinus radiata tree had a transpiration volume that was 4.7 times that of the most transpiring indigenous tree. Indigenous species' relatively lower water-use efficiencies were more a consequence of slow growth rates and not high water-use rates, which could be attributed to competition for resources in the dense indigenous forest. Potential implications for further hydrological research on the development of water-use-efficient tree production systems are discussed.