

Ministry of Agriculture and Rural Development

Vietnam Sweden Mountain Rural Development Programme 1996 - 2001

**Assessment of forest cover and vegetation
of the central parts of the northern highlands 1989-1998**

Forest inventory and planning institute - FIPI

Forest resources and environment centre - FREC

Dr. Nguyen Phu Hung et al.

December 1999

CONTENTS

	Preface	7
1.	General	9
2.	History	11
2.1.	1974-1986	11
2.2.	1986-1991	11
2.3.	1991-1996	11
3.	Contents	13
4.	Method	15
4.1.	Opinions and suppositions	15
4.2.	Method of data creation	15
4.2.1.	Data on socio-economic conditions	15
4.2.2.	Map system	16
4.3.	Map digitalizing (coding)	19
4.3.1.	Method for map digitalizing (coding)	20
4.3.2.	Process of analysis and calculation	21

5.	Physical and Socio-economic conditions	23
5.1.	Physical conditions	23
5.1.1.	Geographical position of the project area	23
5.1.2.	Topology and Position	23
5.1.3.	Climatic and hydrological conditions	24
5.1.4.	Soil and site conditions	26
5.1.5.	Forest vegetation characteristics	26
5.2.	Social conditions	27
6.	Research findings	29
6.1.	Summary of forest changes during 1976-1989 of the Centre	29
6.2.	Area change (1989-1998)	29
6.2.1.	1989-1993	30
6.2.2.	1993-1998	39
6.2.3.	1989-1998	47
6.3.	Change in forest cover and vegetation both inside and outside of the project area	54
6.3.1.	1989	54
6.3.2.	1993	55
6.3.3.	1998	56
6.4	Temporarily identification of changes	57
6.4.1.	The change of policies of forest development and mountain rural development	57
6.4.2.	Impacts of natural conditions	60
6.4.3.	Impacts of social conditions	61
6.4.4	Negative Impacts relating to forest changes	62
7.	Conclusions and Proposals	65
7.1.	Conclusions	65
7.2.	Proposals	65
8.	Literatures	67

List of Interviewed Persons During Field Visits to 5 Provinces

Name	Position	Organization
1. Lenh Xuan Cuong	Director	Ha Giang Forest Protection Branch
2. Duong Viet Nghia	Staff	Forest management and protection section Ha Giang Forest Protection Branch
3. Hoang Van Tuyen	Staff	Forest management and protection section Ha Giang Forest Protection Branch
4. Nguyen Van Trach	Director - Coordinator	Ha Giang DARD
5. Nguyen Thi Tuoi	Vice director	Planning section Ha Giang DARD

6. Mr. Dau		Tech section, Ha Giang Branch of Forest development
7. Giang Mi Pao	Village head	Suoi Dong village
8. Giang Mi Lenh	Farmer	Suoi Dong village
9. Mr. Xuan	Farmer	Viet Lam, Vi Xuyen, Ha Giang
10. Nguyen Ngoc Xuyen	Acting Chairman	Viet linh commune Bac quang , Ha giang
11. Bui Hai Ha	Vice director	Tuyen Quang Forest protection Branch
12. Mrs. Binh	Staff	Tech section, Tuyen Quang Forest protection Branch
13. Mr. Quoc Anh	Staff	Tech section, Tuyen Quang Forest protection Branch
14. Mr. Quyet		Coordinator MRDP Tuyen quang
15. Vu Do	Director	MRDP Tuyen quang
16. Mr. Nong	Director	Chiem Hoa enterprise - Tuyen Quang
17. Mr. Ky	Head	Forest inventory brigade Chiem hoa enterprise - Tuyen Quang
18. Mr. Bé	Head District	Forest Protection, -Thanh son, Phu Tho
19. Mr. Toan	Vice head	District Forest Protection, -Thanh son, Phu Tho
20. Mr. Viet	Vice head District	Forest Protection, Thanh son, Phu Tho
21. Pham Van Hien	Vice head	Sub branch of forest development and protection - Phu tho
22. Mrs. Hanh	Coordinator	MRDP Phu tho
23. Luong Van Thang	Vice head	Sub branch of Forest protection - Phu Tho
24. Mr. Vinh	Head	Forest protection sub branch - Phu Tho
25. Le Ba Dinh	Head	District forest protection Bac Ha, Lao Cai
26. Mr. Toan	Vice direstor	DARD Lao Cai
27. Mr. Phong	Head	Planning section DARD Lao Cai
28. Mr. Vuong	Director	Agri-forestry inventory and designing institute - Lao cai
29. Mr. Tien	Staff	Agri-forestry inventory and designing institute - Lao cai
30. Mr. Vien	Vice head	Lao cai branch of Forest protection
31. Mr. Thinh	Staff	Forest Management and Protection Lao cai branch of forest protection
32. Vang Van Trang	Chairman	Lau thi ngai commune, Bac Ha Lao cai
33. Mr. Thanh	Head	Extension station Muong Khuong Lao Cai
34. Mr. Xuan	Staff	Extension station Muong Khuong Lao Cai
35. Do Duy Phien	Chairman	Ban Lau commune, Muong Khuong, Lao cai
36. Chau Duc Long		Vice chair Ban Lau commune, Muong Khuong, Lao cai
37. Luc Thuong An	Staff	Ban Lau commune, Muong Khuong, Lao cai

38. Mr. Chinh	Director	Bat Xat enterprise Lao cai
39. Mr. Vui	Director	Van Ban Lao Cai (KIEM LAM)
40. Mr. Chau	Staff	KIM LAM Van Ban Lao Cai
41. Mrs. Le Thi Hiep	Coordinator	MRDP Yen bai
42. Mr. Hanh	Head of Forestry section	DARD Yen Bai
43. Mr. Khai	Head of Planning section	DARD Yen Bai
44. Mr. Cuong	Vice director	Agri-Forest inventory and designing institute - Yen bai
45. Mr. Duc	Coordinator	MRDP Lao Cai

PREFACE

In August 1999, a contract was signed between the Program Board Office of MRDP and the Forest Resources and Environment Centre (FREC) - FIPI to start a research on the change of forest cover and vegetation of the Program area in the Centre of North Vietnam based on the data collected from satellite images namely SPOT and LANDSAT TM 1/250 000 and 1/1000 000 scales.

Having prepared, the working group started with information collection, then images and photo interpretation for draft mapping. Having got draft map, 3 field visits to 5 provinces Lao Cai, Yen Bai, Phu Tho, Tuyen Quang, Ha Giang and a 10 day visit was spent on each province. All information collected from field visits were used for map updating. In November 1999, all maps finished and transferred to base map 1/250 000 and 1/100.000 UTM.

The digitalizing was done in early December 1999, all data were processed for final report.

The study was carried out within a short time, information was 10 years earlier that is why data and materials should not totally satisfied our wish. Also, the study happens in a large and complex area, forest and the vegetation are not concentrated, they are distributes in small areas, and the resolution of the images are of 33 x 33 m for the delineation of an area of at least 25 ha. Due to these constraints, the accuracy of the information from images is limited. But it is possible to say that efforts made by the working group to obtain the seen findings are satisfied and that also shows the possibility of using satellite images to study the changes of forest cover and vegetation.

Authors are longing for the contributions of experts from internal and external sector for this report.

Hanoi, December 19

Group of Authors

1. GENERAL

The Centre consists of 5 provinces Lao Cai, Yen Bai, Phu Tho, Tuyen Quang and Ha Giang, its natural land area is 3,195,500 ha, out of which 837,287 ha is covered by forests (natural forests 670,286 ha and plantations 136,751 ha). Non-forested area amounts to 1,403,268 ha. This is the home of many minority ethnic groups such as H'mong, Dao, Tày... they have their own cultural, social and historic tradition, but the living standard as well as their consciousness and knowledge are too low particularly those live in the remote areas.

From 1991 up to now this Area gets lots of supports from the Gov. of Sweden with 2 big projects such are:

FCP 1991-1996.

Social forestry: Afforestation and forest protection Project, and People and Forest Project, Social Forestry Project, Farm Level Project and many others. During this period, many policies of Gov. came into being for rural development such as Land Laws, Actions for Development and Protection of forest resources , Land Allocation, 327 program, 773... one thing of most significant is that market information was dealt with by this project.

MRDP 1996-2001.

The program is happening in 259 villages, 74 communes, 18 districts of 5 provinces. The focus of the program is to create an environment in which poor households of the upland communities can get benefits from diversified, sustainable economic activities of the project such as production, processing, services in the situation of market economy appearing in the area. The major components of the project:

1. Land allocation, Land use planning and forest management and also joint forest management
2. Agri-forest extension and applied research
3. Rural finance services (Savings and Credits)
4. Market information and rural development.
5. Human resources development.
6. Gender balance.
7. Internal and external information.
8. Strategy research.

2. HISTORY

The Forestry Sector of Vietnam has had relation with Sweden since 1970s. The process of co-operation can be divided into 3 stages:

2.1. 1974-1986

Bai Bang Pulp and Paper Mill Project.

2.2. 1986-1991

Establishment of the Raw Material Area for Bai Bang Pulp and Paper Mill.

2.3. 1991-1996

Forest Development for 5 provinces

3. CONTENTS

1. Reconstruction of map system of forest cover and vegetations in the Centre 1/250 000 scale during 1989, 1993.
2. Construction of new map system of forest cover and vegetation in the Centre of 1998 1/100.000 scale.

3. Digitalizing total map system of 3 periods of time.
4. Overlaying maps of 3 periods of time to assess the changes of forest area, forest types and vegetations.
5. Processing collected data through overlaying maps of 3 periods of time .

4. METHOD

4.1. Opinions and suppositions

Opinions and suppositions can be summarized as follow:

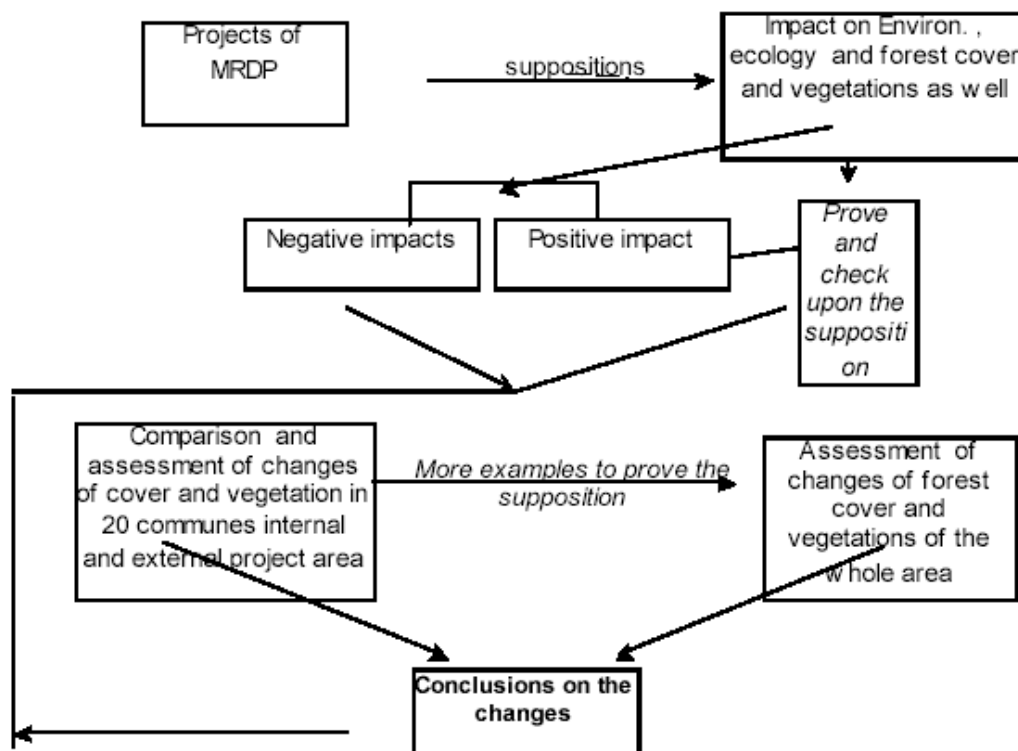


Fig.1. Chart of the methodology

4.2. Method of data creation

4.2.1. Data on socio-economic conditions

a. Method of data collection

+ Data on forest resources:

All reports made by Departments of Agriculture and Rural Development and Branches of Forest Protection in the Project area are collected and classified by the following indications: What is the report used for? On which period of time? Who makes it? To whom it is sent?... to analyzes and compare for the aim of finding out a set of data on the changes of forest resources. These data are used as bases to compare with data taken from images for correction of big errors that may occur during data creation from images.

+ Data on hydrological conditions:

These data are of least changes, that is why they are used immediately after collection in the project area.

+ Information on socio-economy:

Data on ethnic groups and population are taken from new material after the national census on 1/04/99. They are of more significant than the old ones. The development of economy of provinces and districts in the project area is collected from districts and provinces information. Due to objectives of the report and finance limit so recheck is not performed.

b. Method of data processing

All collected data are analyzed by experts to check and compare in order to discover errors that may commit during the collection. Data considered to be best are presented in the form of tables and diagrams.

4.2.2. Map system

a. Collection of maps being used locally

All being used maps locally are fully collected for use to support photo interpretation and mapping in the office. The study area is more than 3 million ha that is why the possibility of field checking for interpretation of 1998 is anyhow limited, that is to say that maps constructed locally contributes to the increasing map accuracy formed by photo interpretation.

For this study, an indispensable requirement is that the reconstruction of map system of the years 1989 and 1993 for the whole area, field checking for these maps is not feasible, so the collection of old maps from old periods contributes to the creation of old materials of the 2 mentioned periods of time.

b. Processing the concerned map system

The collection of old maps from localities should be closely connected to the assessment of this map system. To assess the old maps it is necessary to connect 2 information systems. (1) Local information and (2) Image and aerial photo information. Local information is collected by means of interview local experts, who ever used the map system. Their ideas are noted then summed up for comparison and primary assessment of real values of each map in previous periods, and it is a valuable material for checking maps constructed from images Landsat TM and SPOT 1/250.000 scale in the office.

c. Collecting, recovering map of forest cover and vegetation - 1989-1993

To assess forest changes in different periods of time the construction and re-creation of forest cover map and vegetation are of greatest importance. Forest cover maps and vegetation during 1989, 1993 are re-created from 1989 and 1993 Landsat TM 1/250.000 scale based on the classification system agreed upon in the contract prepared by FREC and MRDP. Results of old photo interpretation are checked and compared with maps collected from localities.

d. Construction of forest cover and vegetation maps for the Centre - 1998

Forest cover map is constructed from SPOT 1/100.000 of 1998 in connection to SPOT 1/250.000 supplied by joint project - FIPI and Japan. FREC experts of photo interpretation in the field check Forest cover and vegetation map - 1998. Transects for field check are designed to ensure that they can cover all natural ecological zones and human ecological zones in the project area as well. The transects also cross concentrated forests and forest vegetation and transects cover the whole project area .

The transects go through

- different climatic zones
- different topographic types and elevations
- different main ethnic groups with different land use and forest use
- more than 70% of districts in the project area

Beside the checking by transacts, maps of 20 communes collected were used for this checking, by means of supplementing, comparing the new information with the ones taken from images as well as ground information collected previously.

+ The classification based on the contents of the contract:

I. Natural forests

1. Timber forests

2. Bamboo forests

II. Plantations

III. Mosaic

IV. Swidden land

V. Land with scattered trees

VI. Land with cash crops and fruit trees

VII. Other land

General concepts on forest types mentioned above:

I. Natural forests:

Timber forests:

According to FAO this forest type defined here is that those timber vegetation ecologies with the coverage of 0.1, the height of timber species is at least 5m.

Bamboos:

Defined as a status of 70% of bamboo species in the composition.

II. Plantations:

This is a man made one and covered by more than 70% of timber species. The composition consists of Eucalypt, Acacia spp. Styrax, Manglietia glauca, Pine...

Mosaic:

Land planted with cash crops, forest gardens as well as open land with the size of less than 25 ha lying in between forest sites.

Fixed and shifting swidden fields:

Used for agriculture production 1 or 2 crops annum, or land covered by grasses, bushes but it will be used for agriculture crops in the near future.

Bushes and scattered trees:

They are vegetation compositions in which timber species are shorter with $0.5m < H < 5m$.

Cash crops and fruit trees :

Tea, rubber, oranges and mandarin ...

Other lands :

Consisting of specialized land for dwelling, roads, ponds, irrigation fields in the low areas and terraces,

pastures, grass land ...

The final maps obtained are of high accuracy, but due to certain constraint of images as the images are of small scale 1/250.000 with the theoretical resolution of 30X30m, that results in difficulty for the differentiation of forest types or vegetations of small sizes. However the size for delineation of at least 25 ha, and in the project areas there are many types of fruit trees, cash crops and the plantations scattered as well as the newly planted ones that is why it is very difficult to get the desired accuracy.

In fact, the difficulty for differentiation where forest recovered after slash and burn practice is, where plantation is, fruit tree sites and plantations often occurs in the project area particular the areas around villages, both sides of roads... So mistake between forest types is unavoidable in photo interpretation.

4.3. Map digitalizing (coding)

The software for digitalization chosen is ARC/INFO 3.5. developed by US Environment Research Organization. It allows to identify the input parameters to control the accuracy as follow:

Snap distance allows setting connected distance automatically Editdistance establishes distances that allows selection of objects in the process of correction.

Weed establishes the minimal distance of the vectors.

Grain sets the distances.

FIPI has the copyright of ARC/INFO 3. that has may super usages: Good topology structure, overlaid processing on vector base with high accuracy ... During processing it is possible to joint the properties of space and non-space of the objects.

The output consists of 2 map types: Map and data. Maps are compiled and decorated by Mapinfo 5.0. Data are processed by Visual Foxpro 3.0 and Microsoft Excel 97.

Mapinfo 5.0 has many advantages for compiling map: many colors, patterns, symbols ... automatically designs and prints out in small sheets .

Visual Foxpro 3.0 in connection to Microsoft Excel 97 can process great and complicated database.

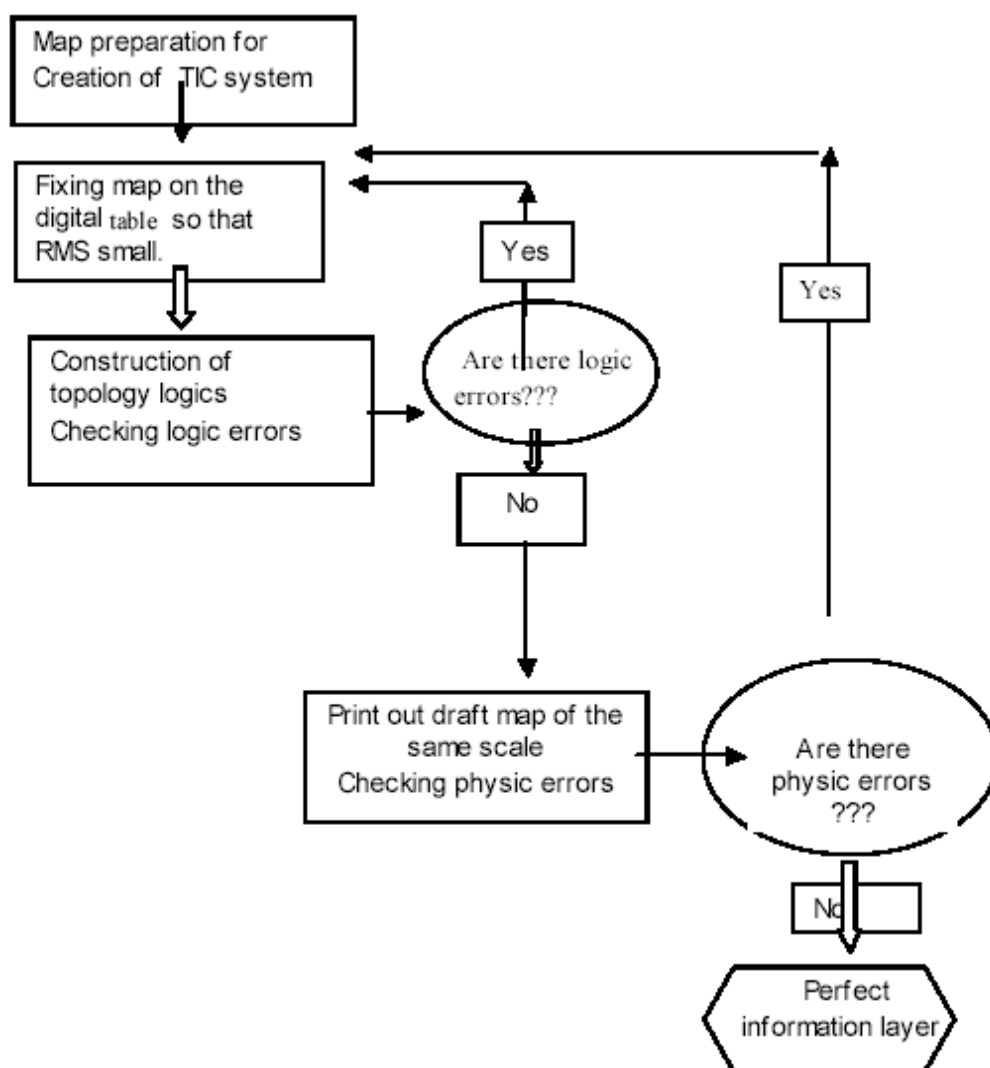
4.3.1. Method for map digitalizing (coding)

All collected maps are corrected, supplemented by a system of reference on the basic of topographical map. Boundaries are controlled so that all are the same. It is very important for later correction and processing. The TIC system of controlled points are formed on the basic of different maps to register coordinators in the computer. Digitalizing is done by means of laying paper maps on digitalized map with the resolution of 1440 line/inch then the operator will use the arrow of the table for digitalization. During digitalization objects are coded and connected to the property of non-space. Objects can be seen are : roads, zones, points and each object in each information layer is stored as a layer or coverage.

Information layers are checked on their logic, and topology structure constructed in ARC/INFO will help check the missing objects or objects coded repeatedly. From which users can find out errors and correct initially.

Information layers are digitalized and perfected by correcting errors. Then, initially print out map of the same scale of the base map. The primary map is overlaid and compared with base map and physical errors are checked. (label, name, missing or surplus of objects...)while digitalizing, marking theses errors and return to ARC/INFO for correction and reconstruction of topology structure. And the complete information layer is obtained.

Fig. 2: Regulation for digitalizing



4.3.2. Process of analysis and calculation

The perfect information layers are overlaid depending on use. ARC/INFO is used for overlaying by means of vectors overlaying, that needs more time but higher accuracy obtained. Each information layer is perfected after the topology structure is finished there will a database which connects the properties of space and non-space. The process of overlaying 2 information layers will create new information layer which contains information of both mentioned layers and a database is also created based on the connection of 2 databases.

From database of synthetic layer information, the method of multifactor matrix construction is applied to create matrices by groups of factors

Notes: Data here are processed by Foxpro and EXCEL, so when rounding the figures, errors may be equal to couple of Ha. That why the figures are not 100% wished.

5. PHYSICAL AND SOCIO-ECONOMIC CONDITIONS

5.1. Physical conditions

5.1.1. Geographical position of the project area

It consists of 5 provinces: Vinh Phu, Tuyen Quang, Lao Cai, Yen Bai, Ha Giang ,3.2 million ha. It is located in

both east and west of North VN. 50km and 300km away from Hanoi.

- 104°20' to 105°43' East longitude.
- 20°55' to 22°46' North latitude.

5.1.2. Topology and Position

It is situated in the East of Hoang Lien Son mountain bearing all topographic terrain types in Vietnam. The west boundary is Hoang Lien Son with the highest peak of Fansipan, the high mountain area belongs to Sapa, Than Uyen and Van Ban.

Medium and low mountain areas consist of: Luc Yen, Van Yen, Tran Yen districts (Yen Bai) Bac Quang (Ha Giang); Chiem Hoa, Ham Yen, Yen Son, Son Duong (Tuyen Quang); Thanh Son, Yen Lap, Tam Dao (Phu Tho)

The terrain is strongly dissected by mountain ranges lowering from north to southeast, they are Con Voi mountain in between Luc Yen and Van Yen with peaks called Nui Cai (1450 m), Nui Ten (1022 m), which forms a mountain range running from Khanh Hoa commune (Luc Yen) to Minh Bao commune (Tran Yen). In the north - Tay Con Linh range, east - Cham Chu in between Chiem Hoa and Bac Quang, highest peak - 1587 m. The southeast is bordered by the North delta with Tam Dao range, highest peak - Mu Yen 592 m.

Middle area : Districts of Yen Bai and Phu Tho. Mainly low and medium hills - 50-200 m, sloping 20°.

Many micro climatic zones. For some of the districts, it is difficult to access as Sa Pa, Than Uyen (Lao Cai) Mu Cang Chai (Yen Bai).

5.1.3. Climatic and hydrological conditions

5.1.3.1. Climatic conditions

Tropical monsoon climate of North VN. Due to different topographical conditions so it forms different micro climatic zones. It can be divided into 3 climatic zones namely high mountain, low and medium, and hilly climatic zones.

a. High mountain climate

Consisting of high mountain districts with average elevation of 700 m such as Bac Ha, Muong Khuong, Sa Pa, Mu Cang Chai, Hoang Su Phi... Winter temp. may go down to < 2°C. Somewhere - under 0°C.

b. Medium and low mountain climatic zone

Consisting of districts in the North and Northwest (Ha Giang, Tuyen Quang, Lao Cai, Yen Bai.)

- It is colder in Winter than the Northwest and the Northern Delta, the average lowest temperature in Tuyen Quang is 15,3°C, Lao cai 16°C. Due to the affect of the Northeast wind and the mountainous terrain so the lowest temp. in Winter is 2°C (Bac Quang); 2,4°C (Tuyen Quang), in valleys there has often been frost, the range of temp. between day and night is great.
- Sunny hours: The Centre area is lower than some of other areas in Vietnam such as the Northeast and Northern Delta, for example Van Chan - 1564 h/year; Yen Bai - 1399 h/yr comparing to Lai Chau 1825 h/yr; Son La 1983 h/yr.
- Hot wind from Laos: This wind comes from Laos through Lai Chau, Son La, Hoa Binh, but it is not as critical as other areas. The west of Yen Bai is more affected than the north of Tuyen Quang and south of Ha Giang (Yen Bai - 9 day/yr. while Lai Chau 16 day/yr.; Ma River 22 day/yr.; Yen Chau 20 day/yr.)
- Typhoon: The area seems not to be affected by typhoon but whirl and hail sometimes happen in Summer.
- Rainy season: Concentrates in June, July, August particularly in Bac Quang rain starts from April to Sep. with very high rainfall, it may reach 3.6 mm/minute or 100-200mm/day sometimes 400mm/day.
- Drizzle: Drizzle often happens in this area. Yen Bai - 51.1; Hoa Binh 22; Son La 8.6. It is advantageous for the increment for vegetations and recover of the ecosystem of the area.

c. Middle area climate:

This zone consists of Tuyen Quang, Yen Bai and Phu Tho. In Winter and Spring sunny days are less but foggy and drizzle, the temp. is low in Winter with long cold days. Rain concentrates most in July, Aug., Sep.

- Temperature: The average T. ranges from 22-23⁰C. The coldest month - 15⁰C, hottest may be 30⁰C (Phu Tho.)
- Rainfall: Averagely 1250mm to 1823mm yearly. The average highest rainfall of a month - 352mm in Tuyen Quang.
- Average humidity: Phu Tho - 83%, Tuyen Quang - 85% Thac Ba - 86%.
- Wind: In Summer the southeast wind blows from April to Oct. and the northeast wind from Nov. to March.

5.1.3.2 Hydrology

The area is located in the 5 river basins : Song Hong, Song Lo, Song Gam, Song Chay, Song Day.

- Song Hong or Song Thao springs from China, running northwest-southeast - 1126 km, 500 km in Vietnam. the average slope of the river bed is 0,23 m/km. Total basin area to Viet Tri is 143.700 km². The average water volume yearly is 4500-5500m³/second, Modul flow 16-16,5lit/s/km², but changes unevenly. Alluvium of the Red river (Song Hong) is rich in nutrient and mineral, which forms fertile planes along the river. There are 100s of rivers in the basin of the red river, Ngoi Hut - 40 km, Ngoi Thia - 83 km, Ngoi Lao - 53 km, Ngoi Gianh - 40 km, Song Bua - 80 km etc. Total length of river in the Centre area can be used for transport is 400 km. This is advantageous for transport of materials but advantageous for forest destruction.
- Song Lo springs from China, running northwest-southeast, with basin area of 22,600 km². The average yearly water level in Vu Quang - Doan Hung district is 1300 cm, highest- 1954 cm, lowest - 1130 cm. Song Lo is formed by 100s of springs among them are:
 - Song Con - 68 km, Song Bac - 36 km, Ngoi Sao - 54 km and total length can be used for transport is 240 km.
- Song Gam - from China, running through the Centre in districts of: Bac Me, Na Hang and Chiem Hoa and joints Song Lo in Nui Cung mount, with total length of 217 km.
- Song Chay springs from Tay Con Linh mount, running by northwest-southeast and joints Song Lo in Doan Hung.
- Song Day springs from Cho Don- Bac Thai, pouring into the project area and joints Song Hong in Viet Tri.

Due to the terrain all rivers running through the project area are deep, steep advantageous for transport but disadvantageous for forest protection.

5.1.4. Soil and site conditions

The Centre is the concentration of many small valleys: the valleys of Song Thao, Song Chay, Song Lo, Song Gam and Pho Day river and dissected by rivers and high and medium mountains running parallel by northwest-southeast such as Phan Si Pang, Pu Luong, Tam Dao, Phia Piooc, Tay Con Linh, and low mountains. The area consists of the following soil groups (Nguyen Van Khanh):

- a). High mountain humus Alite : This group is dominant in area, poor fertility, thin soil layer, less use in agriculture production.
- b). Humus Ferralite: concentrates most in the east of Hoang Lien Son, Con Voi range and Phia Piooc - Tam Dao. This soil types is good for fruit trees (Bac Ha, Muong Khuong, Quan Ba.)
- c). Ferralite: Cover the most area of the Center concentrating in the mountain foot, river valleys and low hills. The valley of red river covers the most of Ferralite, running from Bat Sat district (Lao Cai) to Viet Tri (Phu Tho).
- d) Alluvium along river sides: Good soil group, concentrating in Thao river, Red river and the down stream of Song Lo, and Pha Day.
- e). Swamp soil: covers a rather large area in Phu Tho, Yen Bai and part of Tuyen Quang. Most of this soil type is improved for paddy, but the productivity is not regular particularly when forest is badly destroyed
- f). Beside these 5 soil groups there are other types with small area.

5.1.5. Forest vegetation characteristics

Vegetation is very diversified located in different elevations: high, low mountains and valley.

- The northern part of the Centre is of > 700 m, with tropical rain close evergreen forests with Gie (*Fagaceae*), Re (*Lauraceae*), Moc lan (*Magnoliaceae*), oc cho (*Juglandaceae*), Sau sau (*Hamamelidaceae*), Sa moc (*Taxodiaceae*) ... Besides, there are many valuable medicinal species as HuyŌn SŌm, §«ng SŌm, Tam ThĒt, Ngŏ Gia Bx, §ç Trăng, Sa nhŌn etc...
- The center of the area, < 700 m, dominated by close evergreen forests with: DÇu (*Dipterocarpaceae*), GiĀ (*Fagaceae*), Xoan (*Meliaceae*), Sau sau (*Hamamelidaceae*), DŌu t»m (*Moliaceae*) ... in S«ng L«, S«ng GŌm basins (Tuyen Quang, Ha Giang and Yen Bai.)
- Forest on lime stone mount: Dominated by some the compositions of forest such as NghiŌn (*Burretiodendron hsienmu*), Trai (*Garcinia fragraoides*), accompanied by such as §inh Thèi (*Markhamia sp.*), Vmng Kiªng (*Nauclea purpurea*) ...
- Secondary forests (Bamboo, exhausted timber forest, savan bushes): at the elevation of 100-700 m with bamboo compositions mixed with timber.
- Man made compositions: that create *mosaic* in the low mountains used for pulp industry such as Styrx, Manglietia glauca, Eucalyp, Acacia mixed with cash crops such as Tea, mulberry .

5.2. Social conditions

The study area consists of may ethnic groups: Kinh, Hm«ng, Th,i, Mēng, Dao The distribution is not even. Ha Giang, Lao Cai have the least, the average density is 70-90p / km².

Agriculture production is dominated, or over 90% of the population are tillers. In 1997, total agriculture production is 731,622 ton of food (rice equivalent), or 20 kg/person/month.

Paddy is the most important one, but the production is low, say 2-3 ton/ha/crop.

Production of other crop in general is not high.

Shifting cultivation, slash and burn practice are rather popular and crops rely on rain water mostly. Table 1. shows the unstable rate of swidden land and agricultural land . Poor techniques and low living standards.

Transportation, health, education, culture, information issues are improved, however poor. Social illness is critical (drug addiction ...) which prevents the development.

Transportation: The road, water, rail transport system exists in the area. The average density is 2,73 km/ km². With the support from Sweden the system is improved but still not good enough.

Culture and Information:

This system is being invested by the GoV. Radio, television stations exist in all provinces. Receiving radio and television stations appear in most of the districts of the 5 provinces. The information system is step by step improved and upgraded with modern equipment at district level. To certain extent commune level is engaged to modern net.

6. RESEARCH FINDINGS

6.1. Summary of forest changes during 1976-1989 of the Centre

In 1992, within the National Forest Resources Change Inventory Programme 1991-1995". FREC - FIPI carried out the survey on forest resources change of the Centre for period 1976-1990. It can be summed up as follow:

1976-1990, due to the centralized policy, and due to the demand of timber and other NTFP of the post war time... so forest resources were over exploited resulting in losses of forest area, quality. Within 15 years forest area of the Center reduces 36.7%, or 2.4%/year. Yen Bai, Ha Giang (2.7%) highest, Tuyen Quang & Phu Tho (1.9%) lowest. While the area of open land increases suddenly (32.7% and 31.5%).

The situation of this change is very complicated. 58.6% of forest get lost while the recovered area is 21.9%. The forest quality reduces seriously. The area of rich and valuable timber forest reduces greatly while the area of mixed forest (timber + bamboos), bamboos with low economic values increases significantly (converted from timber forest).

The study shows the negative changes both area and quality during 1976-1990 of the Center as follow:

- Uncontrolled and over exploitation resulting in exhausted status
- Population increasing, demand of food, firewood increasing
- Forest fires.

Positive reasons that affect the changes of forests in the Center during 1976-1990. That are: Afforestation in particular afforestation for pulp industry.

6.2. Area change (1989-1998)

Data obtained from processing of 3 forest status maps during 1989 to 1998 , increasing in area can be seen significantly - 17,6% (1989) 6,2% more in 1998. Area of plantations and timber forest covers the most.

Table 1: Changes in forest types in the Centre (ha)

Category	1989	1993	1998
Timber forest	474951	509048	570407
Bamboos	67344	84555	99678
Plantation	18439	20889	136231
Mosaic			30686
Swidden land	316585	323340	419173
Scattered trees	1721122	1661806	1405104
Cash crops	7008	7008	24057
Others	590055	588857	510182
Total	3195504	3195503	3195518
Forest cover	17.5%	19.2%	26.2%

Table 1 shows the detailed change of forest types and vegetation. Reason of increasing and reduction are presented for each period of time.

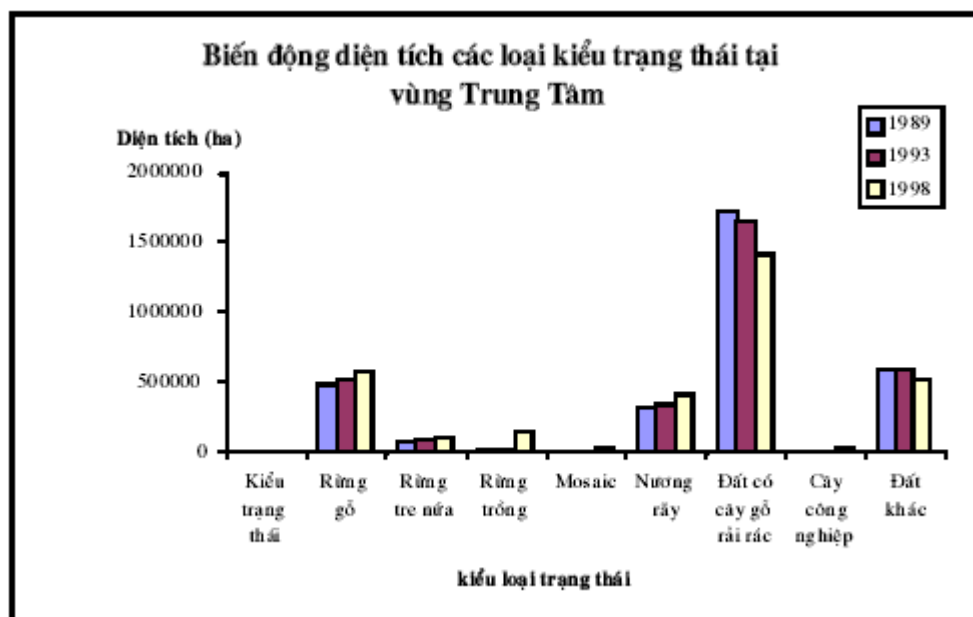


Fig. 3. Changes of area and vegetation types during 1989-1998

6.2.1. 1989-1993

a. Changes in forest area and cover of the whole area

1989 - 1993 Vietnam meets with great economic difficulty. After the Communist party Congress in 1986 new economic orientation is decided for the development that is market economy instead of the former one. There is land law during 1989-1993 but not expanded to local level. So human beings' encroachment to forest is unavoidable.

Table 2. Changes of area and vegetations during 1989-1993

:ha

Forest and vegetation type	1989	1993	Change (ha)	%
Timber forest	474951	509048	34097	7.2%
Bamboos	67344	84555	17211	25.6%
Plantation	18439	20889	2450	13.3%
Scattered tree	316585	323340	6755	2.1%
Land - scattered trees	1721122	1661806	-59316	-3.4%
Cash crops	7008	7008	0	0.0%
Others	590055	588857	-1198	-0.2%
Forest cover	17,5	19,2		
Total	3195500	3195500		

Significant changes can be seen in this period (table 2) more than 50,000 ha of man made forest, bamboos planted or regenerated resulting in reduction of timber forests. The change in area with scattered trees is not high (3,4%) but its absolute value may reach to 60,000 ha. The cover increases from 17.5% to over 19.2%. Bamboos area increases significantly say 5%, and plantation as well by various reasons but in the main

investment is. Local people have not got enough to invest to afforestation but their consciousness is more important. Table 3 shows the change of forest types vegetations of the whole area.

Table 3. Changes of forest types and vegetations - 1989-1993

:ha

	1993							
1989	Timber	Bamboo	Plantation	Swidden	Scattered	Cash crop	Other	Total
Timber	474717			177	57			474951
Bamboo	109	66964			272			67344
Plantation			18439					18439
Swidden	185	1707	300	313462	931			316585
Scattered	32840	15884	1101	9700	1660547		1049	1721122
Cash crop						7008		7008
Other	1197		1048				587809	590055
Total 1993	509048	84555	20889	323340	1661806	7008	588857	3195500

1989 the whole area has 474.951 ha 4 years later are increases to 509.048 ha in land with scattered trees in the main, Bamboo area destroyed to grow indigenous species. This type increases to 109 ha. Part of the land used as swidden (185 ha), to the year 1993 no slash and burn allowed so natural regeneration happens, 32840 ha for regeneration and is considered to be poor forests. More than 1000 ha become forest gardens, natural regenerated sites until 1993 they become timber forests. During the same period, nearly 177 ha of forest previously was converted to be swidden land and about 57 ha of timber forest become bushes and scattered land due to over exploitation. Bamboo area in this period increased significantly, the former open land area with bushes and scattered trees in some humid areas where bamboos grow well that forms an area of 15966 ha more of bamboos. More than 200 ha of bamboos till 1993 was destroyed and become timber forest and scattered trees land (1993 status). See also table 3. It is noted that area of cash crops such as Tea, oranges ... in this period was not developed. Economic value species were introduced since 1993 only.

Distribution of forest types and vegetation are shown in Fig. 4 and Fig. 5. It is possible to say that the percentage of forest and vegetation did not change much during 1989 & 1993. There are many reasons but the main one is that time is not enough to see the change clearly. The comparison between 1989 & 1998 makes it clearer.

Table 4. % of forest types and vegetation 1989

:ha

Category	1989	%
Timber	474951	14.9
Bamboo	67344	2.1
Plantation	18439	0.6
Swidden	316585	9.9
Scattered trees	1721122	53.8
Cash crop	7008	0.2
Other	590055	18.5

Total	3195504	100
Forest cover		17.5%

Fig. 4. Distribution of forest types and vegetation - 1989

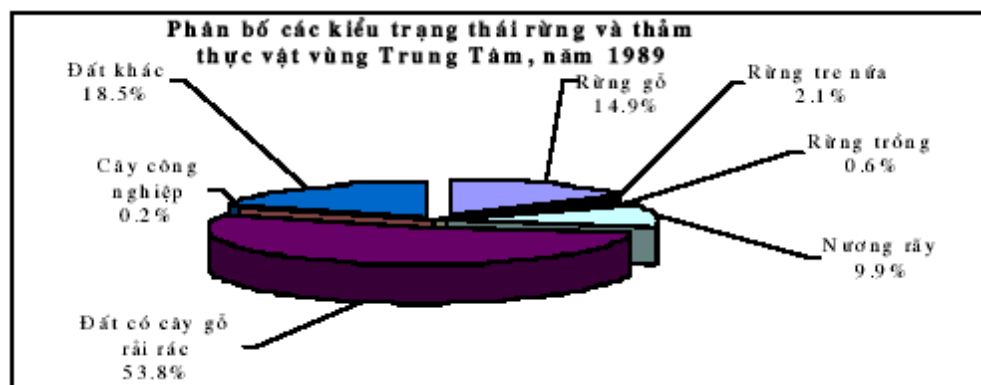
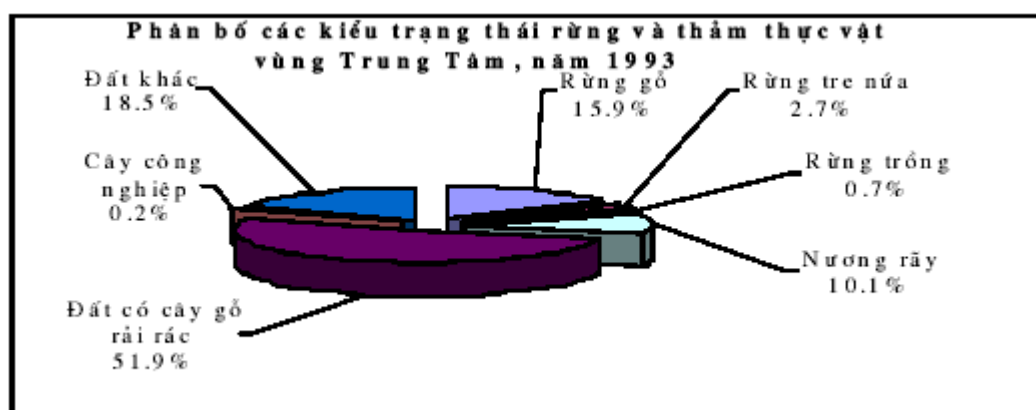


Table 5. % of forest types and vegetation 1993

:Ha

Category	1993	%
Timber	509048	15.9
Bamboo	84555	2.7
Plantation	20889	0.7
Swidden	323340	10.1
Scattered trees	1661806	52.0
Cash crop	7008	0.2
Other	588857	18.45
Total	3195503	100
Forest cover		19.2%

Fig. 5. % of forest types and vegetation 1993



b.Change in area and forest cover and vegetation - Lao Cai

Lao Cai is 200 km away from Bai Bang Pulp and Paper Mill, less attention is paid to the production of pulp wood. People are poor, low knowledge resulting in forest destruction for cultivation.

Table 6. Change in area and vegetations of Lao Cai 1989-1993

:ha

Category	1993	1989	Change (ha)	%
Timber	115238	113182	2056	1.80
Bamboo	7934	7776	158	2.00
Plantation	1688	1596	92	5.80
Swidden	92962	92962		
Scattered trees	512321	514628	-2306	-0.40
Cash crop	737	737		
Other	74120	74120		
Total	805000	805000		
Forest cover, %	15.50	15.20		

Table 6 shows very small change in area, forest types and vegetation during 1989-1993 of Lao Cai comparing to other areas of the country. However, in 4 years more than 2000 ha of timber, bamboos and plantation were established. Plantation increases significantly in this period. Only 92 ha of plantation at that time which can compare to nearly 6% of plantation area. One thing worth to deal with is in this period area of cash crops and other land did not change that proves that the economy of the province seems not to develop, particularly forestry and agriculture. Only 15% of land covered by vegetation, environmental condition threatens people within and without the area because it is the upper stream of many rivers which forms the red river deltas.

Matrix formed to show the change of types in table 7.

Table 7. Change in area and vegetation of Lao Cai, 1989-1993

: Ha

1989	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	113182							113182
Bamboo		7776						7776
Plantation			1596					1596
Swidden				92962				92962
Scattered	2056	158	92		512321			514628
Cash crop						737		737
Other							74120	74120
Total	115238	7934	1688	92962	512321	737	74120	805000

Table 7 tells the increase of more than 2000 ha of timber forest during 1989-1993 in Lao Cai. That is the conversion of land with scattered trees to timber forest due to protection for regeneration. Forest structure is improved and enough indications to be considered them as forests. Also, in that period 150 ha of bamboos recovered. Plantation increased to less than 100 ha from bushes and scattered trees land areas.

c. Change in forest cover and vegetations of Yen Bai

Yen Bai is a boiling point of VN as regard forest destruction and uncontrolled logging. That is why national provincial Gov. pay attention to. so the forest destruction during 1989-1993 is gradually stopped. Table 8 timber forest area during 1989-1993 increases significantly (6,5%) or 7306 ha. Bamboos increases gradually (20,6%) or 5% annum. The rate of plantation of Yen Bai at this time is low (1,4%) of the natural land area of the province but the area planted reaches more than 434 ha. Yen Bai has the most area of scattered trees and brush land (11,000 ha) but only 3% reduced in this period (1989) comparing to this type. See also table 8.

Table 8. Change in area and vegetation Yen Bai -- 1989-1993

:Ha

Category	1989	1993	Change(ha)	%
Timber	112570	119876	7306	6.5
Bamboo	16384	19755	3371	20.6
Plantation	9350	9784	434	4.6
Swidden	102525	102325		
Scattered trees	356761	346015	-10746	-3.0
Cash crop	197	197		
Other	83014	82849		
Total	680800	680800		
Forest cover	20.3%	21.9%		

Table 9. Change of forest types and vegetations - Yen Bai, 1989-1993

Ha

1989	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	112570							112570
Bamboo	109	16275						16384
Plantation			9350					9350
Swidden		62	139	102325				102525
Scattered	7197	3418	130		346015			356761
Cash crop						197		197
Other			165				82849	83014
Total	119876	19755	9784	102325	346015	197	82849	680800

112.570 ha of timber forest in 1989 and 119.876 ha in 1993. The increased area of timber forest that replaces bamboos is 109 ha and more than 7,000 ha of bush and scattered tree land. The area of timber forest increases however the quality is not high, poor standing volume. In 1989 bamboos area of YB seems to remain. Within the increased area of bamboos 62 ha from swidden land and 3,418 ha from bush and scattered tree land. From 1989 to 1993 139 ha of former swidden land is converted to be plantation, 130 ha - bush and scattered land destroyed for plantation, 65 ha - from other land. Probably, this is too small for identification from images.

d. Change in forest cover and vegetation of Tuyen Quang

Tuyen Quang , Yen Bai are planned for Bai Bang Mill. They are impacted by industrial development. See details in table 10.

Table 10. Change in area and vegetation of Tuyen Quang 1989-1993

:ha

Category	1989	%	1993	%	Change(ha)	%
Timber	88143	15.2	97134	16.7	8990	10,2
Bamboo	14476	2.5	20230	3.5	5754	39,8
Plantation	4298	0.7	5878	1.0	1580	36,8
Swidden	30377	5.2	39016	6.7	8639	28,4
Scattered trees	297428	51.3	272103	46.9	-25324	-8,5
Cash crop	2199	0.4	2199	0.4		
Other	143180	24.7	143541	24.7	361	0,3
Total	580100	100,0	580100	100,0		
Forest cover, %	18,4		21,2			

In 1989, forest cover of Tuyen Quang is 18,4%, 1993 - 21%. Timber forest area increases 2%/year, bamboos - 39,8 %, plantation- 36,8% during 1989 to 1993 in average. Cash crops did not develop in this period. According to data from map constructed from images 1/250.000 area considered to be cash crop land changes. Area of bush and scattered tree land reduces considerably, say more than 25 000 ha, however it covers an area of 46,9% of natural land. See table 11.

Table 11. Change in forest types & vegetation -Tuyen Quang 1989-1993

:ha

1989	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	87966		177					88143
Bamboo		14474						14474
Plantation			4298					4298
Swidden		312	161	29904				30377
Scattered	9168	5444	879	8935	272103		901	297430
Cash crop						2199		2199
Other			540				142640	143180
Total	97134	20230	5878	39016	272103	2199	143541	580100

As shown in table 11 in 1989 to 1993 Tuyen Quang has 177 ha of timber forest after exploitation and utilization which is converted to timber and scattered tree land, on the contrary 9168 ha of timber forest is recovered from this land type. The area of plantation increases due to new afforestation activity mainly from the open land and with bushes and scattered trees (BSL) is 879 ha and swidden land 161 ha. Bamboos also increases mainly recovered from (5444 ha) and swidden land 312 ha. See table 11.

e. Change in forest cover and vegetation of Phu Tho.

See table 12.

Table 12. Change in forest area and vegetation - Phu Tho 1989-1993

:ha

Category	1989	%	1993	%	Change(ha)	%
Timber	22227	6.4	24578	7.1	2351	10.6
Bamboo	10461	3.0	12353	3.6	1892	18.1
Plantation	3117	0.9	3461	1.0	344	11.0
Swidden	31760	9.2	31760	9.2	0	
Scattered trees	110362	31.9	106119	30.6	-4243	-3.8
Cash crop	3875	1.1	3875	1.1	0	
Other	164698	47.5	164354	47.4	-344	-0.2
Total	346500	100	346500	100		
Forest cover, %	10.3		11.7			

As shown in table 12, in 1989, the forest cover of Phu Tho is 10,3% in 1993 increases by 11,7%. Area of timber forest increase by 10,6% or 2,6%/year, bamboos - 18,1 % and plantation 11,0% from 1989 to 1993. According to data from map constructed from images 1/250.000 in this period cash crop area did not increase, area of SBL reduces 4243 ha, however this type of vegetation still 30,6% of natural land of the province. The changes happens very complex. (The matrix of the change is shown in table 12).

Table 13. Change in forest area and vegetation - Phu Tho, 1989-1993

:ha

1989	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	22227							22227
Bamboo		10190			272			10461
Plantation			3117					3117
Swidden				31760				31760
Scattered	2351	2164			105848			110362
Cash crop						3875		3875
Other			343				164354	164698
Total, 1993	24578	12353	3461	31760	106119	3875	164354	346500

Swid.	185	1333		56511	931		58961
Scattered	12068	4700		765	424260	148	441941
Other	1197					123846	125043
Total	152222	24283	78	57277	425248	123993	783100

Table 15 shows that from 1989 to 1993 area of timber forest increases 13393 ha, in which most of it (12068 ha) once was SBL, that is the rehabilitation, forest structure was formed, the area bears all indicators to be considered as forests. Part of timber forest area increases from status called other lands (may be forest gardens). At the same time more than 6 000 ha of bamboos increases from scattered tree land (4700 ha) and swidden land (1333 ha).

6.2.2. 1993-1998

a. Change in forest cover and vegetation of the whole Centre

Table 16 shows the change in area during 1989-1993 of the whole Centre. For only 5 years, the forest area increases significantly, bamboos and timber in particular. Area of afforestation increased a lot, and well developed. The forest cover increases from 19,2% in 1993 to 26,2% in 1998, i.e. 2% annum 2%, with rate of increasing the 5 million ha program of the Gov. will certainly be successful.

Table 16. Change in forest area & vegetation of the whole Center 1993-1998

:ha

Category	1993	%	1998	%	Change (ha)	%
Tim.	509048	15.9	570407	17.9	61359	12.1
Bam.	84555	2.6	99678	3.1	15123	17.9
Plant.	20889	0.7	136231	4.3	115342	552.2
Mosaic			30686	1.0	30686	
Swid.	323340	10.1	419173	13.1	95833	29.6
Scatt.	1661806	52.0	1405104	44.0	-256702	-15.4
Cash crop	7008	0.2	24057	0.8	17049	243.3
Other	588857	18.4	510182	16.0	-78675	-13.4
Total	3195500	100.0	3195500	100.0		
Forest cover	19.2%		26.2%			

In 1993 the whole Centre had only 2000 ha of plantation, But in 1998 - over 40 000 ha, or 6 times as much comparing to 1993. There many reasons but the main one is farmers are allocated land to, and contract for forest protection. During this period, the area of cash crops increases significantly (over 17 000 ha), because of open policy came into being farmers themselves find tree species that required by the markets. Cash crops in the area are Tea, oranges, mandarin, litchi, plum.... In the Centre many localities are dealing with commodity production as Bac ha plum, Yen Bai cinnamon, Ha Giang and Tuyen Quang oranges...

The Centre is the humid area of VN so the area of bamboos if not to be destroyed repeatedly bamboos grow

very fast. This is the reason why within a short time bamboos here develop so fast as such in this area. Within 5 years bamboo area increases by 17,9% of more than 15,000 in total. The status that reduces in area among them are other land and SBL See table 16.

b.Change in forest cover and vegetation - Lao Cai

Lao Cai has 805,000 ha of natural land, according to data fro map constructed from images 1/250.000 the forest cover of Lao cai in 1998 was 22,6%. Forest of Lao cai in 1998 mainly covered by natural forests or nearly 20% of the whole province. From 1993-1998 area of timber forest of Lao Cai increases by 35%, i.e. 7% bigger annum in average. Plantation area in this period increases very fast or 7 times . In 1993 Lao Cai had nearly 1,700 ha of plantation but in 1998 it is increased by more than 12.000 ha. As mentioned in *Methodology Section* it is impossible to differentiate plantations and sites of big size fruit trees from images as plums, peach, cinnamon, that is why area of cash crops and fruit trees may include in plantations. In humid areas bamboo forest in 1998 comparing to 1993 increases by 48.4%.

Table 17. Change in forest area and vegetation - Lao Cai 1993-1998

:ha

Category	1993	%	1998	%	Change (ha)	%
Tim	115238	14.3	156610	19.4	41372	35.9
Bam.	7934	1.0	11777	1.5	3842	48.4
Plant.	1688	0.2	13808	1.7	12120	718.0
Mosaic			30617	3.8	30617	
Swid.	92962	11.5	79745	9.9	-13217	-14.2
Scatt.	512321	63.6	438358	54.5	-73964	-14.4
Cash crop	737	0.1	70	-667	-90.6	
Other	74120	9.2	74016	9.2	-104	-0.1
Total	805000	100	805000	100		
Forest cover, %	15.5		22.6			

Also in table 17 the area of swidden land and planted sites of cash crops reduces. Area of SBL and swidden land in this period reduces by 14,2%. See also table 17. Cash crops area reduces most, main reason is that poor tea sites were left fallow. This types covers a rather big area.

Table 18. Change in forest area and vegetation - Lao Cai, 1993-1998

:ha

1998	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	93988	379	183	2690	56596		2776	156610
Bamboo	429	4366		454	6204		323	11777

Plantation	198		625	2083	8868	30	2005	13808
Mosaic	797			10818	17523		1480	30617
Swidden	501	120	158	43137	28718	129	6984	79745
Scattered	16978	2965	638	26554	372078	386	18760	438358
Cash crop							70	70
Other	2349	104	85	7227	22336	123	41793	74016
Total	115238	7934	1688	92962	512322	737	74120	805000

According to data in table 18, area of timber forest increases by 115.238 ha (1993) to 156.610 ha due to the conversion of forest status and vegetation previously they were SBL and bamboos as bamboo forest was cut so over 300 ha of bamboos was converted into new timber forests. Forests recovered after slash and burn practice in this period is over 2690 ha. Nearly 57,000 ha of open land with SB is projected for regeneration and after few years they recovered well and became young forests or poor volume timber.

From 1993 to 1998. More than 16,978 ha of Lao Cai timber forest was cut, and to 1998 this area become SBL. Felling in different places so many small areas were destroyed and amounts to nearly 800 ha that resulted in new status that is the Mosaic. This status is described in *Section 4.1.2*. More details can be seen in the matrix of table 18.

c. Change in forest cover and vegetation of Yen Bai

Yen Bai is close to ViÖt Tr× industrial centre, it is advantageous for transport that is why forest area reduces during this period when management is poor. Also in this period the land law was and forest contract law were promulgated, but in the early 1004,1995 forest destruction still happened in some districts which have valuable timber species as *Forkinia* (P→ mu). Table 19 shows the forest area lost in this stage was rather big, say 18504 ha in 5 years, equal to more than 3000 ha/year. This is worried. During 1997-1998 this situation has been completely stopping with the start of land allocation and forest contract for protection to households.

Table 19. Change in forest area and vegetation - Yen Bai 1993-1998

:ha

Category	1993	%	1998	%	Change (ha)	%
Tim	119876	17.6	101372	14.9%	-18504	-15.4
Bam.	19755	2.9	21782	3.2	2027	10.3
Plant.	9784	1.4	45233	6.6	35449	362.3
Mosaic			69		69	
Swid.	102325	15.0	111349	16.4	9024	8.8
Scatt.	346015	50.8	308521	45.3	-37494	-10.8
Cash crop	197		5445	0.8	5248	2667.4
Other	82849	12.2	87030	12.8	4182	5.0
Total	680800	100	680800	100		
Forest cover	21.9%		24.7%			

Table 19 shows the changes of area of forest status and types and vegetation of Yen Bai. According to this data however the area of natural timber forest reduces by 5,4% in 5 years, the forest cover of the province increases from 21,9% (1993) to 24,7% (1998). That proves that natural timber forest area reduces, other forest

types replaces the losses . Also , during 1993 to 1998 plantation area increases significantly, say 3.6 times as much in 5 years , the reason is from 1993 the Gov. invested to big programmes such as 327....

However assessment of the program is different from area to area, organization to organization, according to local assessment this is a good program for forest rehabilitation of the province From 1993 to 1998 area of plantation and cash crops increase significantly (Cinnamon, tea, oranges, mandarin). Also in table 19, cash crop area taken from images of 1993 is only 197 ha, but in 1998 this area increases by 5,445 ha say 27 times bigger.

Table 20. Change in forest area and vegetation Yen Bai, 1993-1998

:ha

1998	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	65079	1461	184	1658	31606		1385	101372
Bamboo	6564	4739	97	913	9055		413	21782
Plantation	345	512	2618	14067	19895	91	7705	45233
Mosaic				60	9			69
Swidden	3088	1554	1598	32889	53562	98	18564	111349
Scattered	43403	11199	4443	30249	205831	1	13397	308521
Cash crop	55	9	21	2261	1660		1438	5445
Other	1343	281	824	20231	24397	7	39954	87030
Total	119876	19755	9784	102325	346015	197	82849	680800

According to results of table 20 timber forest area in 1993 of the whole province is 119.876 ha after 5 years 1,343 ha converted to other land, 55 ha having been cut converted to cash crop land, 3088 ha of timber forest destroyed for swidden land, 345 ha of natural timber forest destroyed for replanting and 6,564 ha of timber forest after heavy felling and impossible for recover because bamboos grow fast on these sites. It is noted that a big area of natural timber forest after over use impossible for rehabilitation converted to open land and SBL - 43,403 ha and distribute throughout the province but mainly concentrating in the remote areas and difficult for protection and management. They were destroyed again and again for swidden land that resulted in the appearing of SBL. Area for cash crops coming from former swidden land (2261 ha), SBL (1660 ha) and 1,438 ha from other land such as grazing, land grass land and non-used land. See also table 20 for details.

d. Change in forest cover and vegetation of Tuyen Quang

Tuyen Quang is in the north of Viet Tri industrial centre with advantages of water and road transportation that is why at the beginning of Bai Bang P&P Mill project, Tuyen Quang is located in the master plan to supply raw materials for P&P Mill. Because of this, forest area here was strongly influenced by external conditions.

Right the beginning of the 1990s, the authorities of Tuyen Quang paid due attention to the protection of natural resources of the province. During the 1980s policy of close forest was not promulgated in VN, but Tuyen Quang itself promulgated a policy for not logging, so TQ could protect its forests better than others.

According to data collected from SPOT in 1998 forest cover of TQ is nearly 34%. Data also indicate that forest cover of the whole province is 21% in 1993. 13% of forest cover increased from 1993 to 1998, timber forest area increases by 41,5% bamboos - 32,1% and plantation - 4 times bigger within 5 years. At the same time, area of cash crops increases by 2.4 times. Other lands i.e. open land with grasses along main road sides and

SBL reduced, local authority encouraged local people to afforest and grow cash crops. Local people also use this land for swidden sites. In case of lack of investment for afforestation cash crops can be planted instead. See also table 21 for details.

Table 21. Change in forest area and Tuyen Quang, 1993-1998

:ha

Category	1993	%	1998	%	Change (ha)	%
Tim	97134	16.7%	137474	23.7%	40341	41.5%
Bam.	20230	3.5%	26716	4.6%	6486	32.1%
Plant.	5878	1.0%	31610	5.4%	25732	437.8%
Swid.	39016	6.7%	91187	15.7%	52171	133.7%
Scatt.	272103	46.9%	204951	35.3%	-67153	-24.7%
Cash crop	2199	0.4%	7406	1.3%	5207	236.8%
Other	143541	24.7%	80756	13.9%	-62785	-43.7%
Total	580100	100.0%	580100	100.0%		
Forest cover	21.2%		33.8%			

Results of overlaying maps of the 2 periods 1993 and 1998 are shown in table 22. In 1993 Tuyen Quang had 97.134 ha of timber forests, but only 59152 ha remains as timber forest and the rest changes greatly. In the converted area, 1863 ha converted to other land, 4.206 ha to bamboos, 453 ha of exploited timber forest was replanted in intensive way, nearly 6743 ha was destroyed by farmers for swidden land. The area lost in this period 24,717 ha is impossible for rehabilitation and converted to be Scattered tree land. Beside the loss of natural timber forests during 1993-1998 54,986 ha SBL recovered with indications to be considered as timber forests. Relying on these data it is noted that forest area increases but the quality is not as good as it used to be as lots of primary forest with diversified genetic pool of tropical characteristics was broken and replaced by recovered forests, poor in genetic pool. For example, the destruction of 453 ha of timber forest for afforestation however better economic values obtained, the ecological ones get worse. 12,596 ha out of 31,610 ha of plantation planted on SBL in the province. See table 22 for details.

Table 22. Change in forest area and vegetation Tuyen Quang 1993-1998

:ha

1998	1993							
	Timber	Bamboo	Plantation	Swidden	Scattered	Cashcrop	Other	Total
Timber	59152	2910	195	3023	54986	32	17177	137474
Bamboo	4206	4709	51	891	14830		2028	26716
Plantation	453	657	1663	4376	12596	218	11648	31610
Swidden	6743	2341	1248	11117	41939	439	27361	91187
Scattered	24707	8325	1592	14645	124786	163	30733	204961
Cash crop	10	7	64	446	3412	277	3190	7406
Other	1863	1283	1066	4518	19554	1070	51403	80763

Total	97134	20230	5878	39016	272103	2199	143541	580100
-------	-------	-------	------	-------	--------	------	--------	--------

e. Change in forest cover and vegetation of Phu Tho

Phu Tho 100 km northeast of Hanoi is advantageous geographically and naturally. It is one of the industrial centers of the North. Water and road transportation is very convenient. Bai Bang P&P Mill is the timber big consumer of the Centre. This results in forest changes of the province. Results of image interpretation show the changes of forests in 2 periods -1993 and 1998. During these 2 periods natural forest area increases of the province significantly. As shown in table 23 the area of natural timber forest increases in 5 years 3,354 ha totally or 13.6% or 3% annum. Particularly the case of plantation in 1998 increases by 9.1 times as much comparing to 1993. Area of bamboos reduced 32.3% comparing to 1993. It is easy to understand as Phu Tho is drier than other provinces (Tuyen Quang, Ha giang..) it is not good for the rehabilitation of bamboos, moreover, PT is nearing Hanoi and people knowledge is higher, land use is more efficient that why bamboos are destroyed for other uses - cash crops for example. Other for swidden land with better economic values.

Table 23. Change in forest area and vegetation Phu Tho 1993-1998

Category	1993	%	1998	%	Change (ha)	%
Tim.	24578	7.1	27932	8.0	3354	13.6
Bam.	12353	3.6	8366	2.4	-3987	-32.3
Plant.	3461	1.0	35095	10.1	31635	914.2
Swid.	31760	9.2	76066	22.0	44306	139.5
Scatt.	106119	30.6	71156	20.5	-34963	-32.9
C. crop	3875	1.1	7917	2.3	4042	104.3
Other	164354	47.4	119967	34.6	-44387	-27.0
Total	346500	100.0	346500	100.0		
Forest5 cover	11.7%		20.6%			

Also table 23 shows the increasing of cash crop area during 1993-1998 by more than 104%. SBL reduces by 34.963 ha, or 33% and other land also reduces greatly.

Table 24. Change in forest area and vegetation Phu Tho 1993-1998

	:ha							
	1993							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C. crop	Other	Total
Tim.	12276	1068	28	1335	11832		1393	27932
Bam.	1474	3622	37	157	2856		221	8366
Plant.	203	349	820	7085	9630	349	16660	35095
Swid.	1687	1540	1257	13736	21673	806	35367	76066
Scatt.	8544	5439	548	2857	45614	79	8075	71156
Cash crop	158	44	15	1204	2753	761	2983	7917
Other	236	292	771	5386	11762	1881	99654	119982
Total	24578	12353	3461	31760	106119	3875	164354	346500

As is shown in table 24, within 5 years only 12,276 ha of timber forests that maintains the original status however timber forest area of the whole province is 27,931 ha. Among the new increased area, 1,068 ha was bamboos, 28 ha - plantation and 1,335 ha - swidden land in original. This is recovered forests after slash and burn practice. One thing worth to be mentioned is that in the past 5 years it was open land with scattered trees which was protected for regeneration. Among the lost area there were 8,544 ha of 1993 after 5 years of repeated logging and impossible for rehabilitation and became vegetation of no timber forest structure and by 1998 this land became scattered tree land. At the same time there was 1,678 ha of former timber forest converted to be swidden land and 1,474 ha of 1993 timber forest became bamboo in 1998. See also table 24 for details.

f. Change in forest cover and vegetation of Ha Giang

Ha Giang is bordered by China, during the war time with China a large area of forest was destroyed and particularly when the border of the 2 countries opens. Local people took this opportunity to destroy forests to get timber for selling to China that resulted in forest destruction seriously in this province this time.

Table 25. Change in forest area and vegetation Ha Giang 1993-1998

:ha

Category	1993	%	1998	%	Change (ha)	%
Tim.	152222	19.4	147019	18.7	-5203	-3.4
Bam.	24283	3.1	31037	4.0	6754	27.8
Plant.	78	0.0	10485	1.3	10408	13401.1
Swid.	57277	7.3	60837	7.8	3560	6.2
Scatt.	425248	54.3	382097	48.8	-43151	-10.1
Cash crop			3234	0.4	3234	
Other	123993	15.8	148391	18.9	24398	19.7
Total	783100	100.0	783100	100.0		
Forest cover	22.5%		24.1%			

Data collected from map overlaying of 2 periods of time (1993-1998) of Ha Giang indicate that forest cover of the province in 1998 was 24.1% and 1993 -22.5%. Within 5 years forest area of Hang was in increasing. Afforestation is the main reason for this increase. As is shown in table 25 the area of plantation in 1998 was 13 times bigger than 1993's. Ha Giang is located in the relative humid zone that helps the growing fast of bamboos resulting in significant increasing of bamboo area in this time. However, the area of timber forest in this time got lost by more than 5,000 ha. The lost area is mainly poor forests and is destroyed for swidden land or they were over exploited that results in no possibility for recover and finally replaced by bamboos.

Table 26. Change in forest area and vegetation Ha Giang 1993-1998

:ha

	1993						
99	Tim.	Bam.	Plant.	Swid.	Scatt.	Other	Total
Tim.	82834	1395		2574	49754	10462	147019
Bam.	3649	7061		963	17010	2354	31037
Plant.	444	476		142	7063	2362	10485
Swid.	4105	1399	11	12860	30010	12452	60837
Scatt.	45099	11794	66	27118	266752	31268	38297
Cash crop	131	100		66	1100	1837	3234
Other	15960	2059		13554	53559	63260	148391
	152222	24283	78	57277	425248	123993	783100

As is shown in table 26, Ha Giang has 152,222 ha of timber forest but by 1998 this forest type remained only 82,834 ha that retain their primary state. The converted area to scattered tree land is 45,099 ha, 4,105 ha to swidden land, 3,649 ha to bamboos, 444 ha destroyed for new plantation. During the same period 49,754 ha of open land with scattered trees was protected for recover, 2,574 ha of forest recovered after slash and burn practice was allocated as timber forest. More than 1,000 ha of exhausted bamboos was converted to be timber forest of higher values by means of gradual wiping out bamboo stems. In the same period a large area is considered to be plantation from images. Total area recorded is 10,485 ha, 7,063 ha out of this springs from open land with scattered trees , 2,362 ha from other land, 476 ha from bamboos, 444 ha from natural forests. See also table 26 for details.

6.2.3. 1989-1998

a. Change in forest cover and vegetation in the Centre

From 1989 to 1998 the GDP growth of VN is approximately 7% to 9%/year, that affected the development of Agri- forestry in general and forestry sector in particular. And during this period many policies came into life. This is a motive power for the development of the sector. The Gov. invested a lot for afforestation and forest rehabilitation. No wonder, these impact on the changes of forest cover and vegetation of the Centre of Vietnam. Table 27 shows that within 10 years the area of timber forest increases by 20% or 2% yearly. Plantation area increases by 6.4 times in the same period.

Bamboo area also increases in the Centre. According to these data the values of bamboo- increased area in the Centre is 48% within 10 years. Due to this increasing the forest cover in the Centre increases from 17.5% in 1989 to 26.2% in 1998. Cash crops area also increases by 24 times. Land with scattered trees and other land reduced most. See also table 27 for details.

Table 27. Change in forest area and vegetation of the whole Center 1989-1998

:ha

Category	1989	%	1998	%	Change (ha)	%
Tim.	474951	14.9	570407	17.9	95456	20.1
Bam.	67344	2.1	99678	3.1	32334	48.0
Plant.	18439	0.6	136231	4.3	117792	638.8
Mosaic			30686	1.0	30686	
Swid.	316585	9.9	419173	13.1	102588	32.4
Scatt.	1721122	53.9	1405104	44.0	-316018	-18.4
Cash crop	7008	0.2	24057	0.8	17049	243.3
Other	590055	18.5	510182	16.0	-79873	-13.5
Total	3195504	100	3195518	100		
Forest cover	17.5		26.2			

As is shown in table 28 the area of timber forest of the Centre in 1998 is 570,407 ha, bamboos - 99,678 ha, plantation - 136,231 ha. It is possible to say that plantation plays the key role of timber supplying for industrial centers in the whole area. From 1989 to 1998 about 220,874 ha of timber and scattered tree land regenerated to become timber forests, 9,125 ha of former swidden land also became timber forests. In the same period 3,948 ha of former bamboos was destroyed for new planting. Area of natural timber forests was strongly converted. Look at table 28 we can see that area of timber forest in 1989 was 47,495 ha and after 10 years only 302,335 ha remained unchanged (64%). Others changed in positions. This makes researchers and forest protectors concern as it is not enough to concern the question of forest area but it is more important to deal with natural, primary forest ecosystem which have been destroying and replaced by secondary forest stands. This is the reason that makes poorer the biodiversity of the tropical forest ecosystem. See table 28 for details.

Table 28. Change in forest area and vegetation of the whole Center 1989-1998

:ha

	1989							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C.crop	Other	Total
Tim.	302335	3948	537	9125	220803	32	33628	570407
Bam.	14766	22811	185	3461	53114		5339	99678
Plant.	1324	1668	5200	27841	58906	688	40608	136231
Mosaic	797			10818	17523		1480	30617
Swid.	13781	5303	3596	113684	180317	1472	101034	419184
Scatt.	122149	30208	6554	97237	1046734	628	101573	1405082
Cash crop	344	144	39	3977	8999	1108	9470	24081
Other	19460	3255	2315	50444	134725	3074	296954	510222
Total	474951	67325	18433	316585	1721123	7001	590078	3195501

b. Change in forest cover and vegetation of Lao cai

In general, change in forest cover and vegetation of Lao cai during 1989-1998 bears the positive character. Forest area is increasing (quantity) however during this period lots of forests got lost due to over exploiting and slash and burn practice.

Table 29. Change in forest area and vegetation Lao Cai 1989-1998

:ha

Category	1989	%	1998	%	Change (ha)	%
Tim.	113182	14,1	156610	19,4	43429	38,4
Bam.	7776	1,0	11777	1,5	4000	51,4
Plant.	1597	0,2	13808	1,7	12212	765,2
Mosaic			30617	3,8	30617	100,0
Swid.	92962	11,5	79745	9,9	-13217	-14,2%
Scatt.	514628	63,9	438358	54,5	-76270	-14
Cash crop	737	0,1	70		-667	-90,6
Other	74120	9,2	74016	9,2	-104	-0,1
Total	805000	100	805000	100		
Forest cover	15,2%		22,6%			

Table 29 shows that forest area (natural and man made forests) increased 59,640 ha or 48.7% in which timber forest - 38.4%, bamboos - 51.4% and plantations - 765.2%. In the same period, SBL reduced from 514628 ha

down to 438358 ha and the area of swidden land remained only 79745 ha, say 13217 ha disappeared. This is a good signal due to great efforts of the province and changes in policies of the Gov. in forest management and protection from 1993 up to now. However changes of forest area and vegetation of Lao cai is very complex. It can be seen in the matrix below.

Table 30. Change in forest area and Lao Cai, 1989-1998

	1989							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C. crop	Other	Total
Tim.	93143	255	174	2690	57572		2776	156610
Bam.	429	4366		454	6204		323	11777
Plant.	198		605	2083	8887	30	2005	13808
Mosaic	797			10818	17523		1480	30617
Swid.	501	120	158	43137	28718	129	6984	79745
Scatt.	15766	2931	582	26554	373379	386	18760	438358
Other						70		70
Total	2349	104	77	7227	22344	123	41793	74016
Forest cover	113182	7776	1596	92962	514628	737	74120	805001

The above table shows that in both periods 1989 and 1998 Lao Cai had 43,429 ha of timber forests. Most of the increased area sprang from regeneration on open land with scattered trees and bushes or former swidden land. Only 93,143 ha or 82% of timber forest area retains its original state, however forest quality changed. It is worth to mentioned that during this period the provinces planted 12,000 ha out of which nearly 2,000 ha was open land with scattered trees . See table 30.

c. Change in forest cover and vegetation of Yen Bai

As mentioned above on the changes of forest area and other lands which strongly influenced by Bai Bang P&P Mill as the province was planned to supply raw materials for the Mill. The change of forest area of the province is shown in table 31.

Table 31. Ratio of change in forest area and vegetation Yen Bai, 1989-1998

:ha

Category	1989	%	1998	%	Change (ha)	%
Tim.	112580	16,5	101372	14,9	-11208	-10,0
Bam.	16384	2,4	21782	3,2	5398	32,9
Plant.	9350	1,4	45233	6,6	35883	383,8
Swid.	102525	15,1	111349	16,4	8823	8,6
Scatt.	356751	52,4	308521	45,3	-48230	-13,5
Cash crop	197		5445	0,8	5248	2667,4
Other	83014	12,2	87099	12,8	4085	4,9

Total	680800	100	680800	100		
Forest cover, %	20,3		24,7			

After nearly 10 years forest cover of Yen Bai increased by 4.4 %. The area of plantation increased significantly during 10 years. In 1989 Yen Bai had only 9,350 ha but in 1998 it had 45,000 ha of plantation. While the natural timber forest reduced by 11,000 ha. This something different from other areas in the Centre. Particularly area of cash crops and fruit trees increased significantly. Data collected from maps constructed from images scale 1/250 000 cash crop area of YB is 5,445 ha, almost of it planted on former swidden land open land with scattered trees. SBL reduced by 50,000 ha in 10 years. The matrix of changes of forest types and vegetation shown in table 32.

Table 32. Matrix of change of forest types and vegetation 1989-1998

:ha

	1989							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C. crop	Other	Total
Tim.	62380	760	184	1658	35005		1385	101372
Bam.	5719	4412	97	913	10228		413	21782
Plant.	271	492	2472	14154	19976	91	7777	45233
Swid.	2848	1370	1576	32908	53986	98	18564	111349
Scatt.	40084	9072	4281	30331	211356	1	13396	308520
C. crop	55	9	21	2261	1660		1438	5454
Other	1224	269	721	20300	24539	7	40040	87092
	112580	16365	9367	102525	356751	197	83014	680800

Looking at table 32 it is seen that from 1989 to 1998 YB had 40,084 ha of timber forest after exploitation and utilization which became SBL, 5,719 ha of timber forest changed to be bamboo forests. Most of bamboo area of the province was cut in the same period mentioned 9,072 ha or cleared for swidden land (1,370 ha) or impossible to recover and became scattered and bushes land (SBL). Part of plantation area in 1989 was exploited with replanting and became SBL (4281 ha) and 712 ha was former plantation and in 1998 became other land. See also table 32 for details.

d. Change in forest cover and vegetation of Tuyen Quang

Tuyen Quang as well as Yen Bai are nearing Viet Tri Industrial Centre and Bai Bang Pulp and Paper Mill, and right at the beginning it is planned to be raw material area for Bai Bang Pulp and Paper Mill. That is why the change of forest cover and vegetation of the province strongly influenced by the Industrial centre. See also table 33 for details.

Table 33. Ratio and change in of forest types and vegetation Tuyen Quang, 1989-1998

:ha

--	--	--	--	--	--	--

Category	1989	%	1998	%	Change (ha)	%
Tim.	88143	15,2	137474	23,7	49331	56,0
Bam.	14476	2,5	26716	4,6	12240	74,6
Plant	4298	0,7	31610	5,4	27312	635,4
Swid.	30377	5,2	91187	15,7	60810	200,2
Scatt.	297428	51,3	204951	35,3	-92477	-31,1
Cash crop	2199	0,4	7406	1,3	5207	236,8
Other	143180	24,7	80756	13,9	-62424	-43,6
Total	580100	100	580100	100		
Forest cover, %	18.4		33,7			

Table 33 shows that in 1989 the forest cover of TQ was 18.4% and in 1998 - 33.7%. During this period thanks to Gov. and project supports the changes of forest area of this province was positive. This is very different from other provinces. (See also LC, YB). Area of timber forest increased by 49,331 ha or 56% comparing to 1989, bamboos - 12,240 ha or 74.6% and plantation - 27,312 ha or more than 600%. In this period the area of cash crops did not increase much, 5,207 ha. The area of SBL reduced significantly, more than 90,000 ha. However this vegetation types still covered a relative big ratio of 35.3% of natural land area of the province.

See also table 34.

Table 34. Change in forest area and vegetation Tuyen Quang 1989-1998

:ha

	1989							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C. crop	Other	Total
Tim.	56171	1669	151	856	61519	32	17077	137474
Bam.	3927	4279	51	648	15783		2028	26716
Plant.	253	462	1322	4377	13194	218	11785	31610
Swid.	5444	1735	865	10244	45083	439	27377	91187
Scatt.	20874	5675	1077	9900	137119	163	30143	204951
Cash crop	10	7	8	446	3486	277	3190	7406
Other	1465	648	825	3907	21262	1070	51579	80756
Total	88143	14476	4298	30377	297446	2199	143180	580100

Table 34 shows that from 1989 to 1998 however area of timber forest of TQ increased significantly after 9 years 20,000 ha of timber forest became SBL due to exploitation and utilization, on the contrary more than 60,000 ha of timber forest recovered from this type of land. During this period area of plantation increased due to new plantation appeared on open land with scattered trees and bushes of 13,194 ha and on former swidden land of 4377 ha. Bamboos forest area increased due to recovering from open land with scattered trees (15783 ha), former swidden land (648 ha) and particularly 3927 ha converted from timber forest. See 34 for details.

e. Change in forest cover and vegetation of Phu Tho

Phu Tho has Viet Tri Industrial Centre and Bai Bang P&P Mill so the change of forest area and vegetation is greatly influenced by the development of the Mill. See table 35.

Table 35. Ratio of change in forest types and vegetation Phu Tho, 1989-1998

:ha

Category	1989	%	1998	%	Change (ha)	%
Tim.	22227	6,4	27932	8,0	5705	25,7
Bam.	10461	3,0	8366	2,4	-2095	-20,0
Plant.	3117	0,9	35095	10,1	31978	1025,9
Swid.	31760	9,2	76066	22,0	44306	139,5
Scatt.	110362	31,9	71156	20,5	-39205	-35,5
Cash crop	3875	1,1	7917	2,3	4042	104,3
Other	164698	47,5	119967	34,6	-44730	-27,2
Total	346500	100,0	346500	100,0		
Forest cover, %	10.3		20,6			

Table 35 shows that in 1989 the forest cover of Phu Tho was 10.3% and in 1998 was 20.6% or more than 1% per year in average. It is possible to say that during that period forest area of the province increased due to . Area of timber forest increased by 25.7% or 2.5 % per year in average, plantation increased most(1025.9% (ha) ?), bamboo forests got lost 2095.4 ha or 20%. To certain extent it is possible to explain by the influence of Bai Bang P&P Mill as the Mill also uses bamboos for material. As regard bamboos, after cutting no re-growing was applied except the case of natural regeneration. Besides in YB there are organizations who also produce paper for export to Taiwan that is why bamboos suffered from heavy utilization resulting in reduction of area. Area of cash crops increased twice as much during 9 years. However as regard absolute figures, area of cash crops of PT was not high, only 7,917 ha or 2.3% of natural land area of the province. Area of SBL reduced by 39.205 ha however it still covered a big area of 20.5% of the natural land area of the province. However there have been many policies prioritizing the development of rural mountains , until now the area of swidden land of P.T is still high (76,000 ha) or 22% of natural land area of the province, comparing to 1989 it increase by 44,306 ha or 139.5%. This is a worried thing.

See also table 36 for details.

Table 36. Change in forest types and vegetation Phu Tho 1989-1998

:ha

	1989							
1998	Tim.	Bam.	Plant.	Swid.	Scatt.	C crop	Other	Total
Tim	11836	598	28	1335	12742		1393	27932
Bam.	1308	3230	37	157	3413		221	8366
Plant.	158	327	801	7085	9697	349	16679	35095

Tim.	78805	666		2586	53965	10997	147019
Bam.	3383	6524		1289	17486	2354	31037
Plant.	444	387		142	7152	2362	10485
Swid.	3774	705	11	13659	30217	12482	60837
Scatt.	37995	7928	66	27595	277313	31199	382097
Cash crop	131	100		66	1100	1837	3234
Other	14297	1945		13624	54703	63823	148391
Total	138829	18254	78	58961	441936	125054	783100

Table 38 shows that from 1989 to 1998 timber forest area of Ha Giang increased mainly by rehabilitation from open land with scattered trees and bushes (53965 ha). Bamboo forests and plantations shared the same situation. On the contrary, in the same period, part of timber forests (37995 ha), bamboos (7928 ha) got lost due to exploitation and conversion to open land. Swidden land converted to forested land did not cover a big part. See also table 38 for details.

6.3. Change in forest cover and vegetation both inside and outside of the project area

6.3.1. 1989

This study aims at comparing the changes of forest types and vegetations in different periods in on-going project districts of MRDP and non-project districts to see the differences if so and working out suppositions for such differences. To do this, 18 on-going project districts of MRDP are mapped scale 1/250.000 after that Arlinfo is used for data processing. See table 39 for details.

Table 39. Comparison area changes of forest types and vegetation in the MRDP area and Non-Program area in 1989

1989	Program	%	Non-Prog.	%	Difference
Tim.	240893	14.6	234195	15.2	-0.6
Bam.	39355	2.4	28171	1.8	0.6
Plant.	12612	0.8	5921	0.4	0.4
Swid.	164350	9.9	152019	9.9	0.1
Scatt.	919051	55.6	800504	51.9	3.7
Cash crop	3517	0.2	3513	0.2	0.0
Other	273198	16.5	318200	20.6	-4.1
Total	1652976	100.0	1542523	100.0	
Forest cover	17.7%		17.4%		

In 1989 forest cover of districts and later on are on-going project districts is 17.7% and the forest cover of non-districts projects by now is 17.4%. These data prove that the collected data are rather harmonious as regard the statistic probability. It is because at that time no projects happened resulting in no impacts of human beings on forests of the whole area. The differences range from 4.1 down to 0.6%, with this results it is possible for us to temporarily accept the harmony between the 2 areas (project and non project area). The differences can be seen in table 40.

The compared results through analysis of interrelation by statistic method are shown in table 40.

Table 40: Analysis of interrelation among the forest status and vegetations both inside and outside the Project - 1989

<i>Regression Statistic (*)</i>	
Multiple R	0.99
R Square	0.99
Adjusted R Square	0.99
Standard Error	37659.31
Observations	7

**(Written by the author)*

6.3.2. 1993

To clarify the identity it is necessary to establish the relation between the areas (project and non project) at the time of 1993. Collected data shown in table 41.

According to results indicated in this table the differentiates of forest types and vegetations in both areas (P&NP) range from 4% to 3.3%. In 1993 the forest cover of project and non project areas increased comparing to 1989. The figures can be seen here is 19.4% and 19.1%.

Table 41. Comparison area changes of forest types and vegetation in the MRDP area and Non-Program area in 1993

1993	Program	%	Non-progr.	%	Difference
Tim.	257178	15.6	252114	16.3	-0.79
Bam.	49670	3.0	35144	2.3	0.73
Plant.	14337	0.9	6663	0.4	0.44
Swid.	169814	10.3	153394	9.9	0.33
Scatt.	884991	53.5	774962	50.2	3.30
Cash crop	3516	0.2	3513	0.2	-0.02
Other	273472	16.5	316733	20.5	-3.99
Total	1652977	100.0	1542523	100.0	0.00
Forest cover, %	19.4		19.1		

To clarify this it is necessary to analyze statistically this differentiations. The results are shown in table 42

Table 42. Results of analysis of the interrelation between forest types and vegetation inside and outside the Program area in 1993

Regression Statistics

Multiple R	0.99
R Square	0.99
Adjusted R Square	0.99
Standard Error	36788.23
Observations	7

According to these results the percentage of forest types in project and non project areas is not different.

From the results of analysis of the 2 periods 1989 and 1993 it can be seen that no difference between the 2 areas (P&NP) when MRDP is expanded.

6.3.3. 1998

MRDP started since 1996, and data collection is only 2 years later, that is why when dealing with the analysis of the differentiations let not hope much on the change of forest area and vegetations .

However, the comparison between on going project districts and non project districts with the hope to find out certain differences. Results of collected data shown in table 43.

Table 43. Comparison of change in forest types area and vegetation inside and outside MRDP in 1998

1998	Inside	%	Outside	%	Difference
Tim.	291152	17.6	279194	18.1	-0.5
Bam.	60837	3.7	39103	2.5	1.2
Plant.	82412	5.0	54340	3.5	1.5
Mosaic	4452	0.3	25798	1.7	-1.4
Swid.	225887	13.7	194035	12.6	1.1
Scatt.	731954	44.3	671314	43.5	0.8
Cash crop	19185	1.2	5016	0.3	0.8
Other	237098	14.3	273724	17.7	-3.4
Total	1652977	100	1542523	100	
Forest cover	26.3%		24,2%		

As is shown in this table the forest cover of the project area is 26.3% and non project area 24.2%. So, in 1998 there was great difference in forest cover of the 2 areas (P&NP). The size of the difference was 2.1%. It is impossible to differentiate the difference for the periods 1989 and 1993 and even in 1998 this difference does not satisfy conditions of statistics. The only one condition is that there is a difference in forest cover (absolute value). The difference is examined by statistic method. The results of statistic analysis are summed up in table 44.

Table 44. Interrelation between forest types and vegetation in and out of Program area - 1998

<i>Regression Statistics</i>	
Multiple R	0.99
R Square	0.99
Adjusted R Square	0.98
Standard Error	29596.33
Observations	8

So, as regard mathematic statistics even in 1998 it is impossible to find out the reliable difference between the inside and outside of the project area. Temporarily we can see the difference through the absolute value of forest cover of the 2 areas (P&NP). Hopefully, with a long period of time we can clarify more clearly the role of the project as regard forest cover in the project areas.

6.4 Temporarily identification of changes

6.4.1. *The change of policies of forest development and mountain rural development.*

In the recent years, the Gov. promulgated many policies for forest, management, development and utilization effectively which suit the requirement of the new development stage. The policies were concretized by legislations. They greatly affect the change of forest resources. Efficiency and impacts of these policies on the development of forest in particular and the Centre in general are of difference. The difference depends on provinces.

a. Law for Forest Protection and Development

Law for Forest Protection and Development was approved by the National Assembly VIII (meeting No. 9, dated 12-08-1991) of the Socialist Republic of Vietnam and issued by Decree No. 58-LCT/H\$NN8 dated 18-08-1991 by President of State Council of the Socialist Republic of Vietnam. In Chapter III of the Law for Forest Protection, forests are divided clearly for functional organizations from national to grass root levels. As regulated in Article 18, People's Committees of different levels based themselves on their own functions , rights and duties and the forest owners must organize the management and protection of forest estates ; prevent activities of forest destruction; carry out measures of protection, development of the flora and fauna ; water source, soil to control erosion. From Article 19 to Article 25 of the Law, clear regulations for what to be done to protect and develop forest estate. On the basic of legislation of the Law, the functional organizations from national to grass root levels must try their best to carry out the Law of forest protection and development. The efficiency of implementation of Law for forest protection and development depends on many factors, so on the basic of the Law the functional organizations ceaselessly bring into full play the efficiency of the Law to protect and develop the existing forest estate in their localities, so forest destruction, forest encroachment was greatly reduced. Number of forest fires, damages also reduced significantly since the coming into life of the Law for forest protection and Development.

b. Land Allocation Policy

Based on the Law for forest protection and development (dated 19-08-1991), based on the Land Law (dated 10-07-1993), on 15-01-1994 the Gov. promulgated Decree No. 02 - CP on the allocation of Forestry Land to organizations, households, privates for long term and stable use for forestry aim. According to the mentioned Decree from Article 1 to Article 5 the Gov, regulates who are allocated and forest types are allocated to which organizations. Article 6 of the Decree regulates the duration of time of use for allocated organizations, households and privates . Article 15 regulates the rights and duties of allocated land users . Article 16 regulates those are to be fined or rewarded.

On the basic of this Law many farmer households were allocated land to, their land tenure and rights for management and at the same time they must be responsible for forest estate protection. Forests got their real owners that is why forest destruction as well as slash and burn practice was limited. Many former open sites and bald hills were used for afforestation for industrial use. Until now many households grew 10s of ha, forest garden system widely applied in the project areas. People's life is to some extent improved. Forest destruction

and slash and burn practice are limited.

c. Decree 39-CP dated 18/05/1994 of the Gov. on the institutional system, task and rights of Forest Protection

To strengthen the forest management and protection on 18/05/1994 the Gov. issued a Decree to perfect the organization and rights of Forest Protection Units of the country. Chapter II of this Decree clearly regulates the rights and duties of Forest Protection (KIEM LAM). As said in Section 1. Article 4 the Department of Forest Protection is responsible for the implementation of the Law, policies relating to forest management and protection, management of forest products circulation. Section 6 of Article 4 regulates that KIM LAM is responsible for the conduction of the examination, inspection and solving of violation of what relate to the circulation of forest products.

Article 5 regulates that KIEM LAM Branches are assistants to Provincial People's Committee to carry out the function of State Management on forest management and protection of their provinces. Article 8 of the Decree clearly regulates the power of fining of KIEM LAM officers. This is a tool for KIEM LAM officers to deal with forest protection effectively.

d. Other Policies and Programmers

+ Program - 327

Decision 327-CP dated 15/09/1992 of the Prime Minister on the policies on forest utilization, open land... it is called 327 Program. This is a National Program, which consists of agri-forestry and fishery production, fixed agriculture and moving people to new economic areas. In 1995, afforestation was the main activity, protect the Conservation Forests (National parks and nature reserves)

+ Program- 245

The responsibility of State Management on forest and forest land of all People' Committees relies on Decision No. 245/1998QS-TTg dated 21/12/1998 of Prime Minister on the implementation of responsibility of State Forest and forest land Management of different levels . At present, this program is expanding to grass root level (commune level). The expansion is still slow that is why the program does not bring into full play its role

+ Program - 06

This program deals with the abolishment of opium growing in the upland areas of Mountain Ethnic Committee. Tens of billion of VND was spent on this program. Different project also contributed to this program. In general, the efficiency was not so high as not good plant and animal species were found to completely replace the opium.

Local people (the Dao) get used to growing opium as it brings about high economic values and now they grow rice and the economic value is lower that is why they are meeting with economic difficulties as well as area for cultivation that is the reason for higher level of slash and burn practice and this a big challenge for forest protection in the Centre. If this question is not paid due attention to the risk of forest destruction is unavoidable.

+ Program - 661

Decision No. 661/QD-TTg dated 29/07/1998 of Prime Minister on the 5 million ha Program. The Centre will be responsible for million of ha and protection of the existing forests. Some of the provinces as Lao cai, Tuyen Quang the natural conditions are suitable for natural regeneration and rehabilitation because taking care for natural regeneration is cheaper than new planting. At present according to forest protectors 50000 VND /ha /year spent on forest protection is too little and until now the Gov. has not got any official policies on the benefit sharing between the Gov. and forest protectors, that is why the efficiency of forest protection is not so high, farmers are not confident enough to live with their forests. It is proposed that the

Ministry of ARD (MARD) should timely issue suitable policy in this regard. The remained provinces as Phu Tho, Yen Bai ... afforestation in the 5 million ha Programme is in difficulty as lack of investment, too low production investment, particularly the case of unclear benefit sharing that is why the efficiency of afforestation is not high.

+ Program - 135

In 1999 the Gov. launched a movement of support more than 1000 poor communes in the remote and upland areas of the whole country in order to improve their living conditions through it is possible to limit the pressure on natural forests of people. Each so called poorest commune can get 400 million VND to invest on the construction of schools, roads, stations. With that sum it is not much improvement that is why the supports of international projects such as MRDP will be great values in case of improving living conditions and contribute to forest management and protection.

e. Policies on forest development and protection at local levels

Beside the policies of the Gov. on land allocation and protection of forest by contract as well as policy of economic development for the rural areas, at province level there are also their own policy on the basis of the province APO and stages. The most distinguishable policy is the forest protection of the province. These policies and decision were expanded to village level particularly thing concerning forest destruction and slash and burn practice. Tuyen Quang issued the forest closed policy right at the beginning of the 1990s. Due to this policy Tuyen quang forests were well protected. By 1998 60,000 ha of natural forests regenerated and allocated to KIEM LAM for protection of these forests. Forest protection of provinces is of different. forest regeneration of Phu Tho and Yen Bai took place slowest. There are various reasons but the major one is poor conduction of forest management organizations.

f. National and International Projects

The Centre is the key area that supplies raw materials for Bai Bang Pulp and Paper Mill. Since 1970s Sweden supported to establish the raw material area and it is an on-going project, and MRDP at present. The efficiency of projects is reflected rather clear when assessing changes of forest resources of the Centre and when comparing the change of forest resources of communes inside and outside project areas.

6.4.2. Impacts of natural conditions

Forest resources are always impacted by physical conditions such as soil, humidity, and climate. When finding the change of forest resources it is impossible to forget the interrelation and the climatic impacts on these changes. The Centre is favorable for the development of the forest vegetation.

As the statistics on soil conditions of the Centre it can be seen that most of soil types in the Centre is Ferralite with good soil depth (>50 cm). Land that bears the characters of forest land is of very high fertility, this is a necessary condition for forest rehabilitation and recover of the Centre. Results of soil survey show that 29.1% of natural land area of the Centre is of soil depth of over 50 cm. Soil conditions in this area are advantageous for natural regeneration and rehabilitation. This is why fast rehabilitation and recover of forest happen in this area

6.4.3. Impacts of social conditions

The mountain area of the North is the home of many ethnic groups (30 groups) amounting to 55% of the ethnic minority of the country. The most distinguishable feature is the alternative settling, forming villages where forest is rich. But due to different traditions, cultures and customs that results in uneven population distribution. The upper land is the home of Dao, H'mong, Kho Mu, Giay. The middle is for Cao Lan, San Diu, Pa Then, and the low is for Kinh, Muong, Thai, Tay, Nung. The upland people mainly rely on slash and burn practice by means of shifting cultivation and totally depend on natural conditions. In such a situation human beings' touch forests is unavoidable which poorly limited forest area. According to data of present survey 80% of people are farmers this does not impact little on forests if there is policy of investment in afforestation this is an advantage in labour force. In case of not good investment, this labour force will be forest damagers.

After 10 years of *doi moi* (1993-1998) the economic growth of the Centre can be clearly seen, say 8.9% annum. GDP per capita amounts to 1,525,000 Dong/year in average, but income is uneven among different walks of life, zones particularly productivity in agriculture and forestry production is low and unstable. In the recent years, many cash crop species were introduced into the Centre and more area for high economics value species such as Tea, Doan Hung pomelo, Ham Yen, Chiem Hoa mandarins, oranges, waxtrees ... But area for paddy is still lacking as well as capital, fertilizers, techniques, low productivity while the increasing of population is high and slash and burn practice still happens. These are reasons of forest damages.

Statistic figures show the total forestry production that:

Afforestation : 15.6%

Forest product exploitation : 81.3%

NTFP : 2.5%

Bee keeping : 0.6%

That is to say that exploitation of forest products is the main focus recently. While afforestation and forest tending cover only a small part. This reason results in difficulty for forest rehabilitation and it should be solved.

6.4.4 Negative Impacts relating to forest changes

a. Forest fires

Forestfires for a long time is considered to be one of reasons that makes forest lost its area. The Forestry sector in which KIEM LAM (Forest protection) playing the key role has had many active measures in the control and stopping of forestfires, but it still happens very often. Reasons for forestfires is still a lot of different level of losses but the most popular one is the careless of human beings.

Lao Cai forest protection branch indicates that most of the cases spring from slash and burn practice, and buffalo boys. Lots of forest area can regenerate naturally if without fires. Forestfires often happen in Sapa , Than Uyen (Lao cai) ...

In general forestfire control is getting better in most provinces.

Lost area of Ha Giang, Lao Cai and west of Yen bai, east of Tuyen Quang , forestfires often happen. Collection is however not enough, data collected from Forest Protection Branch of Yen Bai, Vinh Phu (Phu Tho at present) from 1986 - 1990 show that forest area got burned in Vinh Phu was 580 ha, Yen Bai is higher 1,010 ha.

b. Slash and burn practice

Slash and burn practice is the question of ages of the upland ethnic minorities when the problem of food is not solved absolutely.

Recently, to some extent the Gov. paid attention to the living conditions of the upland people, however the problem of food supply is not completely solved, that is why slash and burn practice is unavoidable.

c. Illegal exploitation of forest products

During the 1970s and 1980s the Centre was main firewood supplier for the North. According to statistics, 150.000 m³ of timber and 300.000 steers of firewood and millions of bamboo stems were removed from this area for different uses to say nothing about the supply of timber for Paper Mill. By the end of the 80s, many factories, enterprises were lacking of work due to *doi moi* policy (renovation) workers had to earn by collecting firewood. Data given by the former Ministry of Forestry show that from 1986-1990 provinces of the Centre exploited about 2.4 million m³ of timber (including pulp wood), 18.7 million steres, 70 million of bamboo stems for construction and 110,000 ton of bamboos for pulp .

Forest of the Centre remained so little, rich and medium forests in standing volume and species compositions is less. Forests were repeatedly cut and they became swidden land and finally open land with scattered trees.

Bai bang Pulp and Paper Mill has the capacity of 300,000 ton/year (1987-1990) each year it need 129,000 cubic meters of timber and 91,000 ton of bamboos. Due to price mechanism, while timber of forest enterprises cannot be fully used, a large area of plantations is fell to get timber for the Mill. According the Mill, fro 6/1960 to 6/1962 plantations of all enterprises in the paper raw material area lost 2,700 ha

d. Identification of the trend of forest change in the coming future

In the coming future the trend of forest change in the Centre will still be positive in case of forested area and forest cover and forest vegetations however forest quality still reduces however forest management significantly improved and policies that encouraged people to involve in forest protection and development of forest estates, but due to the increasing requirement of timber forest protection still meets more difficulties.

However the fact is like that, the efforts made by functional sectors in the coming future forest area will increase particularly in the 5 million ha program, whether little or more, the Gov. has to invest in would-be afforestation, it is sure that forest area of Vietnam in general and in the Centre in particular will increase. On the other hand, when the living conditions of local people is improved so does their consciousness and knowledge on the importance of forests and they themselves protect forests well particularly when the are allocated forest land to and contract to protect forests.

7. CONCLUSIONS AND PROPOSALS

7.1. Conclusions

Within only 4 months of implementation with support of most modern equipment - the advanced software , the working group constructed the map system for the whole Centre scale 1/250.000 and 1/100.000.

So, the following conclusions can be withdrawn as follow:

From 1989 to 1998 the economic situation of Vietnam changed greatly from centralized one to market one which strongly impact the changes of forest area and vegetation.

During this period there were many policies for forestry development and investment for agri-forestry sectors. And the efficiency of these policies is clearly seen.

The Gov. invested a lot for afforestation and protection. So forest destruction was stopped.

The forest cover and vegetation of the Centre after 10 years increased by 9% (from 17.2% in 1989 to 26.2% in 1998).

Area of timber forests increased mainly from SBL after protection for regeneration, however the quality of forest is not so high.

Area of plantation increased significantly which supplied the requirements of timber of people and industry...

The role of plantation increased significantly and it is sure that in the coming future it can replace the role of natural forests as regard timber.

When comparing the changes in forest cover and vegetation in MRDP on-going project districts and non project districts it is possible to see the difference (but not reliable enough), i.e. forest area in on-going project districts increased more than that of non ones.

7.2. Proposals

As time for this study is short, materials used are mainly maps and images so mistakes are unavoidable. The study of forest cover changes in 20 communes is the main base for the assessment of changes on forest cover of communes inside and outside the Program area to work out conclusions on the role of the Project in the Centre.

8. Literatures

Do Xuan Lan (1995) : Assessment of forest resources change of North of Trung Bé (Central Vietnam) 1976-1990

Pham Duc Lan (1992) : Assessment of forest resources change of the Centre 1976-1990

Nguy Huy Phon (1996) : Assessment of type of land uses in agriculture and forestry to contribute to t land use in the Centre.

FREC - FIPI (1996) : Research on forest resources change of Son Duong district Tuyen Quang province 1980-1985

FIPI (1990) : Forest Resources data 1990 FIPI (1995) : Forest Resources data 1995

FIPI (1998) : Forest Resources data 1998

List of interviewed persons during the field visits to 5 provinces

Name Position Organization

Mr. Lenh Xuan Cuong

Mr. Duong Viet Nghia

Mr. Hoang Van Tuyen

Mr. Nguyen Van Trach

Mrs. Nguyen Thi Tuoi

Mr. Dau

Mr. Giang Mi Pao

Mr. Giang Mi Lenh

Mr. Xuan

Mr. Nguyenn Ngoc Xuyen

Mr. Bui Hai Ha

Mrs. Binh

Mr. Quoc Anh

Mr. Quyet

Mr. Vu Do

Mr. Nong

Mr. Ky

Mr. Bo

Mr. Toan

Mr. Viet

Mr. Pham Van Hien

Mrs. Thanh

Mr. Luong Van Thang

Mr. Vinh

Mr

Director Forest protection Branch Ha Giang