Teak tree-ring chronologies in Myanmar — A first attempt

NATHSUDA PUMIJUMNONG1, DIETER ECKSTEIN2* AND WON-KYU PARK3

1Faculty of Environment and Resource Studies, Mahidol Univ., Nakhon Pathom 73170, Thailand.
2Institute for Wood Biology, University of Hamburg, 21031 Hamburg, Germany.
3School of Forest Resources, College of Agriculture, Chungbuk National Univ., Cheongju 361-763, Republic of Korea.

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ABSTRACT


A preliminary dendrochronological study with teak in Myanmar was performed in order to test its potential as a palaeoclimatic archive. There was a strong signal for rainfall in April, i.e., for the transition period between the dry and the rainy season.

Key-words—Teak, Dendrochronology, Myanmar.

INTRODUCTION

Teak (Tectona grandis L.) has been proven for some time to be of great dendroclimatic potential in several areas of its natural distribution: Berlage (1931) and D’Arrigo et al. (1994) studied teak in Java, Bhattacharyya et al. (1992) and Wood (1996) in India, Pumijumnong et al. (1995) in Thailand and Eckstein and Xayvongsa (unpubl.) in Laos. However, in Myanmar teak has not yet dendrochronologically been explored. Since the old-grown teak forests in the whole area from India to Laos are endangered by logging activities, it is high time to rescue the unique source of climatic information archived in those trees. The present paper is the first attempt from Myanmar.
METHODS

The tree-ring widths of these cores were measured to the nearest 0.01 mm using a binocular microscope with a linear stage interfaced with a computer. Various routines out of the DPL program package (Holmes, 1994) were applied for the data management and analyses, among them COFECHA (Holmes, 1983) to statistically check the visual cross-dating, and ARSTAN (Cook, 1985) to detrend and autoregressively model the tree-ring series. Finally, the series were averaged for each site to a master chronology using the robust mean function.

RESULTS AND DISCUSSION

A 136-year long chronology covering the time span from 1998 to 1863 (Fig. 4) has been made from the site MA (12 teak trees with 36 cores). The mean tree-ring width is 1.77 mm. The mean sensitivity of the raw tree-ring series is fairly high (0.48) and conversely, the autocorrelation rather low (0.54). The mean correlation of all tree-ring series with the master chronology made from all tree-ring series except the one which is not correlated, is 0.45.

From the site MB, 21 teak trees with 73 cores were included into a 165-year long chronology from 1998 to 1834...
Fig. 3—Teak forest in the Pyinoolwin Forest Reserve.
To study the climate/growth relationships, the monthly values for rainfall and temperature from October prior to the growing season until current September were correlated with the so-called residual tree-ring chronology, that is the chronology where the autocorrelation has been eliminated by autoregressive modelling (Fig. 7). The highest positive correlation is with rainfall in April, i.e., the transition period from the dry to the wet season. However, there is also an unexpectedly high negative correlation with rainfall in the preceding October, but only for one of the two sites. There is also some correlation with temperature in the previous December, a result which is physiologically not explainable since we know from our studies in N.-Thailand (Punijiammong, et al., 1996) that the cambium is dormant after the beginning of November.

In N. Thailand, the growth of teak is also mainly stimulated by the amount of rainfall during the beginning of the rainy season, although not as strictly concentrated on one single month as in Myanmar. In addition, our results get supported by Pant and Borgaonkar (1983) who found a similar response of teak in India. The climate-growth relationship for
the teak in Laos has not been studied yet, but from the similarity of its growth pattern with teak in N-Thailand a similar climatic signal can be assumed.

CONCLUSION

Our first attempt to evaluate teak trees in Myanmar as an archive for palaeoclimatic information was successful. Teak

<table>
<thead>
<tr>
<th>Study site</th>
<th>Trees(n)</th>
<th>Cores(n)</th>
<th>Start/endyear</th>
<th>Age (years)</th>
<th>Tree-ring width(mm)</th>
<th>S.D. (mm)</th>
<th>Autocorrelation</th>
<th>Mean sensitivity</th>
<th>Mean corr. with master chron.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>12</td>
<td>33</td>
<td>1863-1998</td>
<td>136</td>
<td>1.77</td>
<td>1.34</td>
<td>.54</td>
<td>.48</td>
<td>.45</td>
</tr>
<tr>
<td>MB</td>
<td>21</td>
<td>73</td>
<td>1834-1998</td>
<td>165</td>
<td>2.08</td>
<td>1.53</td>
<td>.49</td>
<td>.50</td>
<td>.46</td>
</tr>
</tbody>
</table>

Fig. 6—Pyinoolwin Forest Reserve: tree-ring statistics of the MA and MB site.
is a reliable recorder of rainfall in April, which is an important month for the onset of the monsoon. In the nearest future it is urgently necessary to sample old-grown teak trees in Myanmar in order to get tree-ring series extending back into the past as far as possible. With such proxy data we want to contribute to the reconstruction of the variability of the monsoon climate and thus for its better understanding.

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**REFERENCES**

Berlage HP 1931. Over het verband tusschen de dikte der jaarringen
von Djatiboomen (Tectona grandis L.f.) en den regenval op Java.
(About the relationship between annual ring width of Djati trees


