The offset prices in rubber plantations by environmental valuation

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ABSTRACT

Prospective imbalances between supply and demand have been indicated in the rubber market resulting in a continuous plunge in rubber prices. The highest average price in 2011 to the present (2014), has dropped 54.84 percent due to direct impact on the costs of rubber planters. There is the possibility of **"the offset prices in rubber plantations by environmental valuation"** for assessing carbon stocks of rubber biomass in order to predict the environmental valuation. Consequently, it provides the contracts of carbon credits in the voluntary rubber market for 1-7year-old rubber trees before latex tapping by biomass allometric equations. The results showed that rubber plantations for 1-7year-old rubber trees with the carbon stocks in biomass were 0.014, 0.099, 0.321, 0.727, 1.671, 4.039 and 7.607 Mg ha-1 respectively. The relationship of rubber age in the polynomial equation (r2=0.98) was represented in a net income due to the contract of carbon stocks through7 years as 47.05 US$ ha-1. Accordingly, the equation of the relationship between carbon stocks of rubber biomass (CT) and the accumulation of rubber biomass (WT) was CT = 0.5 (WT) + 0.0002 as a level relationship (r2 = 1.00).

Keywords:. The offset prices, rubber plantations, environmental valuation

Introduction

From past to present, rubber plant is an important economic plant in the world since it is a key raw material for the manufacture of products such as tires. Major rubber producing countries in top 5 of the world are Indonesia, Thailand, Malaysia, China and India account for the proportion of 30.36, 24.55, 8.99, 8.86 and 6.28, respectively (Rubber Research Institute of Thailand). In the field of export, ASEAN countries are the largest rubber exporter representing a market share of 80 percent and Thailand is one of the world's top exporters with a market share of 33.1 percent followed by Indonesia with a market share of 30.7 percent (Ministry of Commerce, 2012). The rubber export market is divided into 5 categories: natural latex, smoked sheets, natural rubber and so on, while the imbalance of supply and demand for rubber in the global market. As shown in Figure 1, resulting in a state of decline in global rubber prices, the highest average price in 2011 was 4,078.67 US$ ton-1 to the present (2014) in the average price, 1,842.00 US$ ton-1, as shown in Figure 2, a decrease of 54.84 percent from the average price in 2011.

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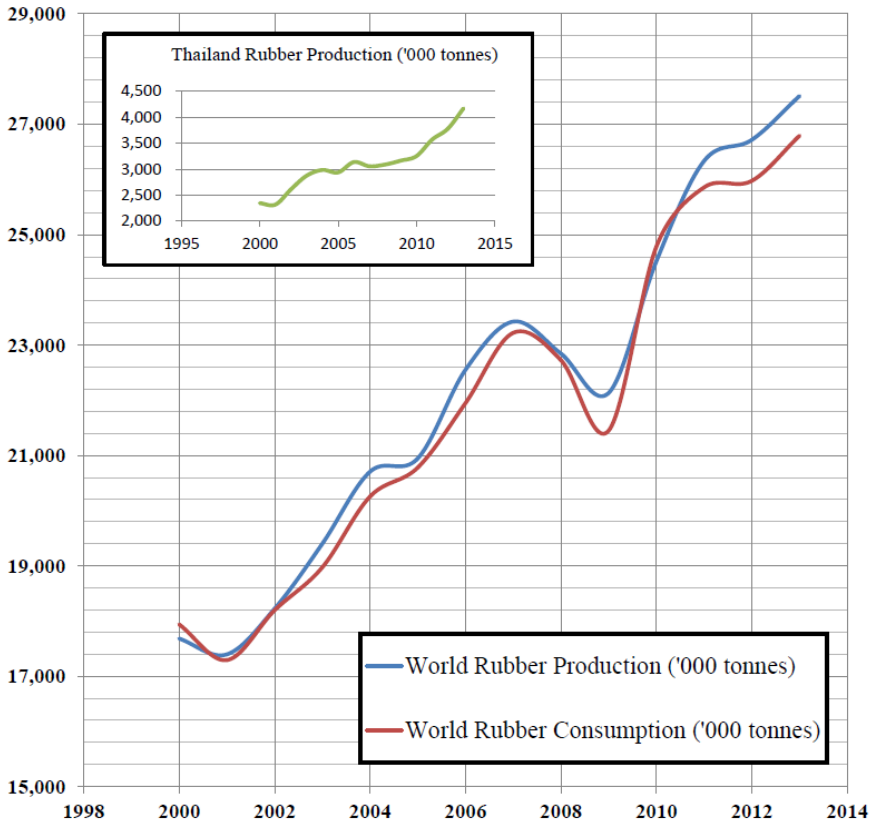

Figure 1: the demand and supply of rubber in the world market

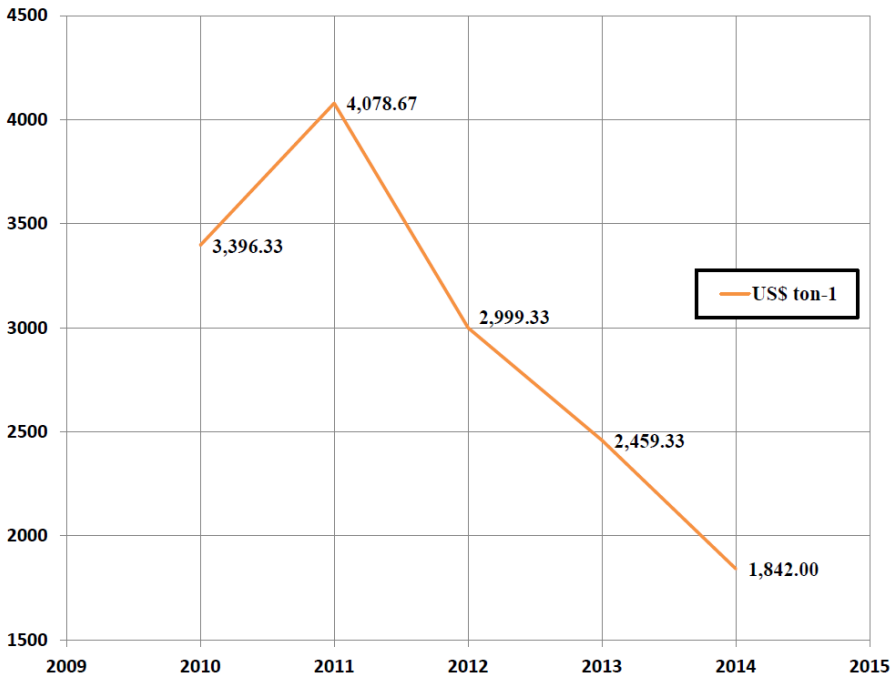

Figure 2: the trend in the decline of rubber prices in the world market

According to the situation, an impact is on rubber planters, especially in 1-7

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years of rubber plantations deprived of latex tapping (a trunk perimeter of less than 50 cm. and the height of 1.50 m. from the ground) as latex tapping is attained from rubber trees. In the above result, productivity decreased throughout the life cycle by 25-59 percent and rubber growth rate by 28-60 percent. In the meantime, planters receive the expense of rubber plantations aged 1-7 years for 26,204 baht / rai (1,600 square meter) (5,459.16 US $ ha-1) (Madurai came to admire Chan, 2010). Accordingly, the prospect of offset rubber prices by environmental valuation of carbon stocks in the rubber biomass in order to predict the environmental value is derived from the carbon credit contracts in the voluntary rubber market. This concept reduces the effects of global warming through the plant mechanism to absorb carbon dioxide (CO2) for photosynthesis. By this means, the amount of reduced carbon dioxide in the atmosphere is through the plant life by carbon stocks in biomass (Redondo-Brenes&Montagnini, 2006) for sustainable low carbon society development.

Research and Methodology

Assessment of carbon stock in rubber plantation

The study was conducted by carbon storage in the biomass of the rubber in age of 1-7 years in a district of HuayTaleang, Nakkhonratchasima. By allometric equation, the relationship between carbon stocks in biomass and independent variables as parabolic volume was in the variables included diameter at breast squared height (DBH2) multiplied by the height of the tree (H). The plot samples and rubber growth measurements are shown in Table 1.

Table 1: the plot samples and rubber growth measurements

Age (year)	**duration** meter(m.)	**Density** t./m.	**Height(H)** meter (m)	**diameter at breast squared height(DBH)** centimaters(cm)	**perimeter** (cm)
1	3x6	104	1.80±0.24	1.78±0.40	5.60±1.26
2	3x6	104	2.60±0.46	3.54±0.83	11.13±2.61
3	3x6	104	4.28±0.46	5.03±0.62	15.81±1.95
4	3x6	104	5.66±0.41	6.59±0.74	20.69±2.31
5	3x6	104	6.62±0.55	8.82±1.01	27.68±3.16
6	3x6	104	7.96±0.51	11.67±0.92	36.66±2.88
7	3x6	104	9.93±0.66	14.28±0.93	44.84±2.93
8	3x6	104	11.95±0.72	17.46±1.26	54.83±3.97

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Allometricequation for carbon stocks in rubber biomass was developed for Watershed Conservation and Management Office as the equation shown in Table 2.

Table 2: allometric equation for carbon stocks in rubber biomass

Carbon Stocks (kg C/t)	**Equations**	**R^2**
Equation (C_S)	$C_S = 0.03860 (DBH^2H)^{0.8341}$	0.97
Stems (C_B)	$C_B = W_T - W_S - W_L$	-
Branch (C_L)	$C_L = 0.000004 (DBH^2H)^{1.4986}$	0.91
Root (C_R)	$C_R = 0.00023 (DBH^2H)^{1.269}$	0.95
Rootlet (C_r)	$C_r = 0.00109 (DBH^2H)^{1.0296}$	0.92
Above the ground (C_T)	$C_T = 0.00230 (DBH^2H)^{1.2046}$	0.95

Source: Watershed Conservation and Management Office

Assessment of carbon stock in rubberplantation

Assessment revenues from contracts in the voluntary rubber market as stated by implementation of the contract of Chicago Climate Exchange (CCX) (quoted in RaweeChiarawipa et al, 2012) of 1-7 year-oldrubber trees before latex tapping in order to estimate annual value and total revenue (US $) over the 7 years as shown in the equation.

$$\mathbf{T_c = N_c + R_c}$$

As $N_c = I_a - F_i$ และ $R_c = I_r - F_j$

$$\therefore \mathbf{T_c = [I_a + I_r] - [F_i + F_j]}$$

$$\mathbf{T_c = [I_a + I_r] - F_T}$$

As $I_a = 0.8 \times (C_S) \times (CXX)$ and $I_r = 0.2 \times (C_S) \times (CXX)$

$$\therefore \mathbf{T_c = [(C_S) \times (CXX)] - F_T}$$

As N_c = revenue from carbon credit contracts ($)

R_c = revenue from the offset of carbon credits at expiration of contract ($)

I_a = value from trading carbon credits ($ / year)

I_r = value of offset of reserved carbon credits ($)

C_s = the amount of carbon stock in the rubber garden (t)

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CCX= average trading prices of carbon credits in the CCX (4 $ / t.)

F_i =contract fees of carbon credits ($)

F_j =contract fees of offset of reserved carbon credits ($)

F_T =total cost of contract fees of carbon credits and offset of reserved carbon credits ($)

$$\mathbf{F_T = F_a + F_v + F_c}$$

As F_a =total cost of contract fees with the agent ($).

= 10% of [(CS) x (CXX)]

F_v =total costs of fees to validate the contract ($).

= 0.15 $ / ton (CS)

F_c =total cost of fess for the trading market, CCX ($).

= 0.20 $ / ton (CS)

Result

At 1-7 year-old rubber trees before latex tapping, (the average perimeter of trunk, 44.84 ± 2.93 cm.), the value of the biomass accumulation and carbon stocks in biomass in the maximum equal to 15.213 and 7.607 Mg ha-1, respectively, at the age of 7 years, as shown in Table 3.

Table 3: the carbon stocks in biomass and biomass accumulation of rubber trees

Age (years)	**Cumulative biomass Mg ha^{-1}**	**carbon stocks in biomass Mg ha^{-1}**
1	0.027	0.014
2	0.200	0.099
3	0.641	0.321
4	1.454	0.727
5	3.343	1.671
6	8.078	4.039
7	15.213	7.607

The equation of the relationship between biomassac cumulation and rubber

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age is **the value of biomass accumulation = 0.6956 (age) 2 to 3.2787 (age) + 3.339**at relationship level (r2 = 0.98) and the relationship between the value of carbon stocks in biomass and the rubber age.**The value of carbon stocks in biomass = 0.3479 (age) 2 to 1.6398 (age) + 1.67** level relationships (r2 = 0.98) by carbon stocks in biomass (CT) is associated with biomass accumulation of the rubber trees (WT) as**CT = 0.5 (WT) + 0.0002**relationship level (r2 = 1.00). For 1-7 year-old rubber trees before latex tapping, the value of carbon stocks in biomass through7 years as14.478 Mg ha-1, representing a net income due to contracts for the offset of carbon credits over 7 years as47.05 US $ ha-1 as shown in Table 4

Table 1Estimation of potential income through 7 years of the contract for rubber plantations

Contract (yr)	**Annual tonnage, (C_s)** **Mg ha^{-1}**	**Estimated annual value, (Cs)x(CXX)** **$ ha^{-1}**
1	0.014	0.056
2	0.099	0.396
3	0.321	1.284
4	0.727	2.908
5	1.671	6.684
6	4.039	16.156
7	7.607	30.428
estimated subtotal (the 7-year period)	**14.478**	**57.912**
80% carbon trading, I_a		46.330
20% carbon- reserve pool, I_r		11.582
Fees and deductions		
10% aggregator fee, F_a		(5.791)
project verification fee ($0.15/ton), F_v		(2.172)
CCX exchange fee ($0.20/ton), F_c		(2.896)
Net income ($ ha^{-1})		**47.054**

However, the carbon stocks in rubber garden are different in each plantation area. The climate and soil regions particularly are affected by drought (Wauters et al., 2008). Subsequently, the rubber gardens are potential for carbon stores. In comparison with other perennials in similar ages in forestry plantations such as teak and

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eucalyptus (Wongratana et al., 2008) as the rubber trees can grow before and after latex tapping. The garden management principles, it contributes carbon stocks in trees and soil such as intercropping or multiple cropping with no-tillage after latex tapping. (Rubber Research Institute, 2007)

Conclusion

The storage of carbon in the biomass for 1-7year-old rubber trees before the rubber tapping correlated with the rubber age. As concern on the rate of carbon stocks through to7years is equal to14.478 Mg ha-1andestimate the net income from contracts to offset the carbon stocks and 7years equal to47.054 $ ha-1fromthecarbon stocks of rubber in case of trading of carbon credit sin the voluntary rubber market. In addition, the effective approach can off set prices of rubber plantations and increase global rubber industry valuation sustainably.

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