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Investigation of ergonomic parameters of easy chairs in Moratuwa furniture manufacturing establishments

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Sitting on a comfortable seat helps to relax the body and reduce energy consumption, but on the other hand prolonged sitting slackens abdominal muscles and may cause back ache. Application of medical and ergonomic principles in the design of a seat can maximize advantages and minimize disadvantages in sitting.

In Sri Lanka the demand for a furniture depends on the customer perception to comfort and beauty of the product. The present study aimed to find out whether the easy chairs manufactured in the Moratuwa Furniture Manufacturing Establishments were ergonomically designed for the Sri Lankan users.

The investigation was initiated with the identification of easy chair designs in the Moratuwa Furniture Manufacturing Establishments. A representative sample of two popular easy chair designs, the Kulu Putuwa and the Medal Putuwa, was then selected. The different design parameters of these two chairs were measured. It was observed that there were differences in the dimensions of the major design parameters of the chairs between companies.

Sri Lanka has no specific standards for designing of furniture. Hence design standards were developed for easy chairs in the present study based on available anthropometric data for Sri Lankan users and other published anthropometric data on seat designs.

The different design parameters of Kulu Putuwa and Medal Putuwa were then compared with those developed ergonomic standard values. It was observed that only the back rest height of the easy chairs was ergonomically acceptable in all the companies surveyed. Seat height, seat depth, seat width and arm rest height were lower than the accepted standard values. Such improper dimensions should result in discomfort and body pain. The angle of rake and angle of tilt, which indicate the inclination of the back rest, were significantly lower in the sampled chairs. The inclination of the back rest was lower than the required 115^0-120^0, which should result in low back stress and static muscular tension, which may lead to development of back injuries.

In order to improve the ergonomic parameters of the Medal Putuwa, a prototype chair was designed. Seat height, seat depth, seat width, arm rest height, of the prototype char was lower and it had higher angle of tilt and angle of rake. The designed prototype chair was evaluated against a normal control chair, and the users rated the ergonomically designed chair was much better compared with the control in terms of comfort.

The present study reveals the need for Sri Lanka to have specific standards based on the body sizes of users, for design of furniture. This will enable the production of ergonomically correct and aesthetically acceptable quality furniture in Sri Lanka.

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Estimation of above ground biomass of forest trees using dbh as a single parameter

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Forests in Sri Lanka contribute to the mitigation of climate change through sequestrating a net amount of carbon dioxide and also maintaining carbon stock as biomass. Total tree biomass comprised of above ground and below ground biomass of trees. This paper presents a methodology developed to estimate individual tree above ground biomass using allometric relationships. The advantage of this method is that the above ground biomass per unit area can be determined by estimating these values for different species separately within that area. The present study was conducted in Yagirala Natural

Forest Reserve situated in Kalutara District, low country wet zone of Sri Lanka. In this study, the above ground biomass of different species available in that forest were predicted using the diameter at breast height (dbh).

45 tree species were identified in the forest and models were separately developed for each species. For each species, 3 classes were established using the size, i.e., small, medium, and large. For class 1 and 2 trees, the main stem and the average size branch were divided into sections and for each section end diameters and length were measured. The volume of each section was estimated using Smalian's formula. The total branch volume was estimated by multiplying the average branch volume by number of branches. Then a volume and biomass relationship was estimated for each species by measuring the biomass of a known volume.

The leaf biomass in the crown was estimated by measuring that in 1 m^3 of crown volume. Then it was converted to the entire crown via crown volume. Finally above ground tree biomass was calculated by adding branch and crown biomass to stem biomass.

Then allometric relationships were developed to predict the above ground biomass of each of 45 species separately using dbh. A strong relationship was found between total tree biomass and dbh of all species with R^2 values over 95%. In order to test further improvement of the models, total height was added as the second explanatory variable. However, it did not improve the R^2 and for most species height became non-significant. Therefore the finally selected basic model structure was log biomass = $a + b$ log dbh. The model parameters however, indicated different values for a and b for the different species, varying a from -1.71 (*Mastixia tetranda*) to - 0.73 (*Xylopia parvifolia*) and b from 2.01 (*Putranjiva zeylanica*) to 3.29 (*Syzygium cordifolium*).

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An assessment of vegetation and canopy structure of moderately exploited natural forest area in Yagirala forest reserve

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Study assessed the vegetation composition and structure and the forest canopy structure in terms of Leaf Area Index (LAI), Mean Leaf Angle (MLA) and canopy openness in different elevational classes of moderately exploited natural forest area which covers about 82% of total natural forest cover in Yagirala forest reserve, a tropical lowland rain forest selectively logged by State Timber Cooperation in late 70's.

Canopy architecture termed as angle distribution of foliage elements (Chen *et al.* 1992), can be quantified by the leaf area index (LAI) and mean leaf angle (MLA). In this study Hemispherical photographic method was used to characterize canopy architecture at three elevational classes (i.e. valley, mid-slope and ridge top). At each elevational class, hemispherical photos of the forest canopy were taken at each sampling point at a height of 1m above the ground along transects up to 200m at 50m intervals. Hemispherical photographs were analyzed using HemiView 2.1 canopy analysis software.

A vegetation survey was carried out to determine floristic composition of dominant species and families, which contribute more to the forest canopy. The enumeration was carried out using 0.05 ha circular plots at three elevational classes, totally covering 0.6ha of the area. Individuals taller 1m were enumerated and species, diameter at breast height (dbh) and total height measurements were recorded and relative basal area, relative frequency, relative density and Importance Value Index (IVI), diameter class distribution were estimated.

Leaf area index (LAI) and mean leaf angle (MLA) did not show significant variation between three elevational classes. LAI mean value of low elevation areas show high value of 2.256 and mean value of high elevation areas show low value of 2.087. Average MLA value for the moderately exploited area is 29.14. Canopy openness given in terms of visual sky fraction is also not significantly diferent between three elevational classes. The results give an estimation of homogeneity of canopy openness within the moderately exploited natural forest.