



Teaknet Bulletin

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Editorial

Another eventful year 2010 has passed by. TEAKNET now welcomes the New Year with many expectations as it is in this year another grand teak conference is going to take place. The next international teak conference is due for 2-6 May, 2011 in Costa Rica. TEAKNET would gain a true international standing by this conference as important linkages are going to be established with countries in Latin America and Africa.

TEAKNET has started functioning from India since June 2009. Since then many new members have joined this network. These people have joined the organization putting their faith in getting effective value for their investment although they have not so far made their expectations explicit. The members fall under some distinct classes like teak growers, traders, researchers and policy makers. These groups are understood to have different requirements.

TEAKNET Welcomes the New Year 2011

Best Wishes for a Happy and Prosperous New Year



In order to make the service of TEAKNET a little more dynamic, the following facilities are added in our website.

In the home page, three links are added newly, viz., Market watch, Growers' tips and Researchers' corner. Under Market watch, it is intended to display information on availability and price of timber internationally. Those of you wanting to notify your products such as teak logs, saw-timber or any other artifacts may send in the information regarding the product specification and price which will be displayed in the website under the specific link. However, the information can be viewed only by TEAKNET members using their username and password. Such information may be retained only for a specific period. Under the Growers' tips, questions raised by the growers and answers provided by the experts will be provided for general information. Researchers' corner will contain information on latest research findings with full citations sent by the researchers the world over. Over time, this by itself shall form a database. To this effect, the researchers are requested to send in details of their findings to the TEAKNET secretariat. All communications are to be sent directly to coordinator@teaknet.org.

In this issue, Mr. Raymond Keogh has reported information about OLAT a growers' initiative in South America with international connections.

There have been queries from some members about the volume prediction equations for teak like: Is there a particular equation which TEAKNET can suggest? It is to be noted that the parameters of the volume equations change from place to place and so it is always better to use a local volume equation. Sometimes a general volume equation is available for a region based on both diameter and height of trees. These may need to be localized based on height-diameter relation established locally. Superior methods of deriving localized height-diameter relations are also reported in the literature. Responding to the need expressed by the members, TEAKNET undertook a compilation of volume equations reported in teak starting from those from India. A description of this work is available in this issue of the bulletin. TEAKNET would like to extend this work to international level. The readers of this bulletin are requested to report information on local volume prediction equations used in respective places with complete particulars regarding the equation form, the range of applicability, utilization limit, definition of commercial volume and the citation or reprint. A similar compilation is intended for biomass prediction equations as well. It would be helpful if the readers provide information on this aspect as well.

Additionally, there is an interesting article on price changes that have occurred in Asian teak during the last decade or so, by Drs. Florian Zimmermann and Reinhold Glauner of WaKa Forest Investment Services AG, Winterthur, Switzerland.

Selection of plus trees and their multiplication through clonal propagation has become an effective method for productivity improvement. This time, Dr. Surendran of KFRI makes a brief account of his work in identifying and testing some clones he has developed.

K. Jayaraman,
TEAKNET Coordinator



Latin American Teak Growers Association founded

Raymond M. Keogh

Technical Director of Tectona G Capital and Founding member OLAT

OLAT (Organización LatinoAmericano de Teca), a multi-national association, whose objective is to ensure that teak cultivators of the region obtain the best value for their produce, was established on 1st December 2010 in San Jose, Costa Rica. Growers from fifteen countries, from Mexico to Brazil are involved in the new initiative and collectively represent over 100,000 ha of plantations.

The new association is being established against the background of a looming crisis. The supply of high-grade tropical hardwoods worldwide is 90 million m³ per year, most of which arises in an unsustainable manner from deforestation and degradation of natural forests. It is now clear that alternative sources of tropical hardwoods must be found in order to sustain the output of precious timbers while, at the same time, reducing pressure on natural forests. Unfortunately, it is difficult to manage large areas of natural ecosystems on a sustainable basis. The role of plantations in this process is therefore crucial.

OLAT's function in ensuring that growers obtain an equitable return for their produce is vital if the quality of sustainable plantations, like teak, is to be improved. The association brings together a large number of producers from Latin America. It enables its members to develop standards, gather and distribute up-to-date information on prices and apply methods that facilitate the marketing and trading of teak.

OLAT is the brainchild of five international founding members from Costa Rica, Argentina, the Netherlands and Ireland. The international flavour of the association is also underlined through strong export links of its members with Asia, the largest teak market in the world. Commenting on the relevance of OLAT for Latin America, its newly elected President Dr. Pablo Camacho stated that: 'OLAT represents the first step on the road to bringing transparency and clarity to the Latin American teak sector which is in the process of modernising.'

More information is presented on the OLAT website (www.olatgroup.com).

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Standardization of volume prediction equations for teak in India

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Abstract

An attempt made to compile the different volume prediction equations used in India and bring them to a standard form, is described. It is found that the volume equations differ widely in their output but a grouping was possible based on their coefficients in the refitted form. The readers are urged to report information on such equations in use in different parts of the world to TEAKNET so that it is made available for the users in a convenient form.

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Introduction

Volume equations provide estimates of individual tree volumes based on easily measurable characteristics of trees like tree diameter, height or tree form. Parameters of such prediction equations are found to vary over species and from location to location. Hence it is best to use local volume equations to the extent possible for best results. To avoid repetitive works of establishing local volume tables, sometimes, a general volume equation based on diameter and height is established for a species which is then localized based on a locally established height-diameter relationship.

Review of the literature shows that the reported volume equations differ with respect to the definition of commercial volume, range of predictor variables, utilization limit of wood (tip end girth), form of the equation and so on. Moreover, published materials are not readily accessible by many users. Hence it was thought to undertake a compilation and make the information available in a standard form. The results reported below are the output of such an attempt made at the TEAKNET office. The actual intention was to make a compilation at the international level but due to many constraints, the work had to be limited to India for the time being. When additional funds become available, the work will be extended to international levels. However, it is requested that the readers of this paper may report to TEAKNET the details of the local or general volume tables or equations currently in use in respective places to simplify our task of compiling such information internationally.

Methods used and the results

Information on volume equations established was gathered which is presented in Table 1. Equations based on both diameter and height are also available but not included here presently. In order to bring them to a standard form, the following equation was refitted on the predicted volume obtained using the different equations.

$$\ln V = \ln a + b \ln D$$

where V is the volume of wood under bark to the specified limit (m^3)

D is the diameter at breast height (dbh) of the tree (m)

a and b are regression constants.

$\ln$ indicates natural logarithm

Table 2 contains the results of refitted equations. The R^2 values of refitted equations do not carry much significance as the dependent variables are not actual observations. This statistic is reported just to indicate the extent of deviations of the output values from the refitted model. The R^2 values of refitted equations are high enough indicating the very meager loss of information that has occurred through refitting.

Discussion

Figure 1 indicates the graphical output of the equations reported in Table 1. A comparison is now possible because of the common scale. The predicted volume differs mostly at the upper end of the diameter range rather than the lower end meaning that the predicted volume obtained through different equations vary greatly for larger trees. The equations are now available in a much simpler form. For the same diameter at breast-height, the presence of larger volume on the tree reflects either on the more cylindrical bole form, larger branch volume or lesser density of wood.

There is a possibility of grouping the equations based on their parameter estimates. A simple hierarchical clustering done based on Euclidean distance showed the possibility of five distinct groups at 25% phenon, i.e., allowing 25% of the maximum distance within any cluster (Figure 2). The grouping obtained is shown in Table 3. It is found that the grouping obtained is not related to geographical proximity.

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Table 1. Information on published volume equations for teak from different parts of India

Eq. No.	State/Region	dbh (m)		Model	Coefficients				R ²	Utilization limit* (m)
		Min	Max		a	b	c	d		
1	Andhra Pradesh (Mehboobnagar Forest Division)	0.18	1.08	$V = a + bD^2$	-0.0859	5.6408			0.9600	0.3142
2	Andhra Pradesh (Adilabad District)	0.18	1.08	$V = a + bD + cD^2$	0.0236	-0.5310	6.7310		0.9403	0.3142
3	Assam (15 Districts)	0.18	1.08	$V = a + bD + cD^2 + dD^3$	0.1911	-3.2537	17.9194	-1.6612	0.9959	0.3142
4	Gujarat (Surat Circle)	0.18	1.08	$\sqrt{V} = a + bD + c\sqrt{D}$	-0.4059	1.9816	0.9874		Not specified	0.3142
5	Karnataka (Chickmagalur, Hassan and Shimoga Districts)	0.18	1.08	$V = a + bD^2$	0.0860	5.6410			Not specified	0.3142
6	Karnataka (Kodagu District)	0.18	1.08	$V = a + bD + cD^2 + dD^3$	-0.2777	3.1042	-6.1274	15.1699	Not specified	0.3142
7	Madhya Pradesh (Balaghat, Seoni and Mandla Districts)	0.18	1.08	$V = a + b\sqrt{D} + cD^2$	0.0435	-0.2635	8.7933		0.9733	0.3142
8	Madhya Pradesh (Rajnandgaon and Durg Districts)	0.18	1.08	$\frac{V}{D^2} = \frac{a}{D^2} + \frac{b}{D} + c + dD$	0.0452	-0.9186	8.1826	1.9566	0.7603	0.3142
9	Madhya Pradesh (Bilaspur District)	0.18	1.08	$V = a + bD^2$	-0.0168	5.3943			0.9734	0.3142
10	Madhya Pradesh (Raipur District)	0.18	1.08	$\frac{V}{D^2} = \frac{a}{D^2} + \frac{b}{D} + c + dD$	0.1259	-2.4521	16.5234	-7.5714	0.8533	0.3142
11	Maharashtra (Ballarshah Catchment - Chandrapur)	0.18	1.08	$\frac{V}{D^2} = \frac{a}{D^2} + \frac{b}{D} + c$	0.0749	-1.4065	10.1161		0.8239	0.3142
12	Maharashtra (Sondad Catchment - Bhandara District)	0.18	1.08	$V = a + bD + cD^2$	-0.0037	-0.3792	6.3683		0.9858	0.3142
13	Maharashtra (Wadsa Catchment - Chandrapur)	0.18	1.08	$\sqrt{V} = a + bD$	-0.1067	2.5624			0.9768	0.3142

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Eq. No.	State/ Region	dbh (m)		Model	Coefficients				R ²	Utiliza- tion limit* (m)
		Min	Max		a	b	c	d		
14	Maharashtra (Melghat Forest Division)	0.18	1.08	$V = a + bD + cD^2$	0.0320	-0.9954	9.9113		0.7601	0.3142
15	Rajasthan (Udaipur Forest Division)	0.18	1.08	$V = a + bD + cD^2$	0.0621	-0.9280	6.6130		Not specified	0.3142
16	Rajasthan (Southern and Eastern)	0.18	1.08	$V = a + bD + cD^2$	-0.0107	0.1854	1.9554		0.9048	0.3142
17	Uttar Pradesh (Tarai Region)	0.18	1.08	$V = a + bD + cD^2 + dD^3$	0.0885	-1.4694	11.9898	1.9706	0.9958	0.3142
18	West Bengal (Darjeeling and Kalimpong Divisions)	0.18	1.08	$\frac{V}{D} = \frac{a}{D} + b + cD$	0.0034	-0.6562	7.8800		0.9533	0.3142
19	Kerala. M.P., Mysore, Orissa, Tamil Nadu, U.P.	0.18	1.08	$\sqrt{V} = a + bD$	-0.1825	3.1679			0.9699	0.1571

* Utilization limit is in terms of tip end girth of wood over bark; The maximum diameter reported in column 3 was found to vary slightly over the equations but was kept at 1.08 m uniformly for refitting purposes.

Table 2: Revised volume equations for teak

$\ln V = \ln a + b \ln D$				
Eq. No.	Region	Coefficients		R ²
		a	b	
1	Andhra Pradesh (Mehboobnagar Forest Division)	1.7805	2.2846	0.9946
2	Andhra Pradesh (Adilabad District)	1.8477	2.1743	0.9997
3	Assam (15 Districts)	2.6542	2.4615	0.9960
4	Gujarat (Surat Circle)	1.9443	2.2007	0.9959
5	Karnataka (Chickmagalur, Hassan and Shimoga Districts)	1.7093	1.8173	0.9980
6	Karnataka (Kodagu District)	2.3704	2.5104	0.9943
7	Madhya Pradesh (Balaghat, Seoni and Mandla Districts)	2.1690	2.1275	0.9995
8	Madhya Pradesh (Rajnandgaon and Durg Districts)	2.2439	2.3640	0.9997

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9	Madhya Pradesh (Bilaspur District)	1.6922	2.0467	0.9999
10	Madhya Pradesh (Raipur District)	2.0144	2.0539	0.9870
11	Maharashtra (Ballarshah Catchment- Chandrapur)	2.2145	2.3451	0.9986
12	Maharashtra (Sondad Catchment- Bhandara District)	1.8171	2.1887	0.9992
13	Maharashtra (Wadsa Catchment - Chandrapur)	1.8280	2.2309	0.9991
14	Maharashtra (Melghat Forest Division)	2.2267	2.2689	0.9989
15	Rajasthan (Udaipur Forest Division)	1.7777	2.2949	0.9994
16	Rajasthan (Southern and Eastern)	0.7483	1.8741	0.9999
17	Uttar Pradesh (Tarai Region)	2.5499	2.3363	0.9997
18	West Bengal (Darjeeling and Kalimpong Divisions)	2.0165	2.2622	0.9985
19	Kerala, M.P., Mysore, Orissa, Tamil Nadu, U.P.	2.2352	2.3390	0.9979

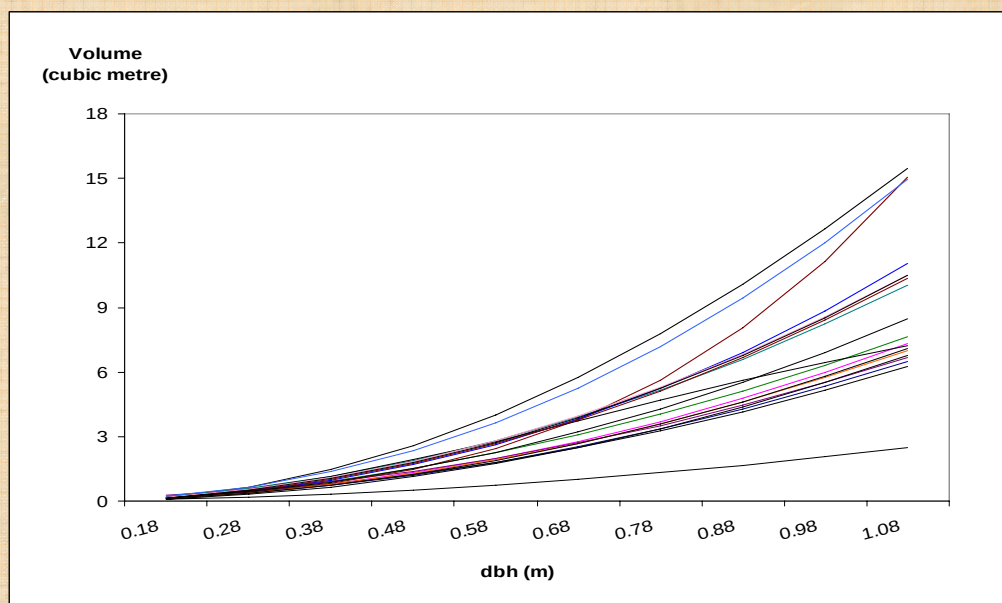


Figure 1. Graph of the fitted equations

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Rescaled Distance Cluster Combine

Figure 2. Dendrogram using Average Linkage (Between Groups)

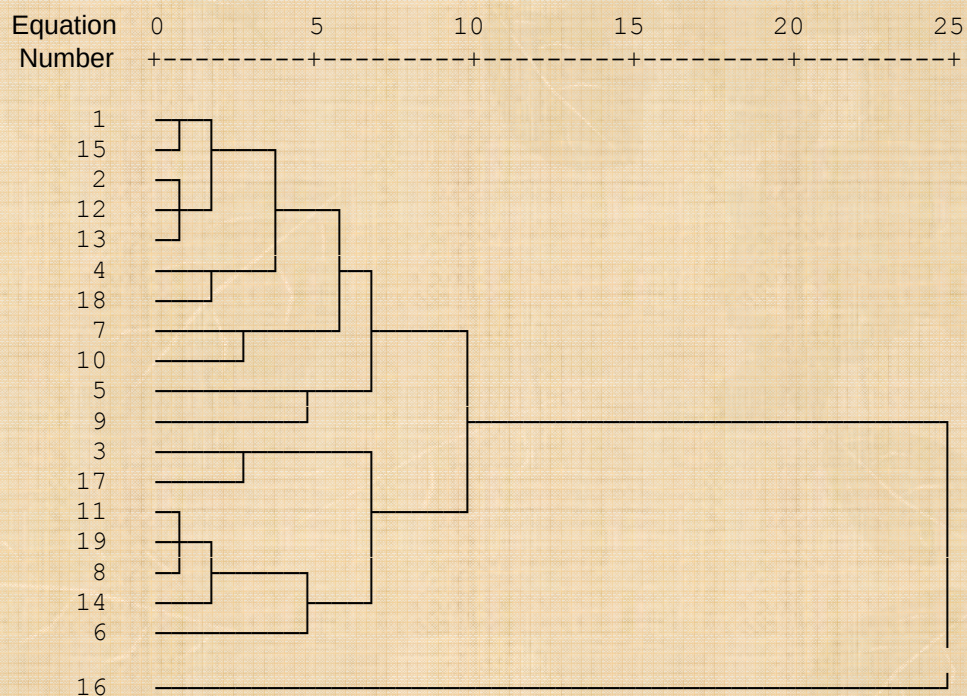


Table 3. Grouping of the refitted equations based on cluster analysis

Group	Eq. No.	Region
1	1	Andhra Pradesh (Mehboobnagar Forest Division)
1	15	Rajasthan (Udaipur Forest Division)
1	2	Andhra Pradesh (Adilabad District)
1	12	Maharashtra (Sondad Catchment - Bhandara District)
1	13	Maharashtra (Wadsa Catchment - Chandrapur)
1	4	Gujarat (Surat Circle)
1	18	West Bengal (Darjeeling and Kalimpong Divisions)
1	7	Madhya Pradesh (Balaghat, Seoni and Mandla Districts)
1	10	Madhya Pradesh (Raipur District)
2	5	Karnataka (Chickmaglur, Hassan and Shimoga Districts)
2	9	Madhya Pradesh (Bilaspur Districts)
3	3	Assam (15 Districts)
3	17	Uttar Pradesh (Tarai Region)
4	11	Maharashtra (Ballarshah Catchment - Chandrapur)
4	19	Kerala. M.P., Mysore, Orissa, Tamil Nadu, U.P.
4	8	Madhya Pradesh (Rajnandgaon and Durg Districts)
4	14	Maharashtra (Melghat Forest Division)
4	6	Karnataka (Kodagu District)
5	16	Rajasthan (Southern and Eastern)

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Clonal propagation of teak

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Plus trees of teak (*Tectona grandis* L.f.), 40 to 50-year-old, were cloned through a unique technique standardised at Kerala Forest Research Institute, Peechi. The technique involves two major steps viz., production of juvenile epicormic shoots on branch cuttings obtained from plus trees and rooting of juvenile epicormic shoot cuttings. Sufficient number of juvenile epicormic shoots were produced on large branch cuttings (3 to 10 cm diameter) collected from the crown of the Plus trees and planted in large poly bags filled with sand and soil, kept inside the mist propagation chamber. When the epicormic shoots, sprouted on the branch cuttings, attained 10-15 days' growth they were harvested and made into suitable shoot cuttings having two pairs of leaves and apical bud intact. Leaf area was reduced by trimming away the distal half of the lamina. For induction of rooting, these cuttings were treated with 6000 ppm of a rooting hormone, Indole Butyric Acid (IBA) prepared in talc after subjecting them to prophylactic treatment with Bavistin (0.05 % a.i.) solution. The pre-treated cuttings were inserted into vermiculite-filled root-trainers (cell volume = 300 cm³) and kept inside the mist propagation chamber for rooting. Within a period of 30-45 days the epicormic shoot cuttings sprouted and rooted. The satisfactorily rooted and sprouted cuttings were hardened inside the hardening chamber to obtain rooted cuttings of desired plus trees suitable for field planting. Following this technique, 30 plus trees of teak were cloned successfully to get true to type rooted ramets in sufficient numbers, as and when required. Hardened ramets, 120-days-old, were field planted at different locations in Kerala during 2000-'02. These ramets showed 99 per cent survival and very good growth in height and girth (maximum 8.5 m height and 25 cm gbh after 23 months of growth).



a. 11 months after planting



b. 23 months after planting.

Estimating price development for teak using a Teak-Price-Index

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Abstract

Teak is one of the most preferred tree species in tropical plantation forestry for production of high-value timber. The forest investment industry becomes increasingly aware of the species and is offering investment opportunities in all tropical countries. This paper shows by using a timber price index, that timber prices for teak increased approx. 4.8 per cent per annum over a period of 13 years. Moreover, the price increase for teak is 1 per cent higher than for a mix of tropical species. The index yields only relative increases and the market price in USD shows an extremely wide range depending on quality (Grades), source (planted or natural forest), and processing (log or sawn). The ratio between low quality sawn timber in India to high quality logs from Myanmar is in the range of factor 9.

Introduction and objective

Teak (*Tectona grandis* Linn.) has a worldwide reputation as premium timber. It grows in natural forests of Asia in countries, India, Myanmar, Thailand, Laos, Cambodia, and Vietnam (Lamprecht, 1986), but is also one of the most important planted hardwood species for the production of saw logs (Evans and Turnbull, 2004). In 1995, teak represented around 4 per cent of planted forests in the tropics or around 1.1 per cent of the global planted forest area (Pandey, 1995; 1998). Projecting these figures to the recent development of planted forest resources (FAO, 2010), it can be estimated that the global planted teak forest area amounts to approx. 5 million hectares. Further, assuming a mean annual increment at global level of 10 m³ per hectare per year (FAO, 2001; Anon., 1959; Pandey, 1983), the potential sustainable supply from teak plantations is estimated to be in the order of 50 million m³ per year.

Most of the planted teak forests were established by governments, communities, or private tree growers for the purpose of timber production (Ball et al., 1999). Recently, the forest investment industry has taken a growing interest in the establishment of timber plantations, particularly with teak (Haltila, 2010) and a large number of small- to medium-sized forest investment schemes are offering opportunities for private and institutional investors. Despite the undisputable benefits of such investments at local level, e.g. through the creation of rural employment, they bear a tremendous risk, if their financial objective of generating high rates of return cannot be met. Investors might eschew further investments or even withdraw funds thus preventing long-term investments in forest resource development. Thus, from a long-term business perspective it is essential to identify and evaluate the value drivers in forest investments commensurate with the natural conditions on-site.

The two main drivers for returns on forest investments are the growth performance of trees and the price of round logs or timber respectively. Growth figures of teak plantations are readily available for most of the nearly 40 countries, where teak is grown (Pandey, 1983; FAO, 1998; Keogh, 1979). Teak prices and their development over time, particularly for plantation-grown teak, are however hardly accessible for the managers of timber funds or cannot be properly evaluated in the contextual perspective as the given data vary as a function of transport distance, dimension, and quality, and their credibility and comparability rely heavily on the data sources.

This paper describes a method on how to develop a reliable teak price index from publicly available data in order to be able to analyse price development over time, evaluate their volatility and predict possible future trends.

Method

One of the most reliable, publicly available, long-term source of tropical timber prices is the International Tropical Timber Organization (ITTO), which publishes fortnightly timber prices by country and species since 1998 in the Tropical Timber Market Report (ITTO, 1998-2010). From the very beginning prices of teak logs from Myanmar, and since July 2009 prices of plantation-grown teak have been included. Apart from teak, we have also developed price indices for the major tropical timber species by setting the initial prices dated January 1998 to the level 100 and monitoring price development continuously over time.

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By monitoring the index over the entire observation period neutral price ratios can be developed and comparisons can be made. The species used in the development of an index for planted forests are eucalypts, pine and rubber wood. Those for natural forests include meranti, selangan batu, ipé, jatoba, and khaya.

Results

The average price index for planted and natural forest species has increased from 100 in January 1998 to 165 at the end of 2010. This corresponds to an annual increase of approx. 3.9 per cent p.a. The volatility, generally expressed as a variation around the mean value, computes to 25 per cent. In the same observation period the teak price index rose from 100 to 185, or approx. 4.8 per cent p.a., i.e. 1 per cent higher than the average index. Volatility of teak is 22 per cent and slightly lower than the average. Overall, teak shows the second biggest price increase after khaya, which has the highest growth rate of 5.6 per cent p.a. The lowest price increase at 1.3 per cent p.a. applies for eucalypts.

Table 1: Price index increase and volatility of selected tropical forest species since 1998

	Species									
Index Jan 1998 (=100)	Meranti	Selagan Batu	Ipé	Jatoba	Teak	Euca- lyptus	Pine	Rubber- wood	Khaya	Average
Dec 2010	172	131	171	179	185	119	159	165	202	165
Increase p.a. (%)	4.3	2.1	4.2	4.6	4.8	1.3	3.6	3.9	5.6	3.9
Volatility (%)	32	28	38	40	22	31	34	24	18	25

A detailed analysis (Figure 1), clearly shows that the teak price index is superior to the average price index, though fluctuations are quite significant. The average index is made up of a mix of species which hedges these fluctuations.

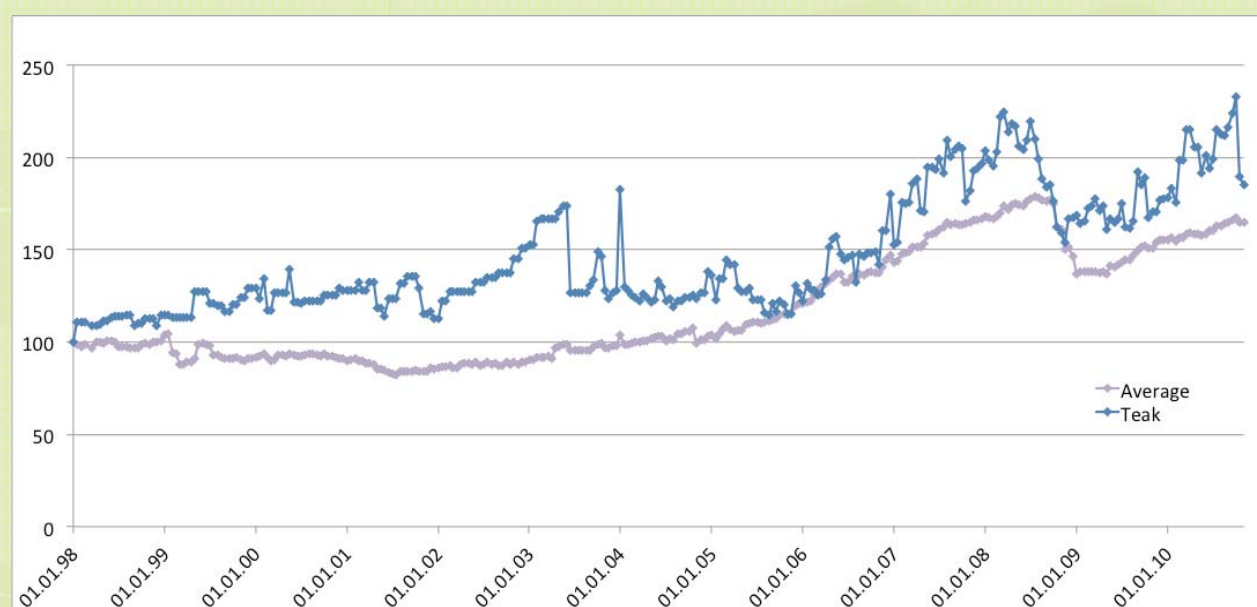


Figure 1: Development of teak and mixed species price index since January 1998

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It should be noted in this context that the teak price index only yields relative price changes that show that the prices increase on average by 4.8 per cent per annum. As for standard investment appraisals, such as discounted cash-flow calculations, however, it is of utmost importance to use reliable price data in absolute terms. ITTO reports these data for plantation-grown teak in different producer countries. In most countries they are reported as FOB log prices (free-on-board), while for India they are reported as domestic sawn wood prices (CIF: costs, insurance, freight, see Table 2). As prices of plantation-grown teak are available only since July 2009 and, thus, the observation period is too short as to compute reliable annual fluctuations, we report in Table 2 only ratios, maximum and minimum prices, which suffice to estimate possible rates of return from teak investments. In teak producing countries, mainly those in Central America, the minimum FOB-price for round logs is given at USD 288 per m³, the maximum at USD 775 for African countries. The corresponding domestic price for sawn timber in India varies between USD 1,042 (Grade C) and USD 2,123 (Grade A) per m³. The price of the top-quality sawn timber of India (Grade A) is close to the FOB-price of USD 2,483 for Myanmar logs (Sawmill Quality Grade 1).

Table 2: Average teak prices in 2010

	CIF sawn wood India			Producers FOB logs		FOB Myanmar
	Grade A	Grade B	Grade C	Min	Max	Nat. Forest SQ 1
Price Jan 2010 in USD/m³	2,123	1,819	1,042	288	775	2,483
Ratio (lowest = 1)	7.4	6.3	3.6	1.0	2.7	8.6

Conclusions

1. The price increase of teak over an observation period of 13 years is 4.8 per cent per annum displaying a relatively high volatility of 22 per cent.
2. Teak prices are highly dependent on the quality of the product and on the countries of origin and destination. Minimum FOB prices for plantation-grown teak as reported by ITTO (Jan 2010) are below USD 290 per m³. Assuming yarding and transport costs of USD 100 per m³, producers may receive as little as USD 190 per m³ at the forest road. The highest FOB price in producer countries was reported by ITTO at USD 775 per m³, corresponding to around USD 675 per m³ at the forest road. In teak investments, which generally encompass one rotation period of 20 years, a reliable estimate of an average FOB price in producing countries would thus be in the range of USD 490 per m³ (190×1.048^{20}), the maximum in the range of USD 1,720 per m³ (675×1.048^{20}).
3. Assuming a minimum price of USD 190 per m³ round log, an average price increase of 4.8 per cent per annum, a harvesting level of 250 m³ after 20 years, and a discount rate of 10 per cent, no downstream processing, the costs of establishing and maintaining one hectare of teak including the land value should not exceed USD 18,000/ha to achieve acceptable returns.
4. The price of plantation-grown teak is well below that of natural forests. Even prices of Grade A sawn timber from plantations in India (CIF, approx. USD 2,100/m³) are below, but close to the FOB price of prime quality logs from natural forests in Myanmar (approx. USD 2,500/m³, see Table 2).
5. Estimating the annual harvestable volume of plantation-grown teak at 50 million cubic metre and further assuming an average FOB price of USD 500/m³, the global market size of plantation-grown teak computes to USD 25 billion per year.

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