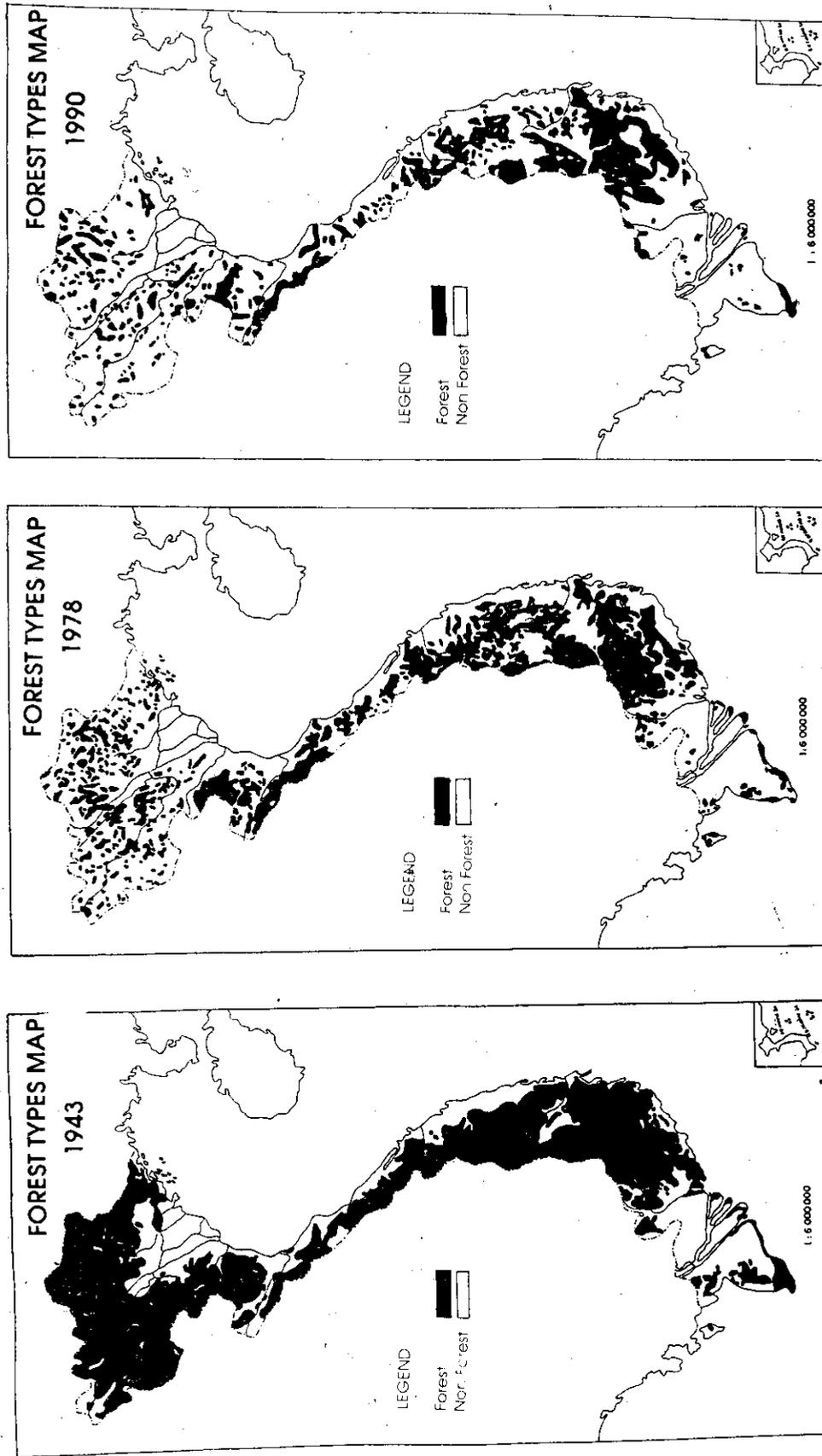


Figure 22



# Forest Cover in Vietnam (Percent cover)

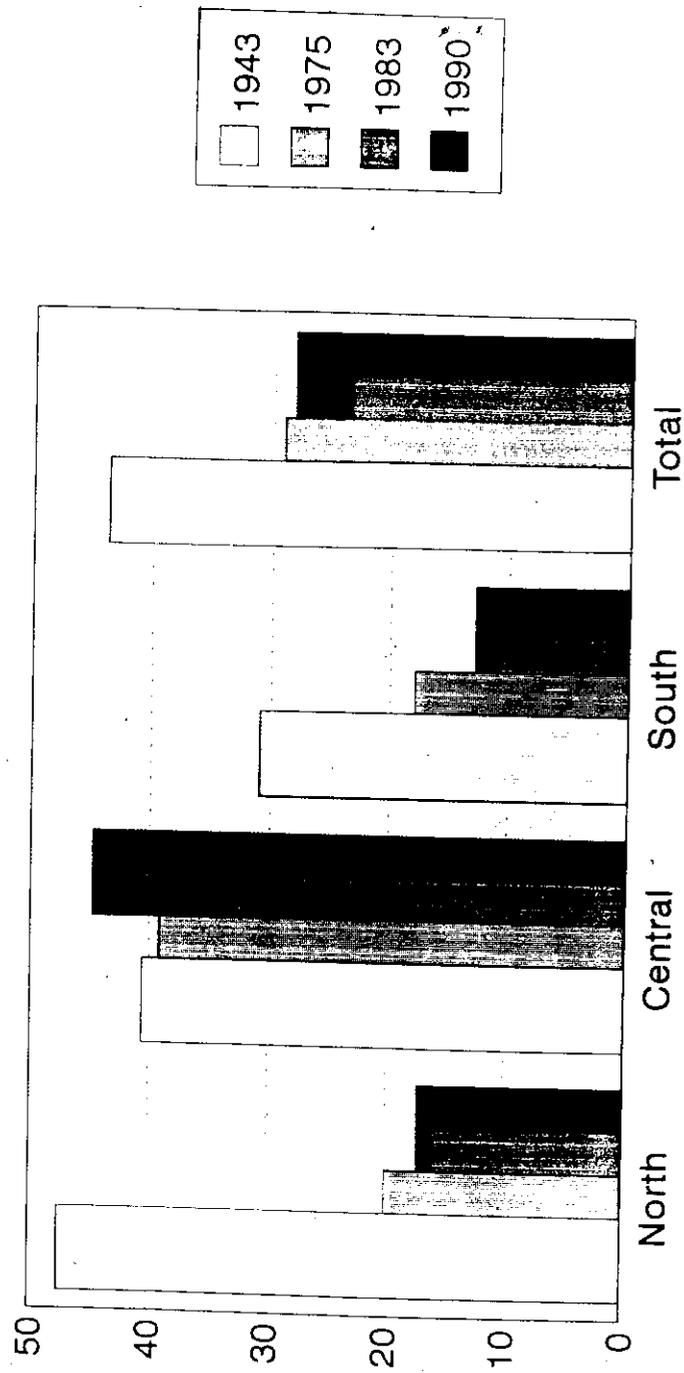
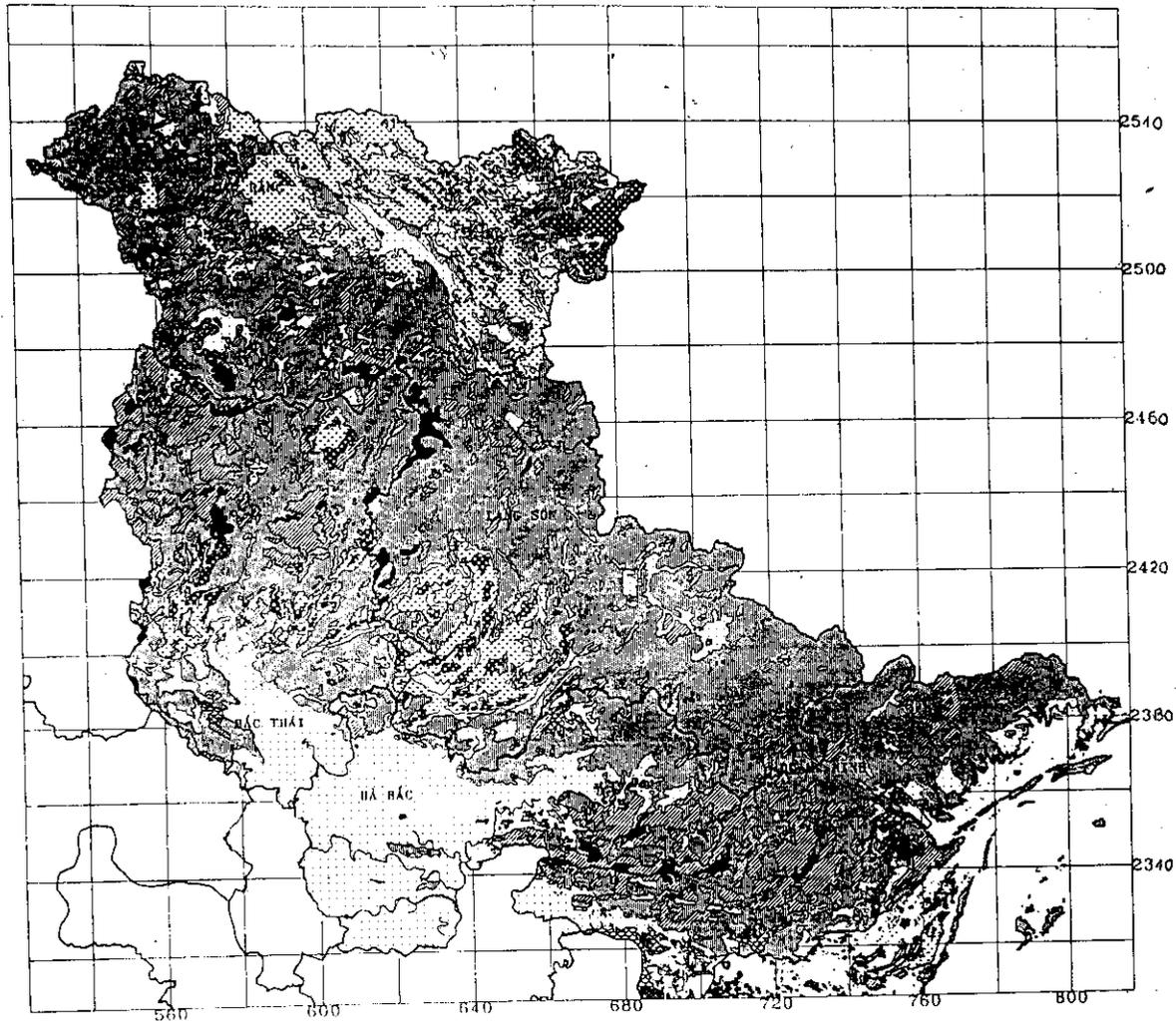


Figure 23

Source: FIPI, Hanoi

Hình 24



**Forest Classification**

1... Good Ever/Semievergreen
2... Disturbed Modified Ever/Semi
4... Conifers
5... Mangrove/Mecaleuca
6... Plantation
7... Cultivation/Settlement
8... Bareland
9... Poor Limestone
10... Good Limestone
3300... Water Area

**Boundary Legend**

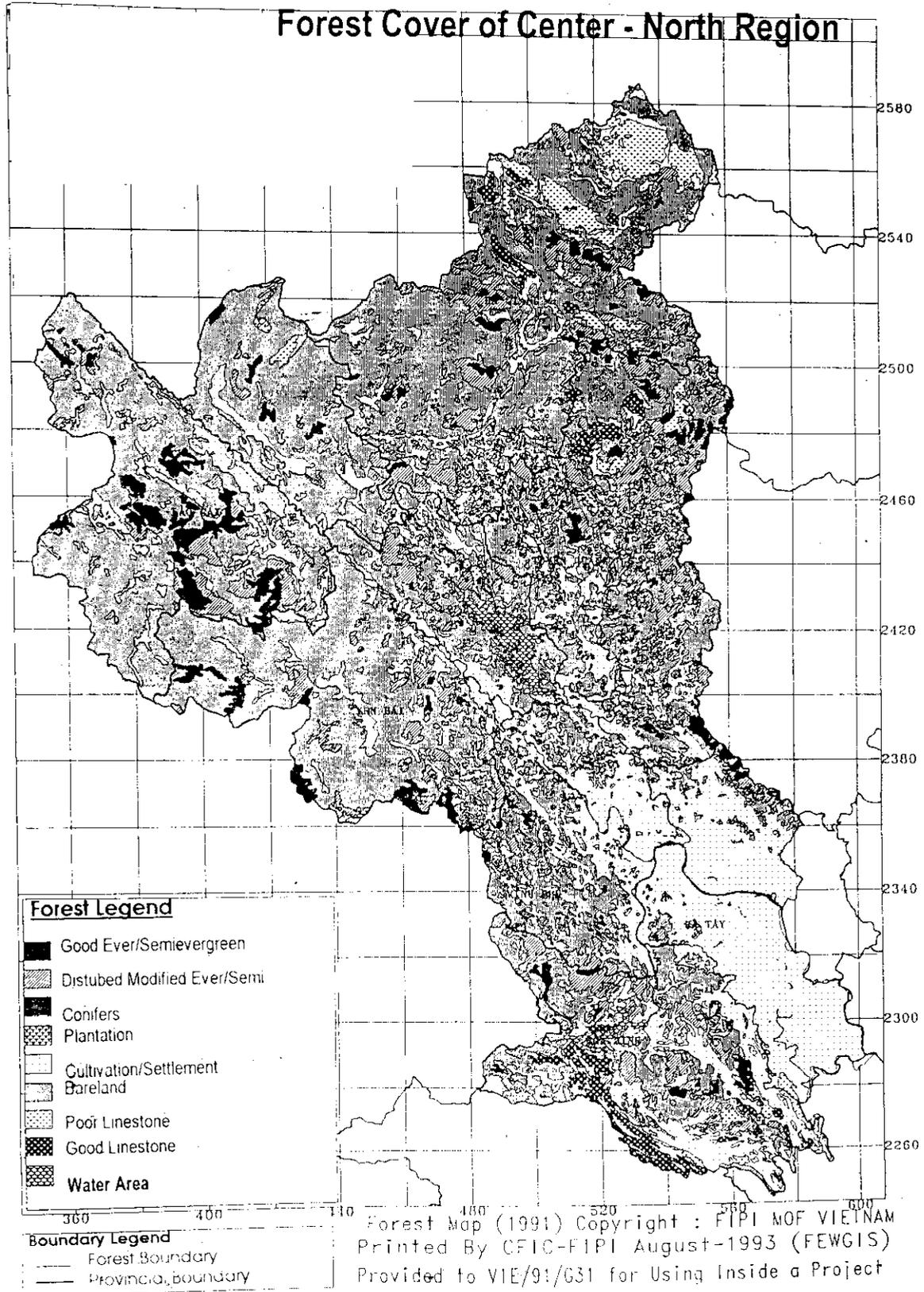
—	Forest Boundary
—	Provincial Boundary

Hình 24

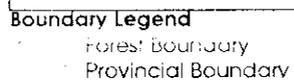
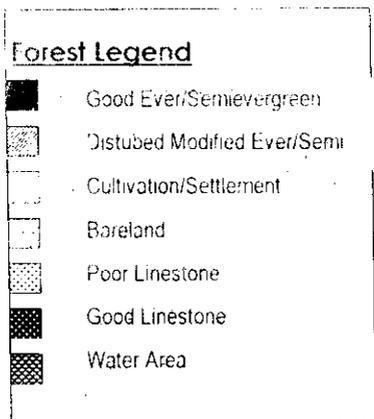
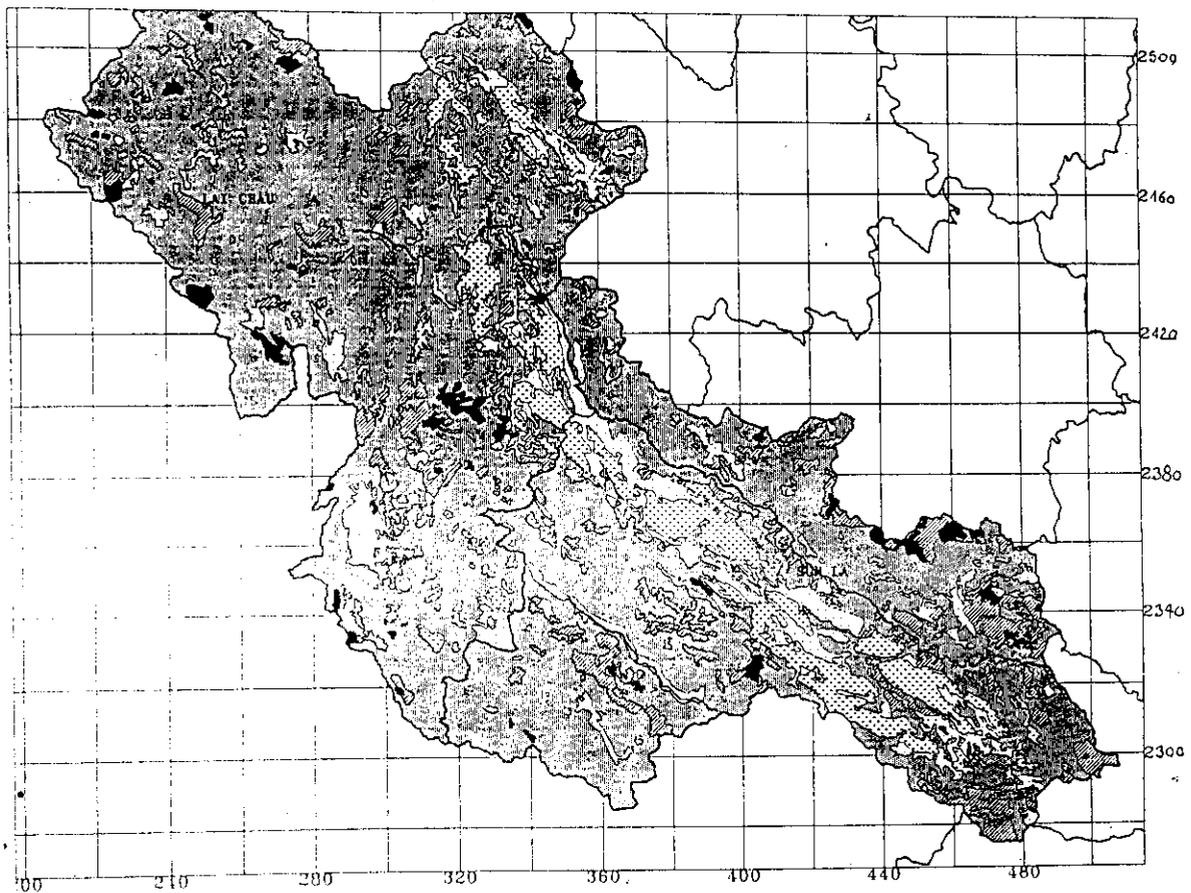
**Forest Cover of North - East Region**

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Figure 25



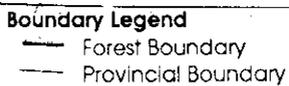
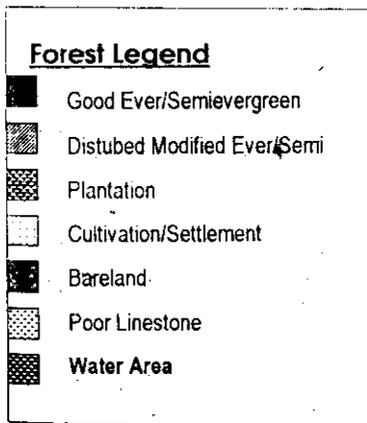
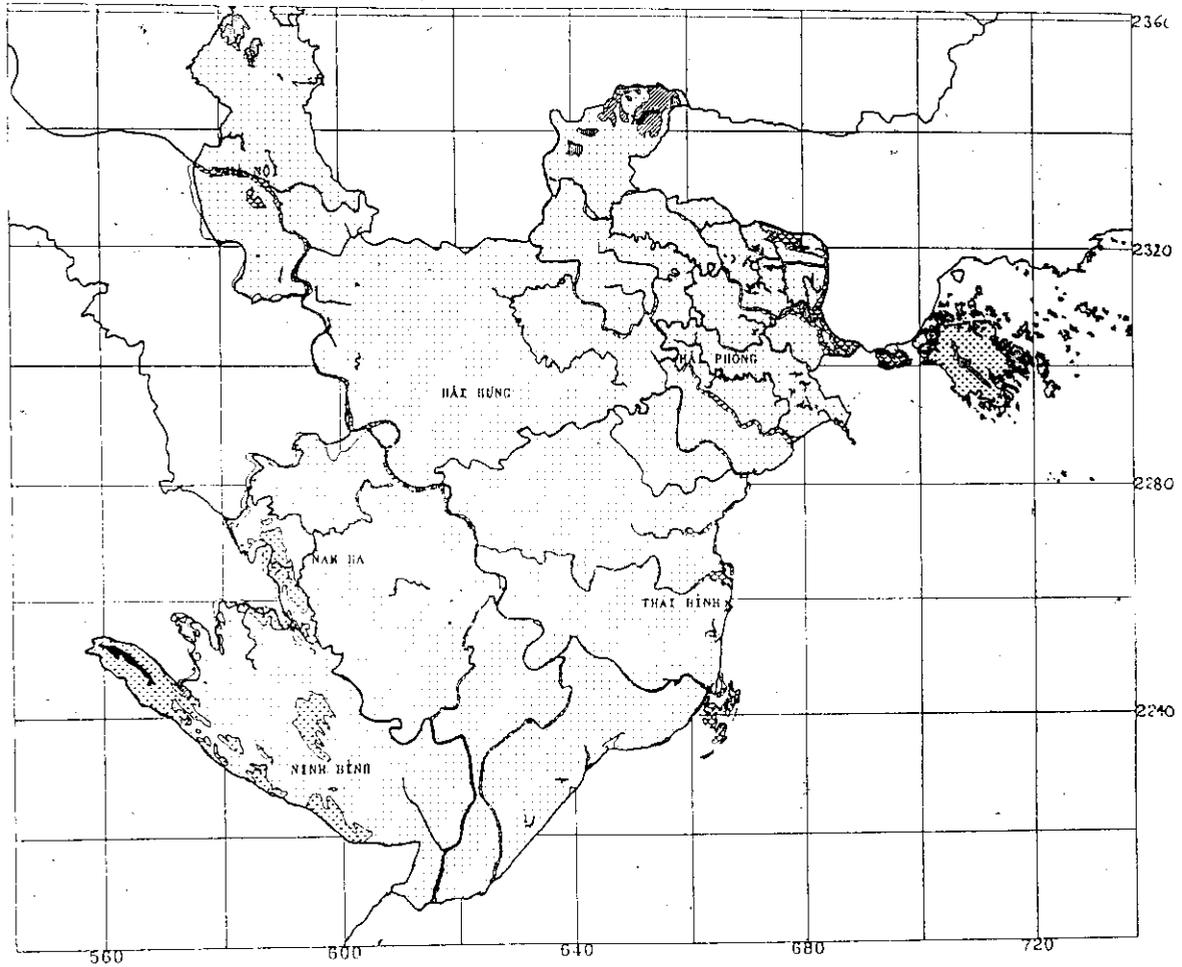
**Figure 26**



## Forest cover of North West Region

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**Figure 27**



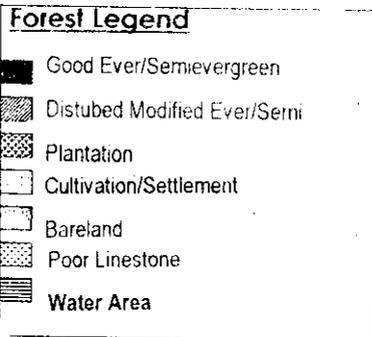
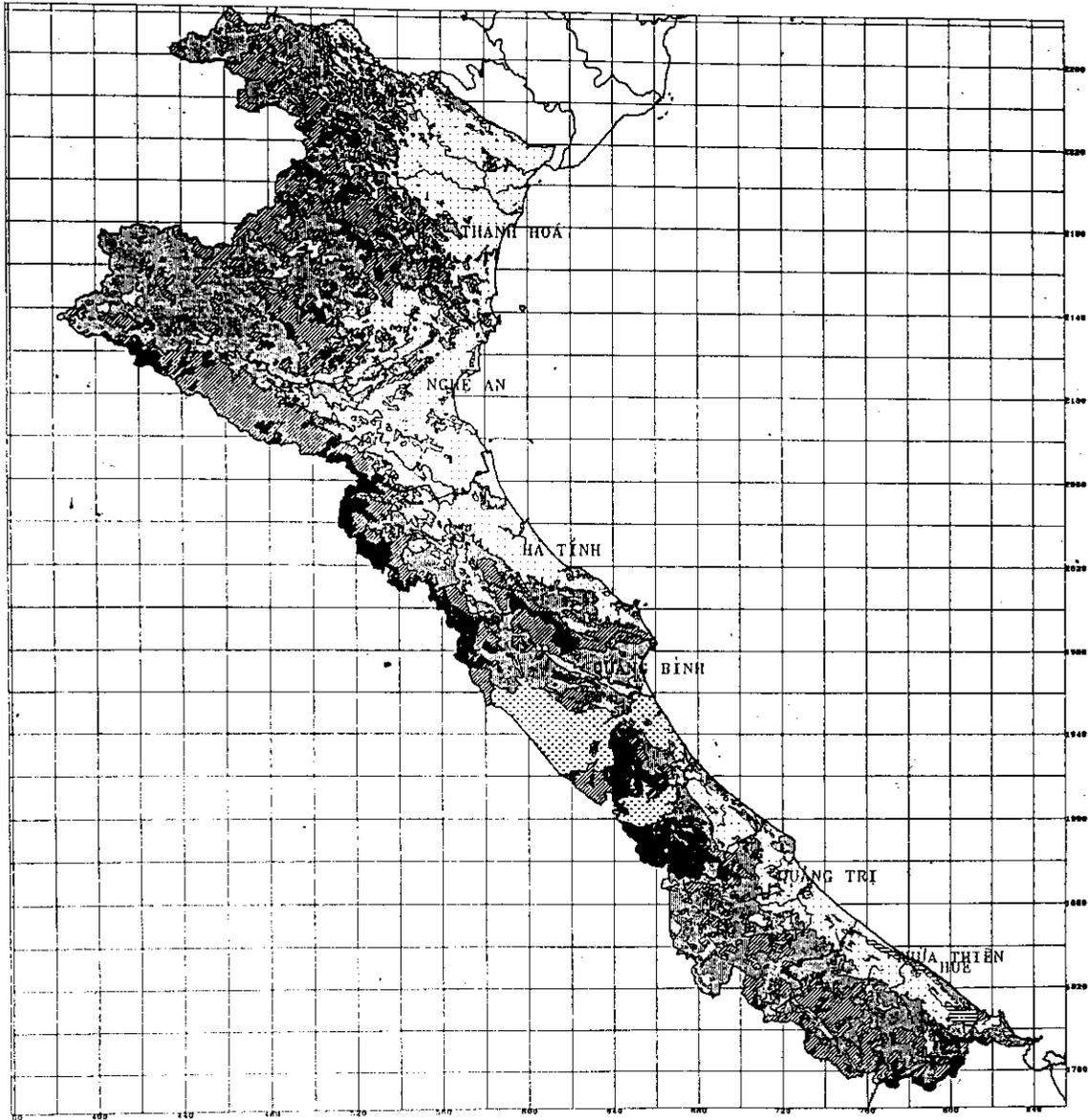
### Forest cover of North - Delta Region

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Figure 28



### Forest cover of North - Centre Region

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Figure 29

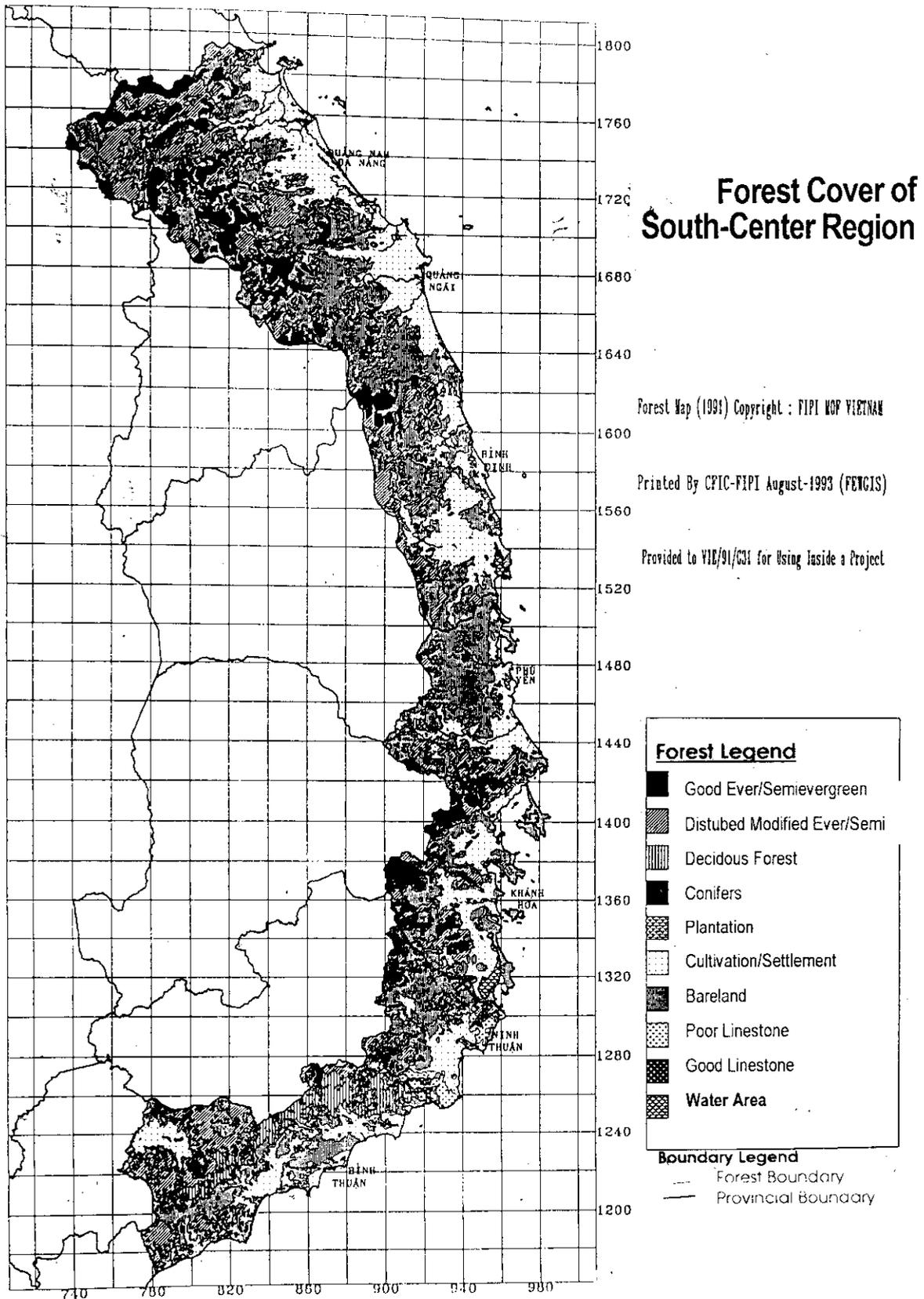
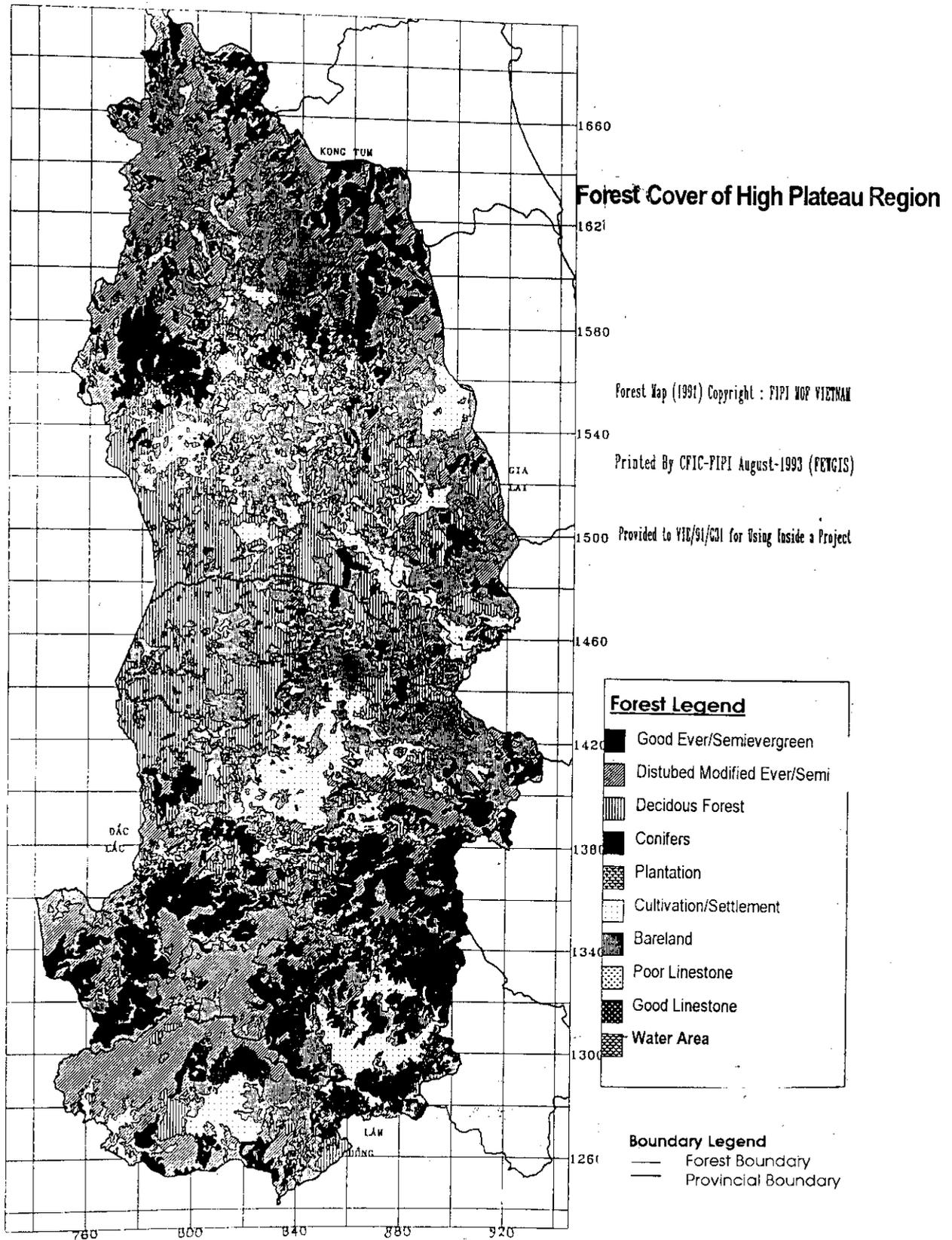
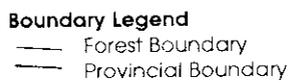
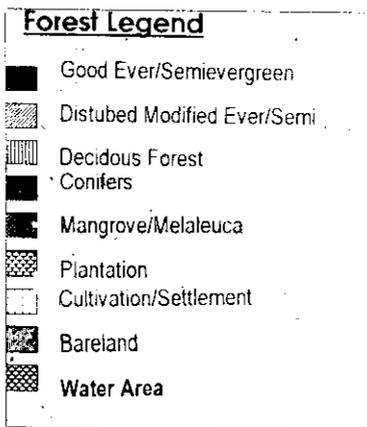
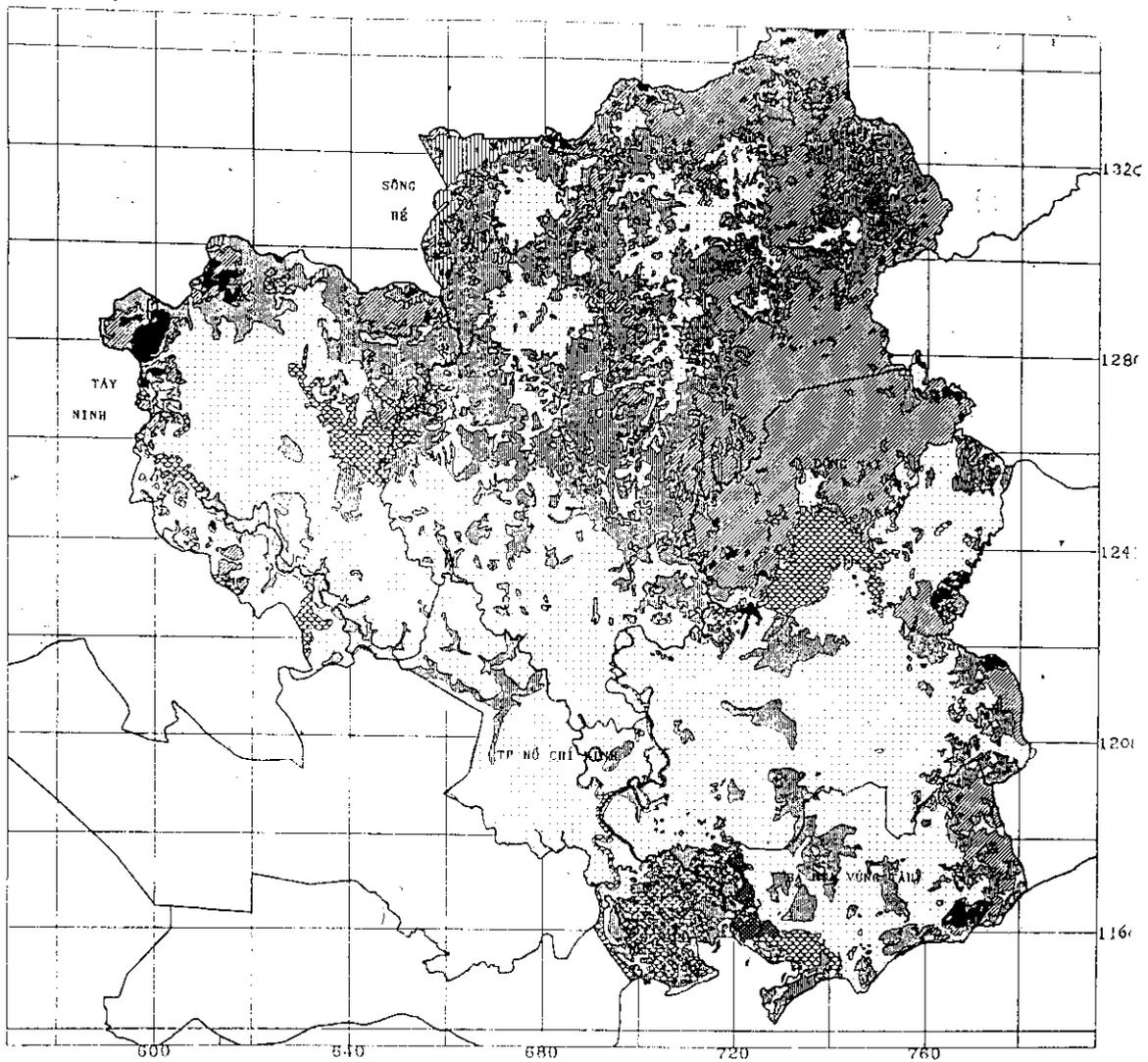


Figure 30



**Figure 31**



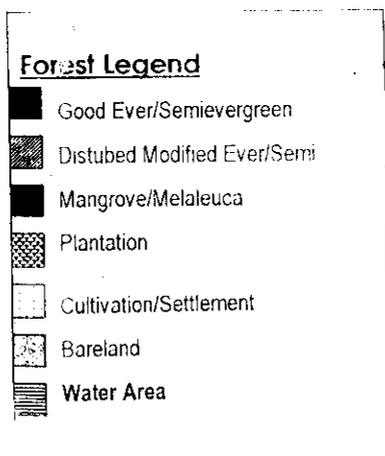
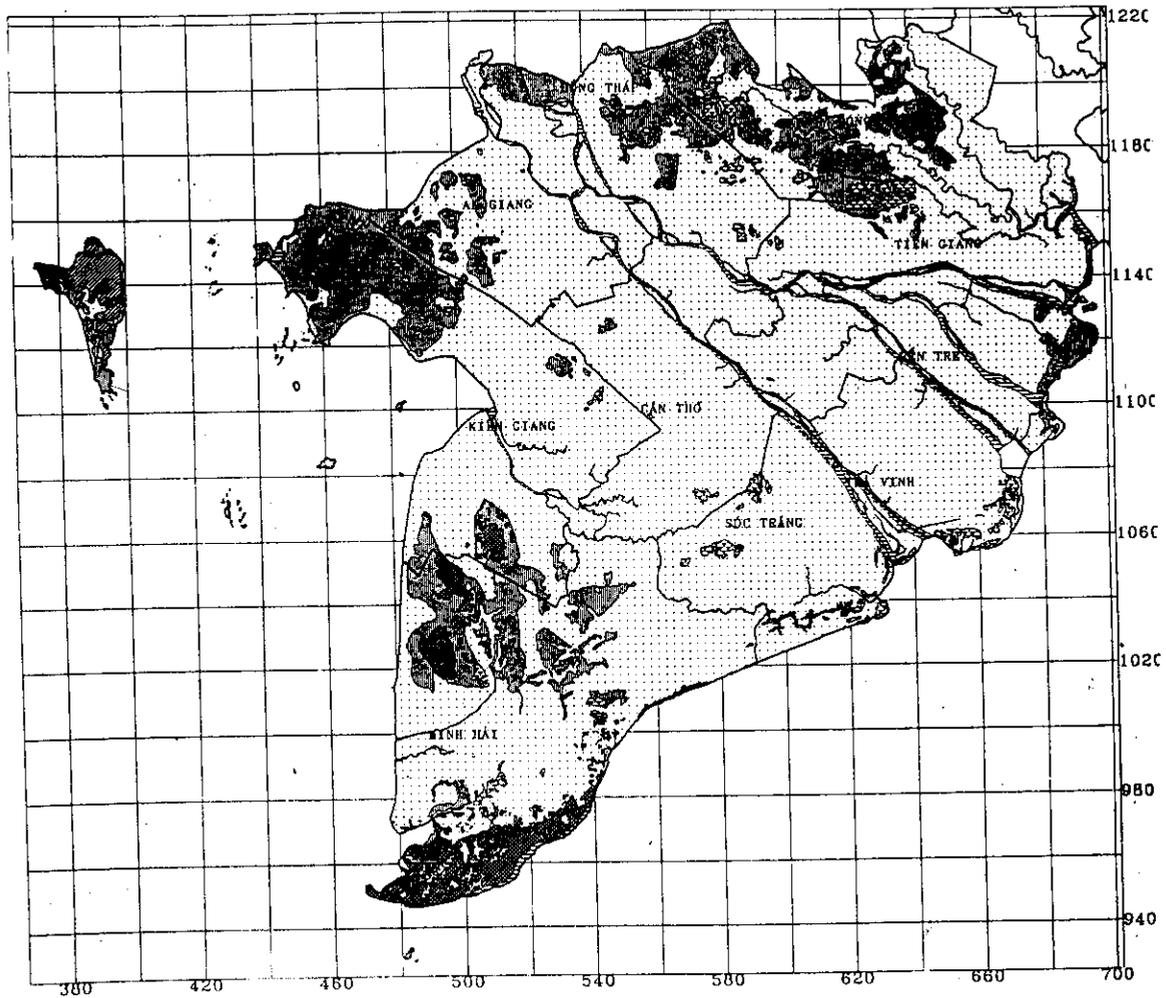
### Forest Cover of East - South Region

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Figure 32



**Forest Cover of North-East Region**

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## 1.11 Threats to Biodiversity

Table 10 summarises provincial level perception when officials were asked to assess the main threats to biodiversity in their provinces. In addition, provincial heads of Forestry from every province were asked to complete questionnaires to rank threats to biodiversity. The results are summarised below. Threats are listed in order of perceived magnitude.

**TABLE 10: Provincial Officials' Views on the Major Threats to Biodiversity**

<b>Major Threats to Biodiversity (in ranking order on importance)</b>	<b>Summary of Provincial Officials' Comments</b>
1. Encroachment	A major loss of biodiversity.
2. Hunting/fishing	Very difficult to control.
3. Logging	Has been serious, now much reduced.
4. Forest fires	Serious in some areas, but now under better control.
5. Fuelwood collection	Serious everywhere.
6. Wildlife Trade	Serious for some species.
7. Pollution	Increasing.
8. War damage	Formerly very important, now less serious.

It should be noted that these are the views of provincial government officials. The local communities living in these areas would very likely have a much different perspective of the major threats to biodiversity. A study is needed to examine this area.

For marine ecosystems, the major threats have been identified as:

- i) Over-exploitation and disregarding fish size and quantities.

- ii) Destructive fishing methods, especially using dynamite.
- iii) Coral mining for lime and cement processing.
- iv) Curio trade demanding hunting for rare species such as turtles and uncontrolled harvesting of seashells and corals.
- v) Pollution including siltation from land, coastal activities such as mining and construction.

The ratings of threats on marine biodiversity for six coastal provinces were obtained from questionnaires distributed to local government officials (*Table 11*). Coastal forest cutting and dynamite fishing were highly ranked as most serious in almost all regions.

**TABLE 11: Provincial Officials' Views on Marine Conservation**

Threats on Marine Biodiversity	Quang Ninh-Hai Phong	Hue-Danang	Binh Thuan	Kiep Giang - Phu Quoc
Pollution from land (including siltation)	-	2	2	-
Pollution at sea	-	1	2	-
Coastal activities (sand-mining, reclamation etc.)	-	2	2	-
Dynamite fishing	-	4	4	-
Coral mining	-	1	3	-
Overfishing	-	2	5	-
Wildlife & curio trade (turtle shells, birdnests etc.)	-	2	3	-
Others	-	3	1	-

Evidence has indicated domestic and oil pollution at Bach Dang (Haiphong) and Dong Nai (Ho Chi Minh City) estuaries. Aquaculture encroachment, reclamation and hydraulic projects such as the building of Dinh Vu dam across the Cam River at Bach Dang, also impose serious threats to estuaries.

Like tidal flats in estuaries, high tidal flats in river deltas are commonly reclaimed for agriculture or converted into aquaculture ponds.

Threats to inland and coastal wetland habitats are diverse. Forty species of freshwater and estuarine fish are already listed in the Red Book. The main threats facing these are identified as overfishing (including the use of unsuitable and destructive methods such as poisons, explosives and fine mesh nets), pollution (especially agricultural runoff of pesticides and fertilisers) and deterioration of habitat (siltation, reclamation).

### **Shifting Cultivation**

For generations some ethnic minorities practiced a sustainable form of shifting cultivation. Fields were cleared and cultivated for a few years then left fallow for many years before being used again. Such a system only kept a small proportion of the forest open at any one time and had an enriching effect through allowing colonisation by new invader species. In many areas the system is no longer sustainable because the population has increased, mainly through migrations, while the forest area has shrunk. This means that fallow periods are no longer enough for forest regeneration.

### **Agricultural Encroachment**

This threat comes from farmers migrating, or being relocated by government, from poor lowland areas to new farming areas in hilly terrain. They are not traditional shifting cultivators, know little about forest and its values and uses, and open up substantial tracts for agriculture.

The mangrove areas in Minh Hai Province face particular threats from local farmers clearing mangrove to make shrimp ponds. These mangroves are among the richest in the world. They were heavily destroyed as a result of defoliant sprayed in the war. They have been restored by intense replanting efforts by forestry brigades and the army. Now they are being destroyed for the short-term gains of shrimp farmers at the expense of biodiversity and estuarine fisheries. *Figure 33* on page 71 shows the dynamic changes in forest cover over the last 50 years.

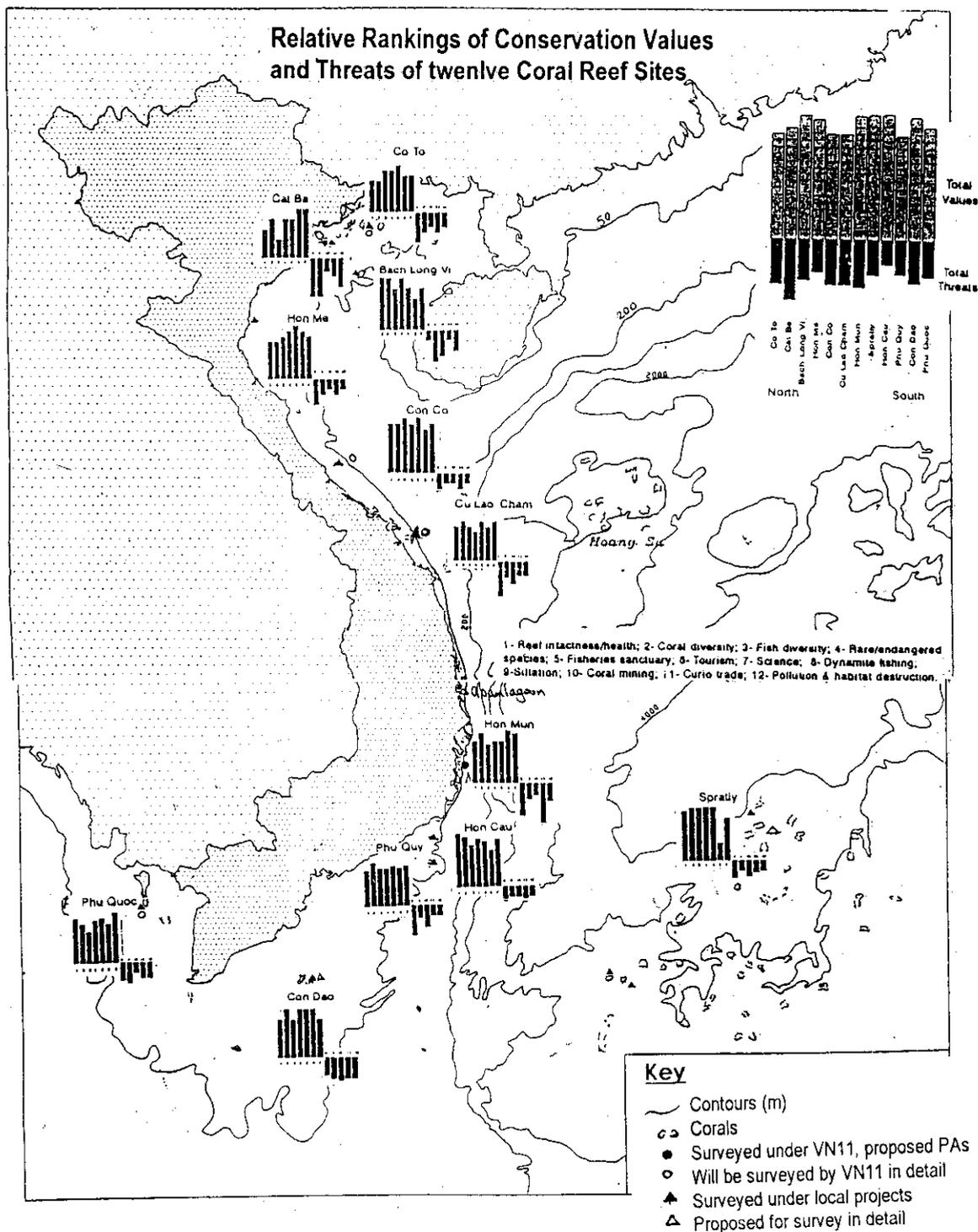
## Overhunting and Overfishing

Hunting is rated as only a moderate threat, but this is certainly a major threat for some endangered species. The rural countryside is notable for a paucity of birds in the fields and villages. This is due to hunting combined with over-use of pesticides and fertilisers and the ecological monotony of rice monoculture.

Overfishing is a fact of life everywhere. Moreover, the methods used are non-selective and very destructive - fish traps, sluice traps, electric fishing, gill nets, dynamiting and the use of poisons.

Overfishing is clearly shown by the noticeable decline in catch per unit effort (CPUE) despite the increase in fisheries effort over the past ten years (*Figure 34* on page 72). Such a phenomenon is most serious in the north above 20°N where actual production has declined drastically since 1987 and by 1992 production had dropped by 39% despite a 32% increase in total vessel power. A number of species have shown serious depletion including *Nemalalosa nasus* which was being caught in volumes of 1,000 tonnes annually 30 years ago but is now extremely rare. In northern Vietnam catches of the three Clupeidae, *Hilsa reveesi* (Five-spotted herring), *Clupanodon thrissa* and *C. punctatus*, have dropped from 500-1,000 tonnes per year to only 10-20 tonnes. Non-fish products such as lobsters (*Panulirus*), abalone (*Haliotes*), scallop (*Chlamys*) and squid (*Loligo*) have also shown a marked decline. The pearl shell *Pinctada martensii* and *Lutraria philippinarum* have disappeared from many sites in the north. Exploitation of these species continues although all of the three Clupeids, four lobster species and two abalones are listed as vulnerable and *Loligo formosana* as endangered in the Red Book.

Figure 33



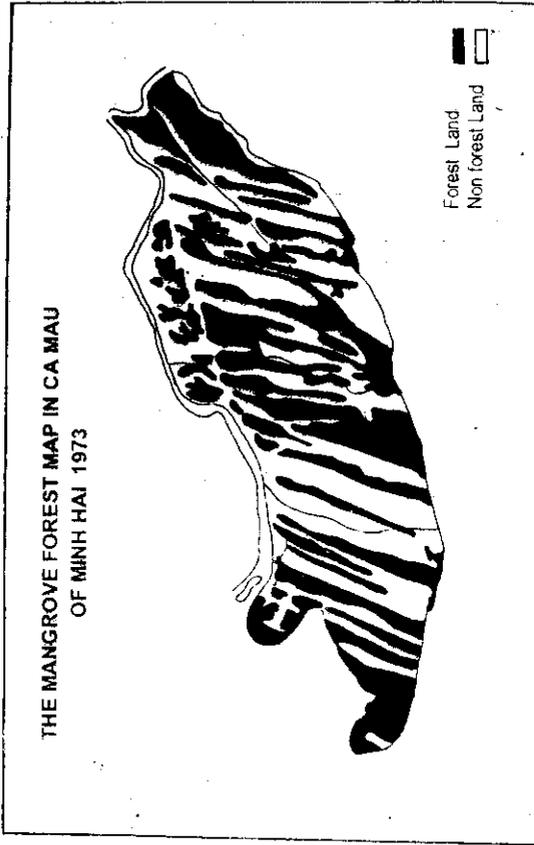
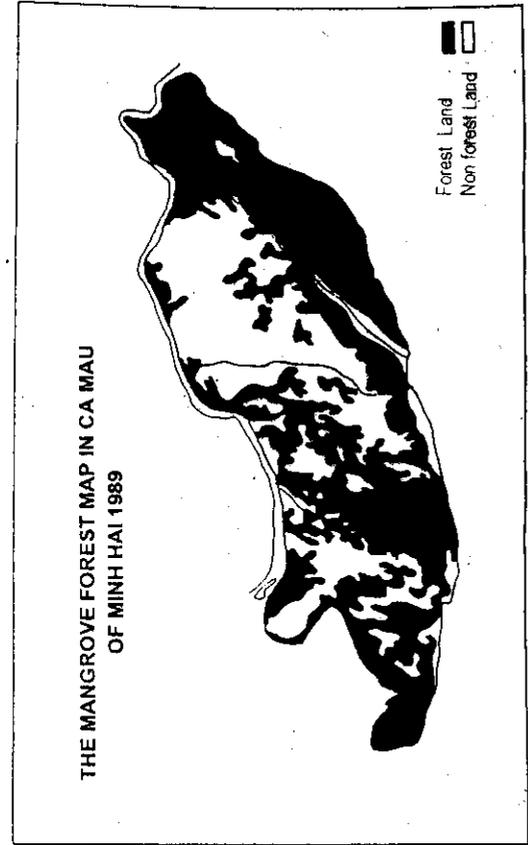
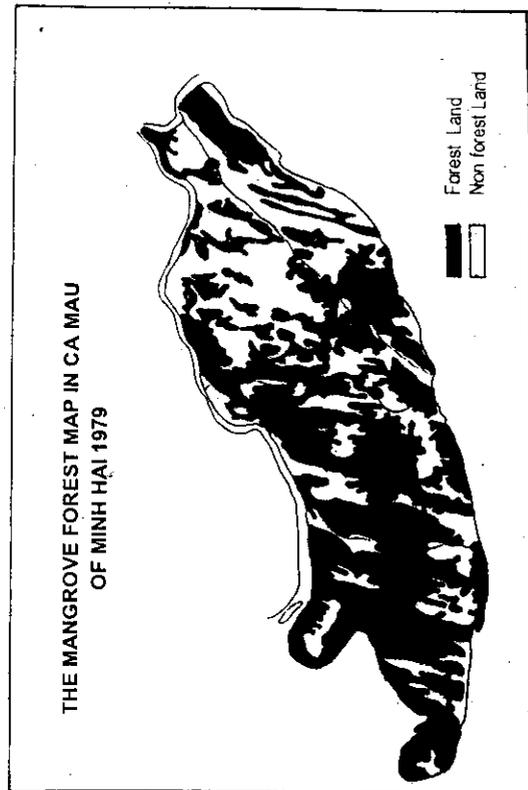


Figure 34



## Wildlife Trade

Increasing trade in snakes, tortoises, terrapins, geckos and almost any edible or medicinal species is a continuing drain on the natural populations of many wildlife species. The trade is largely uncontrolled and much is even undertaken by quasi-government agencies. Many endangered and protected species can be seen for sale in the markets of Ho Chi Minh City and Hanoi. These domestic trade points are small compared to the volume of wildlife being smuggled across the borders into China or by boat to Thailand and Singapore.

Since there is no single department directly responsible for the control of wildlife trade, concrete figures to show the extent or trend of such activities are unavailable. General observations have also indicated over-exploitation of many marine species.

### Marine turtles:

The hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*) are heavily hunted for their shell and meat respectively. The hawksbill's shell is made into souvenirs for tourists. The centres of turtle trade are Nha Trang, Vung Tau and Ha Tien. The turtles sold in Nha Trang are mainly caught from Quang Ngai to Binh Thuan. Before 1990, 2,000 turtles were being sold every year in Nha Trang. The number has now dropped to below 1,000 and the size of turtles caught has also decreased. Small, adolescent turtles are often more lucrative items as they are easier for tourists to carry home than the larger mature turtles. The average price of a hawksbill turtle ranges from US\$ 30 to US\$ 80, however vendors will charge higher prices when the buyers appear willing to pay.

Turtles sold in Vung Tau are mainly caught from Con Dao and the submerged banks off Vung Tau and Dong Nai. Turtles sold at Ha Tien are from Phu Quoc and Tho Thu. Several turtle farms on Phu Quoc have closed down due to habitat degradation and increasing hunting pressures (on both adults and eggs). Only one family still rears juvenile turtles.

In the north, the turtle trade has collapsed as the animals are almost hunted out.

### Corals:

Hard coral colonies are commonly sold as souvenirs for tourists and decoration for aquaria. Nha Trang is the centre for coral trade with a production of 50 tonnes a year. The price of each colony is 3,000-15,000 Vietnamese dong (US\$0.27-US\$1.4). A small coral trade also occurs in Ca Na, Vung Tau and Danang.

Favourable species such as *Pocillopora damicornis*, *P. verrucosa*, and *Acropora formosa* used to be dominant at many sites in Nha Trang Bay in 1960's but are very rare now.

#### Lobsters:

Most species of *Panulirus* are sold as food and for souvenirs. Annual production from Quang Tri - Binh Thuan amounts to 120 to 150 tonnes. The demand for lobsters as food, especially from Hong Kong and Singapore, is increasing and the prices range from US\$15- US\$25/kg.

#### Molluscs:

Many species of molluscs are sold as souvenirs. These include the gastropods *Trochus nilotichus*, *Turbo marmocatus*, *Cassis cornuta*, *Charonia tritonis* and *Cypraea* spp. and the bivalves *Pteria panguin*, *Pinctada margaritifera* and *P. maxima*.

Nha Trang and Vung Tau are the main centres of seashell trade. In 1992, almost four tonnes of *C. tritonis* and five to eight tonnes of *C. cornuta* were sold in Nha Trang. The pearl shells are made into jewelry and art works. It is estimated that 200 pairs of *P. maxima* are being sold every month in Nha Trang, and each may fetch US\$ 20 (WWF Vietnam Marine Conservation Southern Survey Team, 1993).

#### Echinoderm:

The sea cucumbers (*Theleota ananas*, *Actynopyga echinites*, *A. mauritiana*, *Holothuria scabra* and *Microthele nobilis*) are another species to be exploited severely, mainly in Khanh Hoa, Binh Thuan and Kien Giang. These are often sold to China, Hong Kong, Japan, Taiwan and Singapore. Annual production is estimated at 150,000 to 180,000 tonnes.

Many sea urchins such as *Heterocentrotus mammillatus* and *Echinometra mathaei* and starfish like *Calcita novaeguineae* are sold as souvenirs, mainly in Nha Trang, Vung Tau and on a smaller scale in Danang.

### **Logging**

Logging remains a big threat even though the areas legally being logged are greatly limited and restrictions have been placed on the export of raw timber, cutting of certain species and cutting in important catchments. Regulations require that cut forests are restored to a richer state after logging but this is not controlled. In addition, there remains a serious level of illegal logging including the use of false

documentation and timber smuggling. It is estimated that legal and illegal logging causes the degradation of 70,000 ha per year and an actual forest loss of about 30,000 ha per year.

### **Fuel Collection**

Fuel wood collection occurs on a larger scale than commercial logging and is more difficult control as it is widespread and often clandestine. Although estimates of the scale are crude it appears that uncontrolled fuel wood collection is the biggest threat to biodiversity in many areas. The quality and productivity of forest becomes less the closer one gets to human habitation as amount of wood taken increases. Many villagers often collect fuel wood for sale along roadsides and in markets, as well as for their own use. In some areas the wood is converted to charcoal before sale. A ban on firewood cutting deprives people not only fuel, but income. Any solution that fails to provide real alternatives will fail.

### **Forest Fires**

About 56% of Vietnam's nine million ha of forest is regarded as fire-prone. Fires occur in the dry season when the hot west wind is strongest, with about 20,000 ha to 30,000 ha burned annually, and up to 100,000 ha in the worst years. The fires are mostly caused indirectly by people often as a result of agricultural encroachment, hunting, mining, cooking, smoking bees to collect honey or tree resin. The fires harm biodiversity as well as causing loss of timber, damage to dams, roads, water resources and loss of human life. The problem has been tackled to some degree and rate of fire losses in recent years has reduced.

Although some success has recently been claimed in controlling forest fires, fire remains a serious threat to biodiversity in certain biotopes. The most important biotope for biodiversity conservation to be threatened by fire is the lower-montane evergreen forest of Lam Dong, Dac Lac and Ninh Thuan Provinces and which once probably covered much of the Dalat Plateau.

For many years these forests have been subject to clearance by ethnic minorities, and in the last hundred years by Kinh people. The frequent use of fire to open clearings has resulted in a great reduction in the extent of lower-montane evergreen forest, and has promoted the growth of a fire-climax dominated by *Pinus khesiya* and *P. merkusii*. Pure stands of these species probably also occur naturally on exposed, well-drained easterly facing slopes where there is less precipitation.

The pine forests are very species-poor in contrast to the lower-montane evergreen forests which are of global importance for their biodiversity value, and are a major centre of endemism.

The continuing use of fire is fragmenting the remaining lower-montane evergreen forest, which is now largely confined to higher west or south facing slopes.

Some patches of semi-evergreen forests, such as Nui Ba, have now become isolated and suffer a reduction in species-richness.

## **Pollution**

Pollution is not yet a major problem in forest areas but is a growing problem in urban areas and in freshwater and marine ecosystems. If industrial growth is powered mainly by coal, atmospheric pollution and acid rain could well become a problem in the north.

Oil is one of the most devastating polluters for marine environments. Boats, ships and oil exploration are common sources. In 1992 there were 54,000 fishing boats and 800 ships with a total one million GRT (Gross Register Tonnage) registered in Vietnam. There are 37 main ports, those at Haiphong and Ho Chi Minh City are commercial, while Vung Tau and Cua Ong specialise in coal and petroleum (*Figure 14* on page 44).

Quang Ninh and Haiphong in northern Vietnam, both of which have ports, are seen as being the most polluted coastal provinces. The levels of oil in their coastal waters (0.4-1.0 mg/l) consistently exceeded the maximum permissible concentrations. Oil pollution caused extensive damage to the mangrove and marine ecosystems and the fisheries when in 1989 the cargo ship *Leela* leaked 200 tonnes off the coast from Binh Dinh Province (Pham Van Ninh, 1989).

Exploration for oil begun in 1986 at Bach Ho ( $9^{\circ}49'N$  and  $107^{\circ}56'E$ ) off Vung Tau (*Figure 14*), but pollution from oil fields is not well documented. Two other fields are ready to start production and the effects of oil exploration and its related activities on the marine environment pose a serious threat.

Quang Ninh Province also suffers serious siltation problems due to its coal and clay mining operations, the biggest in Vietnam. The level of suspended solids in the coastal waters reaches 300 mg/l, and sometimes over 1000 mg/l, which damages coastal ecosystems especially coral reefs, reduces the fish catch and hampers tourism.

The millions of tonnes of mud and sand dredged from ports each year (Haiphong port 3-5 million tonnes) raises turbidity. By casually dumping the dredged matter, which is often contaminated with oil and other toxic substances, longterm hazards are imposed on the natural marine environment, fisheries production and aquaculture.

## **Dynamite Fishing**

In addition to overfishing, marine areas are threatened by some damaging fishing methods, notably dynamite fishing. This practice, which is devastating coral reefs, is widespread, especially in the north and some central provinces such as Khanh Hoa and Quang Ngai. Explosives are used in the sea, rivers, estuaries, coral reefs, rocky reefs and even at fake reefs built to lure fish. Caused partly by poverty which forces many fishermen and others into the act, the use of explosives illustrates the low level of awareness among people.

## **Coral Mining**

Coral mining is most serious in central Vietnam from Danang to Ninh Thuan. The collection of coral to make lime is very damaging as dead coral is collected from the intertidal zone, often using dynamite. In Khanh Hoa alone there are 20 lime workshops, each with a capacity of 10 tonnes per year. In some places such as Cu Mong in northern Phu Yen, Ninh Hoa, Thuy Trieu lagoon and Ninh Chu, abundant dead coral can be found buried in sand or mud.

Coral is also mined for cement production. The cement plants in Khanh Hoa and Ninh Thuan each have a capacity of 20,000 tonnes cement annually. The plants use mainly dead coral from the beach as raw material. For every one tonne of cement, four tonnes of dead coral is needed and the large scale removal of coral debris is likely to affect the coastal environment and ability to resist erosion.

## **Coastal Degradation**

The construction of coastal aquaculture ponds, salt beds and land reclamation reduce the size of tidal zones, upset the water and salt balance which often causes acid sulphate to accumulate, alter the sedimentation processes, intensify erosion hazards and affect the inherent coastal communities. Many tidal marshes have been destroyed or severely degraded.

Mining sand for construction or crystal manufacture, for rocks (granite in Nghia Binh and Khanh Hoa) and heavy minerals (ilmenite, zircon and monasite mainly in the south), also impose negative impacts on the marine environment. Large scale sand mining in central Vietnam (particularly at the proposed site of Cam Ranh), and excessive removal of sand, shells and coral debris from beaches and dunes for cement manufacturing, induce erosion hazards, upset water dynamics and affect substrate compositions and ecosystems.

## **Warfare**

The long wars resulted in a great deal of damage (cratering, deforestation, burning and poisoning) to the natural environment. However, this is no longer perceived as a serious threat. A total of two million ha of forest was destroyed by warfare when 13 million tonnes of bombs and 72 million litres of herbicide were dropped on the country.

There remain long-term effects of this damage such as remnants of dioxin in mud and animal tissue. The costs are particularly devastating in terms of human health. Fortunately, the scars are slowly healing, and warfare is not currently regarded as a severe threat to biodiversity.

## **Pest Damage**

13 thousand ha in of forest were lost in 1989 due to pests, and is most significant in plantations. Measures have been taken and losses in 1990 fell to 2,500 ha. Natural forests are barely affected so the impact on biodiversity is minimal. Reports indicate

an increase in pest damage in plantations of *Eucalyptus* that are not suitable to site conditions.

### **Forest Fragmentation**

As forests are fragmented and remaining blocks become smaller and more isolated, they are unable to support their original levels of species-richness. Forest blocks of 100,000 ha can contain all their original bird species, but smaller areas lose approximately half of their original species for each 90% reduction in area.

### **Modernity/Market Economy**

Modernity or the market economy are the biggest threats to traditional crops. These crops have been cultivated by villagers because they suited the climate, soil and needs of the people. In the past the selection criteria of the crops was qualitative which is in conflict with modernity and the market economy which demands mainly quantitative selection criteria.

The market economy also changes the mentality of the rural population as they are increasing experience outside influences leading to the rapid disappearance of traditional ways of life. This change is normal in any developing country but it's important to remember that these traditional crops represent over 2,000 years of gradual selection and knowledge. These crops are as much a potential for future generations as they are a basis for research. History shows that once a certain level of economic development is reached quality again becomes an important criterion.

## 1.12 Capacity for Ecosystem Recovery

### Forest Regeneration

Many of the damaged forests in Vietnam have the capacity to regenerate. Natural regeneration is vastly cheaper and more ecologically restorative than establishing forest plantations. Forest regeneration will take place when an area still contains seeds and/or roots of forest trees, or is exposed to reseeded from residual trees or wind-blown and animal dispersed seed. Regenerating areas need protection from fire and browsing animals until a good ground cover of saplings is established. In too many areas bare hills are regarded as 'hopeless' and deprived of these basic protective measures that would enable natural regeneration to take place.

Many defoliated forests in southern Vietnam show great variation in the degree of natural regeneration they have achieved. In some areas tall evergreen forest has returned and in others grassland or *Melastoma* scrub or bamboo thickets are all that has grown. The varying degrees of success at regeneration were related to subsequent disturbances such as wood collection, fire and grazing.

Some simple land management can lead to natural reforestation such as planting the *Acacia mangium*, a short lived tree gives shade, kills grasses and improves the soil through nitrogen fixation. By the time the mature trees die or are cut out, the pioneer tree species take over and a natural secondary forest can be established.

### Wetland Recovery

Because of the dynamic nature of wetlands, most wetland species have a good capacity for dispersal and recolonisation. This makes it possible to restore wetlands that have been damaged or even to create new wetlands. The ecology of the sites must be understood for regeneration to be effective. Water quality and substrate must be maintained, and hydrology limits understood and managed. Flora will return naturally or can be accelerated by reintroduction and birds will return if the site is safe and attractive. Fish, amphibians and other aquatic species will recolonise as long as they are still present in the water system. If they have been totally eliminated they may need to be reintroduced.

As wetlands can be easily destroyed or restored, they are also threatened by change. Changes in hydrology or introductions of non-endemic species may alter a wetland in ways that destroy its biodiversity value and which are difficult to repair. It is relatively easy to reintroduce a lost species but difficult to remove an unwanted one.

## **Coral Reef Recovery**

Coral reefs in all areas of Vietnam have been badly damaged. Where the cause is pollution or siltation there is no chance of recovery, but where the conditions for coral life remain good as in areas damaged by explosives, mining or physical breaking, the coral reef can be restored through a period of protective management.

It is possible to enhance recovery or establish new reefs in areas with suitable hydrological conditions but which lack natural hard substrate for coral settlement. Experiments in some countries have shown that positioning concrete blocks or even old car bodies on the seabed can promote colonisation by corals and attract fish and other marine creatures. Colonisation of corals may be enhanced by translocation of small pieces of living coral to a site. Some restoration and recreation of reefs for fisheries recovery and tourism would be possible in this way.

### **1.13 Evaluation of *In Situ* Conservation**

#### **Evaluation of the Protected Area System**

An evaluation of the current protected area system in Vietnam was included in the *Forestry Sector Review*.

By 1986 a total of 87 protected areas covering 1,079,937 hectares had been declared, although management of most had yet to be established (*Figure 35* on the next page). Some of the reserves are very valuable for biodiversity conservation, but unfortunately many are too small and contain only areas of interest for historic or recreation reasons.

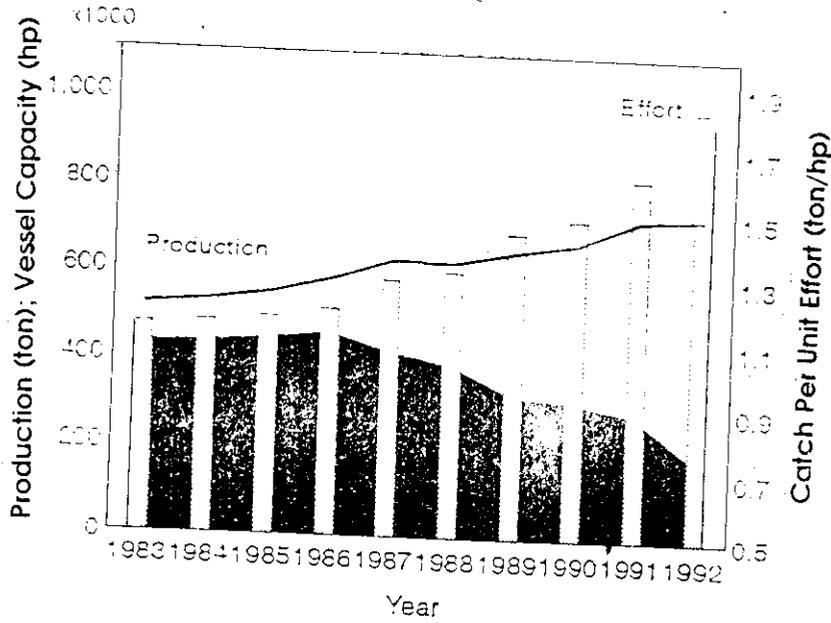
The Tropical Forest Action Plan (TFAP) concluded that the protected area system required considerable revision as it was inadequate in area, forest quality and standards of management to meet its objectives. That plan proposed 18 reserve extensions and four new reserves, which are summarised in Table 12 on pages 82-83.

Marine ecosystems must be added to the protected area system. The Ministry of Forestry approved the proposals and are now surveying and enlarging the main reserves to a new total area of over two million hectares. Management plans have now been completed for 18 reserves, 10 of which have been designated as National Parks.

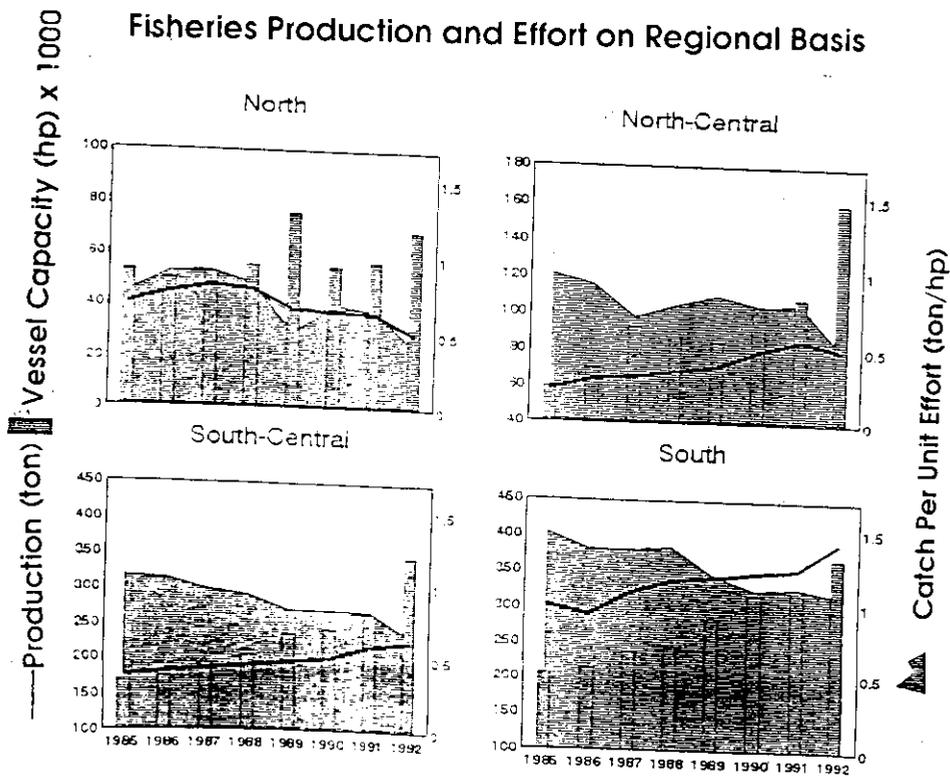
# Fisheries Production and Effort from 1983 - 1992

Filled Area Indicates Catch Per Unit Effort - CPUE

Figure 35



## Fisheries Production and Effort on Regional Basis



**TABLE 12: Enlargement of Major Biodiversity Reserves in Vietnam**

Name of Reserve	Province	Original Area (ha)	Proposed Area (ha)
Muong Nhe*	Lai Chau	180,000	396,176
Cuc Phuong National Park*	Ninh Binh	22,500	no change
Ba Vi National Park*	Ha Tay	7,200	no change
Ba Be National Park*	Cao Bang	7,610	50,000
Cat Ba National Park*	Hai Phong	15,200**	no change**
Tam Dao National Park*	Vinh Phu	19,000	36,883
Huu Lien*	Lang Son	10,640	20,000
Hoang Lien Son*	Lao Cai	29,845	50,000
Ben En*	Thanh Hoa	16,634	50,000
Pu Mat	Nghe An	nil	93,500
Vu Quang*	Ha Tinh	16,000	60,000
Phong Nha*	Binh Tri	2,000	41,132
Bach Ma National Park*	Thua Thien-Hue	22,500	87,000
Ngoc Linh*	Kontum	20,000	50,000
Mom Ray	Kontum	45,000	80,000
Yok Don National Park*	Daclac	58,200	100,000
Kong Cha Rang	Kontum	16,000	
Kon Kai Kinh*	Gialai	28,000	80,000
Chu Yang Sinh	Daclac***	20,000	40,000

Name of Reserve	Province	Original Area (ha)	Proposed Area (ha)
Bi Dup	Lam Dong	nil	40,000
Cat Tien National Park*	Dong Nai	37,900	80,000
Con Dao National Park*	Cuu Long	6,000	20,000**
Phu Quoc*	Kien Giang	5,000	14,400

Key: \* Management Plan is prepared  
 \*\* Includes marine area  
 \*\*\* Extends into other provinces

Figure 36 on the next page shows the extent of loss of each major vegetation type in Vietnam and also the degree of protection afforded by both the notified and planned systems of protected areas.

### Identification of Gaps

Birds and butterflies are believed to be good indicators of overall biodiversity, and can therefore be used for setting conservation priorities (Ehrlich 1988) and identifying gaps. When developing a programme to prioritise areas for conserving global bird diversity, the first step is to identify areas with restricted range bird species (range of less than 50,000 km<sup>2</sup>). Due to the inherent vulnerability of species with limited ranges, they deserve special conservation attention.

The concentration of bird species in Endemic Bird Areas (EBAs) represents global centres of biodiversity and speciation, and EBAs can therefore be viewed as priority areas for global conservation action. In a global study, 221 Endemic Bird Areas (EBA) which correlate well with centres of overall biodiversity have been identified worldwide (ICBP, 1992); three of these centres of biodiversity occur in Vietnam.

The EBAs in Vietnam are the Truong Son lowlands and Dalat Plateau, each with four restricted range bird species; and the lowlands in southern Vietnam with three such species. All of these species are, with the exception of *Arborophila merlini*, globally threatened. The identification of these areas in Vietnam can greatly assist conservation planners to establish programmes for protected-areas.



If we apply the 50,000 km<sup>2</sup> range size and consider the distribution of the remaining mammals listed in Appendix 1 it can be seen that many behave as restricted range endemic species:

*Pygathrix* and *Semnopithecus* species groups at the taxon level

<i>Pygathrix avunculus</i> (also known as <i>Rhinopithecus avunculus</i> )	Tonkin snub-nosed monkey
<i>P. nemaesus</i>	Red-shanked Douc langur
<i>P. nigripes</i>	Blank-shanked Duoc langur
<i>Semnopithecus francoisi francoisi</i> (also known as <i>Trachypithecus francoisi</i> )	François' langur
<i>S. f. poliocephalus</i>	White-headed langur
<i>S. f. hatinhensis</i>	Ha Tinh langur
<i>S. f. delacouri</i>	Delacouri langur
<i>Hemigalus owstoni</i>	Owston's civet
<i>Cynogale lowei</i>	Otter civet
<i>Rhinoceros sondaicus</i>	Javan rhinoceros
<i>Pseudoryx nghetinhensis</i>	Saola

The ranges of five of these 11 taxa fall within the three EBAs in Vietnam. Protected area development within these three regions should be a major focus of conservation action.

The six restricted-range mammal taxa which do not fall within the EBAs are all of great conservation concern. Fortunately a population of white-headed langur (*Semnopithecus francoisi poliocephalus*) occurs in Cat Ba National Park and a population of Delacouri langur (*S.f. delacouri*) is found in Ba Be National Park. The establishment of protected areas within the ranges of the other three restricted-range mammal taxa (*Pygathrix avunculus*, *Hemigalus owstoni* and *Cynogale lowei*) should, however be an urgent priority.

Although two protected areas are planned within the Dalat Plateau EBA, none currently exist. In the Truong Son lowlands EBA a disproportionate amount of sub-montane habitat is protected in Bach Ma, Vu Quang and Pu Mat protected areas, and the only area of level lowland forest is nominally protected in Ho Ke Go (proposed) Nature Reserve. The planned reserve supports two extreme lowland forest specialist species of galliform (*Lophura imperialis* and *L. hatinhensis*) which are critically threatened by habitat loss. Ho Ke Go is the only protected area in the world which is known to support these two species.

The proposed and existing protected areas should be the focus of protected areas development in Vietnam and in addition a number of other sites important for threatened species and for conserving representative habitats should also be a focus for conservation action.