A TECHNIQUE TO IDENTIFY ANNUAL GROWTH RINGS IN *EUCALYPTUS GRANDIS* USING ANNUAL MEASUREMENTS OF DIAMETER AT BREAST HEIGHT AND GAMMA RAY DENSITOMETRY

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INTRODUCTION

- Many tropical eucalypts lack distinct growth rings due to a lack of strong seasonal climatic variation and this makes it difficult to resolve wood property data into annual increments[1,2].
- *Eucalyptus grandis*, one of the most important commercial hardwood species in South Africa, is one such example of a species that does not have well defined growth rings; the light and dark bands visible on the cross-section of the wood of *E. grandis* do not always correspond with the growing season.
- Similarly, the number of growth rings observed on radial wood property profiles for this species exceeded the known age of the trees.
- A technique was developed to identify annual growth rings in *E. grandis* using a combination of annual measurements of diameter at breast height (DBH) from permanent sample plot (PSP) datasets and bark-pith density profiles

METHOD

MEASUREMENT OF WOOD DENSITY

- Non-destructive pith to bark cores were sampled at breast height (1.3 m above ground) from trees within each PSP.
- Strips of uniform thickness were cut along the radius using a twin-blade saw.
- Strips were scanned at consecutive 0.5 mm intervals, from bark to pith, using a gamma ray densitometer to determine the density profile.

METHOD

COMPARTMENT INFORMATION

Growth data was obtained from a PSP in an *E. grandis* compartment in KwaZulu-Natal, South Africa. Diameter at breast height (DBH) was measured on an annual basis for all trees within the sample plots

Table 1. Measurement and sampling history of PSP

Date planted	First date measured	Last date measured	Date sampled	Age at first measurement	Age at final measurement	Age when sampled	Number of measurements
Feb-93	Aug-95	Jun-05	Jul-05	2.6	12.4	12.5	11

CALCULATING AND PREDICTING RADIAL INCREMENT

- Radial increment (RI) was calculated for each year from the bark end towards the pith (i.e. the final PSP measurement till the first measurement) and expressed as a percentage of the radius at the end of the increment for year (%RI).
- Mean radial increment (%MRI) was calculated at a compartment-level and used to predict RI at an individual tree level for trees sampled from within the PSP

RELATING PREDICTED RI TO DENSITY PROFILES

Predicted RI (mm) for each tree was expressed as cumulative distances from the bark end and superimposed onto their respective density profiles to separate growth rings on the density profiles into annual rings (or annual increments).

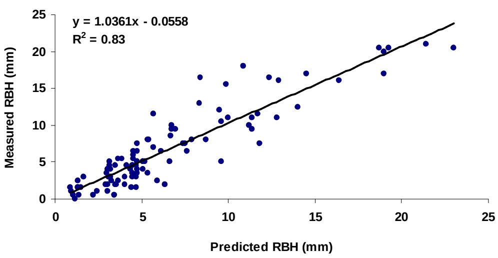

Fig. 1. Relationship between predicted and measured RI. Coefficient of determination (R^2) and significance of correlation (* 0.01<P<0.05) is shown.

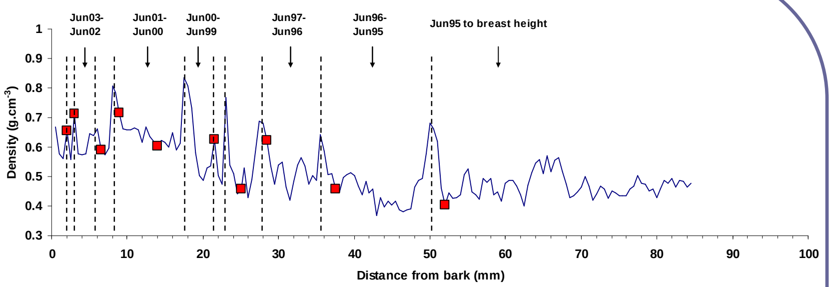

Fig. 2. Density profile with corresponding predicted RI (as indicated by the solid squares) which serve as a guideline for separation points selected for each year of growth (as indicated by dotted lines)

RESULTS

- The accuracy of the method used to predict RI was tested by comparing measured RI with predicted RI (for all years measured) (using 10 trees that were not included when calculating the %MRI for the compartment) (Fig. 1).
- Predicted RI corresponded well with latewood peaks and were used as separation points which served as a reliable guide to divide the density profile into annual increments (Fig. 2).
- These separation points, however; did not always lie directly on top of each latewood peak. This was a result of using %MRI at a compartment level (which represented a range of varying tree sizes) to predict RI at an individual tree level.

SUMMARY

- By assessing the pattern of radial variation in wood density within the context of the growth history of a compartment (by means of annual PSP data), it was possible to corroborate the estimation of annual growth rings on density profiles of *E. grandis*, especially closer to the bark-end.
- This method facilitated the use of density profiles of *E. grandis* as 'templates' to separate growth rings into annual rings on bark to pith profiles for vessel and fibre characteristics where there is no clear or consistent pattern of growth rings.

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