

**Growth and carbon sequestration by street trees in the City of
Tshwane, South Africa**

by

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Submitted in partial fulfilment of the requirements for the degree

Philosophiae Doctor

in the Faculty of Natural & Agricultural Science

University of Pretoria

Pretoria

June 2006

Soli Deo Gloria

I dedicate this thesis to my beloved parents Pierre and Cecilia

Titel: Growth and carbon sequestration by street trees in the City of Tshwane, South Africa

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Abstract

This study focuses on certain urban forestry aspects of the City of Tshwane (previously Pretoria) and in particular that of growth rate and carbon sequestration estimates of street trees with the aim of quantification of the value of these trees. The relationships between tree height and crown dimensions to stem diameter and tree age, as well as the relationship between stem diameter to tree age enable the development of growth rate equations that predict tree dimensions and carbon storage. This permits the calculation of monetary values of urban trees and thus the modelling of costs and benefits of urban forests.

The main objectives were (1) to develop tree height, crown diameter, crown height, and crown base height to stem diameter relationships for the indigenous street tree species *Combretum erythrophyllum*, *Rhus lancea* and *Rhus pendulina*, (2) to develop tree height, crown diameter, crown height, crown base height and stem diameter to tree age relationships for the above street tree species, (3) to determine the 30 year carbon sequestration estimate and monetary value of 115 000 street trees to be planted mainly in poorer previously disadvantaged communities during the period 2002 to 2008 and (4) to determine the monetary

value of the 33 630 *Jacaranda mimosifolia* street trees in the City based on the quantity of carbon stored in the trees.

Combretum erythrophyllum had the most rapid growth rate in many instances, thereafter came *Rhus pendulina* and then *Rhus lancea*, which consistently had the slowest growth rate for the investigated parameters. It is estimated that the 115 000 street trees to be planted will sequester more than 200 000 tonne CO₂ equivalent and have an estimated monetary value of more than US\$2 million if a market related CO₂ price of US\$10.00 per tonne is assumed. The Jacaranda street trees have an estimated carbon stock of 41 978 tonne CO₂ equivalent and this would value the Jacaranda urban forest at US\$419 786.

Keywords: allometry, carbon sequestration, growth rate, stem diameter, street trees, tree dimensions, urban ecology, urban forestry

Acknowledgements

There are numerous people and institutions that aided me in the preparation of this thesis:

To my promoter and mentor, Prof Gretel van Rooyen, I express my most sincere gratitude, especially for her unfailing patience and expert guidance. She was also willing to guide me into the new fields of urban forestry and carbon sequestration for which I am exceptionally grateful.

I gratefully thank the following institutions for financial assistance:

1. Afrox
2. The Bradlows Foundation
3. The City of Tshwane Metropolitan Municipality
4. The National Research Foundation (NRF)
5. The University of Pretoria

This material is based upon work supported by the National Research Foundation under Grant number 2053522.

I thank Jessica, Retief, Lipson and Conrad for assistance with fieldwork. A special word of gratitude to Ina for her help with the Jacaranda section.

I cannot let this opportunity pass to thank Clinton, Katrien and Nico for your support as employers and friends.

Also a big word of thanks to the support staff: Rene and Miranda, as well as Mrs Elna van der Walt and Mrs Marinda Tereblanhce for your vital and pivotal role in obtaining finances. I furthermore specially thank Mrs Marie Theron of the AIS for her excellent service.

I thank Prof Francois Steffans, Prof Hennie Groeneveld and Dr. Mike van der Linde who were responsible for the statistical framework, analysis, guidance and proof reading.

The financing of the Jacaranda research was obtained by Mr Bertie Dry and Mr Juan Mostert from the City of Tshwane Metropolitan Municipality. Thank you for your support.

On a more personal note:

I would not have been able to study without the incredible support and unconditional love and assistance of my parents Cecilia and Pierre. I thank you for all the vibrant discussions, proof reading, guidance and especially the good food. It is with great joy and tremendous gratitude that I dedicate this thesis to you.

I then also express great appreciation to my family: Pieter and Karin, Eduard and Linda, and Theunis and Karin for your loving kindness, encouragement and support. A special word of thanks to Pieter who helped me at a crucial point with an equation.

Lastly to Rene. Thank you.

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