Thailand Voluntary Emission Reduction (T-VER) for forest conservation and reforestation

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9 November 2017
• Mae Fah Luang Foundation

• Doi Tung Development project

• Thailand Voluntary Emission Reduction (T-VER)

• T-VER: Project level REDD+
- improves the lives of people living in poverty and deprived of livelihood opportunities
- ‘helps people to help themselves’ in a sustainable manner
- fosters harmony between humans and nature
The Doi Tung Development Project

Total area of 150 Sq. km.
29 villages; 5 sub-district; 2 districts
Population 11,000
6 ethnic groups
Doi Tung, Northern Thailand

1988
Recognizing the Problem

Vicious Cycle

Poverty
- Opium cultivation
- Migration
- Prostitution
- Deforestation
- Desertification

Poverty and Lack of Opportunity

Sickness
- Malnutrition
- Malaria/TB
- HIV
- Drug addiction

Ignorance
- Weak social structure
- Inability to develop

Poverty

Lack of Opportunity
Co-Existence of Humans and Nature

The use of Natural Resource

Balance

Human

Environmental Quality
“People and Nature Must Co-Exist in Harmony, Interdependently”
Humans and Nature Living in Harmony

Economic Forest
Maximizing limited resources:
Moving up the Value Chain

Coffee cherry €0.5/kg
Green beans €4/kg
Roasted beans €20 BHT/kg
Packaged coffee €32 BHT/kg
Doi Tung Café €230 BHT/kg
Creating Value for Everything

- Roasted Macadamia
- Coffee Topping
- Odor Absorbing Coal
- Macadamia Honey and Spread
- Macadamia Ice Cream
- Shell used as Bio renewable Energy Source
- Compost
Diversifying Risks

Food

Handicrafts

Horticulture

Tourism
Doi Tung as a Social Enterprise

• Financial self-sustainability since 2000
• Annual income of approx. €20 million
• Almost 1,700 employees

All profit is ploughed back for social development

Social Entrepreneur of the Year
2009 Asia Region
**Accountability**

**Economic: Per Capita Income Increase**
- €1800/yr.
- €600/yr.
- €80/yr.

**Social: Higher Level of Education**
- Poverty line of Bangkok
- Poverty line of Northern Thailand
- Doi Tung income
- Poverty line of Bangkok
- Poverty line of Northern Thailand

**Environmental: Forest Regeneration**
- 80%
- <50%

**KPI:**
- “WHAT DO THE PEOPLE GET?”
“Cultivate People, Cultivate Land”

- Increase income from verities of sources (economic forest, livestock)
- Improve health (reduce chemical use)
- Improve self-esteem
- Improve community engagement (regulation on land use and irrigation)
- No further encroachment
- Reduce forest fire
- Increase biodiversity
Sustainable Reforestation projects of Mae Fah Luang Foundation

   - Doi Tung: 14,900 ha.
   - 11,000 pp in 29 villages

2. Pangmahun and Puna reforestation project (FPT 33), Chiang Rai province (2005-2009)
   - Pangmahan and Puna: 6,200 ha.
   - 10,900 pp in 30 villages

   - 3 Districts in Nan: 40,000 ha.
   - 8,600 pp in 20 villages
Why Carbon credit and T-VER?

- To ensure the continuity of forest conservation after project handover
- To provide MRV for the projects
- Cost cheaper and faster to develop a project (vs. VCS, CDM, Gold Std.)
- To promote carbon market in Thailand
- Promote the cooperation to reduce carbon emission within Thailand
- Prepare all stakeholders for future emission reduction mechanism eg. carbon tax, cap-and-trade, etc.
TGO’s Scheme to produce and voluntarily buy carbon credit in Thailand following ISO 14064-2 standard.

Validated and Verified by an independent Validation and Verification Body (VVB) registered with TGO following ISO 14064-3 standard /Accredited by 2018.

Type of greenhouse gas: CO₂, CH₄, and N₂O (1 TVERs = 1 t-CO₂e).
Thailand Voluntary Emission Reduction (T-VER)

- 2014 - Oct. 2017
- 34 methodologies
- 41 VVBs from 17 organizations
- 80 projects registered (67% energy related, 19% waste mgt., 10% forestry);
  8 forestry projects
- Forestry to reduce 157,420 t-CO₂/y
- 32 projects verified (2 forestry projects)

**Expected to reduce GHG**

\[
\text{2,118,206} \quad \text{tCO}_2\text{e/year}
\]

**Verified credits**

\[
\text{1,082,359} \quad \text{tCO}_2\text{e}
\]
Principles of T-VER (ISO 14064-2)

- Relevance
- Consistency
- Transparency
- Accuracy
- Completeness
- Conservative
Registration and Verification process for T-VER project

1. **Project Developer** → **Prepare PDD**
   - Project design document
   - Validated PDD, Validation report, Co-benefit, Additionality, ESA, EIA, Methodology

2. **TGO**
   - Thailand Greenhouse Gas Management Organization

3. **Validation**
   - Validation report
   - PDD

4. **Monitoring**
   - Monitoring report

5. **Verification**
   - Verification report

6. **TGO**
   - TGO reserves 2% of TVERs (T-VER fund)
   - <1000 tCO₂/y no 2% reservation
   - Before 2016 no 2% reservation and fees

7. **Registered project**

8. **Verified TVERs**
   - With serial number for each TVERs

- Every year or every 3-4 year (forestry) for 20 yrs
- 2-12 months for each step
# T-VER Methodologies for Forestry Projects

<table>
<thead>
<tr>
<th>Methodologies</th>
<th>Project types and sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T-VER-METH-FOR-01:</strong> Sustainable Forestation</td>
<td>Carbon sequestered by an increase in biomass / Size: less than 16,000 t-CO₂e/year (about 2,700 ha) / No leakage calculation</td>
</tr>
<tr>
<td><strong>T-VER-METH-FOR-02:</strong> Reducing Emission from</td>
<td>Prevent deforestation and carbon sequestration by an increase in biomass / Size: not specified / No leakage calculation</td>
</tr>
<tr>
<td>Deforestation and Forest</td>
<td></td>
</tr>
<tr>
<td>Degradation and Enhancing</td>
<td></td>
</tr>
<tr>
<td>Carbon Sequestration in Forest Area: Project Level</td>
<td></td>
</tr>
<tr>
<td>P-REDD+</td>
<td></td>
</tr>
<tr>
<td><strong>T-VER-METH-FOR-03:</strong> Large scale Sustainable</td>
<td>Carbon sequestered by an increase in biomass / Size: more than 16,000 t-CO₂e/year</td>
</tr>
<tr>
<td>Forestation Project</td>
<td>/ Project emission (Land preparation and machine use) / leakage (LUC)</td>
</tr>
</tbody>
</table>

**Guidelines and tools:**

1) T-VER and T-VER: forestry and Agriculture sector guidelines
2) Calculation of carbon sequestration by trees, soil carbon, dead wood and litter
Reducing Emission from Deforestation and Forest Degradation and Enhancing Carbon Sequestration in Forest Area Project Level: P-REDD+ (T-VER-METH-FOR-02)

- **R** = Reducing
- **E** = Emission (from)
- **D** = Deforestation
- **D** = (and) Degradation
- **+** = Conservation, sustainable forest management, and additional carbon sequestration

**Activities in REDD+**
1) Prevent additional forest encroachment
2) Prevent forest degradation
3) Forest conservation
4) Sustainable forest management and
5) Reforestation for additional carbon sequestration in the project area

Community participation is needed in every step
<table>
<thead>
<tr>
<th>Applicability</th>
<th>Project conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have measures to <strong>prevent the forest area from being used</strong> for other purposes and/or</td>
<td>1. The Project area must be forest area (area &gt;1 Rai, canopy of &gt; 30%, and the height of fully grown trees &gt; 3 m).</td>
</tr>
<tr>
<td>2. Have activities to <strong>reduce the degradation of</strong> forested land and/or</td>
<td>2. Have the <strong>land use rights</strong></td>
</tr>
<tr>
<td>3. Have activities to <strong>increase carbon sequestration</strong> in the forest area</td>
<td>3. <strong>No intention to change original ecosystem</strong> before the project starts</td>
</tr>
<tr>
<td></td>
<td>4. Must be an area that has a <strong>tendency to change</strong> from forest to non-forest area</td>
</tr>
<tr>
<td></td>
<td>5. In case of reforestation, <strong>indigenous species</strong> must be selected.</td>
</tr>
<tr>
<td></td>
<td>6. Proof of <strong>Additionality</strong> proof (large project) Breakeven &gt; 3 years</td>
</tr>
</tbody>
</table>
**Project conditions**

1. The Project area must be forest area (area >1 Rai (0.16 ha), canopy of > 30%, and the height of fully grown trees > 3 m).

### Land use Area

<table>
<thead>
<tr>
<th>Land use</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>km²</strong></td>
<td><strong>%</strong></td>
</tr>
<tr>
<td>Hill Evergreen Forest</td>
<td>18.73</td>
</tr>
<tr>
<td>Hill Evergreen Forest with bamboo</td>
<td>0.07</td>
</tr>
<tr>
<td>Dry Evergreen Forest</td>
<td>1.19</td>
</tr>
<tr>
<td>Mixed Deciduous Forest</td>
<td>32.28</td>
</tr>
<tr>
<td>Mixed Deciduous Forest with bamboo</td>
<td>60.94</td>
</tr>
<tr>
<td>Coniferous Forest</td>
<td>22.47</td>
</tr>
<tr>
<td>Agricultural Area</td>
<td>27.92</td>
</tr>
<tr>
<td>Urban Area</td>
<td>4.99</td>
</tr>
<tr>
<td>Water body</td>
<td>0.43</td>
</tr>
<tr>
<td>Total</td>
<td>169.02</td>
</tr>
<tr>
<td>Forest area</td>
<td>135.68</td>
</tr>
</tbody>
</table>
Forest types in Doi Tung

- Pine forest (16%)
- Bamboo forest (40%)
- Hill evergreen forest (12%)
- Mixed Deciduous forest (25%)
- Mixed Deciduous forest with coffee (2%)
- Pine forest with coffee (2%)
- Hill evergreen forest with coffee (3%)
Applicability

1. Have measures to *prevent the forest area from being used* for other purposes and/or

Project conditions

2. Have the *land use rights*

3. No intention to change original ecosystem before the project starts

Forest area < 50%  ➔  Approx. 80%

- Area with government permits
- Conservation area (Royal forestry dept.)
- Not in Dept. of National Park area
2. Have activities to **reduce the degradation** of forested land and/or
Applicability

3. Have activities to **increase carbon sequestration** in the forest area

Project conditions

5. In case of reforestation, **indigenous species** must be selected.
Project conditions

4. Must be an area that has a **tendency to change** from forest to non-forest area

% of forest area in Thailand

**Forest area reduction:**
Chiang Rai: 1.2% / yr.
= 6,016 ha./yr.

Annual Rate of Conversion (ARC)

\[ y = -6183.5x + 1E+07 \]
## Project conditions

6. Proof of Additionality proof (only for large project); Breakeven > 3 years

<table>
<thead>
<tr>
<th>Activities</th>
<th>2017</th>
<th>2016</th>
<th>2015</th>
<th>Average/year</th>
<th>20-year payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reforestation</td>
<td>€112,500</td>
<td>€51,014</td>
<td>€22,602</td>
<td>€62,039</td>
<td>€1,240,784</td>
</tr>
<tr>
<td>Forest fire prevention</td>
<td>€56,200</td>
<td>€32,357</td>
<td>€28,257</td>
<td>€38,938</td>
<td>€778,760</td>
</tr>
<tr>
<td>Total</td>
<td>€168,700</td>
<td>€83,372</td>
<td>€50,860</td>
<td>€100,977</td>
<td>€2,019,544</td>
</tr>
</tbody>
</table>

No forestry products from the project
Breakeven point > 3 years
TVERs calculation for P-REDD+

\[ C_{TT0} = \text{Baseline carbon stock} \]
\[ \text{ARC} = \text{Annual Rate conversion (%/year)} \]
\[ C_{TT1} = \text{Carbon stock at 1st verification} \]
\[ C_{INC1} = \text{Increase carbon stock} (C_{TT1} - C_{TT0}) \]

<table>
<thead>
<tr>
<th>Year</th>
<th>Calculation of TVERs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>[ C_{\text{REDD}+1} = 4 \times (C_{TT0} \times \text{ARC}) + (C_{TT1} - C_{TT0}) ]</td>
</tr>
<tr>
<td>8</td>
<td>[ C_{\text{REDD}+2} = 4 \times (C_{TT0} \times \text{ARC}) + (C_{TT2} - C_{TT1}) ]</td>
</tr>
<tr>
<td>12</td>
<td>[ C_{\text{REDD}+3} = 4 \times (C_{TT0} \times \text{ARC}) + (C_{TT3} - C_{TT2}) ]</td>
</tr>
<tr>
<td>16</td>
<td>[ C_{\text{REDD}+4} = 4 \times (C_{TT0} \times \text{ARC}) + (C_{TT4} - C_{TT3}) ]</td>
</tr>
<tr>
<td>20</td>
<td>[ C_{\text{REDD}+5} = 4 \times (C_{TT0} \times \text{ARC}) + (C_{TT5} - C_{TT4}) ]</td>
</tr>
</tbody>
</table>
Calculation of baseline carbon stock ($C_{TT0}$)

1. **T-VER area:** satellite images and land survey
   - Area with government permits
   - Not in National Park land

2. **Classify the forest types:** Satellite images and land survey → 1st stratum (Types of forest)

3. Place **sampling plots** at appropriate locations
   - Each sample plot has an area of 1 Rai (0.16 ha)
   - Divide each type of forest into 2nd strata according to their densities / richness / elevation
   - Each 2nd stratum has >3 different sampling plots

4. **Quantify biomass (t-CO$_2$e) in each sampling plot**
   - Conduct forest survey (DBH, Height, types of trees)
   - Use appropriate Allometry equations
   - Above ground and below ground biomass
   - Calculate CV of each group of sampling plots (CV <25%)

5. **Calculate baseline carbon stock**
   - Avg. biomass value of 3 sampling plots x total area
T-VER provides a tool to calculate carbon sequestration

To find Above ground biomass

Step 1: Setting up a sampling plot and collect data (DBH, Height, and types)
Setting up a sampling plot
Tagging and measuring DBH & Height of the trees
**Step 2: Choose appropriate Allometry equations and calculate above ground biomass ($C_{ABG}$)**

**Equations as suggested by TGO**

**Published equations**
- from academic journal
- appropriate for type of forest in the project area

**Develop own equations**
- need to be approved by TGO

* Dry evergreen forest (Tsutsumi et al., 1983)

\[
\begin{align*}
    w_S &= 0.0509 \ (D^2H)^{0.919} \\
    w_B &= 0.00893 \ (D^2H)^{0.977} \\
    w_L &= 0.0140 \ (D^2H)^{0.669}
\end{align*}
\]

When

\[
W_T = W_S + W_B + W_L
\]

- $w_T$ = Total above ground biomass (kg.)
- $w_S$ = Above ground biomass - Stem (kg.)
- $w_B$ = Above ground biomass - Branch (kg.)
- $w_L$ = Above ground biomass - Leaves (kg.)
- $D$ = Diameter at Breast Height (cm.), DBH at 1.3 m
- $H$ = Tree height (m)
Step 3: Choose appropriate Root-to-Stem ratio to calculate below ground biomass ($C_{BLG}$)

Ratios as suggested by TGO

Published ratios

• from academic journal
• appropriate for type of forest in the project area

Develop own ratios

• need to be approved by TGO

\[
\text{carbon sequestered for aboveground biomass} \times \text{root-to-stem ratio} = (C_{ABG}) (R)
\]

27% of above ground biomass for most trees
Step 4: Calculate biomass in the sample plot

\[
C_{TT} = C_{ABG} + C_{BLG}
\]

Ref: T-VER-TOOL-FOR/AGR-01
Step 5: Calculate carbon sequestered in the forest

Biomass in a sample plot (M)

\[ \text{Project area (or forest area)} \times \frac{\text{Sample plot area (a)}}{44/12} \times \text{Carbon fraction (CF)} \]

\[ \text{Molecular weight of CO}_2 / C \]

CF = 47% of total biomass for most trees

Unit: t-CO\textsubscript{2}e
## TVERs calculation for P-REDD+

### 7 types of forest / 15 strata / 45 sampling plots

<table>
<thead>
<tr>
<th>Types of forest</th>
<th>Elevation (m)</th>
<th>Area (ha)</th>
<th>Biomass (ton/ha)</th>
<th>Biomass (t-CO₂eq/ha)</th>
<th>Biomass (t-CO₂eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo</td>
<td>410-899</td>
<td>3,851</td>
<td>109.35</td>
<td>188.44</td>
<td>725,691</td>
</tr>
<tr>
<td></td>
<td>900-1410</td>
<td>539</td>
<td>158.03</td>
<td>272.33</td>
<td>146,973</td>
</tr>
<tr>
<td>Mixed Deciduous</td>
<td>400-799</td>
<td>2,305</td>
<td>150.82</td>
<td>259.91</td>
<td>599,244</td>
</tr>
<tr>
<td></td>
<td>800-1000</td>
<td>372</td>
<td>179.55</td>
<td>309.42</td>
<td>115,304</td>
</tr>
<tr>
<td>Hill evergreen</td>
<td>600-1199</td>
<td>1,181</td>
<td>147.29</td>
<td>253.84</td>
<td>299,810</td>
</tr>
<tr>
<td></td>
<td>1200-1440</td>
<td>107</td>
<td>239.79</td>
<td>413.25</td>
<td>44,432</td>
</tr>
<tr>
<td>Pine</td>
<td>550-899</td>
<td>705</td>
<td>269.84</td>
<td>465.03</td>
<td>328,199</td>
</tr>
<tr>
<td></td>
<td>900-1199</td>
<td>833</td>
<td>505.38</td>
<td>870.93</td>
<td>725,591</td>
</tr>
<tr>
<td></td>
<td>1200-1509</td>
<td>222</td>
<td>525.58</td>
<td>905.75</td>
<td>201,149</td>
</tr>
<tr>
<td>Mixed Deciduous with coffee</td>
<td>400-1000</td>
<td>190</td>
<td>151.78</td>
<td>261.57</td>
<td>49,844</td>
</tr>
<tr>
<td>Hill evergreen with coffee</td>
<td>600-1199</td>
<td>272</td>
<td>169.69</td>
<td>292.42</td>
<td>79,633</td>
</tr>
<tr>
<td></td>
<td>1200-1440</td>
<td>103</td>
<td>201.12</td>
<td>346.61</td>
<td>35,881</td>
</tr>
<tr>
<td>Pine with coffee</td>
<td>550-899</td>
<td>71</td>
<td>385.71</td>
<td>664.71</td>
<td>47,753</td>
</tr>
<tr>
<td></td>
<td>900-1199</td>
<td>105</td>
<td>291.40</td>
<td>502.19</td>
<td>53,031</td>
</tr>
<tr>
<td></td>
<td>1200-1509</td>
<td>64</td>
<td>434.93</td>
<td>749.53</td>
<td>48,090</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,926</strong></td>
<td><strong>3,500,624</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Biomass of Doi Tung forest**

- Pine forest with coffee: 638.81 t-CO₂eq/ha
- Hill evergreen forest with coffee: 319.51 t-CO₂eq/ha
- Pine: 747.24 t-CO₂eq/ha
- Hill evergreen: 333.54 t-CO₂eq/ha
- Mixed Deciduous: 284.67 t-CO₂eq/ha
- Bamboo: 230.39 t-CO₂eq/ha

**Carbon sequestered:** 320 t-CO₂eq/ha

**Expect to prevent loss of forest area (REDD):**
131 ha/yr. (41,912 t-CO₂eq/yr)

**Expect to sequester more (+):**
64,876 t-CO₂eq/yr.*

**Expect to gain TVERs annually for 20 yrs.:**
106,788 t-CO₂eq/yr

(Valued €562,000/yr. or €51/ha/yr)

*Default value 5.9375 t-CO₂eq/ha/yr.
Benefits from buying carbon credits from forestry projects

• **Lots of Co-benefits:** increase income and better the livelihood of the community living in the forest / Establishment of local Social Enterprises or cooperation / PES

• **CSR:** money from a company to be used sustainably **not just giving it for free**

• **Carbon offsetting:** Carbon Neutral Event / Carbon Neutral Man / Carbon Neutral Org.

• **Sustainable reporting:** Annual report especially for company in SET / DJSI / Carbon Disclosure Project

• **No Tax on selling carbon credit**

• **Priced around €1-4** per 1 TVERs a few companies in Thailand has already purchased
  • Paragon department store 3,000 TVERs price €1/t-CO$_2$e (Biomass energy Mitphol)
  • Chiang Mai univ. 566 TVERs price €4/t-CO$_2$e (Biogas from pig farm)
  • SET 2,403 TVERs price €4/t-CO$_2$e (Hydropower from EGAT)
Thank you