# APFNET - SRI

# Author:

# "Forest Restoration in Vietnam - Lessons from APFNet project and new approaches"

# Contents

# Table of Contents

# List of figures

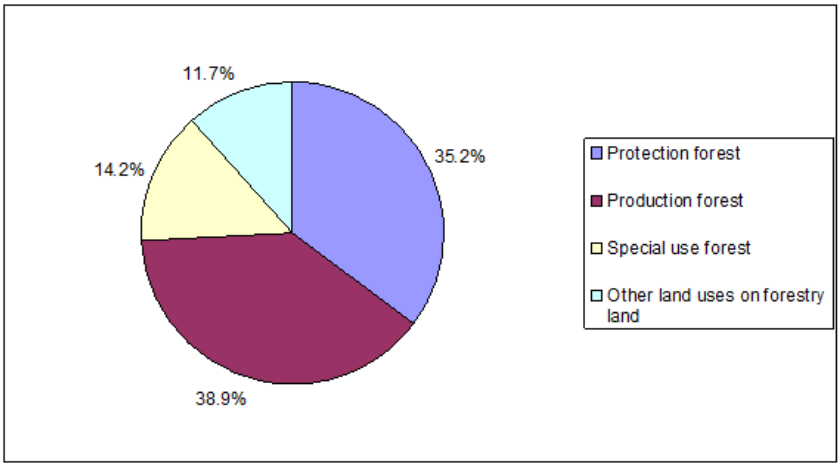
# List of tables

# Chapter 1.Forest degradation in Vietnam

## 1.1. Forest status, history of deforestation and forest degradation

Vietnam is a country with high rate of hilly area, most of the territory are covered by forest. The country stretches out multiple latitude and longitude with the diversity of terrain. Due to the mountainous makes up more than 2/3 of the territory and climate transition from humid tropical monsoon in the South into the subtropical in northern highlands, this has created the diversity of natural ecosystems and abundance of species. These ecosystems consist of a great deal of different forest types such as broadleaf evergreen forest, semi-deciduous forest, deciduous forest, limestone forest, mixed forest of broadleaf trees and coniferous trees, bamboo forest, mangrove forest, melaleuca forest, freshwater wetland forest, etc. Nonetheless, on account of the impacts of many subjective and objective reasons, Vietnam's forests have been severely declined in both terms of quantity and quality in the last half of the $20^{th}$ century and recent years.

Vietnam Forestry Development Strategy (2006-2020) determined that of the total of 16.2 million ha of forestry land, Vietnam are setting a goal to obtain the stability of 14.3 million ha forest area, add 1.9 million ha of other land using on forestry land as the agroforestry system (Ministry of Agriculture and Rural Development 2006).



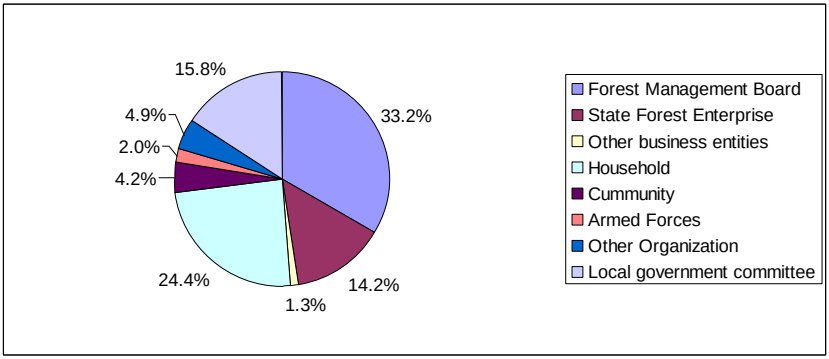

*(Source:* Ministry of Agriculture and Rural Development, *2006)*

***Figure 1. Plan on forest kinds to 2020 (the total area of forest land: 16.2 million ha)***

According to statistics of Directorate of Forestry, by 2012, the total forest area is 13.86 million ha (accounting for 41.9% of the total natural area), including 10.423 million ha of natural forests and 3.428 million ha of plantation. If

dividing into three forest kinds, by 2012: special use forest: 2.02 million ha (equivalent to 15.7% of the total forest area), protection forest: 4.7 million ha (making up 36.1% of the forest area) and production forest: 7 million ha (accounting for 47.3% of the forest area) and other forest types: 200.23 ha (accounting for 0.9% of the forest area) (Directorate of Forestry 2013).

Forest classification under management units in 2013 showed that the forests under Forest Management Board occupy the largest percentage of 33.2% of the total forest area, primarily being special use forests and protection forests (Figure 2) (Directorate of Forestry 2013).




*(Source: Directorate of Forestry, 2013)*

***Figure 2.Forest classification under management units***

Farmers are managing the forest with the second largest area of the total forest area (making up 24.4%). The forests of smallholds are principally production forest.

***Table 1. Forest status and forest classification under management units in 2012***

*Unit: ha*

| | Total forest area | Forest Management Board | State Forest Enterprise | Other business units | Households | Community | Armed Forces | Other organizations | Local authorities |
|---|---|---|---|---|---|---|---|---|---|
| Total forest area | 13.862.043 | 4.606.365 | 1.965.471 | 177.573 | 3.388.948 | 588.253 | 271.599 | 672.446 | 2.191.388 |
| Natural forest | 10.423.844 | 4.028.354 | 1.429.400 | 49.625 | 1.809.976 | 553.7 97 | 207.831 | 554.505 | 1.790.356 |
| Plantation | 3.438.200 | 578. 010 | 536.071 | 127.948 | 1.578.972 | 34.456 | 63.769 | 117.941 | 401.033 |

*(Source: Directorate of Forestry, 2013)*

Forest cover has increased in recent years but uneven distribution among regions. The regions with relatively high forest cover are: North-western region, North-eastern region, North Central region, South Central Coast and Central Highlands. These areas have forest cover from 40% -50%, particularly some provinces have very high forest cover including Bac Can (accounting for 69.5%), Kon Tum (accounting for 64.7%) (Decision No. 1739 / QD - BNN – TCLN dated on 31/07/2013 by the Ministry of Agriculture

and Rural Development). The rest regions such as the Red River Delta, South-eastern region and South-western region, the forest cover is comparatively low.

Although the forest area has gone up from 7.8 million ha ( in 1981) to 13.86 million ha (in 2012), deforestation and forest degradation have remained in all corners of the country, from the Central Highlands to South Central Coast and South-eastern region. Forest losses and habitat disruption are the causes of natural-forest separation and fragmentation.

***The decline in forest area:***

The decline in forest resources is clearliest indicated through the reduction of the forest area. Previously, the majority of Vietnam's territory was covered by forest, but the forests have been seriously degraded within almost the last century. Forest cover makes up about 43% of the territory in 1943.

Forest area has fallen off dramatically for 30 years in the war period. With more than 80 million liters of herbicides (Agent Orange), 13 million tons of bombs, the

war has destroyed no less than 2 million ha of tropical forests.

The forest degradation in the post-war period from 1975 to the early 1990s results from: conversion of forest land into agricultural land to plant industrial trees such as coffee, tea, rubber, etc.; unsustainable logging of natural forests to meet domestic and export demand;

***Table 2. Changes in forest area during the period from 1943 to 2012***

*Unit: million ha*

| **Year**<br>**Forest type** | **1945** | **1976** | **1985** | **1990** | **1995** | **2005** | **2012** |
|---|---|---|---|---|---|---|---|
| Total area | 14,3 | 11,2 | 9,9 | 9,2 | 9,3 | 12,7 | 13,5 |
| Natural forest | 14,3 | 11,1 | 9,3 | 8,4 | 8,3 | 10,2 | 10,3 |
| Plantation | | 0,1 | 0,6 | 0,8 | 1,0 | 2,5 | 3,2 |
| Forest cover (%) | 43,0 | 33,8 | 30,0 | 27,8 | 28,2 | 38,0 | 41,9 |

*(Source: Directorate of Forestry, 2013)*

There are two opposing trends, including consecutive decrease from 1943 to the early 1990s and the consecutive increase from the early 1990s up to now. According to the table above, from 1945 to 1990, the total of forest area of Vietnam has fallen into continuing decline (5 million ha for 45 years, the average decline of about 0.11 million ha), rapidly decline during 1976 -1985 with the average annual area loss of around 0.14 million ha (Tran Van Son, Nguyen XuanQuat and others 2006, Directorate of Forestry 2013). The forest area steadily rised during the period from 1990 to the 2000s with the average annual area increase of 2.3% and 1.6%, respectively (Pham, Moeliono and others, 2012).

The area of plantation has quickly expanded since 1990, from about 1 million ha in the early 1990s to 3.2 million ha in 2012 (Directorate of Forestry 2013). Positive achievements result from not only the policy of forest land allocation, the timber demand of market, the improvement of seeds and seedlings, and forestry policies, etc. but also the support for financial and technical aspect from donors in the afforestation programs.

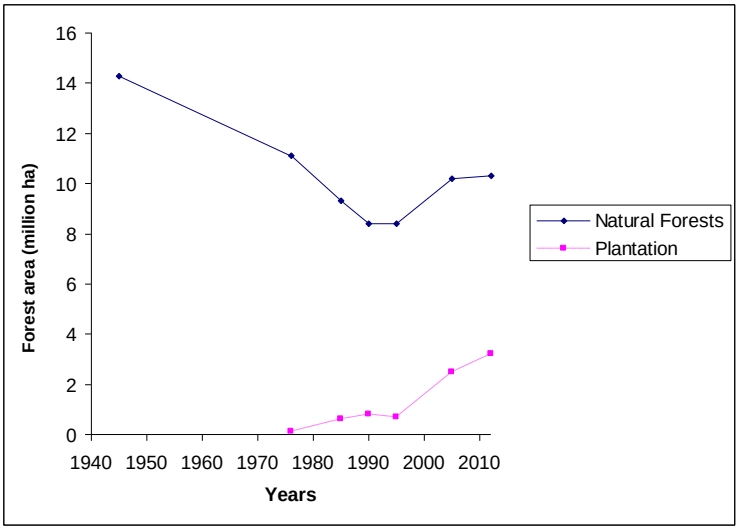



***Figure 3.Changes in natural forest and plantation in Vietnam***

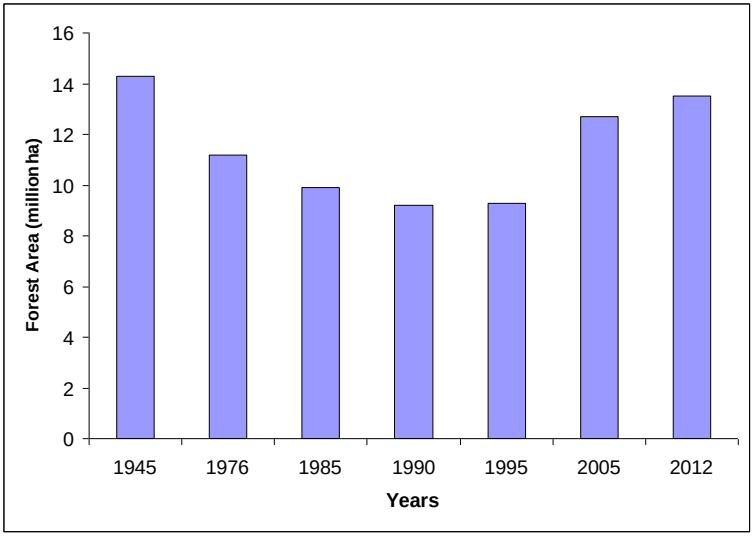



***Figure 4.Changes of forest area 1943- 2012***

Average forest area per capita of our country is listed into the the lowest level in the world. The period of 1943 - 1995, forest area per capita has drastically reduced from 0.63 ha / person to only 0.13 ha / person. In 2012, this indicator increased to 0.15 ha / person, much lower than the average level of the world (the world's forest area per capita is 0.93 ha / person). Increasing growth of our population is the main reason; meanwhile, the land area for forestry and forest area have decreased for other manufacturing industries.

***Table 3.The average forest area per capita of Vietnam during the period 1943 - 2012***

| Year | 1945 | 1976 | 1985 | 1995 | 1999 | 2005 | 2012 |
|---|---|---|---|---|---|---|---|
| ha/ person | 0,63 | 0,23 | 0,17 | 0,13 | 0,14 | 0,15 | 0,15 |

***Decline in forest quality***

Natural forest with the highest value on the ecological environment has been dropped sharply and replaced by plantations and industrial-tree species such as rubber and coffee, etc. The natural forest area has continuously downed from 1945 to 1995, drastically down in the period of 1976-

1995 (from 11.1 million ha to 8,3 million ha, loss 2.8 million ha within 19 years, the average annual decrease of 0.11 million ha). After 1995, the natural forest area tended to up back from 8.3 million ha in 1995 to 10.3 million ha in 2009 (the average annual increase of 0.5 million ha). The increase of natural forest area commonly roots from forest restoration after shifting cultivation and forest degradation (Directorate of Forestry 2013, Phan Minh Sang 2014).

According to report data of National Forest Inventory and Monitoring Programme (NFIMAP), Phase III, 2/3 of the natural forest area in Vietnam was considered as the poor forest (with the reserve of no more than 100 $m^3$ / ha); rich and average forest made up only 4.6% of the total forest area, mostly distributing in mountainous and remote areas. Mangroves and Melaleuca forest in the coastal plain that play an important role in maintaining biodiversity have disappeared. The restoration of natural forest with high reserve is only able to do in small and scattered areas. Additionally, the report showed that the reduction of forest quality and biodiversity has remained. In the period from 1999 to 2005, rich and average forest have decreased to about 10.2% and 13.4%, respectively. Most of natural forest

in the Central Highlands, South-eastern region and North-western region has been destroyed during the period of 1991-2001.

Natural forest has also declined in forest quality. Most of primary forest and rich forest which are a type of special use forest and protection forest distribute in remote and mountainous regions. Primary forest has been reduced from 384,000 ha in 1990 to 187,000 ha in 2000 (FAO 2006). Primary forest has been reduced from 384,000 ha in 1990 to 187,000 ha in 2000 (FAO 2006). Production forest is natural forest, accounting for about 652,645 ha (21%) at the present; Poor and young forest making up around 2,453,002 ha (79%), mainly belonging to natural secondary forest and renewable forest after clearcutting and shifting cultivation (Tran Van Son, Nguyen Xuan Quat and others. 2006 ).

Plantations have rapidly increased in both terms of area and yield over years, making a great contribution to enhance the forest cover in all over the country and meeting the timber demand for industry and export. Nonetheless, commercial plantations mostly paying attention to monoculture of exotic species such as Acacia and

Eucalyptus spp. may exist ecological problems. Biodiversity and environmental values of the plantations are also not high. Upstream natural forest and mangrove forest have remained severe destruction. Rich forest, closed forest and primary forest makes up only approximate 13%, whereas poor forest and secondaryforest account for up to 55% of the total forest area.

## 1.2. Causes of forest degradation

### 1.2.1. Direct causes

According to the national environment report 1998 on Deforestation and forest degradation, the primary causes of deforestation in Vietnam consist of overexploitation, shifting cultivation, conversion from forest land to agricultural land, free migration, war and conversion of other land-using purposes (Ministry of Science, Technology and Environment 1998). The percentage of these reasons in deforestation in each ecoregion is presented in the following table:

***Table 4. Reasons for forest loss in accordance with economic - ecological regions***

| | **Over Exploitation** | **Shifting cultivation** | **Conversion of forest land into agricultural land** | **Free migration** | **War** | **Conversion of other landusing purposes** | **Total (100 %)** |
|---|---|---|---|---|---|---|---|
| Northern Delta | 12 | | 17 | 41 | 9 | 21 | 100 |
| North-eastern region | 27 | 29 | 11 | 7 | 8 | 18 | 100 |
| North Central | 29 | 27 | 16 | 9 | 5 | 23 | 100 |
| North-western region | 11 | 36 | 12 | 11 | 3 | 27 | 100 |
| Central region | 34 | 21 | 14 | 6 | 14 | 11 | 100 |
| South Central coast | 28 | 17 | 11 | 9 | 29 | 6 | 100 |
| Central Highlands | 31 | 24 | 21 | 5 | 17 | 2 | 100 |
| South-eastern region | 29 | 15 | 13 | 9 | 24 | 10 | 100 |
| Mekong Delta | 19 | 4 | 19 | 21 | 31 | 6 | 100 |

*Source: National environment report 1998 on Deforestation and forest degradation*

In general, overexploitation and deforestation to plant agricultural trees are the main causes of deforestation in Vietnam. After war, North Central region, South Central Coast, Central Highlands and South-eastern region, the regions with the richest natural forests, have the same problem of logging in excess. Meanwhile, the purpose conversion of using land and shifting cultivation is the reason with the strongest impact on deforestation in North-western region (Ministry of Science, Technology and Environment, 1998).

The survey of reasons for forest degradation in 42 projects of forest restoration of de Jong and others (2006) identified that the most frequent causes are logging , livestock grazing and forest fires (de Jong, Do and others 2006). This result is similar to the report from the Ministry of Agriculture and Rural Development.

*Table 5. Causes of forest loss and degradation*

| **Causes of forest loss and degradation** | **Production forest** | **Protestion forest** | **Special use forest** | **Total** |
|---|---|---|---|---|
| Agricultural production | 5 | 7 | 1 | 13 |
| Forest fire | 1 | 17 | 3 | 21 |
| Forest fire | 4 | 5 | 1 | 10 |
| Grazing | 3 | 15 | 3 | 21 |
| Grazing | 2 | 14 | 3 | 19 |
| Deforestation for timber products | 5 | 20 | 5 | 30 |
| Others | 3 | 6 | 3 | 12 |
| Total | 23 | 84 | 19 | 126 |

According to analysis of the causes of forest loss and degradation in Vietnam, we can consider some main reasons as follows (de Jong, Do and others 2006, Tran Van Con, Nguyen XuanQuat and others, 2006, MARD 2007 Meyfroidt and LAMBIN 2008):

** Shifting cultivation and conversion from forest land to agricultural land*: After war and before economic reform (in the late 1980s), shifting cultivation was considered as a key factor of deforestation in Vietnam. It is estimated that slash-and-burn resulted in losing up to a half of forest area at this phase. Synthesize data about fluctuations of forest area during the period of 2004 - 2008 (Table 6) also showed that land-using conversion is the biggest reason for natural forest reduction in Vietnam (Hoang, Do and other 2010).

***Table 6. Increase, decrease of forest area in Vietnam, 2004 - 2008, and the causes***

| Forest type | 2004 | 2005 | 2006 | 2007 | 2008 | Total |
|---|---|---|---|---|---|---|
| Forestry land covered by trees | 12 306 859 | 12 616 699 | 12 873 850 | 12 903 423 | 13 118 773 | _ |
| 1.Natural forest | 10 088 288 | 10 283 173 | 10 410 141 | 10 348 914 | 10 348 591 | _ |
| a.Reasons for increase | 161 912 | 215 188 | 112 331 | 59 204 | 32 974 | 581 539 |
| Increase NF | 161 912 | 178 596 | 74 328 | 59 204 | 32 974 | 507 014 |
| Other forests | _ | 36 522 | 38 003 | _ | _ | 74 525 |
| Reasons for decrease | 53 523 | 35 311 | 35 588 | 85 126 | 63 278 | 272 826 |
| Legal exploitation | 238 | 530 | 120 | 376 | 355 | 1 619 |
| Forest fire | 2 141 | 446 | 259 | 697 | 109 | 3 625 |
| Pests | _ | 197 | 68 | 58 | _ | 323 |
| Illegal exploitation | 3 061 | 7 989 | 6 199 | 1 694 | 3 395 | 22 338 |
| Land conversion | 24 916 | 15 260 | 18 449 | 11 808 | 23 508 | 93 941 |
| Other reasons | 23 167 | 10 889 | 10 493 | 70 493 | 35 911 | 150 953 |
| 2.Plantation | 2 218 571 | 2 333 526 | 2 463 709 | 2 554 509 | 1 770 182 | _ |
| a.Reasons for increase | 205 257 | 158 624 | 195 601 | 178 779 | 203 601 | 941 862 |
| New planting | 182 699 | 154 787 | 171 444 | 178 779 | 174 918 | 862 627 |
| Other reasons | 22 558 | 3 837 | 24 157 | _ | 28 683 | 790235 |
| b.Reasons for decrease | 43 566 | 35 120 | 39 231 | 45 153 | 45 334 | 208 404 |
| Legal exploitation | 16 362 | 19 046 | 23 194 | 26 855 | 35 147 | 120 604 |
| Burning | 3 422 | 4 818 | 1 276 | 1 631 | 679 | 11 826 |
| Pests | _ | 153 | 71 | 279 | 18 | 521 |
| Illegal exploitation | 600 | 1 159 | 2 249 | 136 | 502 | 4646 |
| Land conversion | 10 026 | 8 237 | 12 441 | 4 802 | 8 988 | 44 494 |
| Other reasons | 13 156 | 1 707 | _ | 11 450 | _ | 26 313 |

*(Source: Hoang Minh Ha and others, 2010)*

* Market Economy has boomed in the 1990s and 2000s in which agricultural production demanding for land to grow industrial trees such as coffee, rubber, etc. with higher economic value has dramatically increased. This has placed tremendous pressure on converting from forest to agricultural land to plant these trees. The area of coffee plantations increasing from 120,000 ha in 1990 to nearly 620,000 ha in 2012, meanwhile the area of rubber plantation rising from 250,000 ha in 1990 to 910,000 ha in 2012 (General Statistics Office 1990 - 2013). As a result, more than a million hectar of forestry land in hilly and mountainous areas started planting coffee and rubber in this phase.

In coastal areas, conversion from mangroves forest to aquatic farming system is the major cause of forest loss in a large area. Approximately 5% of the total mangrove area is lost each year to convert to other land-using forms. Besides, conversion from mangrove forest to agriculture (planting rice) due to the development of irrigation system is also a big problem of the Mekong Delta (Pham, Moeliono et al. 2012).

Indiscriminate and excessive exploitation of natural forest: After war, in order to serve for rehabilitation and economic development, Vietnam has massively exploited forest to use for domestic and export demand, particularly for the former socialist republics. Making the subjective exploitation plan which ignored the ecological characteristics of the forest has drastically declined natural forest quality. Unsustainable selective logging of natural forest is the principal reason for serious degradation of forest quality, converting from many rich natural forests to depleted secondary forests with composition of almost species without commercial value. Poor management and "everybody's business is nobody's business" status in forest farms and state forestry enterprises - the entities assigned to manage the largest forest area and forest land - in the former period also leaded to forest degradation (de Jong, Do and others 2006).

Furthermore, illegal logging and chopping firewood also have a considerable impact on forest resources. According to Castren (1999), the amount of firewood consumed in Vietnam was about 36 million $m^3$ by 1992 (Castren 1999). It is assumed that if a large proportion of the

firewood is brought from the forest, compared to the amount of annually harvested timber, firewood occupies much larger biomass from the forest ecosystem. Logging makes up about one third of the causes of forest loss in the areas where have richest forests in Vietnam such as the Centre Northern, North Central region, South Central Coast, Central Highlands and South-eastern region (Ministry of Science and technology and Environment 1998).

* Land conversion for infrastructure, hydroelectric power and irrigation: Economic development with an increasing demand for energy, infrastructure need to use the large amount of forest resources. Particularly, hydroelectric power and irrigation works in the countrywide have taken away hundreds of thousands of hectares of forest and forestry land. From 2006 to 2012, the lost forest area because of working hydroelectric power was more than 50 thousand ha (Ministry of Trade and Industry 2012). In order to cater for other infrastructure works such as road system, electrical system, etc., thousands of hectares of forests have been cut down. (Pham, Moelionoand others 2012).

* War: War is not only the direct cause but also the underlying cause of biodiversity degradation. Only in the period from 1961 to 1975, 13 million tons of bombs and 72 million liters of toxic chemicals sprayed mainly in Southern Vietnam by United State have destroyed about 2.2 million ha forest (Phung and Le 1994). After ending war, the country's forest area left only about 9.5 million ha – with 10% of primary forest, accounting for about 28% of total area of the whole country. According to preliminary calculations, over 3,3 million ha of natural land was sprayed toxic chemicals, in which inland forests have severely affected with different degrees. Consequences of spraying toxic chemicals of United State also brought about a series of other damages to forest environment, particilarly upstream protection forest (Phung and Le 1994).

* Forest fires: Forest fires are also a significant cause of forest loss and degradation of forest resources, influencing to the living activity of organisms in a large area and causing bad effects such as erosions, floodings and droughts to human life. According to incomplete statistics of Directorate of Forestry 2010, there are about 704 forest fires each year. In the phase of 2002-2011, the average annual

lost-forest area was about 3617.9 ha. There were 897 fires in 2010, losing 5,668 ha forest. Meanwhile, in 2011, 241 cases occurred, losing 1744.98 ha forest. This chart below presents the changes in burned forest area from 1995 to 2010.

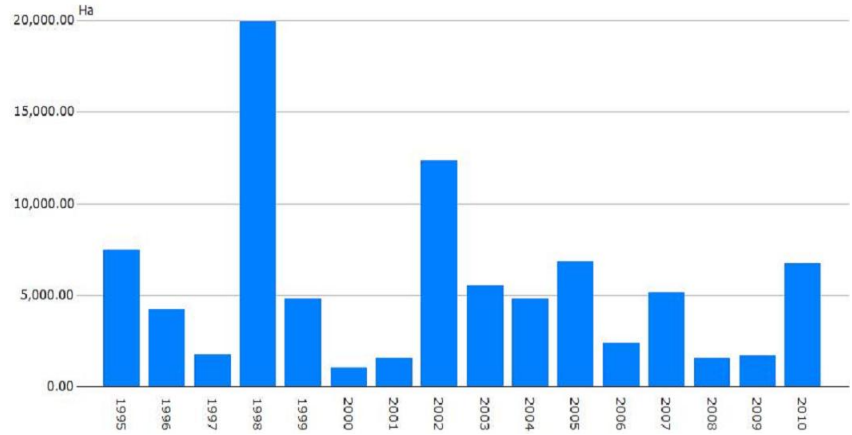



***Figure 5. Burned forest area due to forest fires, the period 1995 -2010***

*(Source: General Statistics Office, 2014)*

1.2.2. Underlying reasons

* The pressures of population growth and poverty: Estimate to 2020, population of Vietnam can increase to 100 million people. Although experiencing for a long time of war with great loss of life and indirect through starvation due to insufficient supply of population's foods need, the

population of Vietnam from 1941 of 20,9 million people has speeded up 4 times against 2005 of 83,1 million. Rapid population growth but restriction on agricultural area generates a high pressure on meeting the demand for foods of the people. To solve the problem of population growth and high population density in the plains as well as mountains region where have been exhaustedly exploited resources in the North, the Vietnamese government has migration policy to resource-rich and fertile regions in the South. Right since the 1980s, the Government Council had big policy (Government Council 1980) to encourage to migrate and build new economic zones centralized in remote areas where is rich in forest resources (Phan Minh Sang 2014). These migrants deforested to slash and burn (Ding in 2005, FAO 2010). Additionally, a large segment of the people of free migration also is the reason for deforestation in the mountainous region (Tran Van Con, Nguyen XuanQuat and others 2006, Phan Minh Sang 2014).

* The policy of economic development: Needs of economic development from the industrial trees with high economic value such as coffee, rubber, cashew, pepper, etc. or increasing wood needs to meet timber processing and

furniture exporting industry also put tremendous pressure on natural forest conversion and ecological value – conversion environment to agricultural land and plantation. For example, Circular No.127/2008/TT-BNN of the Ministry of Agriculture and Rural Development of rubber plantation on agricultural land in which natural depleted forest conversion was abused to massively convert from depleted natural forests in Central Highlands and other provinces to grow rubber (Ministry of Agriculture and Rural Development 2008). Policies to promotion of development and export of products from industrial plants have negative impacts on forest resources. On account of the economic development purpose, local governments in many provinces allow to convert from natural forests to industrial-tree plantations. The natural forest area is significant reduction, and continues to be lost recently due to conversion to other land-using types. Moreover, infrastructure construction to develop economy such as hydroelectric power, mining, transportation, etc. also results in decline of forest cover in Vietnam.

* Weak institutional framework and law enforcement: Forestry management system is unit and complete from the

local level up to the provincial level (de Jong, Do and others 2006, Tran Van Con, Nguyen XuanQuat and others 2006, Pham, Moeliono and others 2012). Nevertheless, forestry management capability and effect in many locals are not good, especially at the commune level, where directly implement forestry land management and forestry production activities in locals (Pham, Moeliono and others 2012). Because of many reasons such as capacity, incentives, loose organizational apparatus, communal agriculture and forestry officials tend to be difficult to meet the requirements for forest management of their communes in which includes an important activity - forestry extention. Meanwhile, the local forest rangers are responsible for management and protection of the assigned forests, the forces are too thin and are raisen a lot of questions about corruption when performing duty (Sikor and To, 2011).

Non-compliance with the law of forest protection and management is one of the problems seriously affecting forest degradation in Vietnam. Deforestation, slash-and-burn, conversion of industrial and agricultural crops have happened everywhere. However, owning to a great deal of reasons such as legal awareness, corruption, overlapping

regulations, thin law enforcement forces, etc., so the legal remedys have low deterrent effect which makes stealthy logging, deforestation, etc. still remain (Sikor and to, 2011, Phan Minh Sang 2014).

On the other hand, system of land forest management database includes inaccurate GIS data, overlap and contradiction between related units (environmental resource sector and forestry sector). Moreover, the complicated land-using history such as land encroachment of offices, state enterprises, trade among people, inheritance, etc. makes management issues of forestry land and forest become more and more difficult and hard to achieve good results (de Jong, Do and others 2006, Pham, Moeliono and others 2012)

* Lack of investment: To enforce the policy of forest protection contracts according to Decision No.02/CP of Prime Minister, millions of hectares of forest and forest land of state enterprises, forest management boards has been contracted forest protection. The amount of money, which is granted per hectare for forest management and protection per year of only 50 thousand vnd in the first phase, according to many assessments, is too small to create

motivations for effective forest protection (GoV 1995, de Jong, Do and others 2006). Lack of resources to maintain forest management and protection has become a big difficulty of management boards of special use forest and protection forest, particularly, the protection forest management boards. The number of personnels and expenditure allocated for protection forest management boards are generally lower than necessary level, and thus effects of forest management and protection of a lot of boards have remained bad results (de Jong, Do and other 2006, Phan Minh Sang 2014).

### 1.2.3. Impacts of deforestation and forest degradation

The calculation of the economic impact of deforestation is very complex. With the current data, it is difficult to give reliable figures due to deforestation, even direct impacts to forest products (timber and non-timber forest products) or direct negative impacts to resilience of natural disasters such as floods, droughts, storms, pests and diseases of crops ..., and decline in capabilities and value of the hydroelectric power, irrigation works, etc. From 1980 up to now, Vietnam has experienced a series of big natural

disasters, in which floods and droughts are likely to mostly affect lives and property of human. Statistically, natural disasters cause the average number of 519 deaths/year and economic loss of $ 256 million/year during the period 1980-2010 (PreventionWeb 2014). Soil erosion reduces longevity, enhances maintenance costs of the irrigation, hydroelectric power works, as well as reduces the ability of steady power supply for the system because of unsteady water supply for the reservoir (de Jong, Do and others 2006).

Forest resources play an important role in water regulation each year, water maintenance in the dry season to irrigate and limit floods in the rainy season. Deforestation raised the consequences of severe drought occurred in 1995 in Central Highlands, in 1997 across the country. The droughts have severely affected agriculture and industrial plants, in which thousands of hectares of coffee plantation on hilly and mountainous land in Central Highlands died due to water shortage, being the direct consequence of deforestation in this region (de Jong, Do and others 2006, PreventionWeb 2014).

Deforestation and forest degradation causing the loss of habitats of wild plant and animal species is one of the most important causes of population reduction, extinction of these species. The number of plant and animal species listed on the Red Book are in danger of extinction, increasing by 167 species from 1992 when the first Red Book was released comparing with that from 2007 when the Vietnam Red Book was published. Vietnam has witnessed the rapid decline in the population of many rare animal species. Some species have been recognized to be extinct in the wildlife such as rhinoceros horn, grey cow, tapir, otter civet, lilac crocodile, spotted deer, etc. Forests after unsustainable selective logging, illegal logging have been severely depleted on the ecological value, especially plant diversity. Many plants, especially the high-value species such as timber, rare non-timber forest products have been exhaustedly exploited and at risk of extinction (Ministry of Science and Technology 2007).

# Chapter 2. Policy and rehabilitation technique of natural forests in Vietnam

## 2.1. The rehabilitation policy in Vietnam

The first attempts to rehabilitate the forest and plant dispersed trees in Vietnam began in 1955. Administration of forestry then it turned into Minister of Forestry and now, it is Ministry of Agriculture and Rural Development. 5 major programs has been developed. One of them is the national program of planting new forests (afforestation) and a national program for forest protection (Sikor 1998, Nguyen 2005).

Policies and forest rehabilitation activities should be understood in the context of the role of forestry and agriculture in the overall socio-economic development of the country.

The Government of Vietnam prioritized rehabilitation work. This point were institutionalized in many types of legal documents listed in Table affiliation 3.1 These documents related more or less to the policy , regulations, guidelines, rules, technical procedures about management

and forest rehabilitation. This section will mention to some important texts relating to rehabilitation policy in Vietnam.

Natural Conservation National Strategy 1984 is a significant evidence for Vietnam's commitment to restoring forest, increasing cover to improve and protect soil, conserving water sources and controling flood. The main reason of this commitment is the awareness of how the upstream forest loss threats to the economic development in the lowland delta and coastal plain.

Upon a conservation strategy, protection and development laws were also promulgated in 1991. This law refers to conservation areas with the aim:

- Re-establish national coverage is 40%

- Establish forest rehabilitation system about 6 million hectares of forest

- Establish 2 million ha of special-use forests

This law was amended in 2004. The most significant change is the area of forestry land. Under this law, the total planning area of forest land was more than 16 million hectares instead of 19 million hectares in the past. Land Law

at 1992 were also supplemented and amended in 2003. It was recognized that communities (villages) which have legal entity can be allocated forest, forestry land for management, protection and use. Decree 02 / CP created opportunities for people to have more rights about forest land, including most forest produces. These rights consist of the right to exchange, transfer, lease, mortgage and inherit the forestry land and allocated forest land with a period of 50 years. The purposes of the allocation of forests and forestry land were protection and restoration of forest cover in the mountains, increase in contribution of forests to improve livelihoods and environment. Therefore, forestry land which was allocated to different objects must be used for forestry purposes. It meaned that after exploiting, thinning a form of forest must be reforested. Other important documents related to assigning forestry land under the form of allocation was Decree 01 / CP. According to this decree, families and individuals were not only assigned but they also had the rights of allocation of forestry land from state enterprises for cultivation. In fact, most of the natural forest lands are controled by forest plantations and forest management. They are allocated to the individual and household to protect. The

allocation for the household must be done with vacant land, scrub. According to the original rules, except from to the wages paid by the forest owner at 50,000/ha/year in the past, the receiver just had the right of harvesting a limited amount of dry wood and non-timber forest under forest canopy.

The activity of logging, grazing and changing to agricultural purposes is prohibited. Decree 163 that was born to replace Decree 02 stipulates details, particular on the allocation and leasing forestry land. This is the first time that lease problems has mentioned. It opened up opportunities for organizations, families and individuals who have demand and ability to use forestry land. Also it was more clearly defined the rights and obligations of the parties in the management of forests. Documents guiding the implementation of the land law in 2003 as Decree 181, Decree 197 and Decree 182 and Decree 198 stipulates in detail several with related issues to the rights and obligations of holders of land use in general and forest use in particular.

Besides the system of regulatory policies on land, the state has also focused on the management policies for forest

protection in particular. Law on the Protection and Development of Forests in 1991 identified "Forest is precious resources of the country, capable of regeneration, is an important part of the ecology, has tremendous value for national economy people, associates with people's lives and the survival of the nation "and also clearly defined in the forests and responsibilities in the management of forest protection.

Decree 245 stipulates the responsibilities of the authorities in the forests management. It has just been renovated by the Decision 186/2006 of the Government on the regulation of forest management. Decision 178 of the Prime Minister in 2001 can be considered as a breakthrough in forestry policy in Vietnam. This is the first time that issues of the household and individuals benefit from forest products are defined particularly and in detail. This decision has created incentives for the allottees of forest and forestry land to develop forest more effectively. However, the rules on interests in decision 178 is very general and difficult to implement. To concretize and clarify issues such as beneficiaries, cleavage rate products harvested from the forest between the parties and form of the production

sharing ... Ministry of Finance and the Ministry of Agriculture and Rural Development issued Circular joint Circular No. 80/2003 / TTLT / BNN - BTC dated 03/9/2003 guiding the implementation of Decision178. Generally, legal systems and policies relating to rehabilitation in Vietnam is relatively comprehensive and complete. They refers to all aspects of land use rights, benefits and policies of supporting technique, finance ... to forest owners and has brought significant results. However, in the legislation system, policy has many overlapping, sometimes conflict with each other caused restrictions of forest restoration effectiveness. It is necessary to evaluate seriously and adjust legislation systems and policies.

***Table 7. Policies relating to forest rehabilation over time***

| **Kinds of text** | **No** | **Date** | **Description** | **Issued by Office** |
|---|---|---|---|---|
| Annoucement | 18/TB-UB | 23/10/1968 | Protect existing forests and focus on the development of upstream forest, protection forest, expand on vacant land and bare hills | Secretariat |

| | | | | |
|---|---|---|---|---|
| Decision | 179/CP | 12/11/ 1968 | Some policies for cooperatives with forestry business | Council of Ministers |
| Decision | 129/CP | 25/5/1974 | Policy for cooperative expansion of agriculture and forestry development in the midland and mountainous areas, etc | Council of Goverments |
| Instruction | 257/TTg | 16/7/1975 | Promote afforestation and allocate forest land for cooperative business | Prime Minister |
| Decision | 272/CP | 3/10/1977 | Policies for cooperative to expand the area agriculture and forestry development, build new economic, implement sedentary agriculture, residence | Council of Goverments |
| Decision | 682B/ QĐKT | 01/8/1984 | Design codes of Forest Business (QPN 6-84) | Ministry of Forestry |
| Circular | 01-TT/LB | 6/02/1991 | Guide the allocation of land and forests to | Union of Ministry |

| | | | | |
|---|---|---|---|---|
| | | | plant for organizations and individualsto use with forestry purposes | interministe rial |
| | | 1991 | Vietnam nature conservation strategies | |
| Law | | 1991 | Forest Protection and Development Law | National Assembly |
| Law | | 1993 | Land law | National Assembly |
| Decision | 200/QĐ/ KT | 31/3/1993 | Rules on the technical solutions applied to wood and bamboo produce forest (QPN 14-92) | Ministry of Forestry |
| Circular | 22-CP | 9/3/1995 | Regulations on fire prevention and protection | Goverments |
| Instructions | 286/TTg | 2/4/1997 | Strengthen emergency measures to protect and develop forests | Prime Minister |
| Decision | 661/QĐ-TTg | 29/7/1998 | Targets, tasks, policies and organization for implementation of the project on planting 5 | Prime Minister |

| | | | | |
|---|---|---|---|---|
| | | | million hectares of forest | |
| Decision | 175/1998/ QĐ-BNN-KHCN | 4/11/1998 | Rules rehabilitation by restoration with promoting regeneration combined with supplementary planting | Minister of Agreculture and Rural Developme nt |
| Decision | 245/1998/ QĐ/TTg | 21/12/ 1998 | Implement state management responsibility of all levels of forest | Prime Minister |
| Decision | 02/1999/ QĐ – BNN-PTLN | 5/01/1999 | Regulation of logging and forestry products | Minister of Agreculture and Rural Developme nt |
| Decision | 47/1999/ QĐ – BNN-KL | 12/3/1999 | Inspection regulations for the transportation, production and trading of timber and forestry products | Minister of Agreculture and Rural Developme nt |
| Circular | 56/1999/ TT/BNN-KL | 30/3/1999 | Guide to build convention on forests protection and development in hamlet, village. | Minister of Agreculture and Rural Developme nt |

| | | | | |
|---|---|---|---|---|
| Instructions | 24/1999/CT-TTg | 18/8/1999 | General land inventories in 2000 | Prime Minister |
| Decision | 187/1999/QĐ- TTg | 16/9/1999 | Innovate management organization and mechanisms of the State forestry farms | Prime Minister |
| Business guidance | 1553/HD – TCĐC | 12/10/1999 | Land inventory of 2000 | General Department of Land Administration |
| Decree | 163/1999/NĐ – CP | 16/11/1999 | The forest land allocation and leasing to organizations, households and individuals using stable and long-term forestry purposes | Goverments |
| Decision | 162/1999/BNN – PTLN | 4/11/1999 | Temporary regulations on acceptance of the forest contract protection, restoration, promotion of regeneration combined with supplementary planting, afforestation and care | Ministry of Agreculture and Rural Developme nt |

| | | | | |
|---|---|---|---|---|
| Circular | 62/2000/ TTLT/ BNN – TCĐC | 6/6/2000 | Guide land allocation, land lease and forestry certificate (land use rights) | Union of Ministry interministerial |
| Decision | 08/2001/ QĐ – TTg | 11/1/2001 | Regulations on management of special use forests, protection forests and production forests is natural forests | Prime Minister |
| Decision | 178/2001/ QĐ – BNN – KL | 28/8/2002 | Technical regulations for monitoring changes in forest resources and forestry land in forest rangers | Minister of Agreculture and Rural Developme nt |
| Decree | 181/2004/ NĐ - CP | 29/10/ 2004 | Detailed regulations on land law | Goverments |
| Decree | 197/2004/ NĐ – CP | 03/12/ 2004 | On compensation, support and resettlement when the government recovers land | Goverments |
| Decree | 182/2004/ NĐ – CP | 29/10/ 2004 | On sanction of administrative violations in the field of land | Goverments |
| Decree | 198/2004/ NĐ – CP | 03/12/ 2004 | On collection of land use fees | Goverments |

| | | | | |
|---|---|---|---|---|
| Decision | 40/2005/ QĐ – BNN | 7/7/2005 | Regulation of logging and forestry products | Minister of Agreculture and Rural Developme nt |
| Decree | 135/2005/ NĐ – CP | 8/11/2005 | On the allocation of agricultural land, produce forest land and land with water surface for aquaculture in the State forestry farms | Goverments |
| Decision | 186/2006/ QĐ – TTg | 14/8/2006 | Regulation of forest management | Prime Minister |

a. Policies relating to rehabilitation over time

According to Nguyen Ngoc Lung (1998), forest management policy in Vietnam until the late 1990s could summarized in the following:

**From 1945 to 1995**

Along with the establishment of agricultural cooperatives, the majority of forests were nationalized and were under the management of cooperatives and state-

owned units. The forest products management of the cooperative focus mainly on the exploitation of forests for timber and land for growing food crops. Until 1961, Directorate of Forestry was a specialized agency of the government was established. Improvement of forestry production, including the strengthening of the production facility, their management, as well as the increase in the quantity and area of forestry farms managed by the Goverment (later called the State forestry farms). Then, the forestry farms was established in many districts. Although it was a business , at this stage forestry farms was both a comprehensive enterprise and a state management agency on behalf of the Forestry County (MoF 1991 Nguyen Ngoc Lung 1998).

Functions of forest policy was "the foundation for the development of agriculture" and the harmonious combination between agriculture and forestry production. Except from other forestry activities, it was necessary to guide properly the reforestation on land which was cleared by slash and burn (shifting cultivation) to prevent deforestation. The " shifting agriculture" could be replaced by other methods of production, especially the form of state-

owned forestry production or cooperatives. Administrative bodies taking responsibility for the implementation of these goals and objectives are Directorate of Forestry under the direction of the Council of Ministers (MoF 1991).

**From 1965 to 1975**

Administrative framework of Vietnam during the period 1965 to 1976 was characterized by concentrated planning and attempt to serving country's liberation struggle in the South. Agricultural policy emphasized cooperation and production of the mountains. Agricultural production must be intensive. Producing both food and and industrial crops was increased due to the investment in the rice production.

As in the previous period, forest policy focused on increasing output, and tending to server agriculture (protection upstream forests) and industrial production and also increasing in production of wood and non-wood products .

Logging was limited. However, due to lack of infrastructure and labor, the storage conditions were not suitable for the exploited timber. They were ruined by fungi

and insects. In 1968, local authorities had assigned more jurisdiction in the forests management. Directorate of Forestry became more consultative. Most industrial timber facilities was transferred to Directorate of Forestry in that time. A parallel organization, "the People's Ranger unit", was established at the provincial and district level (MoF 1991).

Forestry activities were conducted in the state sector under the leadership of the local authorities. The national supervision of forestry production was strengthened by the establishment of forestry agencies as well as the promulgation of the first forestry law in 1975 (Forest Protection Ordinance 1975). This Ordinance consist of regulations on forest management, reforestation and combating pests and forest fires. Strengthening forest management aimed to enhance the important role of the upland development. Directorate of Forestry was upgraded and became the Ministry of Forestry in 1976 (MoF 1991).

**From 1976 to 1986**

After the Vietnam War ended in 1975, policy and administration systems were built on the basis of the concept

of "collective ownership" , the administrative autonomy of area was abolished. Agricultural policy emphasized the plants with commodity value. Attempts aimed to encourage the output of two sector, the cooperative and state. The new approach has been tested such as allocation of agricultural and forestry land to "stable" production and agroforestry production.

In 1976, the Ministry of Forestry was established and led forestry production in this period. The aims of forestry policy is to increase in production and serve of the defense. The majority of forestry production activities were managed by the state. This thing caused the overexploitation because the production quota was based on the needs of the state, not on the the yield potential forest (MOF, 1991). Target of increasing income by cash is the decisive ideology of the economic sectors and the forestry sector in the late 70s and early 80s. However, until the mid-1980s, the views were changed perceptions of the forestry sector. The natural environment had been destroyed to the level that it was easy to see that "monoculture planting with industrial crops and intensive and rotational system can not protect by forest vegetation "(Ministry of Forestry 1985). In the management,

protection activities were more emphasized than before. Since the vast majority of forest land located in the mountains where most ethnic minorities settled. Policy planners began to pay much attention to policies relating to ethnic minorities, especially unity among ethnic groups was put in the policy of the ethnic guidelines, No 29-CT / TU / 1984 about strengthening of the forest land allocation and construction and agroforestry organizations (Ministry of Forestry 1984).

**From 1986 to 1990**

Since 1990, the government has began the process of redirecting the economy from a planning mechanism into market economy - the policy was known as "innovation". The main content of this policy was the transition to a market economy, the decrease in role of government (especially the production and trade), decentralization by letting province and district plan and decide, stability of macroeconomic environment. A part of this process was a series of activities which were conducted, including the liberalization of prices and markets, the unification of exchange rate and sale off, the control of the State budget's

imbalance. The results of the reform process such as economic growth about 8% / year, decrease in inflation increase in exports and imports, the larger amount of foreign investment, administrative reform in public agencies and a stable background economic (Ministry of Forestry, 1984).

Structural transformation process also extended to the agricultural sector. The government decentralized agricultural cooperatives and allocated most land to farmers to use within 25-50 years. Cooperative system were reformed to perform more service functions. At the same time, the consumption were expanding (market were released). These steps showed result in the rapid growth of agricultural products. In particular, rice output increased rapidly and now Vietnam has become the one of the major rice exporting countries.

In this period, the goal of forest policy was not only plantation expansion by State forestry farms, the organization, as well as implementation household (SPC / UNDP, 1990) but also the main concern that was afforestation and exploitation or often called " reasonable use" of forest resources. Expanding the processing industry

closely related to the encouragement program of forest products exports. Forest protection program in the highlands mainly approached to the management of upstream forests (MOF, 1991). The program was a continuation steps Forestry Ordinance 1975 and then was detailed in the regulations in 1986 relating to the protection of forests (Circular No. 1171 / QD 1987). A large other forest programs related to training and education programs was associated with national forest research and forestry encouragement programs (MOF, 1991).

Some policy planners and forestry management retained their views on the focus production plan (Ministry of Forestry, 1987). However, the changes in the next economic management at the 6th Party Congress in 1986 spurred the rearrangement of the production organization. It was the topics for discussing in the forestry sector in the 1980s. The main changes took place in the management of State forestry farms. he public sector had more financial autonomy. It meand that state support was cut down. In general, they paid attention to the switch from forestry production by state-owned units and cooperatives to work implementation by the family trees of the forest field

workers and other households follow contract with SFE the transfer from implementation of the forestry production by state-owned units and cooperatives to implementation of planting trees by family of forestry farms'workers and other families following contract with forestry farms.

In 1991, the forestry sector proposed a new policy, known as developing a new "social forestry". Social forestry development in the framework of the administration at that time meand to encourage the forestry production by forest land allocation for the sector and the other (from 1983) and cooperatives, schools, military units, families (from 1986). The implementation of the forest land allocation also encountered many difficulties, due to "technical limitations" (To Dinh Mai 1987).

Agroforestry was one of cropping patterns that are encouraged in this stage (Nguyen Ngoc Binh, 1985; Ministry of forestry, 1987; Fingleton, 1990). A thing which was officially recognized was that the forest provided indispensable material in the daily life of local people, also, the forest resources were also an important resource for "developing socialist", "serving ethnic" and the country's

economy (Le Hong Tam and Nguyen Quoc Hung, 1991; Dinh Mai, 1991).

**From 1991 up to now**

Along with the overall reform program, the Government also carried out steps of restructuring with the close collaboration of the international donor community. The process began in 1989, when Vietnam applying to join Action Plan for Rainforest that was funded by Food and Agriculture Organization of the United Nations (FAO). The first step of this process is the overall assessment of the forestry sector. This work was completed in 1991, under the heading " National Forest Action Plan (NFAP)". The evaluation process was important in that it is an opportunity for international and Vietnam experts work together, to give a series of reports on the current state of Vietnam's forests and the guiding principles for the developing forestry. They were the decentralization of management and participation of the people, rearrangement forestry agencies to support local activities, protect the environment, increase in output and income of people living in forest areas.

Action Plan for also providesd a list of projects and expenditures that should be supported. NFAP had been supplemented by a series of laws and decrees (approval of Congress or the Government), directives (issued by the Prime Minister), regulations, guidelines or circulars (issued by the related ministries). Sometimes the provinces could also issue specific, separate guidelines to implement directives, regulations, guidelines and circulars of the Government for the purpose following the development program of the forestry sector.

The years of the 90s became a milestone for the recognition of the natural forests degradation, efforts by policy as well as practices in order to solve this problem. Attention on strengthening the Government's investment created an important change in the decentralization relationship.

For the period from 1991 up to now, a system of laws, policies and legal documents have been published for the forests development and protection as well as speeding up the allocation of forestry land, sustainable forest management (Nguyen Ngoc Lung 1998): Forest protection

and development Law (1991); Land Law (1993) of the Government on forest land allocation to organizations, households and individuals in long-term use for forestry purposes. At the same time, a series of legal documents on forest land tax exemption and reduction, tax of import wood materials, ... to encourage economic sectors, groups and individuals to take part in forest protection and sustainable development.

327 program (begun in 1992), according to Decision No. 327 / CT dated 09/15/1992 by the Prime Minister, was the first attempt to test on the national scale to raise families and other organizations directly to join in the forests protection and development through sharing expenses and profits. In 6 years of implementing this program of State key with protection forests and special-use forests, it left many valuable experiences, including the most common forestry techniques were presented in the Decision 556 / TTg and guide circular (Nguyen Ngoc Lung 1998). The current 327 program had been developing as a program of planting 5 million hectares of forest between 1998 and 2010, Scheme for Forests Protection and Development 2011 - 2020. As a result, forest coverage was increased from 28% to 43% now.

b. Summary of the policies to encourage participation in restoring natural forests following content restoration

The sustainable forest development process of each country and related region and effect on the environmental protection and the development of the countries.

Over the generations, the Vietnam forest have had a big impact on the environment and was potential and reality which bring animals and plants for daily products of human life, have significant contributtion to the development country.

Forests are in all provinces and cities in Vietnam, but 80% of the area of forestry land distribute in mountainous areas, remote areas and craggy areas where have many causes of deforestation, especially in the years of decade 70-80 of last century. Due to many different reasons, both subjective factor and objective factor, the Vietnam forest is declined in area and quality. This thing has a negative impact on the ecological environment, effects on the economic – social. Some times, some places the government raise its voice "alarm - must immediately stop the forest

degradation". Also, during the boom market mechanism of the agricultural commodities, many economic sectors participated in clearing of forest to use for industrial plantation and fruit trees. Fee migration "to find the promised land" also contributed in the degradation of the Vietnam forest.

Since the 90s, Vietnam has approved the national program for sustainable forest development and environment protection. They were made clearly in the 9th session of Congress VIII, passed August 12$^{th}$ , 1991 protection and development of forests Law (1991) and the 2nd session, the National Assembly IX approved the Law on environmental Protection (1993). Therefore, the rate by the Vietnam forest degradation have reduced. In some areas, forest area has increased significantly. The proportion of Vietnam's forest cover has increased continuously since the beginning of 1990 (Chapter 1).

A big challenge for forestry industry is that society required to recreate the forest to serve the economic and social development in a few decades to improve the coverage and quality of forests to contribute to

environmental security, disaster reduction, increased aquatic ability, protection of genetic resources, biodiversity and provide products to society from forests (MoF, 1991).

To recreate forests, sustainable forest development must consist of both objective conditions and subjective inside and outside the country, and in a certain extent, in a crucial region to bring to efficiency it is necessary to have the participation of the international community.

* Systems planning sector: Before 1996, the Ministry of Forestry (now the Ministry of Agriculture and Rural Development) published 4 legal books relating directly or indirectly to the forestry (4 this books is not less than 300 texts). Also, every year, the Government, the Ministries issued many legal documents to served to forests protection and development. Bureau of Forest Development was allowed to publish many books on current legal texts (still effective) to serve for the implementation of the forestry sector by Ministry of Agriculture and Rural Development.

1. The issue of land allocation, lease of land and forest allocation

The Government made many appropriate policies on this issue such as Decision 184 / HĐBT (at that time, it was the Council of Ministers (now it is the Government), Instruction No. 29 / CT-TW (1983) Central communist Party of Vietnam, Resolution 10 / BCT (1998) of the Politburo, Decree 01 and Decree 02 of the Government (the Government, the Land Law (1993 and 1998), the Law on Encouragement of Domestic Investment (amended - 1999 the Decree No. 51/1999 / ND - CP (1999) by the Government.

From the above policies, State created the environment for organizations, individuals and families equality in receiving and leasing land, allocating and contracting forest to organize the management and protection and forestry business. Here it is necessary to see that the State decentralized in the construction and development in a comprehensive manner. Certainly the participants of this workshop knew, before 1980 of this decade, only a single component was joined in the organization, construction and development of the forest - It is the State (State organization). It was focus State forestry farms or forestry establishment most.

Up to now, State has centralized on managing important forests of country. It is the special-use forests, protection forests and forests for large timber, valuable wood in strategic important areas.

Most area of forest land by the State allocated to organizations, individuals and households basing on potential and local land to business forest under current law. In particular, the Government has 3 important decree (Decree 50/1999 / ND-CP and Decree 51/1999, Decree No. 43/1999 / ND - CP), will apply to investment in forest development for all involved economic sectors, this is a great opportunity for those whom wish to build forest development in the future.

*2. Decentralization on management of forest and forest land*

Decree 17 / CP (1992) guidelines for implementation of the Law on Forest Protection and Development, Decree 39 / CP (1994) and recently, the Prime Minister has issued Decision 245/1998 / QD - TTg (1998) that was a open direction and risen responsibility on the state managing on forests and forestry land of the authorities which are shown.

Decree No. 86 / ND-CP dated July 18, 2003 of the Government stipulating: Ministry of Agriculture and Rural Development is an agency of the Government, performing the function of state management of agriculture, forestry, salt, water resources and rural development in country scale; State management on public services and representing the owner of State capital in State enterprises under its management as prescribed by law.

For the forestry sector, in Section 1, Article 3 of Decision No 245/1998 / QD-TTg dated December 21, 1998 of the Prime Minister (hereinafter referred to as Decision No. 245) identified "the Ministry of Agriculture and Rural Development is the agency responsible to the Government for state management of forests, including:

a) Periodical survey, revision and forest classification, statistical areas and forest reserves, forest, mapping and forest land in the country.

b) To plan, conservation plan, forest development, long-term forest use over the country for approval of Government. Appraisal plan, conservation plan, forest development and use of forests and forest land in the

province and municipalities directly under the Central Government before approval.

c) To submit to the Government for approval of natural forest wood production is allowed to exploit, annual consumption on a national scale.

Appraising profile of the design synthesis about exploitation of natural forests and deciding to open exploitation of forests for the provinces and cities under the Central Government.

d) Recommend to the Government decided to establish national parks, nature conservation forest, protection forest with national importance or on the territory of several provinces, national forests and allocate to organizations under the Ministry of Agriculture and rural Development, other related departments or provincial people's Committees for management, protection and construction.

e) Establish bylaws to submit the Government to issued and issued under the authority of policies, regulations, rules, procedures, and technical regulations related to the

management, protection, development and use of forests and forest land in the country.

f) organization and coordination with the State Inspector to conduct inspection and check the state forest management for authorities at all levels; inspection of the observance of the law on forest of organizations, households and individuals who were assigned to forests and forestry land.

g) Resolution of disputes on forests, in coordination with the General Department of Land Administration to resolve forestry land disputes among forest owners in different provinces; reward those organizations, households and individuals with outstanding achievements.

h) In exceptional cases, in collaboration with the Ministry of Defense, Ministry of Public Security to direct the work of forest protection, forest fire effectively.

Steering forest protection agencies under the Ministry of Agriculture and Rural Development to sanction or prosecute violations of law causing damage to forest resources following the law.

Apart from the specific tasks mentioned above, accoeding to Section 6, Article 2 of Decree No. 86 / ND-CP of July 18, 2003 of the Government, the Ministry of Agriculture and Rural Development also performed some tasks of state management on forestry as follows:

a) The State Administration of afforestation, forest resource development, exploitation and preservation of forestry products;

b) To unified management on processing of forest products;

c) State management on forest tree seeds, forestry materials;

d) State administration for protection of forest resources.

The task of state management of the Ministry of Agriculture and Rural Development Forestry were also identified for forestry enterprise, the business units, public service, non-governmental organizations etc .

On the basis of the contents of State management of the Ministry of Forestry, functions and duties of the State

Administration of Forestry were stipulated specifically by the Minister of Agriculture and Rural Development.

At the provincial level, the Department of Agriculture and Rural Development and the related Departments to forestry took responsible on state management forestry. Agriculture and Rural Development and the forestry Ranger units management at districts and localities. Communes with large forestry area had a permanent staff of communal forestry.

These policies affirm the specific responsibilities of all levels of authorities in forest management. Restrict ambiguity in the policy framework and institutional for forest management caused to arose overlaps and inefficiencies in management among the units assigned to use forest and forest land administration system of levels were responsible for the state management of forestry. In particular, forest owners should take responsible and pay all outlay of recovery when their forests are encroached.

3. Policies on benefit and investment in the development of sustainable forest

In principle, the forest owner is gotten outcomes from their investments which brought back after state taxes are paid fully. As mentioning above, the Decree 50, 51 defined that all economic sectors are joined in the investment development.

Besides, for the forest with investment from the state capital, non-refundable aid, the donation of funds for organizations and individuals, State also have specific policy of sharing and getting profit. For investment from foreign aid is the Decision 145 (1998), Decision 162 (1999).

4. Protect forests to conserve biodiversity and ecology

In 1963, the Government issued Decree No. 39 / CP and after the Law on Forest Protection and Development, the Government issued Decree No. 18 / CP (1992) and the decision and instructions to strengthen in forests management, protection and development, mining restrictions and the hunting in some areas. The Government has made decisions on establishment of protection forests which directly service to the irrigation, hydropower, coastal protection, environmental protection industrial parks and

urban, .. Thanks to special-use forests, protection forests characteristic ecosystems and rare genetic resources in tropical forest have been successfully protected and irrigation, hydropower and ecology heave been ensured security

*5. Reorganization State forestry farms system*

Resolution Conference TW4 (key 8) (12/1998) has driven innovation, development and effective management on State enterprises. Instructions No. 20/1998 of Prime promoted new arrangement the State enterprises. Implement that direction, the State forestry farms was reorganized around 410 forestry farms.

In 9/1999, the Government issued Decision 187 on State forestry farms organizational innovation and management mechanisms. This is a new opportunity to State forestry farms not only expect to be granted by the State budget but also business on the assigned forest land. State just invest to help development the field of public services, public facilities, economic livelihood and rural infrastructure. State forestry farms trades on forest land for the purpose of

profit and exploitation of natural forests in reasonable forest business methods.

*6. The national program on forestry*

a) The greening for barren land (referred to as Program 327, Decision No. 327 / TTg of September 12, 1992). The 4-year implementation program has brought some positive results. The average annual protects 750,000 hectares of new planting 500,000 hectares of industrial tree plantation and 50,000 hectares of fruit trees, livestock, building rural installation, create jobs, stabilize the population of nearly 2 thousand people. The program was adjusted, annual supplement ed to be suitable (Ministry of Planning and Investment, Ministry of Agriculture and Rural Development has reported progress and evaluating the program 327, 1998).

b) Project on planting 5 million hectares of forest (called 661 program). The Prime Minister issued Decision No. 661 / QD-TTg dated July 29, 1998, the goals, mission, policies and organization and implementation of the project on planting 5 million hectares of forest. The program focused on planting target is 2 million hectares of new

protection forest, special use forest; 3 million hectares of new planting production forests, protection of existing forests and some other targets have been expressed in the Decision.

c) Scheme for Protection and Development of Forests 2011 - 2020: Continuing two national programs on forest restoration and development 327 and 661, Scheme for Protection and Development of National Forest 2011 - 2020 designed to improve forest cover, moreover, improve the quality of forests to contribute to socio-economic development and environmental values of forests. The objectives and implementation plan for this project was specifically presented in Chapter 5.

Also with the national target program as deleting, reducing poverty, developing rural infrastructure, eliminating opium poppy, ... have contributed significantly to the forests protection and restoration.

Six issues mentioned above have been promulgated by the policy of the State to create broad environment to attract economic sectors joining in the development of forests. It is argued that the policy was clear and open

mechanism was in the form of state -oriented market. Howerver forestry still was not attractive in investment and forestry has not become strong in the agricultural and rural areas structure (where the Government decides to not limit and tend to not exploit natural forests).

**General assessment of the institutional and policy-related forestry restoration**

The difficulties and challenges (Nguyen Ngoc Lung 1998).

+ Policies are not synchronized

There is a limited distance between policy regime and practice

- There are many procedures and cost of land grant

- Financial policy: limited budget is not commensurate with the objectives and tasks; loans are less attractive because of high interest rates, short repayment period, while the forestry business in long time, many risks, difficult economy - social in the plantation and many limitation in investing rural infrastructure.

- Science and technology policy, especially the work of the speices, the transfer of science and technology to the people is too few and asynchronous.

- Policies to attract employees, human resource training are less attractive, rural area's income is low, many conditions are difficult, they only focus on ensuring daily needs less and don not concerned foresters.

- The benefit policies are inadequate, insufficient motivation to attract

- Many procedures also related transactions across multiple levels

+ National program is big , its sphere is wide but institutional programs is still limited as demarcation of land, land alloction, plant structure, capital... and the program implements in disadvantaged areas , low educational levels, slow economic growth.

+ Forestry attractive goal is the social are demanding while performance measures are not commensurate

+ Organizations systems are dispersed, too thin

+ The difficulties and challenges above (which are not full) are set for all members who have a passion for forests and have contribution to construction process achieve the desired results.

c. Recommendation

- When the sustainable forest development program was confirmed, its objectives must be stable in a certain period of 15-20 years

- Land demarcation project is clear, sufficient legal basis and with the participation of the parties, especially people directly received forest land.

- Organizing market research (especially forest business) must have the necessary and trust information for forest owners building a feasible plan.

- Building projects have to ensure goals and reality

- Must have a capital policy which is suitable for a stable and long-term building forest during program execution

- Must have good seed, breeding organization, supervision, supply, transfer ... to growers

- To research and support growers to minimize pests, forest fire prevention.

- State must have a reserve fund for forestry because of perennial under many managements

- Forestry system organizations problem from the central to installation levels must be able to meet the task

- The issue of daily food, the problem is the last but not least, because if people do not have to worry about eating they will draw new capital and work for the forest.

In general, policies and economic – society solution have created a significant impact, beencruciality in the restoration of natural forests in Vietnam. Achievements of forest restoration before 1990 are not documented clearly. Since 1993, 02 big programs, the program 327 and 661 have been performed. More than 1 million hectares of natural forest were restored and regenerated under Program 327 (Tran Van Son, Nguyen Xuan Card et al. 2006). The 5 million hectares of forest program (661) were carried out 803.000 hectares of protection forest and special use forest (Ministry of Agriculture and Rural Development, 2011).

## 2.2. Forest restoration techniques

While some degraded ecosystems capable to recover naturally, some others are not able to recover, due to some limitations. Even in places where natural recovery occured, the recovery was very slow. That thing caused increase in chances for recurrence degeneration or degeneration once again. Human intervention may be necessary for the recovery process to begin or boost the speed of recovery occurs more quickly.

A variety of different approaches that can be used including ways for the purpose of restoring the original ecosystem and restoring biodiversity and the simple purposes which used the land for agriculture or forestry. Different approaches have increased the confusion of terms. The difference between the two terms is especially term restoration (Restoration) and rehabilitation (Rehabilitation) which is given in this report are quoted in Lamb (1999).

Restoratin is used only in the case which intents to recreate ecosystems which have nearly similar characteristics to the original ecosystem once existed in that place.

On the other hand, recovery is used in place with ecological or commerce reasons, more introduced species need added into the next generation. That thing may be because only introduced species such as acacia (Acacia) can withstand in curent soil at the degraded site. They are necessary role as the plants produce nutrients in order to facilitate more , for the introduction and development of the primitive native species. Or may be a immediate ecomnomic request which demands some timber species, agricultural crops. They are included to demonstrate the restoration effort.

The term rehabilitation is used in cases without using any native species. In such case there will be no direct benefit about the biodiversity of the area but there may be significant social advantages or other benefits such as watershed protection. The differences of approaches is that they can allow the original biodiversity to recover. Generally, these approaches aimed to establish and strengthen sustainable land use (Lamb, 1999).

It could be divided into two groups of solutions rehabilitation (Rehabilitation) in Vietnam: (i) reclamation,

reforestation and afforestation; and (ii) restoration of natural forests.

For forest restoration, the phrase " zoning mountain cultivating forest " is included in the policies of the government from the 1950s until the 1980s. The term " reforestation promoting regeneration " replaced " zoning mountain cultivating forest " in the late 1980s . This thing was considered the changing perceptions of forestry science in rehabilitation. In addition, it is intensive in regenerating biological resources by promotion of natural succession (Tran Van Son, Nguyen Xuan Card et al. 2006). Achievements of the research serving forest restoration and rehabilitation in this period is legitimized into the technical rules including " Regulations of silvicultural technical measures were applied to forests produce timber and bamboo" (QPN 14-92), Regulations of restoration forest by reforestation promoting regeneration with supplementary planting "(QPN 21-98) (Ministry of Forestry 1993, MARD 1998). The legal document is a step breakthrough in the guiding and standardizing techniques for forest restoration, reforestation. However, there are many difficulties when they were applied to specific economic and social conditions

in different regions (Tran Van Son, Nguyen General Xuan et al. 2006, Phan Minh Sang, 2014).

From these two regulation, techniques relating to restoration and rehabilitation of natural forest were relatively regutaed in details for (i) logging & regeneration; (ii) Forest maintenance; (iii) forest enrichment; (iv) Promoting natural regeneration; (v) Passive restoration and (vi) reforestation & reclamation. In the technical solution to natural forest restoration under the norm QPN QPN 14-92 and 21-98, there are three groups of technical solution to forest restoration directly relating as follows:

a) Forest maintenance: is defined as silvicultural measures which adjust the density and appropriate composition for each stage of forest succession. Important activities in this technical solution is to remove diseased trees, trees with poor quality, blocked plants to tree for business purposes to raise productivity, quality and shorten the cycle of forest use. The silviculturaltechniques were clearly stipulated in the QPN 14-92 (Ministry of Forestry 1993). However, natural forest owners often do not strictly follow the technical rules because they did not enough

money to do or there were no regulation to force them do (Tran Van Son, Nguyen Xuan Card et al. 2006).

b) Forest enrichment: A technical solution is the impact on poor natural forests by enrichment planting with native tree species. Two important technical issues in the enrichment forests was stated : selecting plants and planting techniques, care and protection. In the fact, the area of the mass enrichment often did not bring much success due to the most important reason is that period of care after enrichment planting is permitted only 2-3 years after planting – according to norms. Meanwhile, the main enrichment plants were native plants with slow growth in the early stages, so they could not compete with regeneration plants in place. The pilot enrichment models or studies were often very successful due to careful care (Tran Van Son, Nguyen Xuan Card et al. 2006).

c) Promotion of natural regeneration

Natural regeneration in Vietnam can be seen as the passive restoration solution (Lamb and Gilmour 2003), main measure is forest protection against the effects of human and nature such as grazing, mining, fire ... In some cases,

particularly for the production natural forests, with the impact of technical measures such as as removing vines, non-purpose trees, moving to distribute evenly seedlings on forest plots, and replanting seeds... However, if these techniques were applied , it will coincide with technical enrichment solutions. There are some technical specifications of the object reforestation by natural regeneration below:

***Table 8.Subjects of forest restoration by restoration, promotion of natural reproduction***

| Status quo, affected object | Quantifying recycled materials |
|---|---|
| A. Timber group<br>1. Areas lose forest due to complete exploitation<br>2. Cultivation with forest nature is fallow<br>3. Shrub savannas mix trees, soil thickness of over 30 cm | Each object must meet at least one of 03 following criterias:<br>- A number of purpose regenerated trees with height 50 cm > 300 trees / ha<br>- Bud at root mother plant evenly distributed and the number of > 150 stem / ha |

| | |
|---|---|
| | - Mother plant seeding in place with even distribution of > 25 trees / ha or seeding sources are nearby |
| B. Bamboo group<br>4. Rehabilitation after the exploitation or cultivation | - Bamboo cover > 20% of the area and evenly distributed in plots |
| C. Group of protection forests is important and very important<br>5. Remote places without afforestation conditions in next 10 years. | - Cover of vegetation, shrubs grasses> 40%, heigh is over 1m |

According to(Tran Van Son, Nguyen Xuan Card et al. 2006)

Despite detailed rules, some technical norms in 02 this rules have no clear, sure scientific basis or do not inherite good experience (best practices) in the world. Therefore, many technical norms are not appropriate with the ecology and production of forest as well as in accordance with

economic-society conditions in the local. A typical example is regulation of logging intensity of exploitation of conventional selective logging. It allowed up to 45% of the forest reserves and its canopy cover after minimum exploitation is 0.4, the area of the hole (gap) which was not larger than 1,500 m2 was too large. They made natural forests after exploitation difficult to recover the initial state (Phan Minh Sang, 2014) . While limit of logging must be adjusted following to the structure and density of forestry components (SIST, Fimbel et al. 2003).

In addition, there are dozens of international ODA aid for the forestry sector to implement pilot or on large scale the forest restoration regeneration measures which is introduced from the other forestry background. Some technical solutions rather successful such as forest enrichment of projects KfW1 and KfW3 - financial support of the Federal Republic of Germany - or some pilot technical of GIZ ... However, scaling promising model is undesirable for many reasons, their impact on planed forestry policy and forestry measures (forestry extension) were not fully implemented (Phan Minh Sang 2014).

Afforestation and regeneration of forests has been one of the biggest successes of the Vietnam forestry sector in recent times. Before 2000, although afforestation and reforestation were prior by the government, but due to various reasons, the success rate is low. The reason is defined such as a low investment in rate planting, undeveloped breeding and silvicultural techniques, policies were unattractive to the growing participation of forest owners, timber from natural forests are abundant, especially forest products market did not really develop (de Jong, Do et al. 2006, Phan Minh Sang 2014). Since the early 2000s untill now, plantations have grown rapidly in Vietnam, especially household-size plantation. Acacia, Eucalyptus monoculture plantations with short business cycles is the main raw material for manufacturing particle boards for export. This thing leads Vietnam become the largest exporter of particle boards in the world two years ago (Phan Minh Sang 2014).

### 2.3. Effectiveness of rehabilitation measures

Up to now, in Vietnam, there have has been no studies which compares the economic effectiveness of different forest restoration strategies. A number of studies assessing

the economic value of forests only mentioned the value of traditional forest products (wood and non-wood forest products) and often were unreliable for assessing growth forests, especially natural forests. Thus they had little value in applications (Phan Minh Sang 2014). Expenses for environmental services of forests are paid attention interest and has gained more recent achievements in Vietnam (Pham, Bennett et al. 2013). Expenses of environmental services of forests have been calculated and applied to many hydropower plants, irrigation, water supply and tourism over the country. Total expenses for forest environmental services which collected in the four years 2009 - 2013 is about 2,850 billion Vietnam dong (≈ $ 135 million) (mostly from hydropower), in 2012 and 2013, the amount of money of each year is over 1,000 billion VND Vietnam (Directorate of Forestry 2014). Thus, except from the value of traditional forest products, a significant financial resources which is collected provided and implemented for the forest restoration, development and management, protection (Directorate of Forestry 2014).

However, the expenses of forest environmental services for forest owners are adjusted according to the

coefficient k for forest types, conditions and the level of difficulty in the protection of forests. The coefficient k3 applied to forest type 1 respectively and 0.9 for natural forests. Plantations showed that differences between the two forest types is not large. The difference which is too small does not encourage forest owners to restore natural forests which have high ecological value more than plantations – majority is monoculture plantation of exotic species. In the near future, when the expenses for other environmental services such as carbon sequestration, biodiversity, conservation of genetic resources ... have not been made, natural forests and natural rehabilitation still difficult to compete with plantation and economy afforestation in Vietnam (Phan Minh Sang 2014). On the other hand, the low level of payments for forest environmental services is too low in some localities (eg, Son La province) .As a result, revenues from maintaining, protecting current natural forests is difficult to compete with the conversion of forests to the type of land use for agricultural crops and other cash crops (Pham, Bennett et al. 2013).

In short, finding points of compromise and harmonious values among rehabilitation strategic of natural forests is

very important. If the value of the ecological, environment of the forest is fully quantified and more and more increasingly enshrined in the context of climate change, the chances of rehabilitation of natural forests and the landscape will be bigger because of dominance of mixed natural forests comparing to monoculture plantations on ecological values.

# Chapter 3.APFNet project

## 3.1.Introduction

The project of "Demonstration of Capacity Building of Forest Restoration and Sustainable Forest Management in Vietnam" sponsored by APFNet organization (Asia-Pacific Network about Forest Restoration and Sustainable Forest Management) was formally implemented from September 2010 to December 2012. The general objective of the project is to maximizethecontribution of improvement the livelihoods of local communities by enhancing economic and ecological value of depleted secondary forests in PhuTho (Forestry Department of PhuTho in 2010).

The approach of this project isappling the best achievements in the restoration of Vietnam natural forests including aspects of techniques and mountainous community development. The best techniques consist of species selection, cultivation and care techniques. Due to the participation of the poorest ethnic minority communities in PhuTho with backward farming practices, therefore, techniques for forest restoration have been designed in the simplest and easiest way. As a consequence,it is the

important base to promise potientals of success in project area and expandability into others as well.

The biggest pressure on natural forest resources oftwoproject communities is arable land shortage, while depleted natural forest is mainly protection forest which people are not allowed to convert into production forest. Hence, the model of forest restoration should also ensure to provide steady income source for the locals in both the short term and long term. In addition to indigenous timbers which are suitable for forest enrich, non-timber forest products with high value planted under the forest capony are also selected to generate income in the short term (Forestry Department of PhuTho in 2010, by Phan Minh Sang in 2014).

## 3.2. Forest status and natural, ecosocial conditions of the areas in APFNet project

This project has been carried out in Thu Cucof Tan Son district and CuuThuongofThanh Son districtinPhuTho province with the model of natural forest restoration. The natural and ecosocialconditions of these communes have a number of key features as follows:

** Geographical location*

There are 2 communes in the project, including Thu Cuc of Tan Son district and ThuongCuuofThanh Son district, in PhuTho province. The two communes are mountainous regions with ecosocial life of the most difficult types inPhuTho province. In the term of geographical location, they all border with other districts and provinces. In addition, they are primarilyinhabited of ethnic minorities such as Muong, Dao and Ray People with poor economic and infrastructure conditions and low intellectual level.

Thu Cuc is located in the Northwest of Tan Son - PhuTho, bordering Yen Bai and Yen Lap - PhuTho on the North; ThachKiet on the East; Son La on the West; Dong Son, Lai Dong and Kiet Son on the South.

ThuongCuu is the most remote area of Thanh Son - PhuTho, 35km from the center district to the Southeast.

** Terrain features*

The terrain has relatively high slope (the average of 10 - 200), particularly, the construction area of model in Thu Cuc spreading along the high from flank to the top of mountain

and strongly dissected topography. With these topographical features, peolple find it difficult to construct the model and study as well.

** Climate and hydrology*

The average temperature ranges from$22^0$C-$23^0$C/year and the total heat ranges 8.300$^0$C- 8.500$^0$C/year. The cold season has Northeast monsoon from November to next March, the average temperature of below $20^0$C, and the lowest temperature in January. The hot season is influenced of Southeast wind, the average temperature of over $25^0$C. The hottest seasons are June and July (at $28^0$C) with the hot, dry west wind on April, May and June, the temperature of up to 39 ÷ $40^0$C, the evaporation of above 70-80 mm, low absolute humidity.

The average rainfall is 1.826mm/year, accounting for nearly 90% in the rainy season (in April -October), the highest rainfall of August and September and often accompanied by a large storm, causing flooding and even flash flooding sometimes. The dry season is from November to next March, accouting for nearly 10% of the total rainfall, however, drought is rare because of having

drizzle, lightrain.The average air humidity is 86%. The evaporation is 653 mm/year. Hoarfrost usually occurs in winter and days with temperatures of below 5℃, possibly lasting for several days and causing negative impacts on the growth and development of plants and animals as well.

** Soil*

Soilis formed on complex geological background. Many types of terrains and parent rocksformvariety of soil types, including: humus feralitsoil on average high mountains, red-yellow feralitsoilon low hills, ranginsoil (formed on limestone), sloping landand alluvium along rivers in the basins and valleys with fertile soil which is favorable for forestry farming, especially plantation of material trees such as paper, tea and timbers, and growth of livestock such as cattle, goats, pigs, etc.

Forestry land accountsforthe majority of natural land, 73-85% of the total natural land area. At ThuongCuu,protectionforest is four times larger than productive forest while people mainly get income from productive forest. Compared to the mechanism of production forest management, the protection forest landis

now maintained too much limitation on exploitation and use of forest products.This somewhat restricts the potential of forestry developmenthere.Besides, the area of agricultural land accounts for very low proportion (at 6% ofThuCuc and only 1.5% of ThuongCuu). Insurance food security and development of agricultural production of native people have become a huge challenge.

** Population, ethnic people and labors*

The project areas are mountainous communes, mainlyMuong, Dao, Ray and Kinhethnic. Muong people account for the majority (up to 82% of the population of Thu Cuc, 85% of the population ofThuongCuu).

Total employment of Thu Cuc is 3.886 people, including 3.585 agricultural labors, accounting for 92.25%, employees in industry and services accounting for 7.75%.

+ On education: All communes have high schools, primary schools and kindergardens in every village which can meet the academic needs of their children.

+ According to the survey of some communes, the number of households used the national grid reaches 70-80%

of total households. However, Sinh Tan village of ThuongCuucommuneinThanh Son districtis the most difficult places in PhuTho province. The national grid system has not yet accessed to the commune, furthermore,it is hard to go by motor vehicles to these communes on rainy days.

** Forest status*

According to the results of the survey of forest resources through system standard cell networkspreading on the forest resources of two project communes, as well as detail results of the survey of construction model in project areas, forest status on the area is depleted secondary forest which has simple structure with the dominant species of light-demanding and fast-growing species,thepioneer species in the process of rehabilitation after shifting cultivation. With this forest status, it is capable of mixing with Bambuseae, especially the most frequent mixture of Bambusaof Schizostachyum sp.7, Schizostachyumpseudolima McClure.

*Figure 6. Forest status in Thu Cuc – Tan Sơn*

*Figure 7. Forest status in Thuong Cuu – Thanh Sơn*

Structural features of crown floor

The basic structure of plots are summarized in table 2.1 and 2.2

Symbols and abbreviations are in Tables 2.1 and 2.2:

Ni: The density of plants/ha

Dtb: The average diameter at the position 1.3

Htb: The average of height

Sd: Standard error of diameter 1.3

Sh: Standard error of tree height

G: Total basal area ($m^2$/ha)

*Table 9.Synthesis of some basic forestry indicators of standard plots in Thu Cuc Commune*

| SP | Forest style/ State | Capony degree | Ni (plant/ ha) | Dtb (cm) | Htb (m) | Sd (cm) | Sh (m) | G/ha ($m^2$) | Formula composition |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ic | 0,4 | 230 | 7,08 | 8,50 | 2,12 | 2,65 | 0,98 | 44,5Bumb+25,74Bob+21,94Bas+7,82Lk(2) |
| 2 | IIa | 0,5 | 250 | 11,80 | 12,74 | 4,63 | 2,85 | 3,14 | 25,33Lom+18,91Bưa+9,55Bac+Mat+7,6Dung+5,63Tram+5,56Bumb+21,42Lk(6) |
| 3 | IIa | 0,6 | 200 | 16,34 | 11,92 | 3,82 | 3,28 | 4,41 | 18,92Thb+13,13Vaa+11,72Mtr+10,09Đb+8,68Bab+7,99Sog+7,18Sang+5,75Tr â+16,54(4) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | IIa | 0,6 | 120 | 10,32 | 9,75 | 2,82 | 2,02 | 1,07 | 17,69Ngat+12,72Lom+10,71Dea+10,41Khao+8,71Mo+7,97Bab+7,08Va+6,87Đatr+6,68Dex+5,8Bas+5,37Huđ |
| 5 | IIa | 0,5 | 370 | 14,47 | 12,09 | 5,84 | 3,17 | 7,04 | 16,02Vaa+11,09Sa+8,88Bas+8,81De a+8,61Teon+6,27Lom+5,98Bura+5,94Tramtr+28,4Lk(9) |
| 7 | Ib | 0,3 | 120 | 8,74 | 8,25 | 3,03 | 1,63 | 0,80 | 17,33Bas+14,73Mat+14,7Bob+12,54Va+11,52Bab+7,8Sa+7,53Chc+7,28Thb+6,58Lom |
| 8 | IIa | 0,3 | 340 | 9,51 | 9,71 | 3,34 | 3,13 | 2,702 | 80,69Bas+6,67Mat+6,38Tramtr+6,25Lk(2) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | IIa | 0,4 | 230 | 6,94 | 8,05 | 1,40 | 2,47 | 0,90 | 29,41Bac+12,69Bab+8,6Bas+6,75Bưa+6,69Mutr+6,14Ngat+5,39Ngl+24,33Lk(6) |
| 10 | Ic | 0,3 | 80 | 8,72 | 8,06 | 1,74 | 2,06 | 0,49 | 35,17Bas+16,69Ngai+13,03De â+11,7Bac+11,29Bob |
| Average | | | 216 | 10,83 | 10,14 | 4,92 | 3,22 | 2,1 | |

***Table 10.Synthesis of some basic forestry indicators of standard plots in ThuongCuu Commune***

| SP | Forest style/ State | Capony degree | Ni (plant /ha) | Dtb (cm) | Htb (m) | Sd (cm) | Sh (m) | G/ha ($m^2$) | Fomula composition |
|---|---|---|---|---|---|---|---|---|---|
| 1 | IIa | 0,5 | 370 | 13,47 | 9,24 | 3,27 | 6,94 | 6,629 | 45,1Đb+13,6Bas+9,1Ngl+ 5,3Dex+19,7Lk(9) |
| 2 | Mỡ | 0,2 | 10 | - | - | - | - | 0,054 | - |
| 3 | IIIa1 | 0,6 | 280 | 21,66 | 13,81 | 6,06 | 30,48 | 29,984 | 41,6Chox+13,4Cal+12,3Quch+ 6,3Bab+26,3Lk(8) |
| 4 | IIa | 0,3 | 120 | 19,02 | 11,73 | 8,31 | 22,07 | 7,609 | 32,7S â+26,1Got+8,8Cal+8,7Sug +5,4Mtr+5,1Cot+13,2Lk(3) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | IIb | 0,3 | 220 | 16,02 | 13,91 | 5,54 | 11,90 | 6,764 | 32,2Rr+24,9Bal+8,9Bab+7,4Mtr+7,4Ngat+6,8Sot+6,5Chc+5,9Lk(2) |
| 6 | IIa | 0,3 | 240 | 16,85 | 14,13 | 5,48 | 8,27 | 6,583 | 15,7Chn+13,0Khao+10,4Sop+8,4Bađ+8,3Mađ+6,6Cal+6,0Bas+6,0Gan+25,7Lk(8) |
| 7 | Ib | 0,2 | 90 | 8,85 | 10,11 | 3,82 | 3,49 | 0,629 | 31,5Trau+25,4Quy+19,5Sug+14,7Thb+8,9Bas |
| 8 | IIIa1 | 0,4 | 330 | 17,23 | 15,24 | 2,98 | 6,08 | 8,613 | 17,5Vaa+16,0Đb+13,9Cal+12,5Bas+7,7Ngl+7,6Sot+7,1Quy+6,7Bab+28,5Lk(3) |
| 9 | IIb | 0,5 | 330 | 19,60 | 14,85 | 3,23 | 10,20 | 12,561 | 18,6S â+13,2Vaa+9,5Cal+8,8Bab+6,3Đb+5,9Bas+5,5Dư+32,2Lk(12) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | IIa | 0,4 | 250 | 9,29 | 10,54 | 2,97 | 3,18 | 1,882 | 23,2Bab+10,2Khao+8,5Bas+8,2Vatr+5,9S â+5,2Thm+38,8Lk (11) |
| Average | | | 224 | 16,18 | 13,12 | 5,02 | 14,20 | | |

***Abbreviations in the formula composition***

| | |
|---|---|
| Bab: Mallotusfloribundus | Bas: |
| MacarangadenticulataMuell | Bđ: |
| Huracrepitans | Bumb: |
| Mallotusapelta (Lour.) Muel | |
| De â: CastanopsisIndica ADC | Dex: |
| Lithocarpuspseudosundaicus | |
| Hđ: Tremaangustifolia | Vaa: Saraca |
| dives | |
| S â: Pometiapinana Prost | Khao: |
| Cinnadeniapaniculata | |
| Thm: Holarrhenaantidysenterica Wall | Sung: |
| Ficusracemosa L. | |
| Mađ: Archidendronclypearia | Gan: |
| Ceratopteristhallitrichoides | |
| Sop: Lithocarpusfissus | Chn: |
| PalatanusKerriigagnep | |
| Got: AphanamixisgrandifoliaBlume | Ngat: |
| Gironnierasubaequalis Planch | |

Rr: Ormosiapinnata Chox: Terminaliamyriocarpa

Bal: Lagerstroemia speciosa Đb: Achidendronrobinsonii

Mtr:Zeniainsignis Chun Tramtr: Canarium

Tram: Syzygiumcumini Mo: Alchornearugosa (Lour.) MuellTrau: Verniciamontana Quch: ChisochetonpaniculatusHiern

Ngl: FicusfulvaReinw. exBlume Ngai: FicushispidaL.f

Sog: Dilleniaindica L. Thb: Alangiaceae

Teon: StreblusmacrophyllusBlume Du: Broussonetiapapyrifera

Dung: Symplocoslaurina (Retz). Wall.exG.Don

Bưa: Garciniaoblongifolia Champ. Ex Benth.

Cal: Caryodaphnosistonkinensis(Leg) A-Shaw

Chc: Scheffleraoctophylla (Lour.) Harms

Choc: Parashoreachinensis Wang Hsie

Lom: PterospermumheterophyllumHance

Vatr: EndospermumsinensisBenth

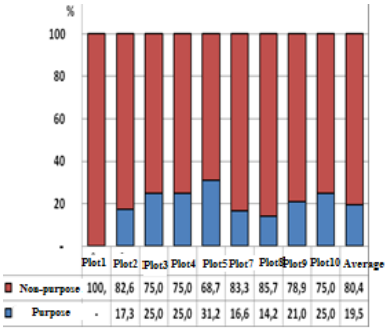
Sot: Sapium discolor (Champ.) Muell - Arg.

Bob: Orthosiphonspiralis (Lour.) Merr

The results in the tables have shown that the characteristics of state type, the density structure, the height, the average diameter of the stand in the poor secondary forest in ThuongCuu are higher than that in Thu Cuc. Moreover, theerrorsof the diameter and the height on each cell in ThuongCuuare also larger than that normin Thu Cuc.

After synthesis results of the survey, collationofeffects and timber groups in the forest stand, the proportion of individuals in the group of purpose and non-purpose species are described in the following chart:

Thu Cuc commune ThuongCuu commune



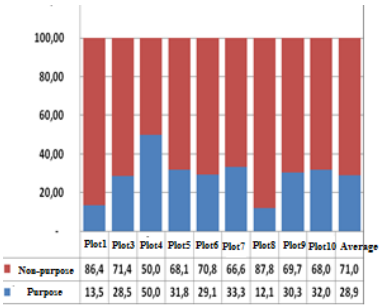




***Figure 8.The proportion of purpose and non-purpose species in the secondary forest of the project communes***

According to the chart above, the proportion of individuals of purpose speciesis on the average of only 20% in Thu Cuc and 30% in ThuongCuu.

Features of reproductive plant

According to the survey results in Table 2.3, the density of forest regeneration is common 8000-10000 plants/ha, plantsmainly with height ofless than 1m; perspective reproductive plants accounting for only 8-15% of the reproductive plants. Nevertheless, in the term of species composition of reproductive plants, there is virtually no reproductive plants with high value, mostly in groups V-VIII such asFicusracemosa L., Fagussylvatica,

Achidendronrobinsonii, etc. or non-timber forest products such as WrightiaannamensisEberh et Dub, Sterculialanceolata, Claoxylonindicum (Reinw.exBlume) Endl.exHassk, Saraca dives.

***Table 11.Features of reproductive plant layer in two project communes***

| SP | The number of plants under height level | | | | | N/ha | Prospective reproductive plants(%) |
|---|---|---|---|---|---|---|---|
| | <0,5m | 0,5-1m | 1-3m | 3-5m | >5m | | |
| Thu Cuc commune | | | | | | | |
| 1 | 2.000 | 1.500 | 1.500 | 1.000 | - | 6.000 | 8,33 |
| 2 | 3.000 | 500 | 1.500 | 500 | 1.500 | 7.000 | 14,29 |
| 3 | 1.000 | 3.000 | 2.000 | - | - | 6.000 | 8,33 |
| 4 | 3.000 | 3.500 | 2.500 | 1.000 | 500 | 10.500 | - |
| 5 | 2.000 | 4.500 | 4.000 | 500 | - | 11.000 | 18,18 |
| 7 | 500 | 1.500 | 500 | - | - | 2.500 | 20 |
| 8 | 0 | 3.500 | 1.500 | 500 | - | 5.500 | 18,18 |
| 9 | 3.000 | 3.500 | 1.500 | 1.500 | - | 9.500 | - |
| 10 | 500 | 2.000 | 1.000 | 1.000 | - | 4.500 | 11,11 |

| SP | The number of plants under height level | | | | | N/ha | Prospective reproductive plants(%) |
|---|---|---|---|---|---|---|---|
| | <0,5m | 0,5-1m | 1-3m | 3-5m | >5m | | |
| ThuongCuu commune | | | | | | | |
| 1 | 500 | 6.500 | 1.000 | - | - | 8.000 | - |
| 2 | - | 1.000 | 1.500 | - | - | 2.500 | - |
| 3 | 3.500 | 2.500 | 2.500 | - | 4.000 | 12.500 | 24 |
| 4 | 7.500 | 500 | - | - | 1.500 | 9.500 | 5,26 |
| 5 | 3.000 | - | - | - | 500 | 3.500 | 14,29 |
| 6 | 1.500 | 8.500 | 2.000 | 3.000 | 500 | 15.500 | 3,23 |
| 7 | - | 500 | 5.000 | 1.500 | 2.500 | 9.500 | 31,58 |
| 8 | 2.000 | 4.500 | 2.000 | 1.000 | - | 9.500 | - |
| 9 | 4.000 | 4.000 | 1.500 | 1.000 | 1.500 | 12.000 | 4,17 |
| 10 | 3.000 | 1.000 | 1.500 | 500 | 1.000 | 7.000 | 14,29 |

Features of shrub vegetation floor

On the natural forests of the commune, because the crown floor has low density, uneven distribution, seldom-cleared area, care shortage, so the shrub vegetation grows fastly, crowding out growth of productive seedlings. In general, vegetation is mainly classified into three types:

- In the state of bare soil, there are alang grasses growing with bananas, accounting for 80-90% of cover, scattering with Chromolaenaodorata, Maesaperlarius (Lour) Merr, etc.
- In state of secondary forests along streams, there are Cyclosorusparasiticus, Chromolaenaodorata (L.), accounting for 60-80% of cover with the height of about 50-80cm, scattering with Languasofficinarump, Psychotriarubra (Lour.), Alocasiaodora K. Koch, vines of Fabaceae and Ficussumatrana.
- On the status of secondary forest on the hills: there are various vegetations such as Chromolaenaodorata, Axonopuscompressus, Languasofficinarump, Caryotamitis, Selaginellatamariscina, Rhodomyrtustomentosa,

MelastomadodecandrumLour, Boehmeria Nivea L.Gaud, etc., growing with vines of Fabaceae and FicuselasticaRoxb.

In short: Most of the production forest area of the communes grows some popular plants including Styraxtonkinensis, Acacia mangium, and Manglietiaconifer with relatively good quality.Whereas, status of natural forest isdegaradedforestwithlow economic, social as well as environmental efficiency. It is difficult to meet the needs of local production or protection. On heavily-fragmented terrains, structural characteristic of timber forest is very simple, but vines and shrubs crowd out timbers, causing the difficulty to the improvement of forest structure.

***Figure 9.Features of shrub vegetation floor in Thu Cuc***

**Diversity of plant resources in the project areas*

Though these communes have large forest area, distribution on variety of terrain types and different habitats, diversity of plant resources have still remained in low standard.

***Figure 10.Diversity of plant resources in ThanhSơn***

Diversity on forest status:

+ Forest restoration status in IIb, with the advantages of light-demanding pioneer species under Euphobiaceae, including:

Mallotusapelta, Macarangadenticulatus, MallotusbarbatusandVernoniaarborea. Some other plants can be easy to find such as Rhuschinensis, Litseacubebaand Evodia lepta. Sacharumspontaneum is the most popular species in this area. All forms the state of the forest after fallow years of cultivation.

+ In poor forest status, mainly Musa acuminata growing with pioneer plants.

This is common found insteep hills; Musa acuminate grows in homozoic or mixed species with Schizostachyumfunghomii, MallotusapeltaandMacarangadenticulatus.

+ Bambusoideae in the nature

***Figure 11.Bambusoideae in the nature in SinhTồn***

Bambusa tends to grow in big clumps, on average of 30-50 plants/clump, possibly mixed with Mallotusapelta,

Macarangadenticulata, Litseacubeba,Evodia lepta, Knemaglobularia, Alangiumkurzii, Ficusfultaand Ficusvariegata Bl.

In addition to above forest states, degraded forest after clearcuttingin IIIa1 has big timbers but low valuable species including:Saraca dives,Albizialucidior, Caryodaphnopsistonkinensis, the most dominant species. There are some mixed species such as Alniphyllumeberhardtii, Callicarpaarborea, Castanopsisindica, Evodiameliaefolia, Pterospermumheterophyllum andAlangiumkurzii.

In term of diversity of timbers: the total of 76 species in the nature, under 31 familias, 54 genuses. The most popular species are Eucalyptus camaldulensis, Styraxtonkinensis, Acacia mangium, Manglietia conifer, Papaversomniferum, Dalbergiaodorifera and Meliaazedarach.

In term of diversity of non-timber forest products: There are 37 species, species for foods occuping the largest number of 15, medicinal species of 14, species for arts and crafts materials of 7, species for feed for livestock of 5, all

species which they can collect in the forest used for firewood .

The survey result of forest resources in degraded secondary forests in the model-designing regions (see Figure 7) has shown that timber composition are mainly plants with low commercial value, accounting for 15-35% of the total number of trees in the forest stand. There are about 17 species of non-timber forest products in the survey; there, however, is too small quantity of individuals of whichproducts can meet the demand of the market (according to Forestry Department of PhuTho in 2013).

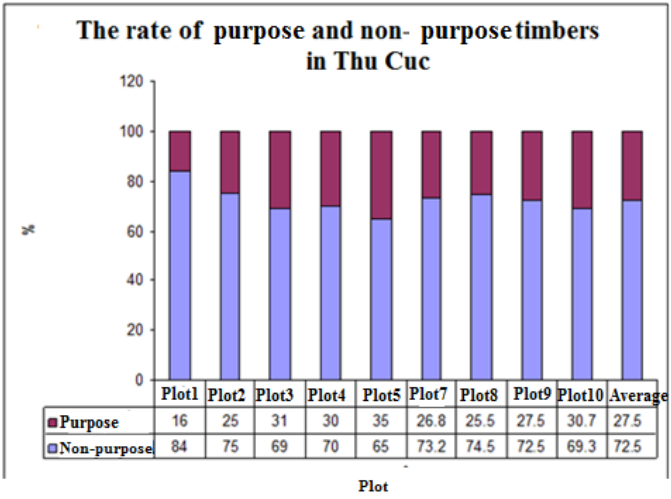



***Figure 12.The rate of purpose and non-purpose plants in model-designing plots of forest restoration***

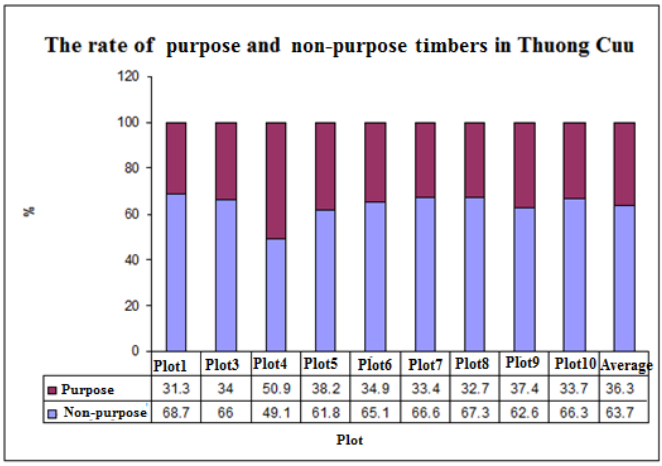



***Figure 13 .The rate of purpose and non-purpose timbers in ThuongCuu***

From the figures, technical designs of forest plantation for enrichment and non-timber forest products have been applied the method of planting on strips which is very easy and simple. In which tree and NTFP seedlings are planted in clear strips width 8m. Unclear strips witdth 12 m are free lianas and uncommercial species to promote targetted trees. The strips are under the contour to maximize the protective functions of forest resources.

The involvement of local communities is a prerequisite for the success of the project. On account of appling the method of community forest management which

has been successfully piloted in many projects of ODA and the government, the project has built micro institutional framework for the protection and development of forests in such communities; particularly, the most important is the construction of village regulations about forest protection and management, benefit sharing from forest harvesting, establishment of village forest management.The project has gained a great deal of achievements, including:

Firstly,in the term oftechniquesof the project: They are not only simple but also highly effective, so that it is easy to broaden to households, commities which have remained limittions of technical, technology, capital, etc.Planting indigenous plants by clear strips following contour lines is the effective technique for forest restoration.

Secondly, in the term of *species selection*:The object to plant for the forest restoration is the indigenous species, especially non-timber forest productswith high economic value and the people and communities of interest as well.The key factors to the success are the relatively simple techniques and adaptability with site conditions. Indigenous plants selected in this project are Parashoreachinensis,

Erythrophleumfordii, Dipterocarpusretusus, Micheliamediocris Dandy, Manglietia conifer, Desmodiumstyracifolium, Chrysopogonzizanioides, Morindaofficinalis How, CalamustetradactylusHance and Erythrophalumscandens. The cultivation and forest enrichment techniques of their plants are availableforappling.

Thirdly, *the involvement of the community and local people*: This is one of the greatest factors bringing about the success of the project. Because local people haveparticipated and supported enthusiastically, so the models have been fullycarried out and maintained.

The project has applied effective method with the participation of local people in all steps, including: species selection, plantiation, care, drafting conventions, exploitation, etc.

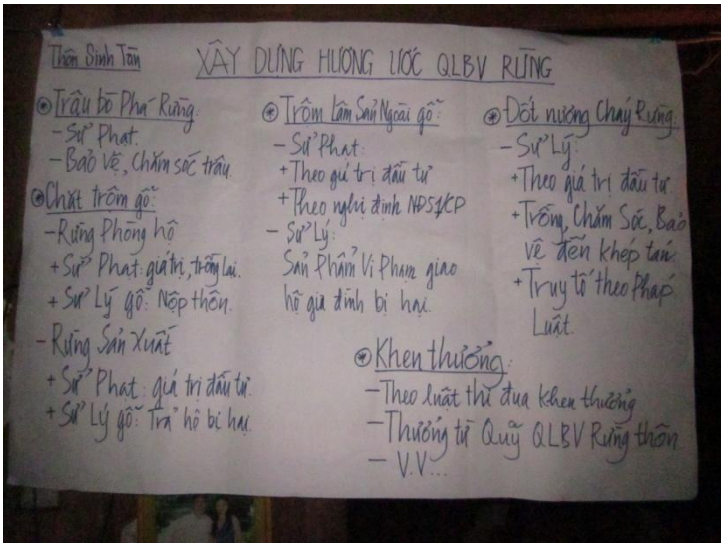
Finally, *the establishment local institutional framework,* this is avitalfactor in maintaining sustainable forest management, particularly for natural forests. Micro institutional framework based on legal framework is the basis for effective forest management (Forestry Department of PhuTho in 2013, by Phan Minh Sang in 2014).

***Figure 14. Technical designs of forest plantation for enrichment by Erythrophleumfordii***

***Figure 14. Technical designs of forest plantation for enrichment by Calamustetradactylus***

***Figure 14. Technical designs of forest plantation for enrichment by Parashoreachinensis***

***Figuge 15. The establishment local institutional framework in Sinh Tan***




***Figuge 16. The local institutional framework in Sinh Tan***

The local communities have been aware of their roles in the forest management, rights and restrictions prescribed by the State. Locals were paid much attention to improvedegradedsecondary forest through boosting the composition oftimbersand non-timber forest products with high economic value. This has contributed to the restoration of natural forests and sustainable forest management of communities in the project. Participating in the activities of the project and paying for labors as well as getting income fromnon-timber forest products have helped to increase incomes for the local households and reducepoverty (Phan Minh Sang, 2014).

Moreover, local people, partners and the authorities of PhuTho province and Vietnam's forestry sector has known APFNet and recognized its contribution to the development of forestry and sustainable forest management in Vietnam.

# Chapter 4: Experience in natural tropical forest restoration in the world

## 4.1. Deforestation and degradation in the Asia-Pacific

Asia - Pacific region is the highest population density area in the world with a large area of tropical rainforest, high biological diversity. However, most of the countries in this region, especially in Asian countries have already undergone the period that the forest are converted and declined an area and quality of forest because of the effects of many factors such as pressure of population growth, war, economic development, unreasonable use of resources ... As a natural cycle, after the economy has been developing in some countries of this region (Japan, Korea, Taiwan, China ...), many resources are invested to restore, maintain and protect forest resources for timber and especially enhance ecological value. **Board 12** below showed different ways to exploit natural tropical forest causes degradation (Lamb 2010).

\

***Table 12.Different ways to exploit forest causes degradation***

| Activities | Degraded soil and abandoned forest when: |
|---|---|
| Hunting and gathering | Rapid pace of harvest is caused by crowded population density or high demand for non-timber products |
| Nomadic in farming | Fallow swiddens period shortened less than 10 years, and fertility of soil declined, grass is crowded and forest fires frequently occur |
| Sedentary agriculture | Soil erosion reduces fertility of soil, grass is crowded, or in the market, price falls suddenly |
| Exploitation of wood | If too many trees are destroyed during the logging process (multi-cycle system) or if the seedlings tend to be commercial and non-renewable (single-cycle systems)<br>Degradation also occurs when forest is exploited continuously before its recovery is completed (during 30 years) |

*(Source: Lamb, 2010*)

For Southeast Asia, the region's population increased from 57 million to 356 million, between 1880 and 1980, six-time growth; so demand for the use of forest resources and especially area of agricultural land also risen. The table below illustrates the volatility of the area of the Southeast Asia forest this period (Richards and Flint 1994, Lamb 2010). Though this data may not reflect fully, it is the best overall picture that reflects changes of the forest this period in Southeast Asia (Lamb 2010).

Table 2.4 shows the forest cover declined from 365.7 million hectares by 1880 to 274.2 million hectares by 1980, lost 91.5 million hectares (25% of the total area of forest cover) (including forest / timber plantations as well as submerged lands and " discontinuous forest ", defined as areas have less than 40% forest cover). The decline of the intact forests (not including discontinuous forest and submerged lands) is 83 million hectares (equivalently 32% of this forest area by 1880)(Lamb 2010).

Reduction of annual cover increased sharply after 1950, from 0.81 million hectares to 1.3 million hectares per year. Most of this change is caused by increasing demand of

agricultural land. Agricultural land has increased from 16 million hectares to 78 million hectares in the same period. Most agricultural land was used for annual crops such as rice, but 17.9 million hectares of land (29%) are used for perennial crops such as rubber (Lamb 2010).

***Table 12. Change in forest cover (million hectares) cultivation land and degraded land (a) in Southeast Asia between 1880 and 1980***

| | 1880 | 1920 | 1950 | 1980 |
|---|---|---|---|---|
| Forest land | | | | |
| - Total [(b)] | 365,7 | 337,5 | 313,3 | 274,2 |
| - Rest [(c)] | 255,3 | 236,0 | 210,1 | 171,9 |
| - Annual reduction | | 0,705 | 0,806 | 1,303 |
| Other lands | | | | |
| - Cultivated | 16,1 | 34,0 | 45,7 | 78,0 |
| - Grassland | 57,1 | 67,5 | 79,4 | 84,0 |
| - Population density [(d)] | 0,13 | 0,23 | 0,39 | 0,79 |

[a] Including grassland, scrub and fallow areas

[b] Including forest/timberplantations, discontinuous forest and submerged lands”

[c] Forest,timberplantations

[d] Person / ha

*(Source: Richards và Flint 1994)*

* The increase of the fallow agricultural land

A key finding from Richards and the analysis of Flint is only 68% exploited forest land has been used for agriculture and 32% left may be added in the form of land as grassland, scrub and fallow land. Some this land may have been used for many purposes such as cattle ranching, but many others have become "degraded lands" and have eroded topsoil, weed invasion and have fire frequently. The land area is nearly 27 million hectares in the above period up to 84 million hectares by 1980. Degraded lands account for 19% of total area, equivalently nearly half of the rest of intact forest (Richards and Flint 1994, Lamb 2010).

The model was continued to carry out. Houghton (2001) suggested that between 1980 and 1985, 59% of all

new exploited land was fallow and become degraded (this is estimate for the entire tropical regions of Asia in general, not only in Southeast Asia). Other estimates of the shrubs, bushes, meadows for cattle ranching, fallow land and "other" lands (some of them may be secondary vegetation) in East South Asia now were indicated by the Fox and Vogler (2001) that degraded lands increased from 26% to 49% in the total explored area. These assessments are affected by differences in the definition of forest cover and the investigative methods of the various countries. The authors also found that the formation of large areas where lands are unsustainably used and 'degradated' in a rather short time. Many of these lands were still used for cattle ranching, for building materials, or for other purposes (Potter 1996) (Lamb 2010). In short, these agricultural lands have low productivity.

**Population and deforestation**

Land for growing food crops need extended because of the growth population. However, the nature of the relationship between population and deforestation is still controversial (Carr and colleagues 2005;. Geist and

LAMBIN 2002; Kummer 1992; Kummer and Turner, 1994; Mather and alloy 2000; Uusivuori and colleagues 2002) (Lamb 2010). During long history of mankind, it is clear that population growth was accompanied by reducing forest cover. This judgment is proved by used-land history in China. However, all deforestations are not completely used for the self sufficient agriculture. Simple cognizance about linkages between population and forest area can not be fully explained the processes related to deforestation, especially local or region scale. Sometimes, current forest cover reflects the changes that have taken place many years ago and are not in all manifestation of the current relationship.

In contrast, changes in the nature of the relationship can also take place by time to increase the forest cover along with the population growth at the same time. This took place in Japan; Gilmour and Fisher (1991), and Lindblade. (1998) show some recent examples from Nepal and Kenya respectively (Lamb 2010). Kummer (1992) also pointed out that there is uncertain to put the relationship between population and deforestation. Which population measurement unit is appropriate most - general population, population density, and population density per unit of arable

land, the percentage of population growth, the absoluted population growth or the number of migrants? Similarly, would the current forest cover, deforestation rate or increase the area of arable land be appropriate most?

According Lahm (2010), most cases, the most useful criteria is probably population density and deforestation (real rate of forest loss). High population density has potential to increase deforestation than low population density, but an area with low population density (lower total population) can occur rapidly deforestation if a group of migrants move to this area.

Although many recent studies have based on the common data sets involving many countries, most of them are acknowledged that this relationship are explored more conveniently if their change by time takes place in a local context or specific area. Richards and Flint (1994) did a study using the above data and this is shown in Figure 9 Their figures were supplemented by the recent updates on estimate of forest cover in 1980 in the Philippines, Thailand and Vietnam; and all countries after 1980 (FAO 2007). The

results showed that, in the region, the forest area has decreased by time with the increase in population density.

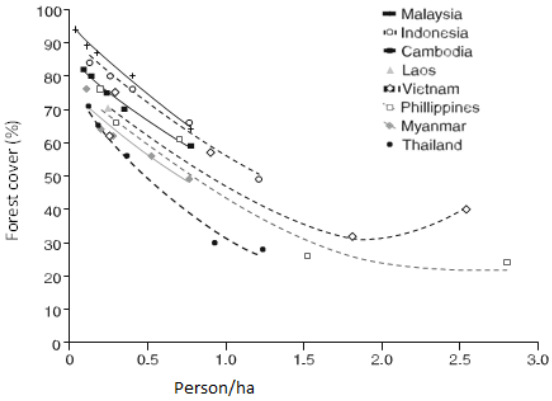



***Figure 7. Population density (persons / ha) and forecast for forest cover (including plantations) by Richards and Flint (1994), and the supplemental data for 2005 from FAO (2007). The updated information was used to change the original forecasts by 1980 for the Philippines (Kummer and Turner 1994), Thailand (Hurst 1990, Poffenberger 1990, Feeny 1988) and Vietnam (de Jong and colleages 2006)***

*(Source: Lamb, 2010)*

The general trend is similar but this relationship has clear differences among countries (Lamb 2010). For example, with a population density of about 1 person per hectare, forest cover in Thailand was about 30%, but in Indonesia was about 60%. These differences show that

deforestation rates are affected by many other factors, not only is the population density. Those elements include the productivity of the farming system (function of soil, climate, technology, etc ...), the percentage of national land suitable for agriculture, land use right systems (people who do not have land can move to find new lands) or government policies affect agricultural crops, commodities and plantation commodities. In Vietnam, the data also showed that at some point of forest cover has begun to rise, despite the fact that population density continues to increase (Vietnam had the lowest forest cover about 26% by the late 1980s when the population density was about two people per hectare). That changes of deforestation process rise the total of forest cover will be discussed in the following section.

**The causes of deforestation in the Southeast Asia**

Some studies have found the cause of deforestation and concluded that many factors affect on deforestation. Most researchers has distinguished between (I) the direct impact or latest impact such as agricultural expansion, logging, infrastructure development, fire or war; (ii) indirect effects or latent impact such as demographic changes,

economic factors, government policies and cultural factors (Chomitz 2007; Geist and LAMBIN 2002; Kummer and Turner, 1994; Nguyen and Gilmour 2000) (Lamb 2010). The important role of agriculture is considered by Kaimowitz and Angelsen (1998). The authors recognize that forests could be cleared for farming when those forest lands can be accessed and have fertile soil. Deforestation is also more popular when the price of agricultural products and timber are risen, business opportunities is good in remote areas, shortage of non-agricultural employment and wages in rural areas is low. The authors also found that many forests were cleared if they are easy access to thier resources (Kaimowitz and Angelsen 1998). In this situation, deforestation is a way to get rich for a person. They have created a complete awareness. It is difficult to explain why so many thereafter unexplored land were fallow? And why so many forests were devastated until they were not be revived in the near future?

### 4.2 Different types of planting for forest rehabilitation

Reforestation on degraded land is capable of contributing to the prosperity of mankind and conserving

biodiversity. There are many different methods of reforestation. Recently, most way to reforestation is industrial homogeneous species on a large scale. These species are exogenous, have fast growing used for paper production. Their rotation is usually less than 10 years. These plantations can effectively produce large quantities of homogeneous wood. They are good ideals for industrial enterprises. Also, it is useful when landowners have other goals. For example, a forest owner may want to produce higher-value timber in longer time, while some others, especially the smaller-size household, just want normal timber. Similarly, some government agencies and non-governmental Organizations (NGOs) can be paid more attention to the way of reforestation for watershed forest protection or provide habitat for wildlife and has no intention harvesting or non-timber products from the forest. This completely contradictory aims imply that standards scale of industrial plantations should not be considered as the only way to be able to afforest. Moreover, this is a simple way to choose forest plants which are suitable to the purposes of landowners (Lamb 2010).

The situation similar to the agriculture while discussing the reason why agricultural planning large-model that was sponsored by the goverment is often not successful.

Simply "production and profit" model in agricultural extension and agricultural research have failed. Its key way which presented hat model does not describe the space of tree harvest by farmers - microclimate, moisture and movement of water, micro-topography, and history of local organisms. Objectives was negotiated with farmers and farming communities. That model does not describe the space of tree harvest by farmers - microclimate, moisture and movement of water, micro-topography, and history of local organisms. It is impossible to show effectively abundance and complexity of the farms and real fields. Basic of success in agricultural modernization is the simplification of the farms and field. Therefor, they can be captured, controlled and managed directly.

The silvicultural solutions can be used for reforestation on fallow or degraded land. They grouped into three major forms of reforestation is presented below.

**Conceptual model of degradation and rehabilitation forest**

According to Lamb (2010) "degradation" was a term that has many confusing issues of definition. Depending on the conditions, "degraded" land is different from ecosystem attributes and resilience without impact. The degradation occurs when human activities cause decline in productivity, economic value or landscape. In Graph 4, at point A, a stable ecosystem has a invariant level of biodiversity and structure or biomass. The transformation of deforestation reduced both biodiversity and structural approaches the point (B). The thereafter impact such as forest fires or overgrazing could lead to be more degraded (C). At this point, some of the original species remained, and landscape was occupied by many grasses and broadleaf weeds. Logging (not cleared totally for agriculture) also caused changes despite of less impact. Therefore, low-impact logging could shift systems into D, while the logging without plans and with bad management can push natural forest ecosystems shift their system into E. Compared to the situation at D, some species may disappear and dramatically transform in forest structure. In some cases, some new and

secondary species, may dominate forest. Some of the new species could be exotic weed species. It is assumed that E is degraded forest stage as B and C.

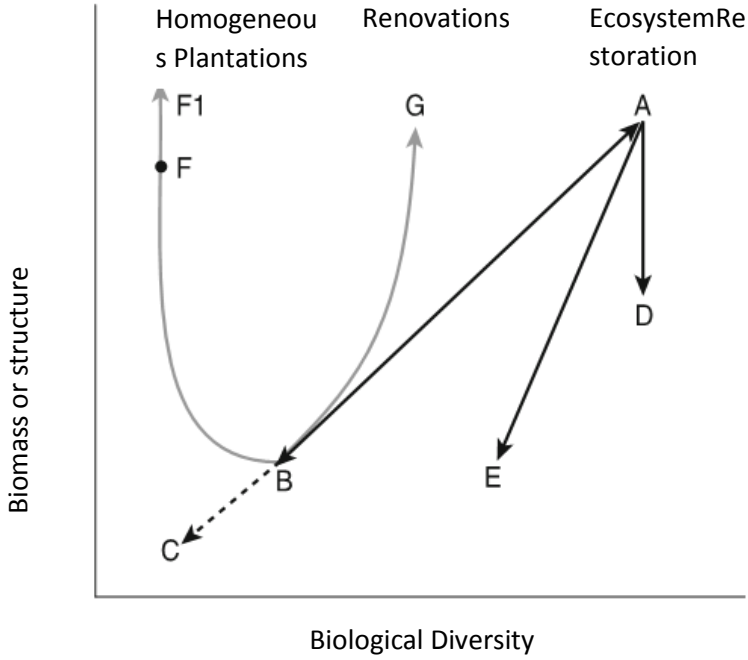



***Figure 8.Concep graph showing the relationship between the rehabilitation and renovation of the ecosystem and monoculture plantations. At point A, primeval forest has invariant biomass / structure and biodiversity. Many types of impact can change its condition. Primeval forest is considered to be degraded if it lost both biomass / structure and biodiversity***

*(Source: Lamb, 2010)*

Naturalforestrehabilitationcan take place in some cases. Thus, it was said that reforestation from D could be quickly efficient to allow the next logging, after 30 years, most primeval species still exist. Actually, this is a good result if logging was well managed.Ifrehabilitating after logging was bad managed(E) may take more time (and there may be some changes in the species composition in the end area of the rehabilitation forest because the new species, including some exotic species, dominated area permanently). Rehabilitating from degradation at B and C was more difficult. Natural rehabilitation could take place quickly in forest which degradation was not serious, soil still features forestry soil and tree species still exist in the area (because the seeds were stored under ground, seedlings, the old rhizomes or can scatter in the area from nearby intact forest). This may be the state after the forest was used for a short time for shifting cultivation. But this rehabilitation could not occur in place which was used more many times or was covered with weeds. In this case, the change of key processes (eg nutrient cycle) or mechanism to support natural rehabilitation (eg seed scatter) may shif the system

into alternative one when the rehabilitation was difficult, or best, very slow (Lamb 2010).

Under these circumstances, there are three guaranteed way of rehabilitation. One is to restore primeval forest and re-establish previous composition and structure. This means to boost to shift from B to C and then to A. The rehabilitation and re-establishment can be done by creating conditions for natural rehabilitation or planting primeval species. This approach was described here as EcosystemRehabilitation. The second way is to give up attempts and turn back the state A, monoculture plantations (or agricultural crops) with a species which have commercial value and can stand the current conditions (for example, the current land is not fertile). In this case, a new condition (F) was built. If many forms of improving field including that fertilizer was used, biomass could increase excessively biomass of quiet forest (F1). There is no appropriate terminology to describe specifically these things. Thus, it's known simply monoculture plantations (cf. Lamb, 2001; Lamb and Gilmour 2003). The third approach lies in between two presented ways. It covers some strengthening foundation, but not at all. Primeval species, biomass and

most composition of restored species, although it is not primeval biodiversity. The new final condition (G) can have a biomass and similar structure of primeval forest but the biodiversity is lower. This approach will be considered as renovation. Examples of these three approaches which were being used in the field are shown in the image below.

***Figure 9.Homogeneous Eucalyptus Uro plantations in Vietnam. By time, a thick layer of vegetation by grasses and herbs grows and well prevents erosion.***

*(Source: Lamb, 2010)*

This three approaches certainly are generalization of many more other ways. Reforestation of degraded sites can

be guaranteed. Each way is described in more detail below. They all are similar. They are trying to create rich forests. However, they are different in the resilience of biodiversity and the complex structure and ability to provide forest products and different ecosystem services. They are also different in the proportion of ability to achieve goals. Many homogeneous plantations which achieved goals werelogged after less than 10 years while some Ecosystem Rehabilitation projects can take over 100 years to complete.

**Choices between Ecosystem Rehabilitation, Monoculture Plantations and Forest Improvement**

***Figure 10.Rehabilitating ecosystems tropical rain forest in the central Thailand. The site has been restored with seedlings and seeds for 15 years and included a large number of native tree species***

*(Source: Lamb, 2010)*

The choice between three reforestation options depends on the objectives of forest owners. They are interested in the production of goods, ecosystem services, or a combination. The advantages of each suitable approach on reforestation are clear but each choice should pay attention to the disadvantages of each option. Some of the advantages and disadvantages are summarized below.

### *Advantages and disadvantages of Ecosystem Restoration*

Reforestation on degraded land which helps regenerate the former forest is a positive goal because it will rehabilitate biodiversity and create a lot of ecosystem services in spite of the fact that commercial goods are not necessary. Forest rehabilitation can be achieved by using methods of natural regeneration or planting (Table 4.1). However, the rehabilitation which is defined in this way can cause a lot of trouble. The first difficulty is unclear goal, especially deforestation took place many years ago and there has been no trace of the primeval forest. This is an obvious problem for the landscapes which were revised and adjusted in a long time in Europe, but it also applies to many areas in the Asia-Pacific region, known as name of a small number of canopy trees.

The second difficulty relates to changes of the physical environment. Degradation can change the chemical and physical properties, hydrology and fire mode. These changes can cause that the original species cannot regenerate in place.

***Figure 11. Forest rehabilitation in a old bauxite mine in the north of Australia. A new forest with many trees and understorey plant has developed. For 15 years it has returned to the original form of tropical rain forest despite the fact that species composition is different because environmental conditions change.***

*(Picture:Peter Erskine)*

At least in the short term, because these trees are no longer withstand the current conditions. Again, a forest is rich in species can expand but is not suitable to primeval forest.

The third problem is that after deforestation, some of the original species may have been lost due to extinction or exotic species may have invaded and become native species and cannot be removed. These changes can affect ecological processes in this new ecosystem. Therein, it may affect on some of the remaining native species. Obviously, the example in some places when disappearing they becomes important species scattering seed or a new species of weed. These species cannot prevent the new forest with plentiful species from growing, but it will have differences quality from primeval forest. And the fourth problem is that the environmental conditions at the site can be changed as a part of the long-term climate change which may be caused by global warming. Therefore there may be changes in temperature, seasonal precipitation, fire mode. These things can change ability of original organisms for regeneration or fertility in specific position, and

**Box 1. Definitions**

Some significant changes of the terminology were used to describethat the ways forests can grow. This problem had been controversial (Carle and Holmgren 2003). The following terms are used following:

Reforestation is used as a term. It includes the development of the forest, including by natural regeneration and reforestation with plants and allowed species. Thus the definition consists of the forests created by monoculture farming, improvement rehabilitation and ecological rehabilitation. Although the term reforestation is often widely used as a general description of the work of reforestation, but it will not be used here to avoid confusion with the more specific term Ecological Rehabilitation (see below). In most cases it was discussed that forests is occupied in positions replanting trees within the previous 50 years. It is contradictory to the term reforestation that is usually used to describe the work of reforestation in the place in which there has been no plants or trees have not occupied for over 50 years.

*Natural regeneration* is the development of native trees or other plants by sowing its seeds or plant redevelopment.

*Monoculture forest* is cultivation of a single crop at the same time. They can be indigenous or exotic species and often planted with a density of 1,100 trees per hectare. Most of them are grown in specific time or rotation time then the crops are harvested and re-planted. Only some natural processes and functions are rehabilitated. Reforestation's yield may be higher than the natural forest because of the used species, the soil preparation and the fertilizer use.

*Forest rehabilitation* describes the development of the new forests which are made up from some former ones but it is not necessary that all original species are in the same place. Forest rehabilitation can also include some exotic species. Most species are developed by planting or sowing, but some species which can regenerate naturally is allowed to develop. Perhaps, significant changes in the number of species are used and in management methods are applied. The former yield and the original ecological processes are often recovered.

*Ecological rehabilitation* is the process supporting the rehabilitation of the degraded, damaged or destroyed ecosystem (SER 2004). It will take much time to recover. An ecosystem can be considered restoring when it consists of biological and non-biology resources for development process without extra support or external support. In contrast, people who want to build monoculture farming or rehabilitate degraded lands and rehabilitate forest ecosystem often desire to reset the previous existence of biological integrity about species composition, community structure and ecosystem function. Ecological rehabilitation can be achieved through natural regeneration or a combination of planting, sowing and natural regeneration.

***Table 13. Reforestation method is suitable to different objects***

| Reforestation methods | Objectives of reforestation | | |
|---|---|---|---|
| | Monoculture cultivation | Improving recovery | Ecosystem rehabilitation |
| Natural regeneration | | Is a result when natural regeneration cannot be completed; | Can be achieved in the place where adjacent natural |

| | | | |
|---|---|---|---|
| | | can also be achieved by planting , enriching by using native species or invasive species | forests are not affected |
| Homogeneous planting | Achieved by planting native or exotic species using short or long-term rotational crop | | |
| Mixed planting | | Achieved by planting different species and permanent or temporary shrubs in the same place | |
| Recovery afforestation | | | Can be achieved |

| | |
|---|---|
| | when a high proportion of native species are planted or sown and nearby native species from native forests can spread to plantations |

Thus spatial and altitude distribution should be changed. The biggest difficulty is the inherent difficulty in efforts to try to reconstruct an ecosystem. However, people who carry out the recovery methods lack knowledge. Moreover it must be done at a scale that allows a number of important ecological processes work. In the planting method, how can they regenerate hundreds of species and living forms at the same time?

They all refer that the task of rehabilitating old forest is extremely difficult. But this task is impossible to do and some promising results were gained despite the fact that the difficulties were listed here. It involves that the method of

natural regeneration was applied. Planting and directly seeding and will be discussed further in Chapters 5 and 8. Interestingly it is unnecessary to relate to the directly monitoring process from the B-to-A as Figure 4.1 was indicated. Because this it is useful to gain a series of the standard measure to monitor the development of the system and figure out whether this new system complies with next appropriate orbit or not. Some standard measure is presented in Box 4.2.

Sphere of changes due to man and the difficulties in rehabilitating degraded lands Oosthoek (2008) argues (in subgroups "Nature is completed);

**Information box:** Properties of Rehabilitation Ecosystems (International Association for Ecological Rehabilitation 2004)

1. Ecosystem rehabilitation includes a group of the characteristics of the species that occurs in the reference ecosystem and provides appropriate community structure
2. Rehabilitation Ecosystem includes native species at the most realistic level.

3. All groups of necessary function for the developingcontinuanceand / or the stability of Rehabilitationecosystem are present or able to invade by natural methods.
4. The physical environment of the rehabilitation ecosystem is capable of maintaining reproductive behavior of populations of species that are necessary for stability or development following desired orbit.
5. Ecosystem rehabilitation will perform common functions for development stage of its ecological and there is no sign of dysfunction.
6. Ecosystem rehabilitation is integrated to fit to the landscape that interact through flow and the biological and non-biological exchange.
7. The potential threat to the health and integrity of ecosystems rehabilitated from the surrounding landscape will be eliminated or reduced as much as possible.
8. Rehabilitation ecosystem is strong enough to endure the normal periodic effects in the local environment to help maintain the integrity of the ecosystem.
9. Rehabilitation ecosystem maintains itself in the level that is similar to its reference and is capable of extending

indefinitely in the current environmental conditions, although the composition and other properties can develop when environmental conditions change.

Supporters of the Environmental Protection admit defeat that the recovery in the future will mainly be paid attention in the new ecosystem that is set up using non-native species rather than trying to return its original state. Hobbs and colleagues (2009) have argued that this is like the "fiction" ecosystem. As a generalization, it can be a gloomy predictions but is likely to be accurate at least some areas of degraded landscapes.In this case, the best choice may be the development of multi-species, self-sustaining and resilient ecosystems containing organisms original as much as possible, but also can take advantage of some non-native species. Although we will not be compatible with the original ecosystem, we can rehabilitate most of the original function and provides a good starting point for adapting to future changes such as the species can endure to global warming. In current terminology crops can be described as " rehabilitationimprovement" and will be discussed further below.

The issues related to the rehabilitation of wildlife populations will be commented exactlly. Deforestation and dispersion will cause some species to extinct locally but allow populations of some species to increase. In most cases, the rehabilitation is only to restore the habitat and food supply. Hopefully this area will be retaken in a natural way from the remaining populations of the species remains elsewhere in the region. This rehabilitation may or may not happen.If it happens it will take time because some environment characteristic slowly growth (eg hollow trees, logs on the ground). The wildlife movement can rarely be done even though these species may affect pollination, seed scatter, seed eating and nutrition structural adjustment. And some wild animals such as large herbivores (such as elephants) or top predators (such as tigers) are not welcome by the human community nearby. Consequences arising from the disappearance of species such as the high levels predator species in the forests have already rehabilitated and mostly unknown although Soule and Terborgh (1999) suggests that we may be greatly affected. The large areas of restoration forest are absolutely necessary for the preservation of the species, but it may be difficult to reset.

On the other hand, some species may be used ecosystems which is called novel ecosystem above and exists in a complex of fully rehabilitated forests and rehabilitation forest.

***Advantages and disadvantages of monoculture***

Large lands which are planted a single species have become popular in many places in the world, especially in Asia - Pacific region. These areas are appropriate to plant indigenous or exotic species in short or long term rotation (Table 4.1). Some can bring in profit, leading to the success of the land owners. Whereas, other owners can not achieve success on account of unsuitable species selection, bad seedling quality, poor preparation, or failure in controlling weeds, pests, diseases as well as processing a series of other problems. Additionly, the failure may relate to species forming natural monoculture forest that have suitable ecological characteristics but low economic value (Box 1.1)

Yield of monoculture method is depended on time. Forest cultivation with fast – growing exotic species to get paper material is easy to cause the losses of nutrients. Because harvested logs have high proportion of nutritious

substances and nutritious substances may be removed when that area is cleared and replanted. Unless this problem is solved, the losses of nutritious substances certainly cause the yield to fall in next intensive farming time. Inevetably, planters have to encounter difficulty in planting on degraded forest, even it seems to be more urgent if forests are only cultivated with a single plant.

Another reason for the failure is the inappropriateness of forest products in the new timber market. Besides, people expect social change such as the increase of living standard. Consumers desire to not only buy timber products with low price but also preserve wild animals and aesthetic landscapes. Monoculture farming is an effective way to generate special products, but fails in creating different ecosystem services.

***Advantages and disadvantages of rehabilitation planting***

Rehabilitation plantingcan create continuous environment for rehabilitation planting and monoculture farming. It does not mainly put emphasis on rehabilitating some former charateristics of forest or maximizing the production of a single product. In fact, it aims at combining

and supporting the purposes of stakeholders and it is considered as the means in order to adapt to new economic and environmental conditions in the present (or in the future). Previously, it was considered as “the novel ecosystem”. Forest rehabilitation involves planting from seeds, natural regeneration or both (Table 4.1). As long as forest rehabilitation is planted with proper techniques, it is expected to improve human interests and ecosystem integrity (Lamb and Gilmour 2003). People are capable of obtaining huge profit from replanting forest with trees of high economic value. The ecosystem integrity is improved by increasing the functional efficiency and ecological nature. Generally, it is found difficult in finding proper design of forest cultivation to reach two factors. Which form should be applied in these methods? How many species needed to use? How many species should be used and what is proper tree percentage? The answer to this question depends on the circumstances of each particular location. In other words, the term of " rehabilitation" consists of a range of forestry and technical methods.

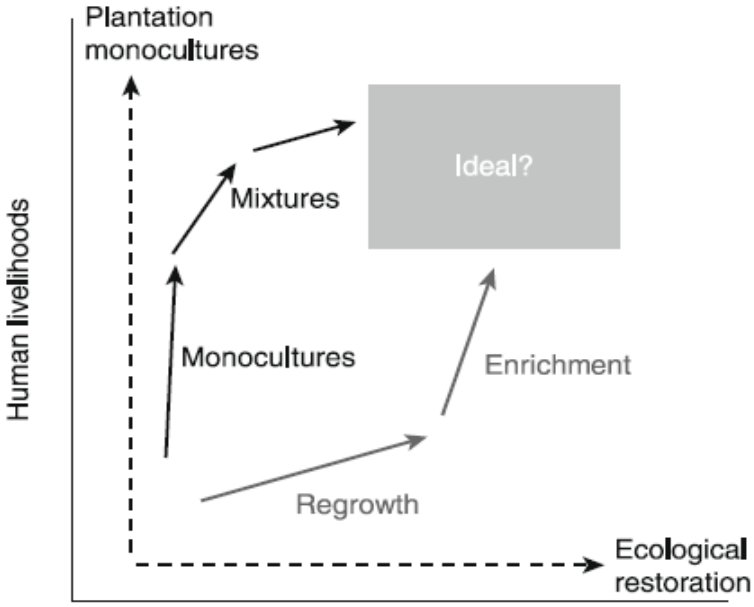
How to make a choice among Ecological rehabilitation, Monoculture farming and Improvement

rehabilitation? Some people prefer a particular method because they want to make financial profit or to improve the ecosystem in a specific location. Others will have a choice after consideration of each alternative ones and cost for implementing. However, attitude and hobby can be changed over time when there are changes in economic, ecological, environmental or personal conditions of the landowners. For instance, extensive natural regeneration on the lower floor of growing region can lead to the decision that a productive forest has more value than timber production. Similarly, a landowner is willing to delay exploiting a mature forest due to aesthetic factor. In other words, the balance can change over time as new forms of management are adopted, shown in Figure 4.5. Consequently, while it is not able to achieve the appropriate balance, people tend to follow this trend for decades when economic and social circumstances allow (Lamb et al. 2005).

**Degradation and restoration**

This is additional factor, providing information about the design process as well as focusing on the urgent needs of the new forest cultivation which is capable of adapting to

future disturbances. The ecologists use the term elasticity to show any system that has the ability of absorbing disturbances and maintaining neccessarily statuses being similar to structures, functions and feedback mechanisms (Berkes and others, 2003; Gunderson, 2002). The system has high elasticity, strong resistance to changes but also maintain the same control. It seems to be necessary to enrich knowledge of elasticity before starting to research on unknowns for the selection of reforestation.




**Reverting ecosystem**

***Figure 12. Reforestation needs to trade off between improving livelihood and reverting ecosystem. Plantation monoculture is likely to enhance livelihood. Meanwhile, rehabilitation of forest ecosystem has potential to improve result of reverting ecosystemthan ever. However, over time,this method can change the forest morphology because it is used for completing the elements of both two targets.***

*(Sources: Lamb 2010)*

In current agricultural and forestry production, the most concerned problem is how to promote the productivity of certain species.People have made a great effort to breed

proper species which are capable of proliferating, to manure and implement intensive farming aiming at stimulating the growth of trees. Then, the managers sought to understand the growth standard and maintain stably this yield (Walker and Salt 2006). Through process of controlling every aspect of the cycle, it is easy to gain the maximum yield. According to managers, the increasing improvement is like a straight line (and thus the better land selection and improved fertilizer technology can bring about the higher yield), but they seldomly concern about some where which are far from farm or operating process with small scale. Besides, they tend to ignore the changes of environment and economic conditions. This approach contrasts with countless agricultural forms cultivated by most traditional farmers, where are a variety of species, commonly growing on the same piece of land to generate a wide range of foods as well as other products and create protection degree for the system.

Over years, "the best practice" model has been carried out well in agriculture and plantation forestry and productivity levels of both forms have increased. Or at least, this model has been operated up to present. It has affected many areas in the world, where the model has some serious

weaknesses and less efficient operation than before. Even some models also failed after a relatively short period because of the increase in the level of chemicals (fertilizers and pesticides). Many the agricultural areas need to maintain productivity and degraded land.

Walker and Salt (2006) pointed out a paradox. Generally, agricultural or forestry production has been boosted performance. Particularly, there are more foods or woods production on each hecta of soil. In addition, people also reduce redundancy by eliminating invalid species. That ecosystem is normally formed by the interaction between the numbers of species is determined by the final result. Many species are abundant, but actually they play an important role in maintaining the system when the environmental condition changes (Folke and others, 2004; Walker and others, 1999). In other words, systems with many species are often more elastic. Therefore, managers find ways to reduce diversity, set a more optimistic valuation on organs of a production system, isolate from the rest of the ecosystem. It means that the system is not protected any more. Though this simple system operates effectively, in fact, it is extremely weak. This seems to be counter-intuitive, but it

appears to terminate the ambiguity of the study. Walker and Salt (2006, page 7) have emphasized:

The paradox is that they are effective when they are applied on a narrow range of special values and interests; however; they do not create high value in society.

In current context, one of the goals of reforestation is to improve the livelihood of smallholders by reducing their losses causing from future fluctuations. If Walker and Salt (2006) are right, the model "output is maintained at the maximum level" can be a mistake and the road ahead is risky.

***Ability of rehabilitation Ecological - Social System***

This issue is part of a larger question relating to the function of the ecosystem to changes or fluctuations. Quite popular among ecologists, ecological systems do not follow the trajectory of change and have the ability to exist in many states with stable mechanism, alternative change in which have differences about structure, function and reaction mechanism (they are like goods and services that can be provided).

These systems are operated in four stages, called the adaptive cycle (Gunderson 2002). The opening of the stage is stage of invasion or exploitation process of unused resources. The next phase is preservation for the adult forest system and the internal constraint between constituent and forming components of the system. Certainly, the more constraints are, the stronger ability of linking are formed, causing a less flexible system and thus becoming more sensitive to the sudden impact from outside. Finally, just a fluctuation can cause the destruction of entire system, stimulating the restructuring and begin of a new cycle. The collapse and restructuring of the system take place chaotially and fastly. During this process, the correction and rehabilitation will be found.

The way of movement of the cycle can be found in the natural ecosystem with biomass and diversity of a sustainable ecosystem. Over time, the proportion of fixed nutrients in the biomass of a bigger ecosystem, the growing numbers of species that live longer, except for those species live in the community and have a low life expectancy. There is more and more connection developing in the higher form. When this development peaked causing the losses of

ecosystem rehabilitation and the weaknesses to the strong impacts or fluctuations. Ecosystems will unavoidably collapse after inevitable natural elements such as as fire, storm, or the ravages of insects. Social ecosystem also expressed the similar nature. The first phase of the cycle of a social ecosystem includes improvement and non hierarchical. Over time, the population and wealth in society is increasing along with sustainable practice sand weak flexibility. In this system, small links form a network of big relationship; however; information tends to be transmitted from only one individual to make a decision. These reforms or test forms minimized. Thus, the system becomes more fragile; finally, it must be faced economic or political changes which have not been seen before, causing losing the ability to respond (Homer - Dixon 2008).

If the fluctuation is a part of the mechanism of historical change, the system can be rehabilitated and the cycle is willing to restart. On the contrary, if the impacts or fluctuations occur in an unusual and serious way, the system can be pushed to the threshold of a new form in which rehabilitation takes place extremely slowly, or disappears. The transformation from forest to grasslands occurs in some

areas of tropical areas. The combined measures of clearing and burning forest are an example of this transformation.

Further consideration of ecological or social, economical, or economic system, we found it is useful to focus on social ecosystem, which Gunderson (2002) and Walker (2006) implied. With a fluctuation, social ecosystem is capable of recovering and restructuring a similar adaptive cycle which have biota of equal importance and economic transformations operating system. However, the system will be in danger if a completely new foundation of ecological communities, socio-economic structure and main economic transformations develop. These changes occur as the adaptability of the system is overloaded, called "degradation". Crossing a boundary in the ecological – social system - may cause major changes to the components in the system. Ecological degradation may root from the economic- social events, but in its turn, it creates other economic changes and promotes the system crossing other economic and social limitations.

For the new combine of social and ecological system or the already degraded systems which have been

reorganized, the most important thing is to find ways to improve rehabilitation ability, preventing from the development of fragile conditions, the first conditions causing the collapse of the ecosystem. Diversity is the core factors of an ecosystem with good rehabilitation ability. The diversity exists in three important forms in ecosystem. Firstly, it is the functional diversity; species diversity has a similar affect on the development of the ecosystem. For example, ecosystems encompass shade species, light – demanding species, fixed nitrogen species, decomposing organisms, herbivores, predators, pollinators and organisms of seed dispersal. To have an effective – operating system, it is necessary to own representative of the groups mentioned above. Secondly, the species biodiversity can generate a specific functional response. The ability of restoration increases because each species has adaptability to specific natural conditions such as drought or moisture. Some species seem to have no role, but it has become more important for the function of the system on own way (Diaz and Cabido 2001; Associate Elmqvist et al 2003). Thirdly, the diversification appears in regional level rather than point level. An area, rich in species composition, can overcome

local extinction due to the re-invasion of species from other areas to this area. Just a small diversity can also store a significant proportion of ecosystem function, but in the long term and for the wider region, it is very vital to ensure the greater degree of functional diversity in order to sustain its own operations.

In the economic - social component of an ecological – social system, diversification of markets, organizations and knowledge sources are also crucial. Therefore, a system that inputs are commodity products and services sold on a lot of specific markets would be more advantageous than the system depending on the only product and buyer. Moreover, the knowledge of the management system gained from a various input sources, including external input sources combining with traditional ecological knowledge as well as input resources from many stakeholders to decide on natural resources having better rehabilitation than management forms under the corridor from the top to the down with a viewing angle. The diversity of the ecological – social system has encouraged to increase self-organized capability to changes, trends or impacts.

The rehabilitation is also a price. In the short term, rehabilitation has brought about more advantages in maximizing products and not totally built restoration. But if the longer the management of system is, the bigger the risk of strong effects on economy or ecology is, leading to pushing the system over the limitation (Associate Anderies, 2006). Somehow, a manager has to create the balance among the value of above short-term benefits by creating elasticity and long-term movement of the collapsing system and transfering to a new state after ignoring the elasticity.

**High adaptability during forest regeneration**

To remove the degradation, people have to make effort to transfer a system into a new state to to create a larger source of finance, resource and human. The increase of such sources leads to flexibility. Some other ideas arising from rehabilitation theory will be carried out to restore the forest.

*Ecology*: Firstly, protect the rehabilitation parts of the areas or the remaining forest plots of secondary regeneration despite of small area. Such forest plots can help preserve the genetic diversity of plants needing for reforestation

programs. Additionally, they can also provide habitat for wild animals such as birds and bats, the species with capability of spreading seeds over the area of the region. This will be discussed more in Chapter 5. Secondly, any activity of plantation also creates links to the species diversity and types of system functions. The most ideal thing is to find the diversity in all points of the area, but this is not always feasible. It's hard to find diversity in a large area (eg, if it is not the alpha diversity, it will be gamma diversity). This will be discussed more in Chapter 7.

*Economy*: Thirdly, before plantation, it is important to consider economic conditions because this will create products and services for different markets. If a planter sells a single product line from a plantation for a specific buyer, the planter seems to be sensitive to lose or risk of economy and biology. The history of agriculture and forestry quite separates from the problems arising from the dependence on individual species (Table 4.2 and 4.2).

*Society*: Finally, the indispensable factor of any reforestation programs is that people and organizations must receive feedback and improvement, then research and

develop new knowledge rather than depend increasingly on external sources of technical guidance. It is necessary to find ways to expand new knowledge to implement forest regeneration. This is quite easily done by stronger developing a strong affiliate network of researchers and practitioners. To get more information, visit Chapter 10.

Degraded lands conducting reforestation are unguaranteed business areas. A plenty of new silvicultural methods have been developed but very easily cause errors. Through management processes, managers are able to gain valuable experiences in order to adjust and control output (Associate Anderies 2006). This process includes studying activities through practices. The rehabilitation system is systems using this approach and has a network of stakeholders as well as a monitoring system with proper function to response to bio-feedbacks, society and economy. These systems can also be provisions of union and adjusted policies when necessary. In short, the main key for all of these suggestions is to adjust changes and remove degradation in the future.

**Some problems for those who are looking for design forms of forest regeneration process.**

There are some interesting questions for those who are conducting the regeneration process.

**Forest rehabilitation under which form - Specific or General?**

Whether species with high adaptability can be restored after a specific affects such as fires, storms or changes of specific wood products in the market or not? Does a general restoration form play a role of padding for ecosystem against change? The reasonable selection of the security measures against external pressures such as forest fire may reduce the rehabilitation ability of entire systems to broader changes or impacts such as climate change.

**Box 3** The serious risks of the single market

Prices of agricultural products such as coffee, cocoa or sugar cane range clearly, but forest goods also have similar fluctuations, causing serious affects to a large number of individuals. In the 19th century, the non-timber forest products were preferred and the main

products were harvested from the rainforest. A large number of these products have gone through the cycle of price volatility in Southeast Asia. There are gutta-percha from *Palaquium* (KNAPEN 1997; Potter 1997), jelatong wood or rubber from *Dyera*(Potter 1997) and yellow gambier catechu from *Uncaria*(Colobijn 1997). In any case, the attempt to generate plants which is suitable with climate ended with failure. It rooted from the importation of alternative products on the market (For instance, *Heveabrasiliensis* from Brazil replaced gutta-percha and jelatong wood) or degradation in small areas (such as gambier).

A recent example of the volatility of the market is the product from rattan in Kalimantan (Associate De Jong in 2003; Michon in 2005). In some cases, the volatility was caused from dry weather; however; the majority comes from the misguided policies of the government in efforts to regulate the export market. These effects can even collapse market. Indonesia has major business tendency to sell rattan products to every corners of international. When exchange rate of Indonesia changes, profitability

of manufacturing rattan in other countries is also strongly altered.

The product has a smaller market share such as GmelinaarboreaRoxb in some southern regions of the Philippines is an example of the type of wood being focused has becomed unprofitable. In this case, a lot of tenants have successfully grown this plant but could not keep the worthy price while wood products from other plantations which are flooding the market at the same time. Because of this fact, tenants have no longer planted this tree (Pansicolan and Macandog in 2007). Sometimes, similar phenomenon also occurs in some parts of Eucalyptus plantation of Vietnam. The growth speed of this tree and the ability of resistant to soil degradation make it become an attractive tree to planters. Most of them have value for paper production market because its market share is quite small (Hawkes 2000; McElwee 2009; Associate Raintree 2002; Rambo and Le 1996). Two species of GmelinaarboreaRoxb. and Eucalyptus spp. are commonly planted as an important tree in many places; however; it also is an example of the fact that

people are too dependent upon seedlings which have been planted widely so that it occasionally causes unpredictable consequences, especially in places that cost transport expenditure due to large distances.

**How is diversity important to plantations to create ability to rehabilitation (enough)?**

Whether planters should mainly focus on a specific tree which has high yield and is favoured in a large market or should grow different types of trees that are not too much pay attention to production or value in order to speculate upon a bet on economy and ecology under changes in the present?The exact number of species scattered in the jungle conjures many ideas. There are two risks including events in the future and the severity of the adverse consequences if occurring. Different plantation owners have contrasting views about the two above factors. Partilularly, the large industrial plantation owners have different perspective from small plantation owners with limited income.Predecessors can base on assessment of their condition to continue planting trees serving paper processing sector which using monoculture method, especially they can be quick rotation

along with different financial instruments protect themselves from risk. Descendants might have a contrast perspective when they live in places far away from the industrial market and have unclear perspective about future market. Nevertheless, even so the tenants are still not ready to copy the current diversity of the natural forest.

**How to encourage the development of rehabilitation forms of forest regeneration**

A lot of tenants along throughout the Asia - Pacific region conduct forms of traditional farming such as converting cultivation with higher rehabilitation. These systems have been formed from experiences of undergoing crisises or changes, but many of them have been eradicated by the deliberate policies of the government which aim at promoting the conversion of fixed forms in agriculture as well as by contacting with new industrial species, new market and changes to each period of land tenure. Currently, there is a tendency to simplify this cultivation system. In light of these trends, what will a small owner decide to propose the partial regeneration of his area to create forest rehabilitation ? Whether they are simply to concentrate in

maximizing productivity and generating money flow or trying to imitate previous agro-forestry system and minimize the vulnerability by establishing plantations with mixture of species or not ? And who can advise them? The governmental agencies supporting simplification are not willing to provide the system that puts pressure on the ability to recover. These questions will be discussed more in Chapter 10 in the discussion of the tenants and their relationships.

**Is the improvement of ability to rehabilitation in large areas easier than the specific location?**

It is often very difficult - or unnecessary to establish plantations with high rehabilitation ability at small area and perhaps diversity of rehabilitation function can easily be obtained by developing a variety of different plantation styles in different parts of the same area*?* Therefore, these areas are like a leaf spot disease on botanicals, including botanicals in the natural forest which has not been destroyed, in secondary forests, monoculture method and perhaps the tree plant can be recovered.Designs in these areas are to balance finance. Becides, ecological needs seem to become

difficult when relating to only one land owner but will be more difficult when there are many land owners and other stakeholders. This topic will be discussed further in Chapter 11.

**Conclusion**

There is no denying that the form of simple monoculture of exotic species is often used here. In fact, there are many ways, possibly planting in degraded reforest land. They are different from the number of planted species and scope of ecosystem rehabilitation and improvement of human life. They also differ with functional efficiency and rehabilitation ability. Some types of reforestation are suitable for replication industrial trees for timber productions but less suitable for producing a wide variety of forest products that minority of owner desire to have. Some form of reforestation can generate ecosystem services such as watershed protection, but it is difficult to create the necessary habitat for wildlife.

Circumstances and objectives of the owner or manager will decide which the appropriate type of reforestation is. In this deciding factor, most industrial developers are able to

withdraw financial. But private developers may have different views. The different qualities of plantations of land owners are originate from time of making decision of investment and the benefits to the developer. This means that there are many bigger risks and replantation can minimize risks.

The following chapters provide information to check out more details about the type of reforestation. Basically, there are two ways of reforestation, including natural reforestation or planting patterns. Natural and secondary reforestation will be discussed in the next chapter. The next chapter will describe in detail some ways of reforestation with planting seedlings

# Chapter 5. Toward the future

## 5.1. The factors affecting to forest rehabilitation and forest development policies in Viet Nam

Thanks to political commitments and determination through government's policy, Viet Nam has gained great success in forest rehabilitation, enhancing the contribution of forest to livelihood improvement, environmental protection and rehabilitation, creating more jobs and

contributing to national income. Forest is also the most important ecosystem in environmental protection in Viet Nam. However, most of natural forest ecosystems in Viet Nam are reduced sharply productivity and quality. To ensure the sustainable development and enhance the environmental - ecological values of forest ecosystem, propose that:

* For guidelines and policies and harmonization with international commitments.

First of all, it is necessary to have objective and accurate perception about the nature of forestry in which forest only may be protected and develop well if only it is used reasonably to bring benefits for all the related parties, especially, communities living in and near the forests. (Tran Van Con, Nguyen Xuan Quat et al. 2006).

- Complete policy system relating forest, mountainous areas and communities in mountainous area. In there, must ensure that evaluating objectively and reliably aggregate value of forests for forest products and environmental services, After that, There will are solutions to promote rehabilitation of the forest ecosystem types with high value in many ways.

- It is essential for forest policies to have a deep interest in the rights and participation of indigenous communities living near the forest. If lack of participation, there is inherent risk of any rehabilitation programs. Forest rehabilitation management and protection must bring adequate incomes for people to encourage them not to deforest or abet illegal loggers. (Tran Van Con, Nguyen Xuan Quat et al. 2006). In any cases, policies sharing profits from forest among related subjects, especially communities living near and in the forests need to be built to ensure justice and attract these subjects to actively participate in forest rehabilitation and management. (Tran Van Con, Nguyen Xuan Quat et al. 2006, Nguyen 2007)

- Viet Nam has participated in most of International conventions relating environment and environmental protection. Viet Nam has signed approximately 20 conventions on environmental or relating to environment (see the below table), and conducted the transferring these contents into building law and other legal documents relating forest rehabilitation and forestry such as: Law on protecting and developing forest, Law on biodiversity, Ordinance on mineral resources, Ordinance on plant

quarantine, royalties, etc. In the next time, Viet Nam needs to actively harmonize its policies with policy on managing tropical forest resources. It is also necessary to concern about building and implementing policies on promoting tropical rain forest restoration. And conservation, especially in the context of anti-climate change, they have been institutionalized by the mechanism to gain benefits from afforestation and rehabitation as CDM, REDD / REDD + ... (Phan Minh Sang 2014)

***Table 14. List of coventions relating forest resource management and protection signed by Viet Nam***

| Treaty's name | Award date |
|---|---|
| Convention concerning the protection of the world cultural and natural heritage, 1972 | 19/10/1987 |
| Convention on Early Notification of a Nuclear Accident (IAEA), 1985 | 30/10/1987 |
| Convention on Wetlands of International Importance, especially as Waterfowl Habitat (RAMSAR), 1971 | 20/9/1989 |
| **Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (IAEA), 1986** | 29/9/1989 |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora | 20/1/1994 |

| | |
|---|---|
| (CITES), 1973 | |
| Convention for the Protection of the Ozone Layer, 1985 | 26/4/1994 |
| The Montreal Protocol on Substances that Deplete the Ozone Layer , 1987 | |
| United Nations Declaration on environment and development, 1992 | |
| United Nations Convention to Combat Desertification (UNCCD), 1992 | 25/8/1998 |
| United Nations Framework Convention on Climate Change (UNFCCC), 1992 | 16/11/1994 |
| Convention on biodiversity (CBD), 1992 | 16/11/1994 |
| Cartagena Protocol on Biosafety | 21/01/2004 |
| Basel Convention On The Control Of Transboundary Movements Of Hazardous Wastes And Their Disposal (BASEL), 1989 | 13/3/1995 |
| Kyoto Protocol | 3/12/1998 |
| International Declaration on Cleaner Production | 22/9/1999 |
| Stockholm Convention on Persistent Organic Pollutants (POP), 2001 | 10/8/2006 |

* Enhancing Administration capacity

The structure of administering forestry sector has been built according to the complete system from the central

to locality. However, there still has been overlap among sectors in forest management and biodiversity. This overlap leads to a conflict between the related government agencies' interests (e.g., management of biodiversity is assigned to both the Ministry of Agriculture and Rural Development and the Ministry of Natural Resources and Environment), and sometimes it makes administration effectiveness reduced (tk). Government needs to revalue and clearly delimit clearly the role and function of these sectors by laws and sub-law document (tk).

The system of the communal forest officials and local forest rangers who perform forest management is extremely thin and do not have enough capacity to meet demand...

There still have been a lot of concerns about the corruption in the force managing forests, including forest rangers. In fact, the wage scale and treatment of the public administrative part in Vietnam is very low, not enough to encourage them to implement public service seriously and carefully. Vietnam needs measures reforming this problemsimultaneouslyimproving the sanctions against corruption in the law enforcement system and state management.

* Markets

- Wood demands, especially woodchips the regional economics have increased highly such as China, Korea and Japan is a very important factor to promote the development of planted forest in Vietnam. But the major objects of rehabilitation are ecosystem with the high value of environmental services and the ecosystems of tropical rain-forest. Currently the ability of providing forest products of Viet Nam natural is low since most natural forests in Vietnam are degraded forests. Therefore, the creation of a developed market and requital environmental services from forests is highly important to restore and maintain the tropical rainforest. In addition to the factors promoting the domestic market, such as customers' payment schemes for environmental services of government are hydroelectric, irrigation and water plants and ecotourism, Vietnam highly needs to participate in international market on carbon uptake by the CDM and REDD/REDD+ mechanism to get financial resource supplementing to rehabitation and sustainable forest management. However, to participate in this market, it is necessary for Viet Nam to have the systems of clear

policies and enforcement team of state's management office and business sectors need to be improved its capacity (tk).

Besides, in the next time, other market factors will have an important influence on natural forest rehabilitation and sustainable forest management may be:

- Price of forest environmental services is accepted by market (buyer and seller) and is enough attractive to maintain and develop natural forests
- Demand of major woodwork export market of Vietnam and Vietnam competitiveness with other countries. If Viet Nam's wood processing industry (woodwork) still continues to develop strongly, the huge wood demand will highly big while import wood is increasingly expensive and it do not create high value-added, leading to high domestic timber supply putting pressure on maintaining and developing sustainably of natural forest.
- Demand and product prices of industrial plants (rubber, coffee ...): in the past years, demand for rubber, coffee increase, the price booms, the profits from planting these tree is high, deforestation for

transfering these crops happens formidably and there is tacit acceptance of the authorities in a few time, some localities.

* Build approaching measure to create social equity:

The big forest owners in Vietnam now are mainly state units including the State Forestry Company and the Board of Management of the protection forests and special use forest. Holding the remaining areas of natural forest with the largest reserve, the areas of planted forests have good land and convenience for transport infrastructure, access more easily to capital, including preference capital, but the state-owned forestry companies are now the most serious loss unit while natural forest resource managed by them still have been degraded (de Jong, Do et al. 2006). Weak administration and the limitations of policies on managing forestry and forestry enterprises (e.g., Enterprises are not allowed to plan forest logging- natural forests logging must have quota while enterprises have forest management plan) make the companies not develop strongly to have greater contribute forestry (de Jong, Do et al. 2006, Pham, Moeliono et al. 2012, Phan Minh Sang, 2014).

Though recognized as a subject of forest management and forest allocation to managers, local communities still do not have enough legal status to manage, business efficiently assigned forest. Moreover, assigned community‘s forests are mainly degraded forests which need nourish in a long time for logging, so authorities cannot encourage them to actively participate in rehabitation, management (Clement and Amézaga 2009) .

Households are assigned small plots of forest land, mainly for reforestation. So, while revenues from payments for environmental services for natural forest are not big enough to attract them, the commercial plantation is still optimum plan. The small-scale households are often difficult to access to concessional resources for afforestation.

The private enterprises mainly with small scale (between 30-500 ha) are popular, obtain from buying land from assigned households or leasing state’s land, the majority of these enterprise also business planted forest with long term cycle quickly creating cash flow and profits (Phan Minh Sang 2014).

Thus, Building policies to ensure equity between the holders of forest management and ensure that the sustainable

recovery of natural forests is the core element to ensure the sustainable development of the forestry and rehabilitation. Because of relating to land and valuable resources in crowded countries like Vietnam, the state is very conservative in the privatization of the forestry enterprise. So equalization of forestry enterprises and improvement the efficiency of forestry administration, fair treatment for all holders of forest management is an important factor for sustainable forest rehabiliation.

In addition, a large area of natural forest is allocated to household for management and protection. There is the appropriate policy for this object that will improve forest quality, reduce illegal logging and factors degrading forest (Directorate of Viet Nam 2014).

## 5.2. National policies on forest rehabilitation and development

After performing two big programs: reforestation and rehabilitation including program 327 and project 661, Vietnam is continuing to implement the Plan of Forest Protection and Development in period 2011 - 2020, the next national program of the two above programs. This plan

focuses on enhancing forest quality and value-added in the forestry sector and the continuing recovery of exhausted natural forest by regenerated restoration measure (Vietnam Administration of Forestry, 2011, GoV 2012) . The below table is a number of specific objectives of the Scheme (GoV 2012):

Plans for 2020 gain targets:

- Increasing forest coverage up to 44-45%

- Regenerate restoration for 750,000 ha (mainly protection and special use forests)

- Afforestation of 2,600,000 ha of forest. In there, plant 250,000 ha of special use forests and protection; 1,000,000 hectare afforestation for production forests; and reforestation of 1,350,000 ha of production forest and reforestation 1,350,000 ha after logging.

- Reclamation of 350,000 ha for degraded natural forest

- Reach 15,100,000 ha of forest area

- Plant 500 million scattered trees

- Improve the quality of natural forests, the productivity of planted forest for production increased by 25% in 2020 compared to 2011

Forest plan from 2011 to 2015

+ Plant forest: 1,250,000 ha, including afforestation of 150,000 ha of protection forests, special use forest (average of 30,000 ha/year), afforestation of 500,000 ha of production forest (average of 100,000 ha/year) and reforestation of 600,000 ha (120,000 per ha / year) after logging;

+ Reproductive restoration: 550,000 ha, of which transition forest reproductive restoration for 350,000 ha of transition forest, new reproductive restoration of 200,000 ha;

+ Reclamation of degraded natural forests: 150,000 ha (average of 30,000 ha/year);

+ Plant dispersal tree: 250 million trees (average of 50 million trees/year);

+ Improve the quality of natural forests, production plantations increased by 10% in 2015 compared to 2011.

The government has proposed 09 solution groups to implement the plan, including: (i) Promote the propaganda, awareness-raising; (ii) Management, planning and forest land; (iii) Forest protection; (iv) Assign, lease forests; (v) Science and Technology and forestry extension; (vi) International Cooperation; (vii) Market; (viii) Build and implement projects, key projects; (ix) Demand for capital and mechanism for mobilizing funds.

For finance: Government builds the plan on expenditure of total capital needs serving Plan on Forest Protection and Development more 49,000 billion VND (≈ US $ 2.4 billions), in which14, 000 billion of the budget capital (≈US $ 700 millions) - accounting for 29% of total capital needs. The budget capital is mainly used to pay for the recovering and managing of protection forests and special use forests.

The government also decided to use and propose amendments to policies, legal mechanism to create a legal corridor for implementing Forest Protection and Development plan in period 2011 - 2020. From this decision and other related policy, Ministry of Agriculture and Rural

Development has approved the Scheme of Restructuring Vietnam, in particular that of many targets in order to achieve the overall targets of the Plan on Forest Protection and Development (GoV 2012, MARD 2013).

Comment on the proposed targets:

In general, the proposed targets under the Plan on Forest Protection and Development of the government are not too ambitious, so it is feasible for the Vietnam forestry to achieve. In case Vietnam still maintains the speed of economic growth and the needs of chipboard wood and carving wood markets do not suddenly decline for any reasons, the areas of reforestation, afforestation and planting scattering tree fully gained thanks to an important part from the thrust of the market. Proposed reproductive restoration plan is feasible because it is lower than the target of 327 programs and project 661. Productivity of forest plantation can improve by 10% in 2020 comparison with 2011 due to breeding, improved silvicultural technics and investment capacity of forest owners, including small-scale household or more and more big scale. However the purpose increasing productivity and quality of natural forests, for example, the

proportion of commercial timber is 75% of standing volume of the natural forests ?, is still a question

For policies:

Continue to apply a number of policies on forest protection and development with good effectiveness such as (i) The policies on forest investment and development under Project 661; (ii) Policies on supporting mountainous communities in foods to reduce, avoid slash and burn, deforestation; (iii) Policy on encouraging enterprises to invest in agriculture and rural areas.

Adjusting and supplementing policies on (i) Forest protection; (ii) Forest management; (iii) Assign and lease forestry land; (iv) Credit policy

Propose building new policies: These are new points showing the clear views of the government on the protecting and managing forest resources. In there, this program emphasizes the reformed directions in the near future, including: (i) Allow all the economic sectors to be protected, developed and used reasonably of protection forests; (ii) Remove quota in managing and logging forest products, manage forest owner under approved forest management

plan; (iii) Implement forest co-management mechanism for sharing responsibilities and benefits from forest management to local communities; (iv) Equalization of forest state's enterprises to improve the efficiency of management, business production (GoV 2012, MARD 2013).

Monitoring and evaluation: monitoring and evaluating mechanism for implementing the Plan on Protecting and Developing forest is not specified in the decision No. 57/QD-TTg dated in January, 2012 by the Prime Minister and government and decision No.1565/QD-BNN-TCLN of the Ministry of Agriculture and rural Development. However, it can understand that system of reporting, inspection and acceptance of works within the Plan Protection and Development of Forests in period 2011 - 2020 will be similar to this system of many other programs and projects of the government as Project 661, Afforestation of 5 million ha of forest. Regulations on reporting, monitoring and evaluation of governmental programs is usually quite tight. However, how the actual enforcement efficiency of these regulations is, is still a defenseless question? Public awareness: The information explosion has

a positive effect on raising the people's awareness of the forest value and the role of the good forest management of protection. Floods and droughts become serious because destroyed upstream forests were informed on the mass media so people are quite acquataint with the effects of deforestation. Deforestation, slash and burn or convert short-term or annual industrial crops have a big reason - the pressure of the people's livelihood.

Thus, continue the previous successful attempts in rehabilitation, Viet Nam government still continues to care deeply to rehabilitation, enhance the value of forest ecosystems by Planning Protecting and Developing forest for this period. However, rehabilitation and maintenance of natural forests has not been concerned on time to ensure that bring profits to all of the related parties. Moreover, up to now, in the legal documents relating to forestry and forest ecology, rehabilitation of forest landscape has not been mentioned. In a context that the benefits of forests, particularly tropical natural forests, are increasingly viewed in the value of ecology and environment, the rehabilitation and sustainable management of forest landscape are particularly important. It not only creates livelihoods for

people, but also built a beautiful forest landscape with the ecological- environmental functions to be ensured and maintained sustainably.

### 5.3. Towards the future

Like many other developing countries, Vietnam is under high pressure on economic development, livelihood improvement for mountainous farmers. For these reasons, policymakers tend to give great priority to the need of rapid economic development instead of paying much more attention on slow economic development combining with social – environmental balance. According to restructuring plan for the forestry sector in the next period, enhancing the added value of forests through its forest products is tightly focused on. Particularly, production forests with the function of providing forest products are major priority. Though Vietnam is one of the leading countries in formulating and implementing payment for forest environmental services, the plan of restructuring the forestry sector has yet to have a strong and clear orientation for recovery of rainforest ecosystems with relatively high ecological – environmental value (Phan Minh Sang 2014).In the short term, because of

the attraction of industrial trees with the high economic value, forest plantation of homozoic imported trees to increase the area of natural restoration forest is hard to be implemented. Therefore, well maintaining and managing natural forest protection is a great success. Nevertheless, natural forest of Vietnam is mainly depleted forest, degrading in both the terms of timber production function and biological, ecological diversity. Forests are strongly fragmented and divided, causing the impairment ofthe habitat of natural species.

- Introduction and implementation of silvicultural techniques with low cost to improve forest composition and boost the quantity of reproductive species.
- Reasonably balance between the value of production of forest products and the ability of providing ecological and environmental services of the forest ( for example, properly regulate coefficient payment for forest environmental services of forest types that is much more higher than payment for natural forest)
- Formulate coherent policies to enhance the access ability to international institutions about absorbing greenhouse gases in the forestry. (CMD, REDD)

## References

Ministry of Science, Technology and Environment (1998). National Environment Report 1998 – Deforestation and Forest Degradation.

Ministry of Science and Technology (2007). Red Data Book of Vietnam. Hanoi, Publishing House of Science and Engineering.

Ministry of Forestry (1984). Directive 29-CT / TU / 1984 " Promoting allocation of land and forest, enrich forest and organize business by the mode of Agro - forestry ". Ha Noi.

Ministry of Forestry (1985). Business agroforestry to promote labor potential of soil and resources. Hanoi, Agricultural Publisher.

Ministry of Agriculture and Rural Development (2006). Development Strategy Forestry 2006 - 2020. Ministry of Agriculture and Rural Development. Hanoi, Vietnam.

Ministry of Agriculture and Rural Development (2008). Circular guiding the rubber platation on degraded forest land. Hanoi.

Ministry of Agriculture and Rural Development (2011). Summary Report of the program: planting 5 million ha of new forest and the plan of Protection and Development of Forests 2011 - 20120. Hanoi.

Castrén, T. (1999). Timber trade and wood flow study, Vietnam. Regional Environmental Technical Assistance 5771 Poverty Reduction & Environmental Management in Remote Greater Mekong Subregion (GMS) Watersheds Project (Phase I) Asian Development Bank.

Forestry Department of Phu Tho (2010). Project Document " Demonstration capability of building Forest Restoration and Sustainable Forest Management in Vietnam". Phu Tho, APFNet.

Forestry Department of Phu Tho (2013). Final report of the project " Demonstration capability of building Forest Restoration and Sustainable Forest Management in Vietnam". Phu Tho, APFNet.

Clement, F. and J. M. Amezaga (2009). "Afforestation and forestry land allocation in northern Vietnam: Analysing the gap between policy intentions and outcomes." Land Use Policy**26**(2): 458-470.

de Jong, W., et al. (2006). Forest rehabilitation in Vietnam: histories, realities and future. Bogor, CIFOR.

Dinh, D. T. (2005). Forestry, poverty reduction and rural livelihoods in Vietnam. Ha Noi, Vietnam, Ministry of Agriculture and Rural Development.

FAO (2006). State of the world's forests 2005, FAO.

FAO (2007). State of the World's Forests 2007.

FAO (2010). Global Forest Resources Assessment 2010 - Vietnam country report, FAO.

GoV (1995). Decree 01/1995 "Land allocation for farming cultivation, forest production and aquaculture by state owned enterprises". Government. Ha Noi, Vietnam.

GoV (2012). Decision 57/QD-TTg on approval of the Forest Protection and Development Plan for the period 2011 - 2020. Goverment. Ha Noi, Vietnam.

Hoang, M., et al. (2010). Evaluate options to reduce emissions from all forms of land use in Vietnam - prepare for REDD +. Hanoi, World Forestry and Agriculture Organization.

Assembly Government (1980). Decision 95-CP on "Policy for development of the new economic zone". Hanoi.

Kaimowitz, D. and A. Angelsen (1998). Economic models of tropical deforestation: a review, Cifor.

Lamb, D. (2010). Regreening the bare hills: tropical forest restoration in the Asia-Pacific region, Springer.

Lamb, D. and D. Gilmour (2003). Rehabilitation and restoration of degraded forests, IUCN/WWF, Gland.

MARD (1998). Decision 175/QĐ/BNN-KHCN on promulgating "General outline of technical procedures on forest restoration by promoting natural regeneration combined with enrichment planting". Ministry of Agriculture and Rural Development. Ha Noi, Vietnam.

MARD (2007). Project of forest allocation and lease for the period of 2007-2010. Ministry of Agriculture and Rural Development. Ha Noi, Vietnam.

MARD (2013). Decision 1565/QĐ-BNN-TCLN on approving the “Forestry Sector Reform Proposal”. ministry of Agriculture and Rural Development. Ha Noi, Vietnam.

Meyfroidt, P. and E. F. Lambin (2008). "Forest transition in Vietnam and its environmental impacts." Global Change Biology**14**(6): 1319-1336.

Ministry of Forestry (1993). Decision 200/QĐ-KT on issuing "Norm of silvicultural techniques for timber production and bamboo forests". Ha Noi, Vietnam.

MoF (1991). Viet Nam Forest Sector Review, Tropical Forest Action Programme. Ha Noi, Ministry of Forestry.

Nguyen, H. N. (2007). Forest Rehabilitation in Vietnam. Keep Asia Green. D. K. Lee, IUFRO. **I - Southeast Asia**.

Nguyen Ngoc Lung (1998). System of forest management and forestry policy in Vietnam. National Seminar on sustainable forest management and forest certification. Ho Chi Minh City.

Nguyen Ngoc Lung (1998). "The issue of science and technology in the project of planting 5 million ha of new forest." Journal of Forestry9: 14-17.

Nguyen, Q. T. (2005). What Benefits and for Whom?: Effects of Devolution of Forest Management in Dak Lak, Vietnam, Shaker Verlag GmbH.

Pham, T. T., et al. (2013). Payments for forest environmental services in Vietnam : from policy to practice. Bogor, Indonesia, Center for International Forestry Research (CIFOR)**:** 78p.

Pham, T. T., et al. (2012). The context of REDD+ in Vietnam: Drivers, agents and institutions. Bogor, Indonesia, Center for International Forestry Research (CIFOR).

Phan Minh Sang (2014). Forest Restoration at Landscape Level in Vietnam, FAO.

Phung, T. B. and V. C. Le (1994). The effects of herbicides on vegetation in forest of South Viet Nam. The 2nd International Symposium "Herbicides in War. The long-term effects on man and nature", Ha Noi.

PreventionWeb (2014). "Viet Nam - Disaster Statistics." Retrieved 20 March, 2014, from http://www.preventionweb.net/english/countries/statistics/?cid=190.

Richards, J. F. and E. P. Flint (1994). A century of land-use change in South and Southeast Asia. Effects of Land-Use

Change on Atmospheric CO2 Concentrations, Springer**:** 15-66.

Sikor, T. (1998). Forest policy reform: from state to household forestry. Stewards of Vietnam's Upland Forests. Research Network Report Number 10. M. Poffenberger, Asian Forestry Network**:** 118–138.

Sikor, T. and P. X. To (2011). "Illegal logging in Vietnam: Lam Tac (forest hijackers) in practice and talk." Society & Natural Resources**24**(7): 688-701.

Sist, P., et al. (2003). "Towards sustainable management of mixed dipterocarp forests of South-east Asia: moving beyond minimum diameter cutting limits." Environmental Conservation**30**(04): 364-374.

To Dinh Mai (1987). These issues need to innovate for construction and development of forest resources and forest activities. Hanoi, Publishing House of Science and Social.

Directorate of Forestry (2013). Figures of forest status in 2012. Hanoi, Vietnam.

Directorate of Forestry (2014). Report of Payments for forest environmental services. Hanoi.

General Statistics Office (1990-2013). Statistics of area planted industrial trees. Hanoi.

Tran Van Son, et al. (2006). Restoration of degraded forest ecosystems - Overview of results of research and development in Vietnam Hanoi, Statistical Publishing House.Trần Văn Con, et al. (2006).

Vietnam Administration of Forestry (2011). Forest Protection and Development Plan. Ha Noi, Vietnam.