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PROBLEMS ENCOUNTERED IN AGE ESTIMATION OF FOREST TREE SPECIES

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In forestry and dendrochronological studies, estimation of age in most cases is based upon cores or cross-sections. In many cases cores or wood samples do not pass through the centre or pith of a tree, an allowance is therefore made to calculate the number of rings in the missing portion of the wood sample. The missing radius is obtained by substracting the core length from the crude radius of the tree and missing years are calculated from the growth rate of the innermost rings and added to the total age of the wood sample. Reliability of the core is also obtained by dividing the core length by the crude radius and expressing it as percentage. This measure gives an approximate idea of how near the end of the core is to the presumed tree centre and hence how reliable the age estimate.

Little is known about the error associated with these estimations. Present study therefore not only shows the errors encountered in age estimtion of trees but also discusses various problems encountered during age determination.

Sixteen centred cores of *Agathis australis* Salisb, were selected. True ages were calculated following standard dendrochronological methods (Frits, 1976). Each wood sample was divided into various reliabilities (60 to 90%) and within each reliability rings were counted and missing radius was calculated according to Ogden (1980). Missing years were calculated on the basis of both growth rate of the innermost 20 rings and overall growth rate for comparison. Estimated ages were compared with true ages (Table 1).

The percentage of over and underestimates of age decreases with increasing reliability of the core (Table 1). In addition growth rate of innermost 20 rings gave better estimate of missing portion of the core than the overall growth rate. The number of missing rings in the centre of the tree should therefore be calculated on the basis of growth rate of innermost twenty rings rather than considering overall growth rate of the core.

If non-centered cores are taken from a distance equivalent to the radius estimated from the circumference, then this distance ranges from as little as 39% of the true distance to over 100% (Ahmed, 1984). Thus if a non-centered core is taken in the field from asymmetrical tree (Fig. 1), calculation of the age, which is based on the missing radius derived from the diameter of the tree may be over or underestimate in proportion to the amount of missing radius.

Table 1. Estimates of error using various reliabilities.

Core length as % of radius (reliabiity)	Mean % over or under estiamte of age (95% CL attached)	Overestimate/ Understimate
on the basis of overall growth rate		
60	19.4 ± 6.8	12/4
70	12.5 ± 4.1	12/3
80	7.8 ± 2.3	13/3
90	4.1 ± 1.4	12/4
on the basis of innermost 20 rings		
60	8.3 ± 3.5	7/9
70	5.5 ± 2.3	6/10
80	4.2 ± 2.3	5/10
90	2.6 ± 1.4	5/11

Based on 16 centered cores from trees ranging from 70 to 120 cm dbh.

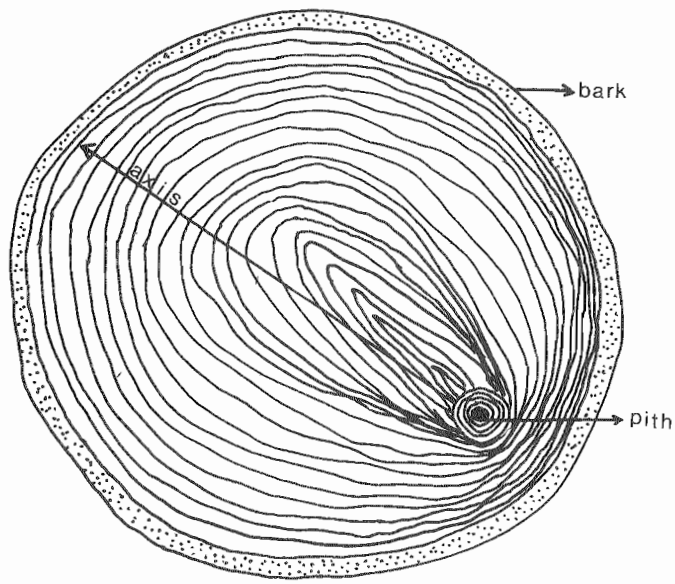

Fig. 1. Asymmetric cross-section. Wide rings on one axis and narrow, indistinct rings 'wedging out' on another axis.

Another problem arises when a non-centered core is longer than the crude radius. In this situation calculation of the missing radius, reliability and age is not possible. This problem can be handled only by obtaining another core from the same tree.

A reliable and accurate age estimate depends upon the radial uniformity of the stem which can be checked by taking atleast 3 cores from different sides of a tree, idcally passing through the centre or pith. In practice this takes more time and labour and in some cases is not possible, especially in those trees which are hollow or rotting in the centre.

Ring width characteristics, internal symmetry of stem and growth rates vary among different tree species. Results presented here may give some impression of the accuracy of the age estimate of *Agathis australis* only. Other tree species should be treated in the same way separately. However the problems discussed here may be encountered with any other tree species.

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