

Situation Analysis Report

On Highland Aquatic Resource and Sustainable Development in Northern and Central Vietnam

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Glossary

HH	Household
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
PPC	Provincial People's Committee
VNAT	Vietnam National Administration of Tourism

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Introduction

The Highland Aquatic Resources Conservation and Sustainable Development (HighARCS) project aims to analyze the status of highland aquatic resources at five sites includes Guangdong, China, Uttarakhand and West Bengal, India, Northern and Central Vietnam. The project examines ecosystem services, livelihoods of poor people and biodiversity conservation issues of highland aquatic resources in order to produce action plans. An integrated action plan on livelihood, conservation and policy issues will be produced and implemented among various stakeholders in order to enhance livelihoods, conserve aquatic biodiversity and encourage sustainable development.

The first phase (Rapid Interdisciplinary Situation Analysis) of the HighARCS project comprised collecting and reviewing existing information on biodiversity, threats to biodiversity, policy, social, economic and livelihoods, including assessing the dependence of local livelihoods on biodiversity. The outcome of the situation appraisal will be used to define the study sites, select appropriate systems and communities to work with. This report describes the overall situation of highland aquatic resources in the Northern mountains and Central of Viet Nam. The review focuses on ecosystem goods and services, social systems and culture, the dependence of livelihoods on natural resources, market networks, communication, institutional and policy frameworks and stakeholders, all of which is associated with highland aquatic resources and livelihoods of people living in highland areas of Vietnam. Furthermore, the report is brief describing the situation in Son La and Quang Tri provinces that have been selected for further study under the framework of the HighARCS project.

Methodology

This report uses secondary materials collected from government, province, district and commune levels, and includes reports on socio-economics, biodiversity, natural resources, gender and age. It also refers to official annual data reported by the General Statistics Office and other projects reports that have studied the four main highland regions in the north and central Vietnam which are North East, North West, North Central and Central Highlands.

Study sites were selected based on the following criteria: study sites must occupy the typical characteristics of highland areas that are not situated on the alluvial plains and they represent for

the northern and central of Viet Nam. These areas are situated within the upper reaches of a watershed where there are home for many poor people. The three communities in each study site are situated along the watershed and showing the dependent of livelihood on aquatic resources, ecosystem services and biodiversity in the watershed; and furthermore project is willing to carrying out by local people and authorities.

The main research limitations of this report concerns its generalizability and variable based on the information would collected. Therefore, the further and specific study finding on ecosystem services and biodiversity values, highland aquatic resources and livelihood, stakeholders, institution and markets will be present in other deliverables that derived from HighARCS field research.

1. Background of Vietnamese geography and climate

Vietnam is a country diverse in topography, and includes tropical lowlands, hills, and densely forested highlands (Wikipedia Contributors, 2010). Two-thirds of the total natural area is covered by hills and mountains, with a general downward slope from west to east (VietNamEnvironmentProtectionAgency, 2005). The country is divided into eight regions which include the Northwest, Northeast (Đông Bắc), Red River Delta (Đồng Bằng Sông Hồng), North Central Coast (Bắc Trung Bộ), South Central Coast (Nam Trung Bộ), Central Highlands (Tây Nguyên), Southeastern (Đông Nam Bộ) and Mekong River Delta (Đồng Bằng Sông Cửu Long) (Wikipedia Contributors, 2010). The four highland regions are indicated below:



Figure 1: Vietnamese regions (Wikipedia Contributors, 2010)

Viet Nam has a tropical monsoon climate area. The annual average temperature is higher than 20⁰C, average annual humidity is more than 80%, and rainfall averages 1500 mm/year (Vietnam Environment Protection Agency, 2005). The differences in climate between regions, especially in temperature and humidity range are strongly influences the biodiversity of each region.

2. Ecosystem goods and services

2.1 Biodiversity and conservation

2.1.1 Biodiversity in different ecology systems

Viet Nam is considered one of the biodiversity hotspots of the world, which have immeasurable importance for the survival of all organisms, providing food, medicines for humans, and materials for industry and construction, as well as protecting human health and maintaining cultural and aesthetic values (Vietnam Environment Protection Agency, 2005). In recently times, Vietnamese biodiversity and ecology have seen major changes due to developments in agriculture, industry and infrastructure, as well as urbanization (Hue *et al.*, 2008). Based on the national statistical data of Viet Nam Environment Protection Agency (2005), there are 546 species of fish, 157 species of protozoa, 403 species of algae, 190 species of crustaceans and 147 species of bivalves living in freshwater wetlands in Viet Nam.

2.1.1.1 Biodiversity in the river system

Viet Nam has a dense river system with a total of 2,500 rivers nationally. Of these, 2,360 rivers are greater than 10 km in length (Ministry of the Environment, 2009; Vietnam Environment Protection Agency, 2005). All the rivers in the north flow in the direction of the Southeast from the Northwest. Rivers and streams in the central region are generally short with many slopes (Tri, 2010). Of the 13 main river systems, 9 of those have basins that contribute to 90% of total river basin area in the whole country. The 9 main river basins are Red river, Thai Binh river, Bang Giang-Ky Cung river, Ma river, Ca La river, Thu Bon river, Ba river, Dong Nai river, and Mekong (Cuu Long) river (Hanh, 2007). Each river system is characterised by water quality, environmental factors, economic and ecological values and biodiversity, which affects the socio-economic conditions of communities living in and around the watershed. Rivers and streams are important habitats for 243 fish species living in the rivers of northern Viet Nam and 134 fish species in the rivers of central Viet Nam. There are high numbers of endemic species of aquatic fauna and flora in stream ecosystems and there are still many species yet to be identified (Vietnam Environment Protection Agency, 2005).

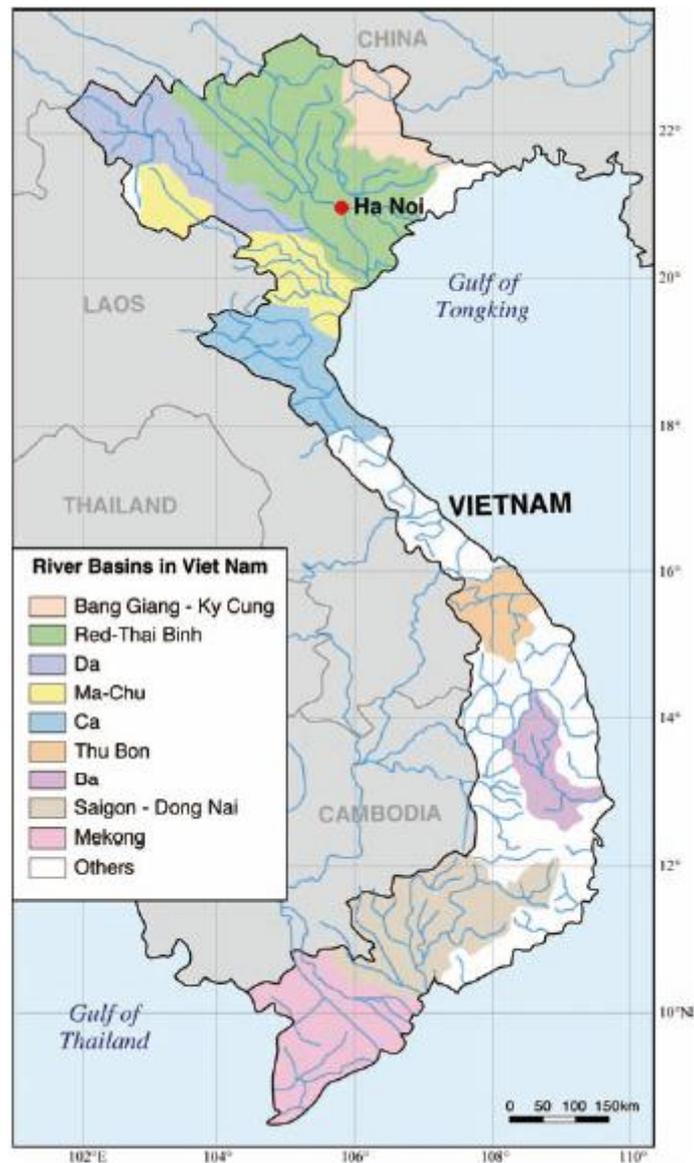


Figure 2: River Basin in Viet Nam (Ministry of the Environment, 2009)

2.1.1.2 Biodiversity in reservoirs and lakes

A study by the Viet Nam Environment Protection Agency (2005) showed that there are approximately 3,600 freshwater reservoirs in Viet Nam which have been built by a variety of sectors. Of these, 539 reservoirs are potential for aquaculture development, six reservoirs have an area exceeding 10,000 ha, and 14 reservoirs are between 1,000 and 10,000 ha in area. Reservoirs are constructed for the purposes of irrigation, hydroelectricity, agriculture, domestic water supply, aquaculture, tourism, and other uses. The reservoirs with the largest output capacity are Hoa Binh (Hoa Binh province) with a surface area of 21,800 ha and capacity of

19,200 MW and Thac Ba (Yen Bai province) with an area of 400 ha and capacity of 108 MW (VietNam Environment Protection Agency, 2005).

Beside the reservoirs, there are many natural lakes in northern and central Viet Nam. The most important natural lakes are Ba Be Lake (Bac Kan Province), Chu Lake (Phu Tho), Bien Ho Lake (Gia Lai), Lak Lake (Dak Lak), Don Duong and Dan Kia Lakes (Da Lat-Lam Dong). Natural lakes provide an important home for aquatic organisms, for example, the 600 ha Lak Lake is home to more than 100 phytoplankton species, 50 zooplankton species, 20 zoobenthos species, 49 fish species, crocodiles, iguana and migratory birds. Bien Ho covers 300 ha, and provides habitats for 122 phytoplankton species, 54 zooplankton species, 15 zoobenthos species and 27 fish species (VietNam Environment Protection Agency, 2005).

Ba Be Lake is a 450 ha natural lake located in Ba Be National Park, Ba Be District, Bac Kan Province. Ba Be is considered a natural lake that supports the most abundant fish fauna in Viet Nam. Ngo Sy Van (2005) reported that the fish population of Ba Be lake comprises 105 species belonging to 65 genus, 18 families, 5 orders and 5 suborders. However, Viet Nam Environment Protection Agency (2005) reported only 87 fish species of 61 genera, 17 families and 5 orders in the lake in 2005. Furthermore, this lake is home to more than 100 phytoplankton species, 24 zooplankton species, 47 zoobenthos species, 20 macrophytes, and some reptile and migratory bird species (VietNam Environment Protection Agency, 2005). Fish production is rapidly declining; in 1964 Ba Be harvesting rates reached 42 tons/year (Van, 2005), but now it is around 10-15 tons/year. Twelve species are recorded in Red Book Vietnam, 21 species have not been collected since 1975, and many species have become extinct. Fish was previously consumed as food by local people, and therefore considered as economically important. However, the number of economically valuable species and large fish has been reduced (Van, 2005). Molluscs and crustaceans recorded in Ba Be lake include 21 species, 11 genus, 8 families, 5 orders that belong to 2 phylums (Van, 2005). The main threats to biodiversity in Ba Be lake are hunting, fishing, logging, forest clearance for shifting cultivation, increasing sedimentation in the lake because of forest destruction in the river catchments, and insufficient enforcement of protected area regulations. Every month, at least 1-2 incidences of dynamite or electric fishing in Ba Be Lake are reported. Encroachment of forest land for cultivation is increasing every year. The development of tourism services is unregulated and poses adverse impacts on the national park from an increasing number of motorboats on the lake causing pollution and disturbances to wildlife populations (Vietnam Environment Protection Agency, 2005).

2.1.2 Biodiversity in difference regions and provinces

2.1.2.1 North East region

The Northeast contains many river systems. The main rivers are Red River, Chay River, Lo River, Gam River, Da River (belongs to Red River system), Cau River, Thuong River, Luc Nam River (belongs to Thai Binh River system), Bang Giang River and Ky Cung River (Wikipedia Contributors, 2010). This region contains 11 provinces: Hà Giang, Cao Bằng, Lào Cai, Bắc Kạn, Lạng Sơn, Tuyên Quang, Yên Bái, Thái Nguyên, Phú Thọ, Bắc Giang, and Quảng Ninh (Wikipedia Contributors, 2010). Based on the research result of Do Van Cuong and Dang Thi Thanh Hoa (2007), the Northeast region contains the highest diversity in dragonfly species with 48 identified in total; 27 of these belong to genus of Libellulidae. Lao Cai, Cao Bang and Thai Nguyen provinces have the highest abundance in dragonflies with 16, 9 and 9 species identified respectively. The fish fauna and diversity of the main river systems of these provinces are detailed below:

Lao Cai and Yen Bai are two mountain provinces located in the North of Viet Nam where the Chay River runs through and joins with the Lo River and Gam River at Doan Hung district, Phu Tho province. These provinces have a network of river systems ranging from large rivers to small springs. A study by Ngo Sy Van and Pham Anh Tuan (2005) showed that in Chay river watershed and Thac Ba lake (Yen Bai province), there are 115 fish species belonging to 76 genus, 20 families and 7 orders. Among them, Carp (Cypriniformes) is the order with the largest number of species, followed by Siluriformes and Perciformes. The number of species has increased due to introduced species for use in aquaculture. However, many highly valuable species such as *Bagarius sp* (cá Chiên), *Hemibagrus sp* (Cá Lăng), *Spinibarbus sp* (cá Bống) event Rohu (*Cirrhinus molitorella*) have become rare. Consequently, production has been reduced to approximately 50-60% (Van, 2005). This report also shows that the gastropods in Chay River, in Lao Cai and Yen Bai provinces, belong to 3 orders (Entomostome, Mesogastropoda and Basommatophora), 5 families and 11 species. Of these, the Entomostome order has family Thiaridae (3 species) and family Bithiniidae with only 1 species (*Allocinma longiconis*); Order Mesogastropoda has only 1 family (Viviporidae) that includes 3 species, Order Basommatophora has only 1 family (Planorbidae) with 4 species. Class Bilavia has 2 orders (Mytiloidea and Actinodontida), 2 families and 4 species (Van, 2005). In addition, Lao Cai has a high diversity of dragonflies with 30 species, 13 families, and 2 orders (Cuong, 2007).

Hà Giang and Tuyên Quang provinces contain the Lo River system and have a complex topography. Research results of Van and Tuan (2005) indicate the fish fauna in these two provinces contain 141 species and subspecies in 89 genera, 20 families, and 7 orders and suborders. Among these, 3 orders are abundant in number and have high economic value. Those are the Cypriniformes (3 families, 54 genera), Perciformes (8 families 11 genera) and Siluriformes (6 families, 10 genera). The other orders have 1 - 2 families, 1 - 3 genera and 1 - 3 species. There are six species endemic and economically valuable species that are typically found in the northwest region; these include Cá Chiên (*Bagarius rutilus*), cá Lăng chấm (*Hemibagrus guttatus*), cá Anh vũ (*Semilabeo obscurus*), cá Rằm xanh (*Sinilabeo lemassoni*), cá Hoả (*Sinilabeo tonkinensis*) and cá Chày đất (*Spinibarbus caldwelli*). However, looking at data collected since 1965, species diversity has increased by 69 species in 34 genera, 11 families and 4 orders. Moreover, 26 species in 24 genera, 12 families and 8 orders are no longer found (Van, 2005). Molluscs in Lo and Gam River systems in Hà Giang and Tuyên Quang provinces comprise 16 species. In the class Gastropoda, there are 3 orders, 5 families and 11 species; class Bivalvia contains 2 orders, 2 families and 5 species (Van, 2005).

Bắc Cạn province has two main river systems, those are Cầu River and Năng River. Fish fauna are characteristic of tropical fish fauna in the Northwest mountains. Ngo Sy Van (2005) reported that fish species composition in Bac Can is rich and diversified. Fish diversity comprises of 116 species in 78 genera, 19 families and 7 orders. Among these seven orders, there are 3 abundant orders (Cypriniformes, Perciformes and Siluriformes). Aquatic resources in Bac Can have dramatically declined; species composition has been reduced by about 20% and production reduced by more than 50% (Van, 2005). Molluscs in Bac Can belongs to 2 classes: Gastropoda and Bivalvia. Gastropoda has 12 species in 4 families and 3 orders, and class Bivalvia has 5 species belonging to 2 families and 2 orders (Van, 2005).

Cao Bang and Lang Son are two mountain provinces located in the northeast of Vietnam. This region borders with China and aquatic resources in the two main river systems are believed to have high potential in aquatic resources (Ky Cung and Bang Giang river). A study by Ngo Sy Van and Pham Anh Tuan (2005) indicated that Cao Bang and Lang Son contain diverse fish species assemblages in the rivers, streams and freshwater lakes. There are 111 species belonging to 73 genera, 21 families and 7 orders. Many of them are endemic, valuable and rare species. This zone is a reputed spawning ground for many high value species such as Lăng Chấm (*Hemibagrus guttatus*), Chiên (*Bagarius rutilus*) and Bống (*Spinibarbus denticulatus*). Fish

species in these provinces mainly live in rivers, streams and freshwater lakes, only a few species originate from the sea. Recently, the aquatic resources have been remarkably reduced; the number of Red listing species is increasing (Van, 2005). In Bang and Ky Cung River, the mollusc species described to date belong to the classes Gastropoda (12 species in 5 families and 3 orders) and Bivalvia (4 species in 2 families and 2 orders) (Van, 2005). Do Van Cuong and Dang Thanh Hoa (2007) showed that there are 15 dragonfly species (6 families) of in Cao Bang province and 15 species, 8 families in Lang Son province (Cuong, 2007).

Thai Nguyen and Bac Giang provinces share four main river systems; these are Cong and Cau river, Thuong and Luc Nam river, all of which flow into the Thai Binh river. In addition, these two provinces contain many small rivers, springs and some medium and small reservoirs such as Nui Coc lake, Cam Son lake, Khuong Than lake, Cam Ly lake, Da Ong lake and Cau Re lake. In general, the fish fauna in these areas are not as diverse or productive as in other areas, in terms of the number of species, quantity and yields. There are a total of 116 species belonging to 74 genus, 21 families, 7 orders and 5 suborders. Among these, the order Cypriniformes is the most abundant, followed by Perciformes and Siluriformes. Molluscs of Cong river system and Nui Coc lake belong to 2 classes; the Gastropoda and Bivalvia. The class Gastropoda has 14 species belonging to 4 families and 3 orders, and the class Bivalvia has 5 species belonging to 2 families and 2 orders (Van, 2005).

2.1.2.2 Northwest region

The Northwest contains four provinces: Lai Châu, Điện Biên, Sơn La, and Hoà Bình. The Northwest has two rivers systems; they are the Da River and Thao River (Red River). It also includes the upstream region of Ma River. However, some parts of Lao Cai, Yên Bái and Phú Thọ provinces are also on the same side of the Red River. According to Ngo Sy Van and Pham Anh Tuan (2005), the fish fauna in the Northwest region is very rich and high in abundance. It includes 144 species belonging to 86 genera, 20 families and 7 orders. Compared to the 1980s, the yield of fish in Da river basin has reduced by approximately 30% in composition and approximately 50% in yield (Van, 2005). Of the 144 species recorded here, the Cypriniformes order is the largest, followed by the Siluriformes and Perciformes. Of 144 species, there are 10 immigrant species (approximately 7% of total), more than 90% are domestic species and many are endemic. Of 144 species, 70 species are confined to rivers and lakes, 70 species inhabit streams and 30 species are widely distributed. There are 42 highly valuable fish species, approximately 29.2% of the total.

Based on the report of Son La People Committee (2009), the fish fauna in Son La province is diverse due to the contribution of fish fauna from stream, river from mountain and Red River. In Son La province, there are 162 fish species had been identified and 89 fish species present in Hoa Binh hydropower dam. However, a study of MARD in 2008 report that there were 127 fish species belonging to 77 genera, 20 families and 7 orders identified in Son La. Of those, 56 species are high economically species (MARD, 2009). High economical fish species reported in Son La such as *Sinilabeo lemassoni* (Pell.&Chev.) (Cá Rằm xanh), *Semilabeo obscurus* (Lin) (Cá Anh vũ), *Bagarius yarrelli* (Sykes) (cá Chiên), *Mystus guttatus* (Lacepede) (Cá Lăng chám), *Spinibarbus denticulatus* (Oshima) (Cá Bống) and *Spinibarbus hollandi* (Oshima) (Cá Chày đất). It is also indicated that there is declining in species composition and production in Son La recently, many species are under threaten (The Son La People Committee, 2009).

In the Da River running through Lai Chau, Son La and Hoa Binh provinces, the composition of molluscs is made up of the Gastropoda and Bivalvia classes. The Gastropoda class has 11 species belonging to 4 families and 3 orders and the Bivalvia class has 4 species belonging to 2 families and 2 orders. The Northwest is very rich in fauna and flora. There are many rare species, of which 13 plant species and 22 odonate species were recorded in the IUCN list. There are 38 species of dragonfly recorded for this region, most of them (30 species) belong to genus *Libellulidae*. Hoa Binh contains 19 dragonfly species, followed by Son La and Lai Chau with 9 species recorded (Cuong, 2007).

2.1.2.3 North central

The North central region runs from the south of the Tam Diep Mountains to the north of Hai Van mountain pass. It is a long, narrow area and runs to the coast. To the west is the Truong Son Mountain and border with Laos. To the east is the sea. North central contains six provinces: Thanh Hóa, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Trị and Thừa Thiên-Huế. As a region, North central is less diverse in dragonflies with only 22 species identified. In Ha Tinh and Quang Tri provinces, for instance, was only one species had been recorded (Cuong, 2007).

Thanh Hoa province contains the large river basins of The Ma and Muc river systems. According to the report of Ministry of Fisheries (1996), the fish fauna in this province includes more than 135 fish species belonging to 86 genera, 32 families and 9 orders. The fish population is very abundant and diversified, and includes a number of freshwater species that originate from rivers, streams, ponds and lakes. There are also many species that originate from marine waters.

Fish resources have been declined dramatically with respect to both species number and yield from rivers and lakes. Molluscs in the Ma and Chu River systems at Thanh Hoa province belong to the Gastropoda and Bivalvia classes. The Gastropoda class has 14 species belonging to 4 families and 3 orders, and the Bivalvia class has 5 species belonging to 2 families and 2 orders (Ministry of Fisheries, 1996).

Nghe An province is located in central Viet Nam. Based on the research of Ngo Sy Van and Pham Anh Tuan (2005), the fish fauna in Lam river in Nghe An is very rich and abundant. There are 180 species belonging to 110 genera, 41 families and 12 orders. Among them, 44 are economically valuable species and many of them are rare, such as *Altigena lemassoni* and *Anguilla bicolor*. Compared to report by Nguyen Thai Tu in 1983, the diversity of fish has increased by more than 20 species. However, some species reported by Nguyen Thai Tu (1983) were not recorded such as: *Onychostoma ovalis* and *Anguilla bengalensis*. The Cypriniformes order is the most abundant, followed by the Siluriformes and Perciformes orders. In general, the yield of fish in Lam River has decreased rapidly in recent years. In the Lam river system at Nghe An province, molluscs belong to Gastropoda and Bivalvia classes. The Gastropoda class contains 14 species belonging to 4 families and 3 orders, and the Bivalvia class has 4 species belonging to 2 families and 2 orders (Tu, 1983).

Ha Tinh province contains are many river systems such as La, Lam, Ngan Sau, Ngan Pho, Ngan Truoi, La, Rao Cai with a total length of about 400km (Wikipedia Contributors, 2010). There are numerous natural lakes, notably Duc Yen Lake (100,000 m²), Ky Hung lake and Xuan Vien lake, and a system of reservoirs (Ke Go, Song Giac). In Ha Tinh province, aquatic resources are very abundant, diversified and similar in composition to the aquatic resources in Nghe An province. Based on the findings of Nguyen Thai Tu (1983), 136 species have been recorded belonging to 87 genera, 30 families and 11 orders. Among them, there are approximately 25% brackish water species. In terms of distribution, there are approximately 65% of species in the river systems, and more than 70% of these originate from freshwater. More than 20% of species are found in ponds and low paddy, and about 25% come from brackish waters in estuaries and coastal areas. Among the 12 orders and suborders, Cypriniformes contains the most species, followed by the Siluriformes order. The natural aquatic resources in rivers, lakes, ponds, low paddy and brackish waters decreased both in terms of yield and species composition, by approximately 35% compared to data from 1970 (Ministry of Fisheries, 1996). Moreover, VoVan Phu and Ho Thi Hong reported that there are 101 of fish species in Cua Sot in 2004 (Phu,

2009). The molluscs found in Ngan Sau system river and streams at north Truong Son mountains in Ha Tinh province include both Gastropoda and Bivalvia. The Gastropoda class has 14 species belonging to 4 families and 3 orders, and the Bivalvia class has 4 species belonging to 2 families and 2 orders (Ministry of Fisheries, 1996).

In Quang Binh province, much research has been focused on Phong Nha – Ke Bang national park. The fish fauna in the limestone mountains of Phong Nha – Ke Bang is abundant, and diversified. There are many rare, endemic and high value fish species.

The project of “Conservation of Unique and Valuable Fish Diversity in Phong Nha Ke Bang Limestone Mountain” carried out from 2001-2003, listed fish species composition in 2002 including 123 species belongs to 71 genus, 33 families and 10 orders, 14 of which are newly discovered species that were included in the Vietnam Freshwater Fish List (seven were identified for scientific purposes, and three were classified under the Critically Endangered Category in the IUCN Red Data List). The seven new species found in Phong Nha-Ke Bang were *Cyprinus quidatensis*, *Chela quangbinhensis*, *Acrossochilus yeni*, *A. carongensis*, *Glyptothorax raobutensis*, *Cyprinus hieni*, and *Carassioides phongnhaensis* (Tu, 2002). Furthermore, the research of Ngo Sy Van and Pham Anh Tuan carried out from 2002-2003 (Van, 2005) showed that fish species in Phong Nha – Ke Bang could be even higher, recording 158 species belonging to 86 genus, 35 families, 11 orders. Among them, the 3 orders that have the largest number of species are the Cypriniformes, Perciformes and Siluriformes orders. The endemic fish species present are *Chella quangbinhensis* and *Cyprinus quydatensis*. About 15 species are recorded in the Viet Nam Red Book.

In Quang Binh, beside the report of fish fauna in Phong Nha – Ke Bang, Vo Van Phu and his colleagues study the fish fauna in Kien Giang river and indentified 169 fish species in that river in 2002 (Phu, 2009). Molluscs in the Gianh river system at Quang Binh province belong to the Gastropoda and Bivalvia classes. The Gastropoda class has 10 species belonging to 3 families and 3 orders, and the Bivalvia class has 3 species belonging to 2 families and 2 orders (Ministry of Fisheries, 1996).

Thua Thien Hue province is situated in the north central region, Thua Thien Hue has over 505,399ha of natural area, comprising 352,679 ha of forestland. The forest is divided into production, protection and special use forest areas (Bach Ma National Park, Phong Dien Nature

Reserve and Hai Van Nature Reserve). During the results of “The Green Corridor” project (Phu, 2006), 79 fish species were identified, belonging to 13 families, 38 genera, and five orders. The Perciformes order had five families (38.5%), followed by Cypriniformes (three families), Siluriformes (three families), Anguilliformes and Synbranchiformes each having one family representative recorded. The carp family (Cyprinidae) were the most species rich with 48 species (71%), followed by Gobiidae (10 species), Balitoridae (6 species), Belontiidae (4 species) and other families (each having one to two species). Overall, there were two species listed in the Red Book Vietnam (2000) *Anguilla marmorata* (Cá chình hoa) which is classified as rare and *Onychostoma laticeps* (Cá Sinh gai) which is classified as vulnerable. There are seven recently discovered species distributed across a small area, and only found in mountainous streams and rivers and mainly in Central Vietnam. In addition, 22 species are of high commercial value such as *Anguilla marmorata*, *Onychostoma laticeps* and *Onychostoma gerlachi* (Phu et al., 2006).

Vo Van Phu and Nguyen Duc Nhuan summarised the number of fish species reported in other watersheds in Thua Thien Hue using data from different reports. In total, 57 fish species were found in Bach Ma National Park (reported by Vo Van Phu et al in 2004), 121 fish species in the Huong River (reported by Vo Van Phu and Phan Do Quoc Hung in 2005), 109 fish species in O Lau River (reported by Vo Van Phu and Nguyen Duc Thuan in 2009), 171 species in Tam Giang – Cau Hai (reported by Vo Van Phu in 2002), and 151 species in Lang Co lagoon (reported by Vo Van Phu and Tran Hong Dinh in 2000) (Phu, 2009). However, the fish population has decreased dramatically, the quantity of high economic value fish caught has declined, and the size of fish has reduced gradually over the years. Some high economic value species are currently threatened due to overexploitation, such as *Anguilla marmorata* (Phu, 2006). Factors influencing biodiversity in Hue province include increased fishing activities and habitat reduction due to the community development in the area. Additional factors may include the effects of past agricultural disturbance or dioxin spraying during the American War (Phu, 2006).

Quang Tri province has had several studies conducted into fish biodiversity. In Dakrong Nature Reserve, 72 fish species have been reported by Mai Dinh Yen in 2004 (Phu, 2006), however Vo Van Phu and Hoang Trong Tu identified 100 fish species in 2006 (Phu, 2009). There are 83 species of fish found in Thach Han river according to Nguyen Truong Khoa and Vo Van Phu in 2000 (Phu, 2009).

2.1.2.4 Central Highlands

The Central Highlands contain five provinces: Lâm Đồng, Đắk Lắk, Đắk Nông, Gia Lai and Kon Tum. This region is divided into 3 climatic areas: north of central highland (Kon Tum province, Gia Lai province), central of central highland (Dak Lak province, Dak Nong province), south of central highland (Lam Dong province) (Wikipedia Contributors, 2010). In the central highland region, the river system is dense. There are three main river systems in the central highlands, including Ba river, Mekong river and Dong Nai river. Ba River is the biggest river in the south central region; 388km in length and the watershed occupies an areas of 13.800km². Ba River originates from KonTum province, and runs through Gia Lai and Dac Lak provinces (Dat, 2008) with north-south orientation (He, 1999).

Based on the research results of He (1999), the fish fauna in the central highlands comprise about 160 species belonging to 28 families, 84 genera, and 10 orders. Among them, there are 8 introduced species, and 12 species are recorded in Red Book Vietnam. The Perciformes order is the largest and contains 11 families. Of these, the largest family is the Cyprinidae with 93 species. The dominant genus included *Osteochilus* (7 species), *Systomus* (5 species) and *Labeo* (5 species). Ba River contains 50 fish species. Among them, 8 species belong to the northern areas of the river, 31 species belong to southern areas, 6 species are distributed widely, and 1 endemic species lives in south central areas; the rest are introduced species (He, 1999). However, Vo Van Phu and Nguyen Minh Ty reported a higher number of species in 2005 when they found 71 species in the Ba River (Phu, 2009). In Mekong River, there are 17 species found in the north part, 111 species in the south part of the river and 8 widely distributed species. The fish species assemblage in the Ba River and Mekong River is similar to the fish fauna in the South Central regions (He, 1999). According to data of ministry of fisheries, central highland areas have approximately 41 species of molluscs. Of these, Gastropoda comprise 24 species and Bivalvia comprise 17 species including *Unionella fabangina*, *Pseudodon exilis*, *Corbicula javanus*, *Pseudosida biantata* (Ministry of Fisheries, 1996).

Based on the documents reported by Cuong and Hoa (2007), there are 32 species of dragonflies identified in this region. Lam Dong has the highest number of dragonfly species with 20 species recorded belong to 2 orders, the Anisoptera and the Zygoptera.

Many threats have been reported to the biodiversity in Central Truong Son (from Quang Tri to Binh Dinh province). These include pollution, species introductions, habitats losses and

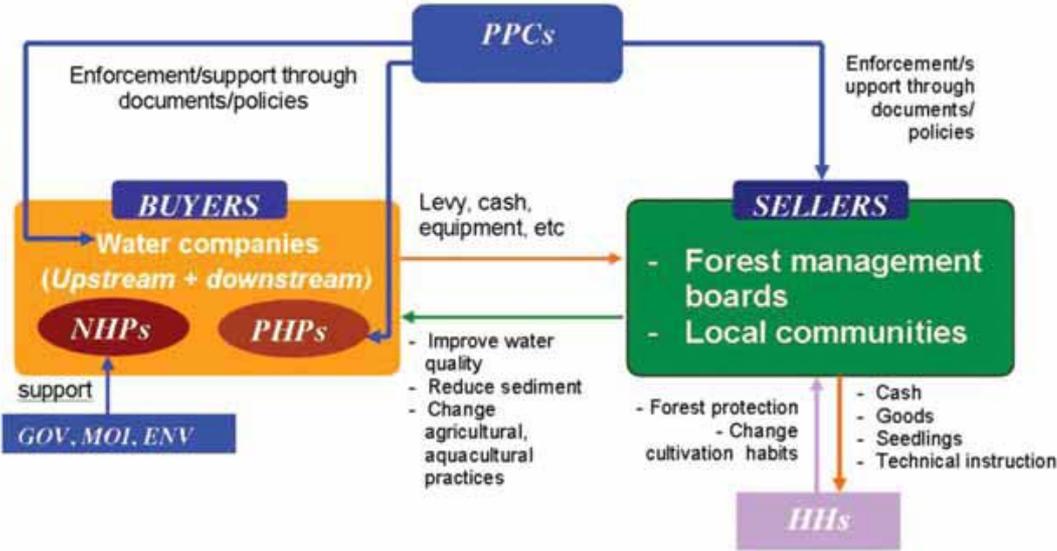
overfishing. In Viet Nam the construction of canals, dams or small-scale hydropower generators has altered ecological and hydrological habitats and created barriers to migration. In some cases, developments have connected previously isolated river basins, thereby facilitating invasions of non-indigenous species. Growing population size and urbanization are creating rising pollution levels from a variety of sources including domestic, agricultural and industrial. These affect freshwater productivity and fish diversity through increased sediment load, deforestation and infrastructure development. Habitat loss is major threat to fish diversity, especially species with restricted distributions. Furthermore, many commercial value fish species are under threat from over-fishing and indiscriminate fishing methods, such as use of poison and electricity (Tordoff *et al.*, 2003). All of the threats above are also found in other watersheds in Viet Nam.

2.2 Ecosystem services and PES schemes

Biodiversity resources are important to food supplies, materials for medicine, aesthetic and economic values, and some exportable species. The ecosystems of Viet Nam are rich and diversified including wetlands, rivers streams and forest (Forest Sector Support Partnership, 2008). Many of the poor Vietnamese live nearby and in forests, and their livelihoods depend heavily on the goods and environmental services from the natural forest (Forest Sector Support Partnership, 2008).

“Payment for ecosystem services (PES) is a voluntary agreement to enter into a legally-binding contract under which one or more buyers purchase a well-defined ecosystem service by providing financial or other incentives to one or more sellers who undertake to carry out a particular land use on a continuous basis, which will generate the agreed ecosystem service at specified levels”. “Payments for ecosystem services” is a new concept globally and especially in Viet Nam (Wunder, 2005; Ha, 2008). The value of ecosystem services, including biodiversity protection, landscape beauty, watershed protection and carbon sequestration, are described in the Law on Water Resources 1998, the Land Law 2003, the Law on Forest Protection and Development 2004, and the Law on Environmental Protection 2005 (Ha, 2008). A study by Ha (2008) indicated that International Fund for Agricultural Development (IFAD), World Wildlife Fund (WWF), International Union for Conservation of Nature (IUCN), Research Centre for Forest Ecology, Environment (RCFEE) and other agencies have established PES schemes in Vietnam. Many programs and projects have been introduced such as the “program of Payment for Environmental Services and Rewarding the Upland Poor for the Environmental Services they provide (RUPES)”, “Sustainable financing for landscape beauty in Bach Ma National Park”,

“Local revenue sharing: Nha Trang Bay Marine Protected Area, Vietnam”, and “Building payment mechanisms for carbon sequestration in forestry: a pilot project in Cao Phong district of Hoa Binh province, Vietnam” (Thanh, 2008). The Danish International Development Agency (DANIDA) funded a project looking into creating incentives for Tri An watershed protection; that project proposed scheme for PES in Dong Nai river.



(PPC: Provincial People’s Committees, PHPs: Provincial Hydropower Plants, NHPs: National Hydropower Plants, ENV: Electricity Vietnam, HHs: Households
 GOV: Government, MOI: Ministry of Industry)

Figure 3: Proposed scheme for PES in Dong Nai River (Ha, 2008)

The studies above show that Vietnam already uses economic and financial instruments to implement PES schemes. Furthermore, on the 10th April 2008, the Vietnamese Prime Minister signed the decision number 380/2008/QĐ-TTg concerning the trial policy on Payments for Ecosystem Services (PES) from forest. The cost for PES is start experimenting in Lam Dong and Son La province from 1 January 2009. The Chairman of Lam Dong people’ Committee signed the decision number 3240/QĐ-UBND on December 3, 2008, the decision indicated that personal and organization involve in the business in tourism and tourism products have to pay 1% of revenue for PES from forest. In Lam Dong, households who take care the forest are paid for forest environmental services as 290,000 VND/ ha / year in Da Nhim hydropower dam, 270,000 VND/ ha/ year in Dai Ninh hydropower dam and 10,000 VND/ ha/ year in Dong Nai river

valley. In Son La the PES cost for 1 ha of forest in 2009 was applied as Protection forests are natural forests: 140,243 VND / ha / year; protection forest is planted: 126,219 VND / ha / year, production forests are natural forests: 84,146 VND / ha / year; forests planted production forests: 70,121 VND / ha / year (Cuc, 2010). After 2 years of experimenting on PES, the policy performed a prospective results and receiving the high agreement from different stakeholders and local people. Vietnamese government will finalize the experimenting and the policy on PES will be applied in all provinces in Viet Nam soon (Linh, 2010).

3. Socio-cultural systems

3.1 Cultural diversity

In Viet Nam, there are about 85,84 million people (April 1, 2009 statistic) belonging to 54 different ethnic groups, of which 85.7% are Kinh (Viet) people (GSO, 2010). Based on languages spoken, 54 ethnic groups are divided into 8 groups namely Việt – Mường, Tày - Thái, Môn Khmer, HMông Dao, Kadai, Nam Dao, Hán and Tạng - Mianma (Forest Sector Support Partnership, 2008; Committee for Ethnic Minorities Affairs, 2004). In 2006, it was reported that 71% of ethnic minority groups live in the mountainous Northeast, Northwest and Central highlands (Hai, 2010). However, 70% of the minority groups were living in poverty (statistic in 2002) (Thuan, 2005).

Based on data from the Committee for Ethnic Minorities Affairs in 1999, Kinh people are dominance in the Northeast, North central and Central highland region; however Northwest is dominated by Thái and Mường people. Quảng Trị is the least ethnically diverse with only 3 ethnic groups, while Đắc Lắc is the most diverse containing 43 ethnic groups. Each ethnic group has its own language and culture which are reflected in their life and economic activities, such as costume, social relations, customs and practice in marriage, festivals, music activities and entertainment (Forest Sector Support Partnership, 2008). This ethnic diversity contributes to cultural diversity in Vietnam and different cultures characterise of different regions. The Northwest region is the home of more than 30 ethnic groups which is very famous in bamboo pole dance and pan pipe dance of Thai people. In the festival season, it is easy to observe the cultural traditions of local ethnic groups in Hoa Binh province as people gather at night and dance together around the fire and drink wine. The Northeast is famous for the Sapa love market (chợ tình Sapa) in Lao Cai province or Khâu Vai love market in Hà Giang province; these are

The study by World bank (2004) show that the wealth of ethnic minorities varies considerably region by region, though in all areas it is estimated that more than 50 percent of the ethnic minority population in Viet Nam lives in poverty. It is considered that Ba-na, Gia-rai, E-de, and Co-ho (in the Central Highlands) and H'mong, Muong (in the Northern Mountains) are the six poorest ethnic groups. Poverty has increased among the ethnic minority population living in the Central Highlands. The relationship between household characteristics and poverty is not the same among ethnic minorities as between the Kinh population. The differences are based on quality gaps such as education received. On the whole, ethnic minorities are less well educated than their Kinh and Chinese; the education rates of household heads and spouses are lower too (World Bank, 2004). The ethnic minorities inhabit the majority of Vietnam's land. However, they have poor infrastructure and accessibility, language and cultural barriers, and educational constraints including unqualified teachers and inappropriate curricula. Communal use of land is common amongst ethnic minorities. Generally, ethnic minority households are larger and have more children than average. about it is estimated that 23% of ethnic minority children are underweight for their age. The proportion is higher among ethnic people in the Northern Mountains (34%) and in the Central Coast and the Central Highlands (45 %) (World Bank, 2004).

3.2. Social systems

The Communist Party of Vietnam is the leader of the Vietnam State and society. The Party produces resolutions, defining overall direction and policies to lead the state. Party Congress is the highest leadership body that meets every five years to assess the implementation of the resolutions of the last term and decide directions and policies of the Party during the coming term, to elect the Central Party Committee, and to supplement and modify the political program and rules of the Party if needed. The Central Committee is the Party leadership body during the period between Party Congresses. The Central Committee elects the Politburo and selects the General Secretary from the Politburo members. The Party organizational system is established in

line with the State administrative apparatus from Central level to provincial, city, district, and communal levels as well as in administrative bodies, schools, enterprises, political/social/professional organizations, army units and police forces (Government web portal, 2010). The state system includes The National Assembly, The State President, The Government, Supreme People's Court, Supreme People's Procuracy and Local authorities. The State administrative organization includes the Government, ministries, ministerial-level departments, and specialized departments under the People's Committees.

The National Assembly is the highest representative organisation of the people; the highest organisation of state power of the Socialist Republic of Vietnam and the sole organisation that has the constitutional and legislative rights. The Assembly has decision making rights over all principal domestic and foreign policies, socio-economic issues, national defense and security of the country, major principles concerning the organization and functions of the state administrative system, and on societal and citizenship relationships. The State President, as the Head of State, is elected by the National Assembly from among its deputies to represent the Socialist Republic of Vietnam internally and externally (Government web portal, 2010).

The Government is the executive organisation of the National Assembly, and the supreme state administrative agency of the Socialist Republic of Vietnam. The Government is responsible to execute and organise the implementation of the Constitution, legislation and the National Assembly's resolutions, as well as to manage the implementation of political, economic, cultural, social, national defense, security and foreign affairs tasks of the state. The Government conducts its affairs centrally through ministries and local authorities in a coordinated and unified manner (Government web portal, 2010).

People's Committees are executive organisations of People's Councils and are the state administrative organisations with responsibility for steering socio-economic development and administrative processes at local levels under the overall leadership of the Government. At the provincial and district levels, national line ministries usually have specialised departments. Examples include the Department of Planning and Investment, Department of Agriculture and Rural Development, and Department of Science, Technology and Environment. These departments receive technical instructions from their national line ministries, but are accountable to the Provincial People's Committees (Government web portal, 2010).

There are four level of the state system of governance: national, provincial, district and commune. Currently, Vietnam has 58 provinces and 5 cities (under the central government) with 697 districts and approximately 10,000 communes (Wikipedia Contributors, 2010). Commune is the lowest level of Government. However, many decisions are made at level of the village. This lowest institutional unit is known as *lang* or *thon* in the North, often referred to as *up* in the South, and also called *buon* by ethnic minority people. Traditionally, the *thon* is a nuclear unit, originating from an individual or a family who settled there long ago. Many *thon* were combined into a commune, and the number of villages in a commune considerably varied from region to region. Under the colonial regime, the *thon* was the lowest level of the administrative unit, but it was replaced by the commune in 1945 in the North and 1975 across the whole country. The *thon* remained at the center of the commune's life; each village (*thon*) has village chief who is elected by a village election. Typical activities of a village chief include collecting taxes, mobilizing villagers to participate in socio-cultural movements, and introducing and explaining laws and policies to villagers. On the other hand, the village chief is the key bridge between the *thon* and commune authorities, they represent the *thon* at the commune level, defending the interests of the villagers when necessary (World Bank, 2004). The communes are organized by government rule and traditional customs. Groups of communes are defined as districts, and a collection of districts forms a province. At each administration level, there are People's Councils and a People's Committee with a chairperson, deputy chairperson and members of the same level.

3.3 Gender and demographics

Vietnamese women have an important role both in society and in the family (Scott, 2007). Women have a positive impact that not only sustains their households but also benefits their overall society through the reduction of poverty (International Finance Corporation, 2004). In Viet Nam, the gap between men and women remains in terms of health, education, wage in the formal labour market, state employment, access to credit and land, time worked, political representation and in decision-making (Asian Development Bank, 2002). As a consequence, women have less opportunity to access resources and fewer benefits received through government policies (The socialist republic of Vietnam, 2003).

In terms of education, the Asian Development Bank (2002) reported that 90% of Vietnamese adult males and 79% of adult females are literate. It is estimated that 12% of girls and 7.5% of boys at the aged over 5 years old have never attended school, and these figures have remained

remarkably constant over the past 20 years. On average, females have 5.6 years of schooling while male have 6.8 years at school (Asian Development Bank, 2002). According to a study on *“The transition of ethnic minority girls from primary to secondary education”*, Vietnamese ethnic minority girls are faced with many barriers preventing them from attending school, including economic and financial barriers, pressure to work, the belief that education lacks value for girls, poor quality of teaching and learning in schools, and inadequate school infrastructure (Miske, 2008). The gap in access to education between boys and girls is significant among the poor and ethnic minorities and in rural areas of the Northern Uplands and Central Highlands (Asian Development Bank, 2002).

There is no formal barrier to women’s participation in the electoral process. However, the National Assembly comprises only 23 percent women (Melissa Wells, 2005), the People’s council at provincial level comprises only 24% women, 23.2% at district level and 20% at commune level (Le Cong Thanh, 2008). According to The Socialist Republic of Vietnam, (2003), this means that Vietnam is one of 15 countries that have the highest female participation in Government bodies of power. There are more than 50% of Vietnamese women are the members of Viet Nam Women Union at the commune, district, provincial, and national level (Bourke-Martignoni, 2001).

Women's roles and status were radically changed during the Vietnam war, when men went to the battlefields. The relative absence of men in the village during the war overturned traditional social relationships, although this did not completely alter the nature of unequal gender relations (Hue, 2008). In the national context, female-headed households comprise 21.6% of all households, although this figure rises in the poorest areas (Northern Mountains, the Midlands, and the Central Highlands) to more than 30%. However, in elder generations aged 50 years or older, 45% household heads are female and women comprise approximately 51% of the population (Asian Development Bank, 2002). These differences were due to a higher loss of life amongst men in mountainous areas during the war, which gave rise to a higher proportion of widowed female-headed households (Asian Development Bank, 2002).

In remote and isolated areas, the most vulnerable group is poor female farmers, especially unmarried female householders and elderly females (The socialist republic of Vietnam, 2003). It is estimated that 42% of state employees are women (Melissa Wells, 2005). In contrast, more women (53%) than men (47%) identify their primary job as farming (Melissa Wells, 2005). It is

due to the fact that major of Vietnamese women are lack of access to resources such as management skills, knowledge of the market, access to credit and land (The socialist republic of Vietnam, 2003).

Approximately, 50% of the total agricultural workforce and 80% of workforce in aquaculture comprise women (FAO, 2009; The socialist republic of Vietnam, 2003). Women contribute more hours of labor than men do to cultivation, livestock breeding, agriculture processing, and marketing of agriculture produce. However, wage employment opportunities in rural areas are limited for women. Women work about the same time in income-earning activities but earn 14% less than men per month (Asian Development Bank, 2002). Only 19% of Land certificates are held by women (Le Cong Thanh, 2008). Finally, women’s burden of both paid work and domestic work also restricts opportunities for economic advancement (Wells, 2005)

In mountain and rural areas, there is still persists the belief that men are more important than women. Women have a lesser voice in decision making in their homes and communities (The socialist republic of Vietnam, 2003). They must defer firstly to their fathers, then their husbands, and finally their eldest son. The sex ratio (101 females:109 males) indicates a male bias among those aged less than 15 years, which suggests male preference in children. If a family has two daughters, they will try for a son. If they have two sons, they are less inclined to try for a daughter (Asian Development Bank, 2002). In addition, domestic violence is reported to be a “very real and widespread issue in Vietnam, affecting women from all social and geographical groupings.” (Bourke-Martignoni, 2001).

The gender and demography of the different regions is reported below using data from the household living standards survey 2006 (World Bank, 2004).

Table 1: Gender and demography in region in Viet Nam (World Bank, 2004)

Region	Sex of HHH		HH size (person)	Immigration rate (%)	Proportion of population by age group		
	Male	Female			0-14	15-59	60+
Northeast	78.6	21.4	4.30	0.24	24.2	66.6	9.3

Northwest	84.7	15.3	4.93	0.13	29.4	63.4	7.2
North	79.1	20.9	4.28	0.27	26.5	62.6	10.9
Central							
Central highlands	81.0	19.1	4.93	0.43	33.7	60.0	6.3

This table shows that the immigration rate is high to the central highlands (0.43%) while immigration is low in Northwest region. Northwest and central highland regions have family sizes that are on average larger than other regions (4.93 people). Viet Nam has a young population, with about 30% of the population aged less than 14 years. The youthfulness of the population creates excessive demand for job creation but also propels the rapid pace of economic, social, and cultural change that is evident today (Asian Development Bank, 2002).

Vietnam has policy systems that are focused on gender issues. There are many laws related to the gender and unequal power between men and women. Beside the constitution, the assembly established Marriage and Family Law (1986), Law on Domestic Violence Prevention and Control (2008) Law for gender equality (2007). The laws ensure human rights and legal protection in general, and for women in particular. In addition, to ensure the punishment of perpetrators, the laws help the victims and build a legal base to end domestic violence. In Vietnam, there are some organizations working on gender issues such as The national committee for the advancement of women in Vietnam; Center study on gender, environmental and sustainable development; Department of Gender and development – Central University for Women; Department in Architecture, gender study and urban development – University of Architecture; Center for Scientific Research on women and children Khanh Hoa; Research Center for Literacy and continuing education Ministry of Education; Center study on gender, family and environment in development; Center for ethnic minority women; Center study in Women – National University; Center study on women labours and gender – Ministry of Labour Invalids and Social Affairs; Family Health Center and reproductive; Center supports education and capacity building for women; Institute of Sociology and Research Institute of family and gender issues. There are many project related to gender and demography have been done and ongoing in Vietnam such as:

- Project on HIV and Gender-based violence.

- The project “Improving health care service and providing counselling service for the victims of Domestic violence” in Bac Yen, Son La
- The project “Building a network of complete community collaboration to protect human rights of the victims of Domestic violence”
- The project: “Let’s protect right of going to school of pupils in ethnic minority Ta Xua boarding school”
- The project: “Building capacity for social workers in supporting for the victims of DV” in Dong Hy district, Thai Nguyen province.
- Project “Promoting effectiveness of communication on domestic violence prevention law” fund by Ford Foundation funds the project.
- Building the self-help clubs network to support the survivors of domestic violence in Hanoi fund by the Global Fund for Women (GFW)
- “Sharing Together” Clubs for Victims of Domestic Violence This project is fund by the Hanoi International Women Club (HIWC)
- Empowering Migrant Women Affected by Violence with Providing Services and Awareness Raising fund by EU
- Building Volunteers’ Group of Supporting Victims of Domestic Violence in Hanoi supported by US embassy.
- Supporting to LGBT’s Rights in Vietnam and Encouraging Men’s Participation to Prevent Domestic Violence
- Prevention of corporal punishment against children in families and schools.

4. Natural resource dependence and livelihoods

4.1 Livelihoods and market networks

In Vietnam, particularly in the mountains, the main livelihood is agricultural production within the family farming system. The family farming system uses the labour of family members and animal labor, and family members consume most farm products; only a proportion of is sold or bartered at nearby markets (Vien, 2003; Cuong, 2005). Agricultural products include uphill field rice, paddy rice, cassava, maize, beans, home garden, fish pond, livestock, tree gardens and forest trees. Other products sold product include coffee, pepper, and cashew (in the central highland) (Thuan, 2005). For the people living close to watersheds, fish resources is used as the main protein sources. Market trading networks and industrial services are underdeveloped or slow to develop in the rural, remote and isolated mountain regions (The socialist republic of

Vietnam, 2003). In many regions, people have to spend a long time or even whole day going to market to purchase food, goods and exchange commodities (Thuan, 2005).

In the Northern Mountains, rural income sources are more diverse than other regions, even among the poorest groups. The majority of the population depend on their own farms for livelihoods (World Bank, 2004). The main activities are: husbandry of cattle and poultry, fisheries and aquaculture, farming agriculture plants, exploiting wood and coal, hunting, services and trading and free works (Cuong, 2006). Farmers increasingly grow crops for market, such as maize, cassava, tea and litchi; staple crops such as rice have become less important (WorldBank, 2004). In Laos, Cai revealed that crop diversification is partly driven by high demand from the lowlands and from China. Other reported causes of diversification were increased access to subsidized inputs, improved infrastructure, and better education and health conditions (World Bank, 2004).

Rural households in Northern East and North West often hold on average 0.6 and 0.3 hectares of forestland respectively. However, forestry contributes about 8% of total rural income. Cultivation of annual crops on sloping land causes increasing soil erosion and landslides (World Bank, 2004). Agricultural activities generate poor income level; production is not enough to meet food requirements, and many households are short of food for 3-4 months/year or even 6-7 months (Cuong, 2005). Animal husbandry also contributes to household income, but these activities are high risk because of animal diseases (Cuong, 2005).

The Northeast has long been a border gate between Vietnam and China. The business and trade in some border provinces are quite developed, such as Mong Cai international gate in Quang Ninh province (Le, 2008). Lao Cai's cool climate and impressive natural view, on the other hand, attracts thousands of international and domestic tourists every year. Thus, services and trade develop and many ethnic minorities people become tourist guides instead of farming and some villages become tourist hotspots (Lao Cai Tourism Centre, 2007).

In the North Central, the main livelihood activity is farming, but the size of annual cropland held by households in this region is about the same as in the rest of Vietnam. Moreover, the rural population have a much smaller area of perennial cropland, only 0.03 hectares on average,

compared to 0.3 hectares of forestry land. It thus appears that the persistence of poverty is related to the inability to turn forestry land into more productive uses (World Bank, 2004).

The Central Highlands have the highest incidence of poverty of any region in the country with more than half the population in this region living in poverty in 2002. Enrolment rates at all levels of education are below the average for rural areas nationwide, and child nutrition and reproductive health also lag behind national averages (World Bank, 2004). The main livelihoods are farming rice, maize, and industry plants such as coffee, rubbers tree, exploiting wood, mineral, husbandry, services, tourism, aquaculture and fisheries. About 40% of households in the central highlands have coffee trees. Farmers in the Central Highlands invested heavily in coffee over the mid to late 1990s and the subsequent fall in coffee prices left many of them struggling. Exposure to fluctuating commodity price movements was described as an important factor behind indebtedness, distress land sales and regression into poverty or hunger following relative prosperity (World Bank, 2004).

4.2 Resource dependence, access and control

People live in mountainous areas depend heavily on the goods and environmental services from natural resources (Forest Sector Support Partnership, 2008). However, natural resources have been exploited unsustainably in many cases. There is a trend of decline in the quality of the environment (The socialist republic of Vietnam, 2003). It is estimated that 25 million people, primarily of ethnic minority groups, live in and near forests. Forest helps to reduce poverty and eliminate hunger through forest resources that moderate the social labour and produce income (Forest Sector Support Partnership, 2008). However, the area of natural forests continues to declining and be exploited in unsustainable fashion (The socialist republic of Vietnam, 2003). Vietnamese Government is going to increase in the number of natural forests and size of protected areas (ICEM, 2003). Thus, livelihoods of many people are affected because they will not allow or get limited permission in exploiting forest product in protected areas. Their benefits from forests are reduced while there are no policies to compensate for this loss. This can be seen as a conflict between forest conservation on hand and poverty reduction and improvement of rural livelihoods (Thuan, 2005)

The most important resource available to farmers is land, which includes annual crop land, perennial crop land, forest land and fish ponds. In Vietnam, land is owned by the people and managed by the state. The Government administers land use right certificates and allocates land

use rights to organisations, households and individuals for stable and long-term use. The certificates are granted for annual crops/agriculture lands for up to 20 years and for perennial crops/forest lands for up to 50 years (ICEM, 2003; Vo, 2007). There are some differences in average land holding between rich and poor households. Based on the report of World Bank (2004), in the North West region the richest people hold about 7,578m² of perennial crop land; that is 12 times larger than the poorest household do. The average annual crop land holding per household (HH) in all regions is about 3900 – 4900 m², the near poorest HH have less annual crop land than other HH do. Nevertheless, in North East region, poor households hold on average 8068m² of forest land; that is higher than the richest households and double that of the middle households. However, rural people have not been able to turn this into highly productive land, even when introduced to advanced cultivation methods by the government due to lack of education (The socialist republic of Vietnam, 2003)

All these regions have rivers and stream systems running through them. In addition, the establishment of hydroelectric power stations and irrigation systems could enlarge the water surface by increasing water level. Thus might permit aquaculture in reservoirs, cage culture and aquaculture in manmade channels. In practice, the aquatic resources in the lakes or rivers are exploited by destructive methods such as electricity or chemical that causes the quick rapid ecosystem decline (VietNam Environment Protection Agency, 2005). Success in preventing illegal exploitation of aquatic and natural resources is not good at the local level in some areas and people's awareness of how to protect natural resources is still low (Quan, 2003).

Ethnic minorities have lived in the mountain areas for thousands of years, and the forests are diverse environments containing many kinds of plants, such as rattan, aloe, fomes japonicus and orchids, as well as wild animals. Many communities are dependent to varying degrees on forestland, either cropping it directly or relying on it as a source of supplementary income. The collection and sale of non-timber forestry products, and the use of food and firewood for domestic use, are reportedly common, especially among ethnic minority groups. Deforestation has occurred in all regions, although the problem is much more serious in the Central Highlands where the unregulated flow of in-country migration has rapidly increased. Large forest areas were converted to crop production lands by poor migrants (Quan, 2003). Accompanying the disappearance of forests are increasingly frequent droughts, floods and storms, and an increase in soil degradation. Deforestation is also facilitated by weak management of local forest enterprises, long delays in land allocation and land zoning, and unclear and unreasonable

administrative restrictions for land use. As a consequence, land erosion has become a serious problem. Due to deforestation, the water sources become exhausted in the dry season and floods occur in the rainy season, causing great losses. Although the government advocates strong punishments for illegal deforestation, enforcement is weak due to poverty and weak forestry management by local government (Quan, 2003).

Land areas for agricultural production have increased rapidly due to population growth. However, land productivity has reduced rapidly because of over-exploitation and poor knowledge of soil resource protection. Cleared forest land erodes rapidly after only a few harvest seasons and becomes unfertile bare land. Frequent drought, floods and landslides, together with deforestation and old method farming practices, have greatly contributed to the loss of arable land annually in the Central Coast and Highlands regions (Quan, 2003). Another major reason for land degradation is the inefficiency of the irrigation systems. The existing irrigation systems are not able to provide enough water for agricultural production. Most of the land in the mountain regions is in drought in dry seasons and, as a result, the soil quickly becomes degraded. Land also becomes quickly exhausted under the monoculture regime. Monoculture and intensive agriculture have made the soil less productive (Vien, 2003).

Water resources becoming exhausted and polluted: Rapid increases in population have led to water resources becoming over-exploited. In addition, local government's weak management of the water supply has led to inappropriate use of this important resource. A shortage of clean water is experienced every dry season. Most communes are not supplied with tap water; 55% of 1,870 especially disadvantaged communes did not yet have access to safe water in 2000 (The socialist republic of Vietnam, 2003). People normally dig wells or fetch water from streams or rivers for domestic use. Poverty might make people over-exploit natural resources for survival. Nevertheless, the degradation of the environment means that natural resources are no longer able to be used for economic activities, and thus people become poorer (The socialist republic of Vietnam, 2003).

In the central highlands, wild foods exploited from nature are still important for ethnic people. For example, a study conducted in three ethnic groups namely Rơ măm ethnic (Le village, Sa Thay district, Kontum province), Ê đê ethnic (Chàm B village, Krông Bông district) and Hmông ethnic (6A village, Đăc Rlấp district, Đăc Lắc province) showed that people living in these areas collect wild plants to use as food and medicines. In total, Ê đê people use 146 plants species for

food, and 42 plants species used as medicine to treat disease such as diarrhoea, and dental teeth problems. Wild food sources included vegetables (30-50 species), mushroom (10-14 species), fruit and roots. Roots are an important food source that helps people out of hunger in the periods of food shortage. When food runs out, people go to the forest to collect roots as a replacement for cereal staples (IUCN Viet Nam, 2008)

4.3 Community resilience and vulnerability

In Viet Nam, poverty remains widespread, especially in rural, mountainous, remote and isolated areas. *“Poverty is a situation in which a proportion of the population does not enjoy the satisfaction of basic human needs that have been recognized by the society depending on the level of economic and social development and local customs and practices.”*(The socialist republic of Vietnam, 2003). The Vietnamese Government defined that in the period from 2006-2010, the poor households are households that have income levels of less than 200,000 VND per person per month in rural mountainous and island areas and less than 260,000 VND per person per month in urban areas. Poor communes are the communes in which the incidences of poverty are 40 % and above, and that lack infrastructure (roads, schools, clinics, electricity and water for livelihood needs, small irrigation works and markets) (The socialist republic of Vietnam, 2005).

The Vietnamese government estimate that 64 percent of the poor live in the Northern mountainous region, the North Central region, the Central Highlands, and the Central coastal region. Poor people in those regions are highly vulnerable to negative shocks such as natural disasters, job loss, sickness, and volatile agricultural prices. They are poor because of difficult living conditions, geographical isolation, very limited access to productive resources and services, underdeveloped infrastructure, harsh natural conditions and high frequency of natural disasters (The socialist republic of Vietnam, 2003). The percentage of the population who do not have assets to cope with shocks in northeast, northwest, north central and central highland is 10%, 4.1%, 8% and 8.3% respectively (World Bank, 2004). As well as lack of available capital assets, the poor are also faced with the poor health, low levels of education, unsanitary hygienic conditions and environmental degradation that makes it even more difficult to improve their situation (The socialist republic of Vietnam, 2003)

The infrastructure in rural and mountain areas is underdeveloped, further increasing the gap between these and other regions of the country. In the year 2000, the status of infrastructure of 1,870 especially disadvantaged communes is as follows: 20-30% of them do not yet have roads

leading to commune centers; 40% do not yet have enough classrooms; 5% do not yet have health stations; 40% of them do not yet have electricity lines to commune centers, 50% do not yet have enough small-scale irrigation works; and 20% of them do not yet have markets at the commune or commune cluster level (The socialist republic of Vietnam, 2003). The poor infrastructure does not meet the requirements of investors especially foreign investors; as a result, the industry, commerce and tourism sectors are not developing in these regions. The underdevelopment of infrastructure, especially transportation, irrigation, water supply and drainage systems is notable. For example, in central highland, water supply is a problematic issue, most of the rivers and lakes become drought-ridden during the dry season, thus, destroyed the crop and causing widespread hunger (Quan, 2003).

Poor ethnic minorities living in rural, remote, mountainous areas are faced with poor sanitation and health care conditions such as clean water and preventive health programs (The socialist republic of Vietnam, 2003). A study by the World Bank (2004) showed that in 2002 the proportion of women who give birth at home with no assistance from qualified health workers in northeast, northwest and central highland is 33%, 65% and 40%, respectively. Due to out of pocket payments for the poor, if diseases occurs, households cannot choose to seek treatment, or at least professional medical treatment so they treat themselves at home (World Bank, 2004). Poor people have to borrow money or to mortgage assets to cover costs of treatment.

Agriculture is the major income source for most people in all regions. The agricultural economy is characterized by traditionally subsistent farming patterns practiced by the majority of local farmers. But regional topography and climatic conditions in mountain areas often make these areas unsuitable for intensive agricultural development. For example, province in North Central has about 25% of its land is flat that is potential for agriculture development, however, it is divided by rivers and streams. Da River divides the North West region into two separate parts. The land is sloping and unfertile, the climatic conditions hard and frequent natural disasters like storms, floods and drought create a risky environment for the agricultural sector and make agricultural production difficult. Moreover, the poor are very limited in resources (land, labor and capital), their income is highly unstable and they are more vulnerable to unexpected shocks. Seasonal factors affecting the agricultural production create more difficulties for the poor (The socialist republic of Vietnam, 2003).

Climate change and dramatic environmental degradation due to the deforestation, soil erosion and exploitation might caused serious problems in health and sanitation due to heavy storm and flooding. Furthermore, the gap between rich and poor has rapidly become wider. Most ethnic minorities are very poor. Poor and ethnic people are the most vulnerable to the risks of the market economy. Whilst some of them have managed to escape poverty, many others have fallen back to their starting point, or even lower.

Out-migration from rural areas in search of livelihoods is providing an important source of supplementary income in poor areas. Seasonal migrants go to work as hired agricultural labour in other regions. The Central Highlands region has large inflows of migrants, only 26.1% of population in this region is indigenous people (2002), the remainder come from the northern and central provinces, aimed at developing new economic zones. About 30 percent of migrants are from ethnic minorities in the Northern Mountains, particularly Tay, Nung, Dao, San Chi and H'mong. Children aged 10 to 16 years, 13.5 percent of work on the family farm, but the proportion is much higher among ethnic minorities (33.5 percent). Only 2.3 percent of children in this age group were found to be working for a wage. But the proportion is 6.7 percent among 15-year olds, who work on average nearly 33 hours a week. New migrants cause pressure on local natural resources. Migrants buy land from local people to cultivate or they do farming on abandoned fields, thus local land sellers go to forests to find new land that cause deforestation (Quan, 2003).

Women, children and ethnic minorities are the most vulnerable groups. In Vietnam, ethnic minority children in mountainous areas face extremely hard living conditions: working in the fields and poor sanitary conditions (Phu, 2009). However, child poverty rates are highest in the North West and North East mountainous regions (Neubourgh, 2008). Here is no significant relation poverty between boy and girl or between the number of children or elderly in the household and child poverty (Neubourgh, 2008). Ethnic minority children who have no written language like Raglai, Ray, and K'ho groups suffer language barriers. They have difficulties in learning and using Vietnamese, thus resulting in low enrolment rates and high dropout rates from schools (Phu, 2009). When the deforestation occurs, women have to travel further to collect firewood and fetch water for their families. An example from DakLak province, female informants in all villages had to go 10 to 15 kilometres to collect firewood as the nearby forest had been destroyed. It is also much more difficult for women in the dry season to fetch water for their family's use (Quan, 2003).

The skills of the population are low, with a high percentage of untrained labourers, illiteracy and unemployment, as well as poor health and disability. Illiterate and unskilled labourers are particularly prevalent among ethnic minorities and women in all regions. Poor people seem to be neglected, they are illiterate, shy and inexperienced so they cannot get enough information about their rights and they have no voice with the local authorities. In addition, the chance for poor households to escape poverty is limited, as many bankers refuse to release loans to the poor due to the high risk of non-repayment and the lack of deposits and assets (The socialist republic of Vietnam, 2003).

4.4 Information and communication assets

In ethnic minority villages, very few people have televisions. Many only have radios provided by the Government. As they do not understand Vietnamese well, they get most of their information from local programs, which are broadcast only once a week. The situation is somewhat better for Kinh ethnic as they can obtain information from TV, radio and loudspeakers, as well as from personal communications with local leaders or group meetings. In addition, all information passed to the villagers, either through village meetings, TV, radio, or loudspeaker, is all in spoken language. This makes it difficult for people to understand and remember the information (Quan et al., 2003). In 2004, in average ratio of telephone is 12.05 telephones per 100 people and 100% of commune have telephone. However, based on the statistic of General Statistic Office at the end of June 2010, there are 151 million telephones registered including landline and mobile telephones (General Statistic Office, 2010). Limited in knowledge and lacking information of markets, policies and laws, poor people struggle to escape poverty and so the poor become even poorer (The socialist republic of Vietnam, 2003).

There are four main types of media in Vietnam including print journalism, reports, television and websites. Vietnam has 706 media agencies, including 178 newspapers and 528 magazines. In Viet Nam, there is a central television with three main channels (VTV, VTC, VOV) and 64 provincial/city radio stations. 34 electronic newspapers, 180 websites of agencies, magazines, newspapers, radio and thousands of pages of electronic information. All the activities of media are under the management and direction of the Ministry of Information and Communication of Vietnam, and under the supervision of the Central Department of Propaganda of the Communist Party of Vietnam. According to the law of Vietnam, currently private press are not got permission (Wikipedia Contributors, 2010).

5. Local planning and projects

5.1 Past and current projects

Table 2: Table Some biodiversity research in Viet Nam

Area	Project title	Implementing	Start and end date
Wildlife Trade	An Analysis of Wildlife Trade Dynamics in the Pu Mat Nature Reserve/Social Forestry and Nature Conservation Project.	Nghe An Province, TRAFFIC SEA	1999
	Transboundary Trade in Forest Products in Northern Vietnam, Lao PDR and Yunnan, PRC	East-West Center, Hawaii	1998
Medicinal Plant	Vietnam Wildlife Medicinal Trade Project	CRES	1999
Legislation and Policy	Vietnam Forest Sector Support Program and Partnership	MARD	2001
Biodiversity Conservation	Biodiversity Conservation Program in Central Truong Son Range	FPD, WWF Indochina	2000
	Marketing Research for Conservation and Development: Case Studies from Vietnam	Forest Science Institute of Vietnam	2002
	Regional Transboundary Biodiversity Conservation Project	Vietnam Gov	1999
	Green Corridor: conserving global conservation targets in a productive landscape	WWF, Thua Thien Hue PFPD	2004-2008
Protected Areas and Management	Phong Dien Nature Reserve Project, Thua Thien Hue Province, Vietnam	BirdLife International, FIPI	2001
	Assesment of Biological Resources in Southeast Vietnam and Tay Nguyen Plateau	IEBR	2001-2003
	Cat Tien National Park Conservation Project	Cat Tien NP& Netherland	2000-2005
	Huu Lien NR Conservation Project	IEBR, Frontier	2000
	Phong Nha - Ke Bang National Park Quang Binh Project	WWF, IEBR	1998
	Feasibility Studies for the Establishment of A Yun Pa and Chu Prong Nature Reserves, Gia Lai Province, Vietnam	BirdLife International, FIPI	2001
Rural Development	Northern Mountains Poverty Reduction (PE_P059936)	MPI PMUs of six provinces	2001-2006

	Integrated Rural Development Project in Quy Chau District, Nghe An Province	Quy-Chau People	1999-2003
	Wetland Protection in Red River Basin	CRES/Mangrove Ecology Centre	1999-2005
Sustainable Use	Strengthening Conservation Areas for Resources Protection In Ba Be, Na Hang, Yok Don (VIE/95/G41)	MARD Forestry Protection Department	1999-2005
	Biodiversity Conservation in Cat Ba National Park	Cat Ba NP, IEBR, FFI	2000-2006
	Biodiversity Conservation in the North Truong Son Mountain Range	CRES Ha Tinh	1999-2006
Environmental Research	Enhancing Laboratories of Viet Nam National Centre for Natural Sciences and Technology to Detect Monitoring Environmental Indexes in Viet Nam	NCST	2000-2005
	Training on Biodiversity Conservation for Staff of National Parks and Protected Areas	IEBR/NCST	2003-2005
Environmental Management	Bach Ma-Hai Van Green Corridor	WWF	1999-2004
	Rural Access Programme	PC of four provinces in Central Vietnam	1999-2004
Biological Uses and Value	Conservation of Unique and Valuable Fish Diversity in Phong Nha	Vinh University	2001-2003
	Ke Bang Limestone Mountain		
	Data Base Programme for Biodiversity in Vietnam	IEBR/NCST	2002-2004
	Community-Based Research for the Conservation in Thua Thien Hue province	Hue University	2001-2003
Ecological Reconstruction	Introduction of the Rare and Endangered Medicinal Plant into Forest Garden in Northern Vietnam for Conservation	IEBR	2001-2003
	Population, Habitat and Measures for Conservation, Development and Use of Beneficial Hymenopteran Wasps in or Around Protected Areas in Northern Vietnam	IEBR	2001-2003
Taxonomy	Fauna and Flora of Vietnam	IEBR	2003-

			2010
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Sources: Nguyen Xuan Canh (2004)

5.2 Development and infrastructures plans

There are many projects that have been completed or are on-going to develop infrastructure for mountain areas. All regions have benefited from the investment program of the Vietnamese government. For example, in the central highland 98.6% of communes now have a road suitable for a car to reach the commune headquarters; 94.4% of communes have government electricity; 52.5% of household are able to use electricity; 100% of ethnic commune have a telephone, clinic and primary school. There are many plans and strategies that have been discussed in national assembly meetings and several have been implemented such as:

- Water Resources Development Plan to the year 2000 and Tentative Development Plan to the year 2010 (MARD, June 1998)
- Direction and Duties of Water resources development to the year 2010 (MARD, September 1999).
- Strengthening Environmental protection in the period of National Industrialization and modernization (Communist Party of Viet Nam, Directive No. 36/CT-TW, 1998).
- Strategy for Rural Agriculture Development in the Industrialization and Modernization Period to the year 2010 (MARD, July 2000).
- Agriculture and Rural development Plan (2001- 2005) (MARD, August 2000).
- National Strategy for Rural Water Supply and Sanitation (NRWSS).
- Second National Strategy and Action Plan for Disaster Mitigation and management in Viet Nam 2001 to 2020 (MARD and Central Committee for Flood and Storm Control, December 2001).

6. Policy frameworks and stakeholders

6.1 Institutional arrangements and stakeholder mapping

The key government agencies for highland aquatic conservation and rural development includes the Ministry of Planning and Investment, Ministry of Agriculture and Rural Development, Ministry of Natural Resources and Environment, Ministry of Culture and Information, Vietnam

National Administration for Tourism, Ministry of Education and the Provincial People's Committees.

- **The Ministry of Planning and Investment (MPI)** response for funding levels and negotiating budget allocations including through the annual budgeting process ministries and the provinces. MPI produce guidelines for and check of ministries and sectors for the preparation and implementation of strategies on socio-economic, rural development and other fields.

- **The Ministry of Natural Resources and Environment (MONRE)** responses for the Ramsar Convention, the Convention on Biological Diversity and co-coordinating the implementation of Vietnam's Biodiversity Action Plan, management of water resources and water quality; making plans on the use, overall management and protection for water sources. Department of Environment with Department of Biodiversity conservation is directing responsible for environment and aquatic conservation.

- **The Ministry of Culture and Information** together with MARD has the responsibility for managing "cultural-historic-environmental sites",

- **The Vietnam National Administration of Tourism (VNAT)** is responsible for developing the country's tourism strategy and promoting tourism in national parks and cultural-historic-environmental sites.

- **Ministry of Industry:** Hydropower development via Viet Nam Electricity Corporation

- **Ministry of Agriculture and Rural Development (MARD)** is a main governmental agency which performs the function of state management in agriculture, forestry, fisheries, irrigation and rural development throughout the country and perform the state management of public service in the domains falling within its management scope. Related to fisheries, aquatic conservation and irrigation, the task and powers of MARD are defined on Decree No. 01/2008/ND-CP dated January 03, 2008 of the Government, Articles 2, specific task 8 and 9 regarding fisheries and irrigation:

- To direct and guide the implementation of mechanisms and policies on fisheries development after they are decided by competent authorities.

- To direct and guide criteria for classification of species- habitat conservation zones and aquatic nature reserves; to decentralization the management of conservation zones of national and international importance; to promulgate regulations on the management, exploitation and protection of fisheries resources after obtaining competent authorities' decision.

- To publicize and direct, guide, inspect, evaluate, sum up and report on the implementation of approved strategies, planning and plans on fisheries development nationwide.

- To guide and inspect provinces and centrally run cities in the implementation of planning on exploitation, protection and development of fisheries resources, to set criteria for classification of species habitat conservation zones and aquatic nature reserves, to guide the decentralization of the management of conservation zone of national and international importance;

- To publicize a list of aquatic species banned from exploitation and the time when fishing is banned; to provide for fishing methods, fishing trades and fishing gear banned or restricted from use, species and minimum sizes of aquatic animals permitted for fishing and fishing season, areas banned or restricted from fishing and aquatic species banned from import or exports.

- To provide for a list of aquatic species which need to be conserved, protected or re-generated; measures for protecting aquatic bio-systems and conserving gene funds and aquatic biodiversity.

- To guide fishing activities of Vietnamese and foreign organizations and individuals in the mainland, inland water areas, sea areas, exclusive economic zones and continental shelf of the Socialist Republic of Vietnam; to decentralize the management of fishing areas routes and grounds.

- To direct, guide and inspect the implementation of approved regulations on decentralization of the competence to grant and withdraw fishing permits. To provide for the order of and procedures for the grant and withdrawal of fishing permits and direct the implementation thereof;

- To assume the prime responsibility for elaborating planning on regional irrigation and reservoirs serving agriculture and for multiple socio-economic purposes.

Decree No. 01/2008/ND-CP dated January 03, 2008 of the Government also defined the task and powers of MARD regarding rural development; and to direct the implementation of manage project and investment programs and related research activities. MARD has divisions that are directly or indirectly involved in the conservation of highland aquatic resources: these are The Department of Science, Technology and Environment; The Department of Aquaculture; The Department of Plant Protection; The Department of Water Resources; The Department for Processing and Trade of Agriculture and Forestry products and salt making; The Department of Forestry; The department of Forest Protection; The Department for Exploitation and Protection of Aquatic Resources; The Department for Management of Work Construction; The Department

for Cooperative Economy and rural development and National center for Agriculture and fisheries extension.

On behalf of ministry and government, there are many related research institutes, media, NGOs and research education centres that contribute to biodiversity and aquatic conservation:

Research: Research Institute of Agriculture technology in the south; Research institute of plant protection; Research Institute of Forestry; Institute of Forest Inventory and Planning; Research Institute for Aquaculture 1,2,3 and National Institute of Malariology parasitology and entomology (Ministry of health);

Public media: The Vietnam Agriculture Newspaper, The Environment resources Newspaper; Vietnam Television (VTV2: science and education channel)

Non Government Organizations (NGOs):_Organization in UN/ ASEAN, Organization of corporation and supporter from other countries and Organization in biodiversity conservation such as IUCN, WWF, International Birdlife, Vietnam Rivers Network

Research and education institutions:_Faculty of protection and management of forestry resources (Forestry University); Centre in environment and bioengineering (Huế University); Centre in research resources and environment, Department in mangrove research and Faculty of Biology (Hà Nội National University); Department of environment and natural resources management (Can Tho University); Institute of ecology and biology resources (Viet Nam Institute of Science and technology); Faculty of Environmental and natural resources; Centre for research and agriculture sustainable development (Hanoi Agricultural University)

Tourism and wild life:_National park and natural conservation areas; Zoos and botanic gardens

- The Provincial People's Committee (PPC) is the highest administrative authority in a province, under which departments are organised following a similar vertical structure to the central level. Each provincial department is responsible for state management on their respective issues, including The Departments of Natural Resources and Environment, Department of agriculture and rural development, Department of economic...Beside that PPC has policy and social organizations: Youth union, women union, farmer union, post war veteran union also participating in conservation and development of aquatic resources.



Figure 4: Map of government institutional involves in aquatic resources research and conservation

6.2 National and international policy frameworks

The Government of Viet Nam has promulgated a number of relevant policies in order to enhance effectiveness of conservation, utilisation and management of biodiversity in the country. Many regulations on institutional structure, mandates, and responsibilities within the wetland management system at the central level have been issued and have gradually been elaborated upon.

Table 3: List of national policy related to aquatic biodiversity conservation and development

Document	Main contents

Decree No. 30-HDBT of the Council of Ministers, 23/03/1989	Article 23: Regulations on the uses of bare lands
Inter-ministerial Circular No. 5-TT/LB, 18/12/1991	Guidelines for the management and utilisation of water bodies for aquaculture
Government Decree No. 64-CP, 27/09/1993	Regulations on long term allocations of agricultural land to households and individuals for agriculture, forestry and aquaculture.
Land Law, 15/10/1993	Article 47: Regulations on the uses of interior water bodies for aquaculture, fisheries and other purposes Article 48: Regulations on the use of coastal water bodies for agriculture, forestry and aquaculture.
Government Decree No. 90-CP, 17/08/1994	Regulations on compensation for reclamation of land by the State for the purpose of defence, security, or national and public benefits.
Government Decree No. 01/CP, 04/1995	Regulations on land allocation for state enterprises for agriculture, forestry, and aquaculture.
Government Decree No. 22/1998/ND-CP	Article 9: Regulations on compensation for damages where agriculture lands, forestry lands, salt-made lands, and aquaculture lands are recovered by the Government. Article 23: Compensation for agricultural losses.
Resolution No: 03/2000/NQ- CP, 02/02/2000	Long-term State policies on the farm economy in which the State strongly encourages investment in and effective use of bare lands on midland, mountain, border, and island areas and to make use of bare lands, ponds, lakes, lagoons, and alluvial grounds for extensive agriculture, forestry and aquaculture
Ordinance on Aquaculture Protection and Development	Article 4: State agencies, societies, organisations, and individuals are allowed to exploit natural fisheries in accordance with this Ordinance.
Law on Environmental Protection	Article 11: The State encourages and promotes organisations and individuals in the use and reasonable exploitation of environmental components. Article 15:

	Application of methods to restrict and prevent erosion, landslides, soil salination and alkination, unplanned desalination, laterisation and desertification.
Decision No. 97-HDBT of the Council of Ministers, 29/05/1982	Every type of water body, including ponds, lakes, rivers, canals, and bays, belongs to the people and is managed by the State. Promotes education and encourages organisations and individuals to protect aquaculture and habitats for aquaculture species.
Directive No. 169-CT of the Chairman of the Council of Ministers, 18/05/1992	Implementation of urgent measures to protect <i>Grus antigone</i> and wetland biodiversity in the Plain of Reeds.
Land Law, 15/10/1993	Article 50: The management and use inshore alluvial lands is regulated by the Government. Article 71: The State allocates water bodies to suitable households and individuals according to the identified utilisation purposes. The Government regulates the management and utilisation schemes of these areas
Law on Land Use Taxes, 10/07/1993, and the accompanying Decree No. 74-CP, 25/10/1993	Article 2: Water bodies for aquaculture are subject to agricultural taxes. Article 7: Agricultural and aquaculture lands are divided into six categories. Article 9: Annually imposed tariffs are calculated by kilogram of rice per hectare for each land category, including land with water bodies for aquaculture. Article 19: Tax exemption for newly exploited land in mountainous regions, marshes, and land reclaimed from the sea for seven years. Marshes and land reclaimed from the sea will be exempted for an additional six years.
Government Decree No. 80/CP,	Defining cost norms for each land category for: <ul style="list-style-type: none"> • Tax on the transfer of land use rights • Money collection when there is a change in land

06/11/1993	<p>use rights</p> <ul style="list-style-type: none"> • Land rental • Value of assets within the property • Compensation for land reclamation, including reclamation of land with waterbodies for aquaculture
Government Decree No. 175-CP, 18/10/1994	Article 21: The uses and exploitation of national parks, nature reserves, and historical and cultural monuments require approval from relevant authorities. Article 35: Financial support is provided for conservation and restoration projects for those ecosystems that are of importance for the long-term social- economic development and maintenance of biodiversity.
Prime Ministerial Decision No. 845/TTg, 22/12/1995	Protection of unique ecosystems of Viet Nam, as well as fragile ecosystems that have either been reduced in area or destroyed as a result of economic activities. Protection of those components of biodiversity that are threatened or depleted. The identification and promotion of values and uses of biodiversity for the benefit of sustainable use of natural resources and national economic development objectives.
Prime Ministerial Directive No. 359/TTG, 29/05/1996	Introduction of urgent measures to protect and develop wild animal populations.
Government Decree No. 14/1998/ND –CP, 06/03/1998	Regulations on the management of lands and other natural resources
Criminal Code No. 5/1999/QH10, 21/12/1999	Articles 182-191: Regulation of crimes and penalties for environmental violations (destruction of aquaculture, deforestation, violations of wild animal protection law, violations in protected areas).
Decision No. 189/2000/QD- BTC, 24/11/2000	Regulations on land, water surface, and sea surface rental applied to foreign investors in Viet Nam, including definition of the unit price of land with water surfaces for aquaculture.
	Regulations on the management of special-use,

Prime Ministerial Decision No. 08/2001/QĐ-TTg, 11/01/2001	protection and production forests. According to this regulation, forest is defined as natural forests on forestry land, comprising plants, animals and other natural elements related to forestry (mountains, rivers, lagoons, wetlands, etc.).
Law on Environmental Protection	Article 12: Organisations and individuals are responsible for the protection of plants, wild animals, biodiversity, forests, seas and ecosystems.
Ordinance on Fisheries Protection and Development	Article 2: The State manages aquaculture benefits and living environments. Aquaculture living environments include water area, wetland surface and the land where aquaculture species live. Article 3: The protection and development of aquaculture is associated with the protection of the natural environment. Article 5: Strictly forbids activities that may destroy the benefits, living environment, protection and development of aquaculture. Articles 8, 9: Strictly forbids extermination activities, exploitative activities in the spawning seasons, and other similarly destructive activities.
Law in fisheries	Chapter I, article 4, Chapter II, article 7 Chapter II, article 8
National Law on Environmental Protection (December 27, 1993)	Chapter II, part 2, article 16 Chapter III, article 46
Law on biodiversity	Including 8 chapters, 78 articles
Decree No 91/2002 dated November 11, 2002	Mandate, Organization and Functions of MONRE
Decree No 26/Cp of the Government dated April 26, 1996	Administrative fines for violation of environmental protection.
Decision 82/2002/QĐ-TTg dated June 26, 2002	Establishment, Mandate and Operations of the Viet Nam Environment Protection Fund.

Decision No 45/QD-TTg dated on April 2, 2003	Establishment of provincial Department of Natural Resources and Environment.
Decree No 43/ND-CP/2003 dated May 2, 2003	Mandate, Organization and Functions of MOFish.
Decree No 70 -CP of the Government dated June 17, 2003	Administrative fines for violation in the fishery sector.
Law on Environmental Protection	Water quality guidelines for protection of aquatic sites
	Standards for industrial effluents discharged into lakes used for protection of aquatic life.
	TCVN 6774 - 2000: Freshwater Quality guidelines for protection of aquatic sites
	TCVN 6980 - 2001: Standards for industrial effluents discharged into rivers used for domestic water supply
	TCVN 6981 - 2001: Standards for industrial effluents discharged into lakes used for domestic water supply
	TCVN 6982 - 2001: Standards for industrial effluents discharged into rivers used for water sports and recreation
	TCVN 6983 - 2001: Standards for industrial effluents discharged into lakes used for water sports and recreation
	TCVN 6984 - 2001: Standards for industrial effluents discharged into rivers used for protection of aquatic life
	TCVN 6985 - 2001: Standards for industrial effluents discharged into lakes used for protection of aquatic life

7. Logistics of HighARCS study site selection

Based on the desk study about the values, livelihoods, conservation issues and wise-use options of highland aquatic resources at northern and central of Viet Nam, two provinces are selected to study further due to the frame work of HighARCS project; Son La is representative for the northern areas and Quang Tri is representative for the central areas of Viet Nam.

7.1 Son La province



Figure 5: Son La map

Son La province is located in northwest region which is highland province with average elevation of 600-700m above sea level. Son La city is 320km far from Hanoi capital. Son La has 14.125 km² of natural areas and this is one of three largest provinces of Vietnam with 1 city and 10 districts. There are two main river systems (Da River and Ma River) that flow through Son La which occupied more than 97% natural areas. The Da river has 32 estuaries of 280km length and 13.110km² of watershed and the Ma River has 17 estuaries of 90 km and 7.210km² of watershed. There are 53km of the Da River runs through this district with north west- southeast orientation.

There are rich and diversity in aquatic fauna in the stream and river in Son La, especially in the watershed of Da River and Ma River (Van, 2005). The fisheries production from river, stream and reservoirs of Son La is about 700 tons per year. In average, Son La has 1.2-1.8 km river and stream per km². There are 96 hydropower stations with capacity of 134.000kw, 21 of those dams have capacity more than 1000kw. Son La hydropower is the biggest in the Southeast Asia with the capacity of 3.600kw, which is started constructing on December 25, 2005. Son La Hydropower

is aim to supply electricity, water for irrigation and contribute to develop the socio-economic in the Northwest region. This project requested 100,000 people to be displaced to Son La, Dien Bien and Lai Chau and that is the biggest involuntary resettlement in the modern history of Vietnam. Son La province has the largest number of resettlement households with 8 districts, 62 communes, 237 sites for resettlement (including 03 standby sites) with capacity to receive 13,100 household (Ha, 2008). Son La has the diversity of culture from 12 ethnic groups, the resettlement program that affected to the livelihood and the cultural of communities, especially of ethnic minority groups who are living close related to watershed. Phu Yen district is one of the poorest districts of Son La and that involve in resettlement program.

Phu Yen located in mountain areas, complicated topography. Phu Yen is listed on district poverty with 14/27 town and commune that have more than 40% of poor household, these communes located along the Da River and highland areas. In Phu Yen district, there are 1200 rivers and streams belong to 4 main river systems: Tac River, Sap River, Mua River and Khoang River, all of them flow to Da River. There are some fishing village in Phu Yen district where people depending on aquatic resources in the river. The average fisheries production of Phu Yen district is 200-300 tons per year, the main production comes from Hoa Binh hydropower dam. Many people in the selected commune go fishing on the Hoa Binh hydropower dam; fishing is the main income sources of many household

7.2 Quang Tri province



Figure 6: Map of Quang Tri

Quang Tri is located in the central of Vietnam and that is 600km far from Hanoi and is defined as province which includes the high mountains. This province is remaining the consequence destroyed from the post war and it is strong affected by hardest climate conditions such as storm and flooding. During the past, this province is the important are in Vietnamese-American war. Quang Tri is one of 10 provinces which received about 47% of dioxin, there are many victim of orange agent and the remaining consequence of past war. Nowadays, Quang Tri is the important location in exploiting and protection of East Sea and East-West economic corridor. There are 3 ethnic groups mainly are the Vietnamese (Kinh), the rest are Bru-Vân Kiều and Pa Cô- Tà Ôi. Quảng Trị has 45 reservoirs with the volume from 1 to more than 10 million m³. There is a dense stream and river systems, in average there is 0.8-1 km of river per km². There are 3 main river systems: Bến Hải (65 km length, 809 km² of watershed), Thạch Hãn (155 km length, 2660 km² of watershed) and Ô Lâu (Mỹ Chánh) (65 km length and 900 km² of watershed). The fisheries production that exploited from river, stream and brackish water is about 668 tons of fish and 87.3 tons of shrimp (report on state of Quang Tri environment in 2006).

The main income of many local people in Quang Tri is agriculture and forest. In addition local people are exploiting fish and aquatic product on the river/dams to supply food for family consumption. Dakrong district is established in 1996 (The Government, 1996), this is poorest district in Quảng Trị and that is on the list of 61 poorest districts in Vietnam (The Government, 2008). There is 48% household in Dakrong district is poor household (in 2008), 80% of poor household is ethnic household. Dakrong commune belongs to Dakrong district Quang Tri province is highland and difficulty commune. There are many people in Dakrong are living close related to the Dakrong river (sources of Thach Han river) and in between the valley of high mountain of Truong Son range, the height of mountain in these area are ranging from 500 to more than 2000m above sea level. The height of Thach Han river source is 700m and the average height of watershed is 301m above sea level. People in this commune use water from river for domestic use, fishing and climate regulation and for agriculture purpose.

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