

**Stichting Terra Vitalis**

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STICHTING

**Terra Vitalis**

## **[Stand Valuation 2010]**

An estimation of the value of the Teak Plantations managed by Stichting Terra Vitalis

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## Disclaimer

The results of this report are based on a model and therefore, although done with great carefulness, a simplification of the reality. As a consequence the results of this report may and probably will deviate from the reality. The results and conclusions in this report are therefore no guarantee of any kind.

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- (iii) acts of third parties based on the (conclusion (s) from the) valuation.

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## Definitions

<b>Actual Value</b>	The value of a commercial thinning or final harvest as it would have been thinned or harvested at this moment.
<b>Basal area</b>	Is the term used in forest management that defines the area of a given section of land that is occupied by the cross-section of tree trunks and stems at their base. In most countries, this is usually a measurement taken at a person's breast height (1.3 meters) above the ground and includes the entire diameter of every tree, including the bark. Measurements are usually made for 1 hectare of land for comparison purposes to examine a forest's productivity and growth rate.
<b>Diameter at breast height</b>	Or <b>DBH</b> , is a standard method of expressing the diameter of the trunk or bole of a standing tree. DBH is one of the most common dendrometric measurements. The diameter of tree trunks is measured at the height of an adult's breast, which is defined in continental Europe, Australia, the UK, Canada and Latin America at 1.3 meters above ground level.
<b>Discount rate</b>	The rate of interest set by STV as target rate. Net Present Value is based on this interest rate.
<b>(Forest) Stand</b>	A group of trees occupying a given area and sufficiently uniform in species composition, age, structure, site quality, and condition so as to be distinguishable from the forest on adjoining areas. Also, a group of trees in a given area that have similar characteristics (e.g. age or species) and can be uniquely distinguished from adjoining areas.
<b>Future Value</b>	The value at some point in the future of a present amount of money. ( <a href="http://www.investorwords.com">www.investorwords.com</a> ).
<b>Harvest, final</b>	Artificial clear cut of a stand, with making profit as goal.
<b>Hoppus formula</b>	The hoppus formula is a logrule, giving an estimation of the useable wood volume of a stem. In general the teakwood prices in Costa Rica are based on this formula.
<b>Huber formula</b>	Huber is a formula estimating the total volume of a stem. It is a mathematic approach.
<b>Net Present Value (NPV)</b>	The present value of an investment's future net cash flows minus the initial investment. If positive, the investment should be made (unless an even better investment exists), otherwise it should not ( <a href="http://www.investorwords.com">www.investorwords.com</a> ).
<b>Participant</b>	A person who has made an investment in the Teakplantations in Costa Rica through and managed by Stichting Terra Vitalis.
<b>Plantation forest</b>	Forest stands established artificially by afforestation on land which previously did not carry forest; and also forest stands established artificially by reforestation on land which carried forest within the previous 50 years or within living memory and involving the replacement of the previous crop by a new and essentially different crop.
<b>Stand</b>	A contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

<b>Teak</b>	A tall evergreen tree ( <i>Tectona grandis</i> ) of Southeast Asia origin, having hard, heavy, durable yellowish-brown wood.
<b>Thinning</b>	Artificial removal of trees from a stand, with the main reason to improve the total production of remaining trees.
<b>Value estimation</b>	An estimation of the value defined in money.

## Introduction

Investors (“participants”) of Stichting Terra Vitalis (“STV”) have been investing in teak plantations in Costa Rica since the year 2000. These investments were done based different motivations such as:

- Improvement of the social environment of the plantations,
- Improvement of the ecological environment,
- Financial return on the investment.

This report is focused on the third motivation; Financial return of the investment. It is of utmost importance and one of the main objectives of STV to inform the participants on a regular bases about the status quo of their investments and to make a prognosis of the value, expressed in US Dollars (“USD”), of their participations.

In the recent past, very positive predictions have been published by others. Most of these positive predictions have been shown to be incorrect, with the consequence that confusion has been generated about what numbers are reasonable and what numbers are not. One of the problems occurring when making reasonable predictions involves the long period of time of the investment (e.g. twenty years). Because of this long period, other factors, like growth and wood price development are factors which are difficult to predict.

For the past ten years STV has been working and still is working on developing systems to estimate the current standing volume and tree sizes and their growth. Every year STV is using more accurate data derived from its own plantations and from other plantations.

## Goal of this assessment:

Provide the Terra Vitalis participants with a transparent and accurate estimation of the value of their investments on a consistent and regular basis. This estimation is based on the current production and on the predictions of developments, both price and growth, during the rotation period.

The wood price at this moment is the starting point for an estimation of the wood price in the future. The wood price increase factor (%) will be used for estimating the wood price in the future. As with most prices of different products, the price of wood is mainly created by

demand and supply regarding Teakwood and this will have a great impact on the potential revenues.

The current production is the starting point of the estimation of the Teakwood production in the future; the growth so far will be used for estimating the growth in the future.

## Assignment

### Output

*This report contains:*

- 1) Current wood prices,
- 2) A prognosis of the wood price trend for estimating the value in the future,
- 3) A prognosis of the present value of the plantations of STV taking into consideration that the plantation will fulfill its entire planned rotation period,
- 4) These prognoses will be done based on volume of round wood at roadside on the next levels:
  - a. all plantations together,
  - b. value per plant year and per hectare,
- 5) A clear explanation of the methods used,
- 6) A clear description of the used parameters,
- 7) A clear summary of the data used for the estimations,
- 8) An approval of Instituto Tecnológico de Costa Rica (ITCR) who has been auditing the entire valuation process (see appendix 1).

## Financial parameters

### Wood price

Young Teakwood, (produced in rotations shorter than 30 years), is not traded on a regulated market so far. As a consequence, verifiable and transparent prices for this specific segment are not (often) published.

Recently, since two years, STV has been involved in selling wood of commercial thinnings of its own plantations on behalf of the participants. STV has been able to collect prices offered by different buyers. This information is used for the stand valuation.

Published prices are used in order to verify the offered prices for the Terra Vitalis' stands. STV is selling its wood as round wood at road side and therefore the stand valuation will be based on roadside prices to be sold in the first commercial thinning (year 12), second commercial thinning (year 16) and in the final harvest (year 20).

**Table 1: Offered prices (hoppus formula) to STV and its comparison with Huber formula, which is simulating the real volume (note: the Huber formula is a formula of a truncate cone, using the average of the large and small end diameter of the log).**

log length	diameter	Volume according to Hoppus	Volume according to Huber	percentage Huber/Hoppus volume	price according to Hoppus	price according to Huber	percentage Huber/Hoppus prices
in m	in cm	in m <sup>3</sup>	in m <sup>3</sup>	in %	in USD/m <sup>3</sup>	in USD/m <sup>3</sup>	
2,3	39	0,0163	0,0208	0,00%	\$ -	\$ -	0
2,3	40	0,0214	0,0274	128,27%	\$ 130,00	\$ 101,35	77,96%
2,3	51	0,0338	0,0434	128,65%	\$ 177,50	\$ 137,97	77,73%
2,3	61	0,0490	0,0631	128,91%	\$ 235,00	\$ 182,30	77,58%
2,3	71	0,0670	0,0864	129,09%	\$ 277,50	\$ 214,97	77,47%
2,3	81	0,0878	0,1134	129,22%	\$ 307,50	\$ 237,96	77,39%
2,3	91	0,1114	0,1441	129,33%	\$ 362,50	\$ 280,30	77,32%
2,3	101	0,1378	0,1784	129,41%	\$ 405,00	\$ 312,96	77,27%
2,3	111	0,1671	0,2163	129,48%	\$ 455,00	\$ 351,41	77,23%
2,3	121	0,1991	0,2580	129,53%	\$ 485,00	\$ 374,42	77,20%
2,3	131	0,2340	0,3032	129,58%	\$ 500,00	\$ 385,85	77,17%
2,3	141	0,2717	0,3522	129,62%	\$ 550,00	\$ 424,31	77,15%

Since August 2009, the International Tropical Timber Organization (ITTO) is publishing teak prices from different countries, among others, from Latin America on a bimonthly base. These prices are given for round wood at the harbor in India and are in principle stable on 300 - 350 USD/m<sup>3</sup> (*Tropical Timber Market Report, Volume 14*) what equals to 127 - 152 USD/m<sup>3</sup> at road side (15 USD/m<sup>3</sup> for loading container and 142 USD/m<sup>3</sup> for transport) according to our estimation based on field experience. Since most of the exported teak logs are smaller diameters, this price range is similar to the price range of Table 1.

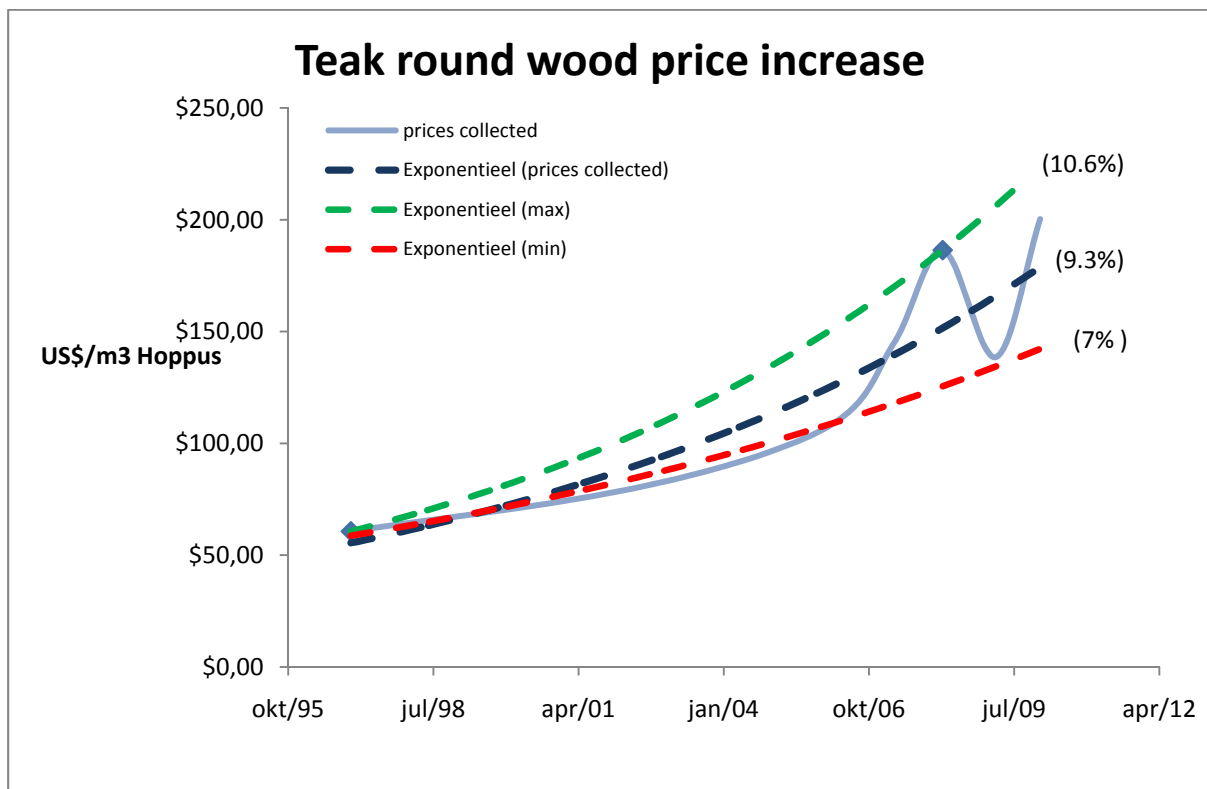
### Wood price trend

In general round wood prices for tropical hardwood species have dropped at the end of 2008 (*Annual Review and Assessment of the World Timber Situation, 2008, Tropical Timber Market Report, Volume 14*). US imports of tropical hardwood lumber in 2009 were down - 33% year on year. Only Teak imports have held up and are similar to last levels achieved in 2008. The combination of higher demand from buyers in Asia and low lumber production in some areas, especially Latin America, has resulted in price increases for tropical lumber in the US market. Currently, US demand for tropical hardwood lumber remains weak despite low inventories. ([http://www.itto.int/mis\\_detail/&lang=en](http://www.itto.int/mis_detail/&lang=en)).

Teak prices from Myanmar have been dropping at the same moment, but are recovering slowly. On average they are still increasing since 2004, although it seems that the lower qualities (grade 7; for description: <http://www.myanmarwood.com>) are increasing more than the better qualities (grade 1- 4; for description: <http://www.myanmarwood.com>). This might be caused by the relatively unknown smaller diameters sold at the market. Prices for grade 7

have been published from January 2007 and onwards, suggesting that this grade was not on the market long before that.

Looking at round Teakwood price trends in Latin America, a similar behavior as the lowest grades of Myanmar Teakwood can be found, although they are not exactly the same. Best price trend predictions are made using available information and our own data collection. These data are most comparable with the type of Teakwood we are producing and in the last years the data are specific for our Teakwood.



**Figure 1: Teak log price increase trends for years 1995 to 2010.**

Figure 1 is showing the average, minimum and maximum trends between 1995 and 2010. These trends were drawn based on the data collected from; SGS, 1997, FAO, 2002, Brais and Miller, 2006-2010, IndoPan 2006-2009, BARCA, 2007-2009, Flor y Fauna, 2008, Fardeen Chapra, 2010 Sudima 2010, Fortune Global 2010, Prime Trading 2010, Panamerican Exim 2010 Brite Timber, 2010.

The blue line is the average line of data collected from all above mentioned wood buyers.

Quiros (2002) published a log price at the log yard between 100 – 189 USD/m<sup>3</sup>. Although it is difficult to recalculate this log price to round wood prices at road side because of the lack of further information (even if we only deduct 40 USD/m<sup>3</sup> for loading and transportation), this price by Quiros (2020) is within the range used for estimating the price increase trend.

We have decided to apply an upward price change of 8.0% annually since the forecasts are between 7.0% to 10.6% as presented in figure 1 and we consider an upward price change of 8.0% to be both conservative and realistic.

**Table 2; Financial parameters and scenarios used for the teak stands valuation.**  
**Note that the percentages in this table are derived from the trends in Figure 1**

Scenario	Wood price increase (%) (incl. inflation) based on USD
Conservative	7.0%
Realistic	8.0%
Positive	10.6%

### Discount rate

For the stand valuation a discount rate of 7.0% is used. This number is comprised by using the discount factor advised by the Dutch Ministry of Finance (2,5% for the region, we feel more comfortable by using a slightly more conservative 3%), 2% for investing in teak as a relative new investment concept (with uncertainties like price, quality, market positioning and long term duration) and 2% for the economic perspectives on the short and middle term.

The final selection and composition of the discount rate will be considered again during the next appraisal cycle.

### Wood production

The tree species is Teak (*Tectona grandis*). All management decisions taken are based on specific knowledge of this species, such as the yield model that optimizes the site occupancy for teak and thus optimizing the production, adjusted to each and specific stand.

### Field Data

A Permanent Sample Plot (“PSP”) is an area of 500 m<sup>2</sup> from which the trees are measured during the entire rotation. Each tree of the plot has its own identification number, painted on the bark. The number of PSP’s per farm depends on the farm size; more or less 1.5% of the total area has been measured; in total 1,250 plots.

Diameter at Breast Height (“DBH”); the diameter at breast height and total height is be measured for each tree in a PSP. During January – March 2009, a total of 46,231 trees have been measured for the composition of this valuation.

The field measurements have been executed by the plantation companies and have been checked by auditors from STV and by Instituto Tecnológico de Costa Rica (ITCR) (Appendix 1).

**Table 3. Plots and trees measured per company and year used in the present teak stand valuation.**

<b>Plantation Company: BARCA</b>			
<b>Stand/year</b>	<b>Total plots</b>	<b>Measured trees</b>	<b>Plot size (m<sup>2</sup>/plot)</b>
2002	30	826	500
2003	33	1,315	500
2004	112	2,976	500
2005	72	3,835	500
2006	55	3,070	500
2007	23	1,325	500
<b>Total</b>	<b>325</b>	<b>13,347</b>	<b>----</b>
<b>Plantation Company: Expomaderas</b>			
<b>Stand/year</b>	<b>Total plots</b>	<b>Measured trees</b>	<b>Plot size (m<sup>2</sup>/plot)</b>
1996	7	91	500
1997	48	962	500
1998	19	322	500
1999	1	15	500
2000	19	642	500
2001	159	4,489	500
2002	133	3,792	500
2003	48	1,401	500
2004	167	7,012	500
2005	103	5,256	500
2006	221	11,902	500
<b>Total</b>	<b>925</b>	<b>35,884</b>	<b>----</b>

## Verifiers

In order to be able to extrapolate the growth in both diameter and height, growth curves have been developed based on experience derived from our own plantations and from plantations at similar sites.

Several thinning scenarios have been developed for different growth classes. This is done in order to optimize the volume production. As a result, faster growing stands are and will be thinned more intensively than slower growing stands.

## Prediction of Wood Production (PWP)

- 1) **The prediction of the production of stands planted in the years 2005 - 2009:** this will be based on our target of 300 m<sup>3</sup>/ha total volume in 20 years and 265 m<sup>3</sup>

commercial volume (since the plantations are too young for a reliable prediction on growth) and the yield model currently in use.

- 2) **The prediction of the production of all stands planted in 2004 and before:** This is based on current growth of each specific plantation and the yield model in use at this moment.

For all stands planted in 2004 and before, height and diameter growth of the average tree is extrapolated to the years of the commercial thinning (year 12 and 16) and to the final harvest (year 20). Based on these data the thinning densities are determined. The predicted thinning tree is theoretically divided in pieces of 2.3 meters each (most common) and the volume of each log is calculated according to the “Hoppus” volume formula:

$$\text{Volume(Hoppus)} = \frac{((\text{girth (cm)} - 6 \text{ (cm)})^2 \cdot (\text{length (m)} - 0.05 \text{ (m)}))}{160000}$$

In general this formula is showing more or less 77% (depending on the dimensions of the log) of the round wood volume assuming that the tree is a truncate cone (Huber Formula), using the average diameter.

The number of trees to be thinned is estimated by looking for the best thinning scenario for the yield, taking into account the available trees (density) and growth.

## Prognosis Plantation Value (PPV)

### Step one

The Actual Value of the stand is estimated by estimating the actual value of each thinning by multiplying the volume (Hoppus) of each price category with the respective current price.

### Step Two

The prognosis of the Future Value is the Actual Value raised with its yearly price increase estimation after deduction of costs; (10% for the first commercial thinning in year 12, 10% for the second commercial thinning in year 16 and 5% for the final harvest, according to the trust agreements).

### Step Three

The Net Present Value estimation is calculated with the discount rate (7.0%) from the future value.

## Used tools

A program has been developed by STV calculating the standing volume, Hoppus Volume, Actual Value, Future Value and the Net Present Value.

## Results and conclusion

**Table 4; General results of the value estimation 2010, regarding a Conservative, Realistic and Positive scenario.**

Scenario	Conservative (7% annual price increase)	Realistic ( 8% annual price increase)	Positive (10.6% annual price increase)
<b>Total Value</b>	<b>\$157.917.913,98</b>	<b>\$179.341.109,28</b>	<b>\$249.178.966,55</b>

Table 5 (below) is showing the value for each plant year. Number of farms and amount of hectares is shown per plantation company.

**Table 5; Results for each plant year and based on the Realistic scenario.**

Plant year	Area in hectares	Yield thinning 1 in USD	Yield thinning 2 in USD	Yield final harvest in USD	NPV p/ha (7,0% disc) In USD	Total NPV (7,0% disc) In USD
1996	13,50	\$ -	\$ 636,92	\$ 43.799,10	\$ 29.741,49	\$ 401.510,17
1997	83,50	\$ -	\$ 1.665,69	\$ 38.126,93	\$ 25.103,23	\$ 2.096.119,76
1998	60,25	\$ 367,44	\$ 4.007,49	\$ 79.598,59	\$ 49.727,80	\$ 2.996.099,77
1999	1,25	\$ -	\$ 6.223,61	\$ 82.658,34	\$ 49.398,01	\$ 61.747,51
2000	51,00	\$ 348,77	\$ 2.452,79	\$ 43.829,78	\$ 24.219,87	\$ 1.235.213,15
2001	433,50	\$ 1.302,18	\$ 3.653,27	\$ 52.633,48	\$ 28.343,83	\$ 12.287.048,70
2002	488,75	\$ 2.605,83	\$ 5.721,37	\$ 71.388,55	\$ 37.015,23	\$ 18.091.195,23
2003	288,25	\$ 2.942,99	\$ 6.919,43	\$ 84.846,30	\$ 41.070,22	\$ 11.838.490,93
2004	682,77	\$ 3.987,38	\$ 8.741,62	\$ 106.017,26	\$ 48.216,07	\$ 32.920.488,73
2005	569,50	\$ 4.125,86	\$ 10.080,38	\$ 118.037,49	\$ 50.140,72	\$ 28.555.137,26
2006	738,00	\$ 4.455,93	\$ 10.886,81	\$ 127.480,49	\$ 50.609,32	\$ 37.349.678,11
2007	389,00	\$ 4.812,41	\$ 11.757,76	\$ 137.678,93	\$ 51.082,30	\$ 19.871.016,35
2008	171,00	\$ 5.197,40	\$ 12.698,38	\$ 148.693,24	\$ 51.559,71	\$ 8.816.710,23
2009	54,20	\$ 5.613,19	\$ 13.714,25	\$ 160.588,70	\$ 52.041,58	\$ 2.820.653,39
	<b>4024,47</b>					<b>\$ 179.341.109,28</b>

Expo	2.644,70 ha	80 farms
Barca	1.379,77 ha	77 farms
<b>Total</b>	<b>4.024,47 ha</b>	<b>157 farms</b>

## References:

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## Appendix 1



### TO WHOM IT CONCERNS

I certify the verification assessment of *Cost Rican teak (Tectona grandis L.)* plantations appraisal from Stichting Terra Vitalis (STV), under technical management from companies BARCA S.A. and EXPOMADERAS, during the end of year 2009 and beginning 2010. Our technical team was integrated for three qualified professor-specialists, with a long experience in teak management, improvement and economics, from the School of Forest Engineering at Technological Institute of Costa Rica (ITCR). Main conclusions from our research are that, **a)** Forest Inventory System in both local companies is reliable and sufficient; **b)** volume and yield model utilized by STV is reliable, consistent and produces the lowest bias from all models investigated; **c)** wood prices used by STV are reasonable and consistent with the current local markets; **d)** finally, Net Present Value obtained by STV and ITCR are, overall, very similar, representing a high level of confidence in the financial analysis performed. Further information can be provided if requested.



Sincerely yours

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