May 2016
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

POLICY BRIEF

Water use and socio-economic benefit of indigenous trees

A recently completed Water Research Commission (WRC) project has sought to quantify the economic benefits and water use of indigenous trees. The project confirmed the potential for managed, productive and sustainable indigenous forest and woodland systems in South Africa.

Background

South Africa is very reliant on its plantations of introduced tree species to meet its pulp and timber needs, and the benefits of this industry in terms of production, income generation and job provision are undisputed.

The downside is that these benefits come at some environmental cost, not least the impact of the industry on water resources.

With over 1 000 species of indigenous trees in the country, South Africa is extremely rich in natural arboreal diversity. The numerous benefits of indigenous trees and forests, in terms of the goods and services that they offer, are widely recognised.

There are also widespread perceptions that indigenous tree species use less water than introduced tree plantations. While data from previous studies are available on water use efficiency (WUE) of common introduced plantation species in South Africa, information on the water-use of indigenous trees and forests is scarce and indirect and relationships between growth and water-use within indigenous forests have only started to be investigated in South Africa in the last ten years.

Motivation for WRC study

Information on the water-use, growth and economic value of indigenous trees is required in order to facilitate sustainable land-use planning from hydrological, ecological and socio-economic perspectives.

New and innovative techniques to quantify the water-use (transpiration and total evaporation) of a range of tree species and forest types are available, and these may be used to broaden our understanding of forest hydrological processes and their associated effects on water resources in this country.

The overall efficiency of water-use for biomass production and the net benefit of the water use are important criteria that need to be understood to permit the evaluation of different land use scenarios.

The overall objective of the WRC study was to measure and model the water use and growth of indigenous trees in different types of tree systems, and to quantify the economic benefits and costs of the biomass production under a range of bio-climatic conditions in South Africa.

Additional funding for this project was made available by the Department of Environmental Affairs. The study was undertaken by a team of researchers from various organisations, led by the CSIR.

Study methods

The project conducted intensive measurements of tree and forest water use, stem growth, weather variables, soil water dynamics and tree attributes, as well as economic and financial assessments within indigenous and introduced tree systems.

Research work focused on priority individual indigenous tree species and forest types, through six phases of field measurements and data collection exercises.

Main results

Results showed that the range and average of observed one-year water-use totals (transpiration component) was noticeably less for indigenous tree species compared to introduced plantation tree species. Maximum water-use was also lower in the indigenous species studied compared to introduced plantation species, despite growing conditions that could be considered ideal for most of the indigenous species sampled.

Evidence suggests that indigenous forests cannot compete with plantations of introduced tree species for wood production, and this was confirmed through a comparison of the growth rates observed in respective indigenous and introduced tree species in this study.

In terms of growth and water use it was found that while biomass production was much lower for the indigenous tree species, they also used much less water than introduced plantation species. Resultant WUE estimates showed substantial variation, even within a particular species, but on average results indicated that indigenous tree species appear to exhibit similar water use efficiencies to introduced plantation tree species. This supports the argument of a general correlation between growth and water use.

While the economic viability of specific indigenous tree species could not be judged the value of indigenous forests in the upkeep and maintenance of rural livelihoods appeared to be substantial.

Regarding the financial viability of a Yellowwood plantation, it was noted that the direct production costs were comparatively small relative to the opportunity cost of the extremely long term.

However, the extremely long rotation period required rendered it uncompetitive against introduced species such as pine, unless it was possible to shorten growing periods (via breeding and selection programmes).

Additional challenges associated with the more formal indigenous wood market were found to be numerous. These included unpredictable and variable supply, widely ranging shape, size and quality of logs, high harvesting and extraction costs, and unpredictable market demand.

Consequently, this study represents an important descriptive presentation of the dynamics associated with the formal and informal indigenous tree product markets.

Conclusions and recommendations

The relatively low water-use characteristics of indigenous tree species suggests that they are promising for expanding natural and plantation tree production systems in South Africa, maximising benefits (goods and services) while minimising resource impact (water use).

Apart from the importance of accurate site/species matching, appropriate species for establishment need to be considered from environment, social and economic perspectives. Potential benefits include suppression of alien invasive plants, biodiversity conservation, provision of ecosystem services, supporting rural livelihoods, ecotourism and urban greening.

Given the increasing pressure on water resources and a growing demand for timber and non-timber forest products, further exploration of the numerous multiple-use indigenous tree species that are found in this country, matched to the wide range of existing climatic and site conditions, is merited.

There is surely potential for managed, productive and sustainable indigenous forest and woodland systems. Considering that further afforestation with commercial forest species is now restricted due to limitations in available land and concerns about reductions in catchment water yields, the possibility of expanding low water-use forms of forestry with indigenous trees deserves to be explored further.

Further reading:
To order the reports, *Water use and socio-economic benefit of the biomass of indigenous trees Volume 1: Research Reports* (**Report No. 1876/1/15**) and *Volume 2: Site-specific technical report* (**Report No. 1876/2/15**), contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.