

An Assessment of the Herpetofauna of the Green Corridor Forest Landscape, Thua Thien Hue Province, Vietnam



Green Corridor Project: Technical Report No. 2



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THE GREEN CORRIDOR PROJECT: MEETING GLOBAL CONSERVATION TARGETS IN A PRODUCTIVE LANDSCAPE PROJECT

TECHNICAL REPORT NO. 2

An Assessment of the Herpetofauna of the Green Corridor Forest Landscape, Thua Thien Hue Province, Vietnam

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ABBREVIATIONS AND ACRONYMS

AMNH	American Museum of Natural History
asl	Above sea-level
CBC	Center for Biodiversity and Conservation, AMNH
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CTS	Central Truong Son
dbh	Diameter at breast height
FPD	Forest Protection Department
FPU	Forest Protection Unit
GEF	Global Environment Facility
GCP	Green Corridor Project
HCM	Ho Chi Minh Highway
IEBR	Institute of Ecology and Biological Resources, Hanoi, Vietnam
IUCN	The World Conservation Union
MARD	Ministry of Agricultural and Rural Development
NP	National Park
NR	Nature Reserve
NTS	Northern Truong Son
SFE	State Forest Enterprise
STS	Southern Truong Son

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BACKGROUND TO THE GREEN CORRIDOR PROJECT

The ‘*Green Corridor: conserving global conservation targets in a productive landscape*’ project is a four year initiative starting in June 2004 implemented by the WWF Greater Mekong programme and Thua Thien Hue provincial Forest Protection Department. The project receives funding from the World Bank - Global Environmental Facility, WWF, Thua Thien Hue Provincial Peoples Committee and SNV - the Dutch development organization. The aim of the project is to protect and maintain the biodiversity rich forests of the Green Corridor forest landscape. This area has been identified through systematic conservation landscape assessments as one of the highest conservation priorities in the Central Truong Son range as it supports some of the last remaining lowland forests in Vietnam and harbors a wide range of endemic and endangered species, such as the saola (Tordoff *et al.*, 2003; MARD and WWF, 2004).

The primary objective of the project is to protect and maintain the conservation value of the landscape in the Green Corridor, an area of globally significant conservation importance presently under extreme threat from illegal logging, hunting and the threats of unsustainable development. The secondary objective is to establish a replicable model for protection and maintenance of high global conservation values in multiple-use forest landscapes of strategic importance for biodiversity conservation. The project conducts urgently needed direct interventions and methodologies for achieving multiple benefits from forest management in productive landscapes to combat the key threats to the biodiversity in the Green Corridor. This includes the identification of conservation and forest restoration priorities through systematic assessment of biodiversity value and forest mapping. In particular the project will improve the quality of management and planning of land and natural resources to increase the level of biodiversity conservation and provide for a productive landscape. To achieve this, the project will work with forest managers, local communities and provincial government, including sectoral development planners. Key outputs of this collaborative approach will be a conservation zonation plan and participatory conservation agreements. Furthermore, they will be instrumental in reducing the threat to areas outside of special use forest from conflicting plans and strategies and will ensure that conservation goals become achievable throughout the Green Corridor. This will enable the realization of a productive landscape in which local communities benefit from improved conservation and resource management and are not adversely impacted by inappropriate development actions at district, provincial or national level.

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EXECUTIVE SUMMARY

This report is an assessment of the herpetological fauna of the Green Corridor Project area, Thua Thien Hue Province. The survey was undertaken as part of the WWF Green Corridor projects assessment to determine the biodiversity value of the Green Corridor forest landscape. The survey was conducted in three Districts of Thua Thien Hue Province at four sites, namely A Roang and Huong Nguyen communes (A Luoi District), Thuong Lo (Nam Dong District), and Duong Hoa (Huong Thuy District) between 14 August and 14 September 2005.

Survey and collection transects ranging from between 300 to 3,000m in length were set up in different habitat types at twenty sample sites in four forest areas within the project area at elevations between 80 to 900 m asl. Habitats comprised evergreen tropical rainforest, secondary forest, mixed forest of bamboo and scrub, plantation forest, agricultural land and residential areas. Information of species occurrence also referred to pictures taken from previous surveys and from interviews of local community members.

The survey documented 93 species of amphibians and reptiles (68 observed directly, 25 referred to interviews and pictures from previous surveys); 43 species of amphibians (40 observed directly); 27 species of snakes (16 observed directly); 16 species of lizards (12 observed directly); and seven species of turtles (none observed directly). The total number of species recorded from our survey of the Green Corridor area represents 44% (93/210) of the known herpetofaunal diversity of the Central Truong Son range. Species richness recorded through collections for the herpetofauna for each forest area was as follows: 35 species in Huong Nguyen, 46 in A Roang, 30 in Thuong Lo, and 27 in Duong Hoa. Additional species were recorded through interview surveys, which were conducted in all sites except A Roang adding a further 11, 15 and 23 species to Huong Nguyen, Thuong Lo and Duong Hoa sites respectively.

The dominant families of amphibians were Ranidae (13 species) and Rhacophoridae (15 species), and for reptiles the Colubridae (16 species). The survey also recorded in the GCP area the occurrence of four species only known from Central Truong Son Range and five species only known from the Greater Truong Son Range. These results indicate that the project area probably already is likely to support a significant representation of the entire herpetofaunal diversity of the Central Truong Son area.

A total of 32 threatened species were recorded during the survey period, including nine species of amphibians and 23 species of reptiles. Among these, 14 species are listed in Decree No 48/2002/ND-CP, 15 species listed in the Red Data Book of Vietnam, 16 species listed in IUCN Red List, and nine species listed in CITES Appendices.

A ranking of the conservation value of the four forest areas was undertaken using a scoring system based on species richness; number of rare and/or threatened species; forest area; habitat quality; and human disturbance factors. According to our methodology, the relative value of each site is ranked as follows: A Roang (17 points), Thuong Lo (12 points), Huong Nguyen (9 points), and Duong Hoa (6 points).

Two main threats to conservation were identified in the GCP area including herpetofaunal hunting; and habitat alteration and loss. Based on the results of our assessment, the following recommendations are made:

1. The area supports a fair number of herpetological species representative of the Central Truong Son including a number of endangered and threatened species. The threat from hunting in the area is high enough to warrant an evaluation of its wildlife trade status particularly for threatened reptiles (turtles, snakes, and big lizards). This will be essential to any future conservation plan for the project area
2. Since the herpetofaunal diversity of the project area is still poorly known, long-term herpetofaunal surveys in areas with the most extensive forests (A Roang Commune; Thuong Quang Commune, and the area bordering with Huong Tra District) need to be conducted.
3. The highly fragmented nature of the forests in this area warrant studies on the impact and effect upon local herpetofaunal populations.
4. Several taxon studies have been carried out in the GCP area. Therefore, overall ranking for conservation value should be made to define the important sites (hot-spots) in the project area, and areas having high priority for interventions from the GCP.
5. Create appropriate conservation areas within the project area, for example a Species and Habitat Conservation Area in particular in the A Roang area, and similar habitats, of the survey area in order to protect the reptile and amphibian fauna.

1.0 INTRODUCTION

1.1 Background

The Central Truong Son, hereafter known as CTS, of Vietnam represents an important area for herpetological fauna diversity in Vietnam. The area is here defined as the upland areas between the Ca River (Quang Tri Province) and Da Rang River (near Gia Lai Province's southern border). Approximately 210 species of amphibians and reptiles are known from the Central Truong Son of Vietnam (64 species of amphibians; 93 species of snakes; 46 species of lizards; nine species of turtles). The CTS contains the highest diversity of herpetofauna within the Truong Son Range. Currently, there are several species of amphibians and reptiles known only from the CTS: *Gekko ulikovskii* (gecko); *Dibamus greeri* (limbless lizard); *Leptoseps poilani*, *Paralipinia rara*, *Vietnascincus rugosus* (skinks); *Calamaria lowii*, *Opisthotropis daovantieni*, *Parahelicops annamensis* (snakes); *Leptobrachium xanthospilium*, *Ophryophryne hansi*, *Microhyla nanapollexa*, *Amolops spinapectoralis*, *Philautus abditus*, *Philautus supercornutus*, *Rhacophorus baliogaster*, and *Rhacophorus exechopygus* (frogs). Although many of these species have been referred to as being endemic to the area, we are hesitant to use this phrase, since the area remains poorly sampled and many of the above species have only recently been described.

1.2 Biogeography

A complete biogeographic picture of the herpetofauna of the CTS is still emerging, since the diversity of the region is still being discovered at a very fast rate; 98 of the approximately 210 species of the CTS, (47%), have only been discovered or documented in the past decade (22 species of lizards, 29 species of snakes, and 47 species of amphibians). However, areas of the CTS still contain patches of forest, including lowland forest, which is unique in this part of Vietnam. The CTS appears to be a transition zone between the NTS and STS, since it has large faunal overlap between the two areas and it has the richest known herpetofaunal diversity in the Truong Son. The herpetofauna of the eastern slopes of the Truong Son (i.e. the Vietnam side) also shares a great number of species with the western (Laos) slopes. Although adequate surveys are still wanting on both sides of the border, the eastern slopes receive greater rainfall, an especially favorable condition for amphibian and freshwater turtle diversity. It cannot be said with authority, but it is reasonable to expect that the Vietnamese CTS has a higher diversity of herpetofauna.

Recent human activities have altered forests of the CTS, activities such as commercial-scale logging, swidden agriculture and the routing of the Ho Chi Minh Highway through the CTS have created forest fragments, altered the composition of the forest flora, as well as the morphology and chemistry of the landscape and waterways. The extent of these effects, including those on the herpetofauna in particular, has not yet been researched.

1.3 Previous Studies

There have been a few important studies on the herpetofauna of Indochina that include the CTS, the most comprehensive works being Bourret (1936, 1941, 1942), and Smith (1931, 1935, 1945), which synthesize information about the south and southeast Asian herpetofauna, including species descriptions and some preliminary biogeographic hypotheses. In the past decade, there has been a surge in herpetofaunal research in Indochina and the CTS in particular. Of these, the most important works that deal with the CTS are Inger *et al.* (1999) and those of Ziegler (e.g., Tillack *et al.*, 2004; Ziegler, 2002; Ziegler and Le, 2005), which have undertaken research on the NTS. These publications report on recent collections from the CTS and northern Vietnam, and include many new species descriptions, range extensions,

and natural history of the herpetofauna of the region. Other important summaries of regional fauna that includes the CTS are Campden-Main (1969a, b; 1970) (snakes of South Vietnam); Deuve, 1972 (snakes of Laos); Iverson, 1992 (worldwide turtles); Szyndlar and Nguyen 1996 (snakes of Vietnam); Stuart, 1999 (amphibians and reptiles of Laos); Stuart and Platt, 2004 (turtles of Indochina); Teynie *et al.*, 2004 (amphibians and reptiles of Laos). Furthermore, there have been an astonishing number of new species described, many of which are very recent: e.g., Darevsky and Sang 1983; Darevsky, 1992; Darevsky and Orlov, 1994; Darevsky and Orlov, 1994; Inger and Kottelat 1998; Brown, 1999; Ohler *et al.*, 2002; Ohler, 2003; Ohler *et al.*, 2003; Bain and Nguyen 2004a,b; Hallermann, 2004; Ohler *et al.*, 2004.

2.0 AIMS AND OBJECTIVES

2.1 Green Corridor Project Aim

The Green Corridor is an area of forest stretching between Bach Ma National Park and Phong Dien Nature Reserve (Figure 1.0). The primary objective of the project is to protect and maintain the conservation value of the productive landscape in the Green Corridor, presently under extreme threat from conservation neglect (WWF, 2003). The secondary objective is to establish a replicable model for protection and maintenance of high global conservation values in multiple use forest landscapes of strategic importance for biodiversity conservation.

2.2 Survey Objectives

In this rapid survey, we endeavored to document as much of the herpetofaunal diversity of the study area as possible. In addition to presence records, we collected as much ecological information as possible (microhabitat information for adults and tadpoles, breeding season, breeding condition, egg deposition etc.). Furthermore, we conducted some informal interviews to gain insight into local attitudes towards and use of the regional herpetofauna. Through these interviews, we hoped to be able to gain some knowledge about the herpetofaunal diversity and natural history of the area.

The results of this survey will help to improve the understanding of the biodiversity and other environmental values that these forests support. This will also allow us to give an initial assessment, evaluating and defining priority areas for biodiversity conservation. Based on these results, we will contribute to the multitaxa survey effort not only to help draw the boundaries but also to develop an operational plan of the proposed Green Corridor in Thua Thien Hue Province.

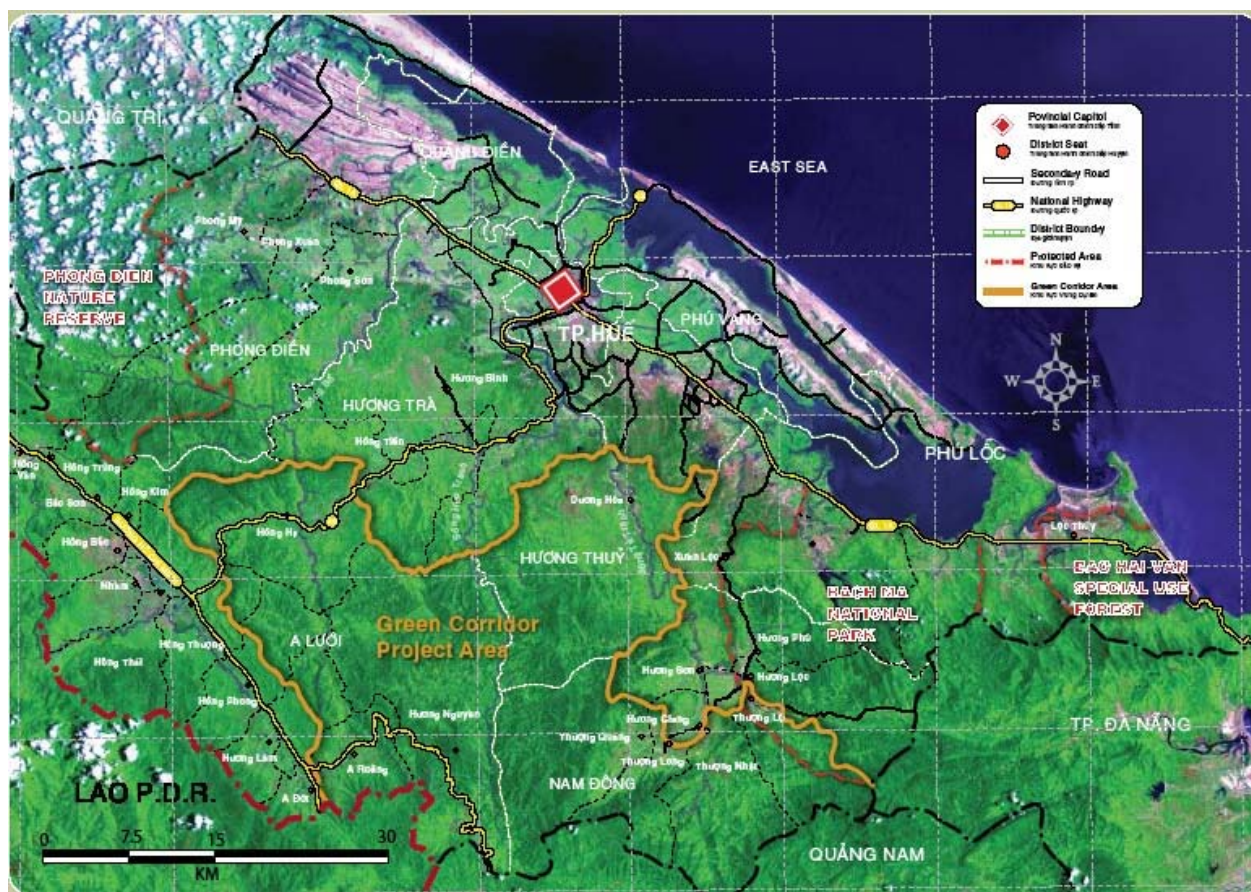


Figure 1.0 Map of the Green Corridor Project area

3.0 METHODS

3.1 Study Area and Site Descriptions

The herpetological survey was conducted in four distinct forest areas within the Green Corridor landscape in Thua Thien Hue Province. Within each area, several sites were surveyed (Figure 2.0); a summary of co-ordinates and habitat types is shown in Table 1.0.

3.1.1 Forest Area 1-Tra Ve Forest Station, Huong Nguyen Commune, A Luoi District

This area bordered between A Huong Tra and A Luoi Districts, Huong Nguyen Commune, Tra Ve Forestry Station, hereafter known as Huong Nguyen Forest Station, at the confluence of the Huong Nguyen River and the Suoi Da, a smaller tributary to it ($16^{\circ}15.282'N$, $107^{\circ}26.976'E$, $\sim 90m$ asl). The forests we visited in this area were all secondary.

Site 1: A Lieng Stream. This stream is about a one-hour walk from the station (~ 3 km), off the logging road (also called the Ha Ma Stream). There is thicker overgrowth than in the forest immediately adjacent to the road. The stream runs about 2-4 m wide, 15-30 cm deep, alternately sandy and rocky bottomed, with a thick layer of detritus. The banks are rocky and steep. The water is clear. The stream is surrounded by good secondary forest (small hardwoods, and other deciduous trees, tree ferns, melastomes, herbaceous and woody undergrowth. At the head of a stream is a small hut for rattan collectors. There are large fish and aquatic invertebrates including shrimp and crabs populations.

Site 2: Liet Si Stream. The forest around the Liet Si (site of an active rattan collecting station) is considerably more degraded than the A Lieng - much more banana and bamboo present, as

well as cudzoo. The stream runs about 2-4 m wide, 15-30 cm deep, sandy bottomed, with a thick layer of detritus.

Site 3: Bomb crater pond. This bomb crater has become a buffalo wallow. It is surrounded by grasses and small deciduous trees (dbh 15-20 cm), with overhanging branches. The pond is about 6 m in diameter and its contents a slurry of water, mud, and buffalo dung. Its depth was not surveyed.

Site 4: Da Stream (upstream from Huong Nguyen Station). This stream is clear running with banks alternately steep and rocky to low and sandy. The forest is secondary, but there appeared to be fragments of primary forest along certain stretches (i.e. large buttress trees > 1 m dbh, thick woody vines, thick herbaceous undergrowth), but this area was small and the stream opened up to degraded secondary forest in long stretches.

Site 5: Khe Coi Stream. This stream is down the Huong Nguyen, 1-2 km below the Station. The stream alternates between many varied habitats: rocky to sandy-bottomed; densely closed to wide open; low and flat banks to steep and rocky banks; slow pools and riffles to cascades and rapids; narrow (~2 m) to wide (>12 m). The stream includes a huge rock formation that is clearly a large cascade in the wet season (it was completely dry); an almost bare white rock, ~50 m in length, 12-20 m in width. The surrounding forest includes large buttressed trees (>1 m dbh).

Site 6: A Bong Stream. We reached the A Bong by taking a small forest path behind the bomb crater pond (site 3). The forest here is a network of paths, overgrown and presumably from metal collection and timber cutters. The forest here is very thick with herbaceous and woody undergrowth and some larger hardwoods (~ 15 m high; ~1 m dbh). There were also small trees that looked like holly (thick leaves almost with spines), large buttress trees, and ferns. The stream, where we entered (coordinates above) is open, slow, only ~1 m wide, flat, with flat open banks. Further along it has high, rocky banks and rocky cascades with deep (~3 m) and wide (>10 m diameter pools). There are some tributaries, but they are very small, slow, and overgrown. The stream alternates between rocky and sandy bottomed; surrounding forest alternates among banana, bamboo, and hardwoods.

Site 7: Vu Vu Stream. We got to the Vu Vu by walking up the road past the bomb crater pond, but before the A Lieng Stream and turned into a reedy grassy stream, on side of which was almost completely open and the other with bamboo and small woody trees. We followed this sandy-bottomed stream a few hundred meters until we came to a rattan collecting camp, where we turned onto a small forest trail that went through very thick undergrowth: thin hardwoods, holly, herbaceous vines. We walked up a hill, across its top and down the other side ~500 m.

The Vu Vu is small and close, densely surrounded by vegetation; sandy bottomed with small rocks; muddy banks. The stream runs through reedy, almost marsh-like areas with more grassy vegetation than open water. It widens upstream, with flat banks, a closed canopy, small vegetation and undergrowth on the banks. The stream also has cascades and (low and slow flowing at this time) and many small pools surrounded by high, steep, muddy banks. The forest floor was dry. The stream widens and narrows continuously along its length. At one point the forest is tall (trees ~30 m high, dbh ~1 m). The stream clearly runs higher and faster in wetter times of the year.

Site 8: Little A Ma Stream. This is downstream from the Station on the Huong Nguyen. After a few kilometers, we pulled off on the A Ma stream, passing a deep impression that used to hold a disabled tank, before locals recycled it. We continued along another forest path that leads us to the Little A Ma. At the point of entry for us, there is an altar for a man who died here 2 years ago. The stream here was very dry - rocky pools of water, with patches of thick overgrowth.

Site 9: The logging road. We also searched all of the open road within a 4 km radius of the Station. This road is about 4m wide and muddy. The roadside vegetation is almost all scrubby second growth. In places, the road has formed a deep trench from the original forest above it - tire tracks also form deep (~10 cm) pits in which water collects. Roadside piles of lumber are scattered along the road, and the edges and 'banks' have a layer of detritus.

3.1.2 Forest Area 2 - A Pat Ranger Station; A Roang Commune, A Luoi District

The A Pat Ranger Station is situated on the Ho Chi Minh Highway number 14 (at sign post km 398 +700). The station is on a broad lip below the highway formed on a curve between two streams. Directly west of the station, on the opposite side of the road is a large rock cut (>100 m high).

Site 1 : Stream A Roang 1, directly across the HCM to the northwest of the station (this is the stream used for the station's water supply). The water pipe runs about 50-70 m above the highway, along a precipitous climb (walkways and a ladder are in place). Once at the top of this climb (and into the forest), the stream runs much more flat. It is primarily rocky, with some big boulders and small rocks in sand. The forest cover surrounding the stream is thick: hardwoods ~15-20 cm dbh and ~35 m high occur streamside; a complex understorey of melastomes and other herbaceous (including ferns) and woody plants; tree ferns were also present. This is primary forest, although disturbed through hunting and some wood collecting. An illegal woodcutting camp was discovered up a smaller tributary to the Stream. This tributary contributed a very high amount of silt to the Stream after rain. The stream is ~4 m wide. The banks are primarily flat, but there are cascades, glides, and deep pools, so the banks run high and steep in places. There are a few small feeder streams that were low, slow and running very muddy. The banks contained many small herbaceous plants. Below the highway, the stream is deforested and muddy. Although there is certainly a large amount of silt carried downstream, the water, when not raining, still runs clear.

Site 2: Stream A Roang 2, directly across the HCM to the east of the station (this is the stream used to house the station's goat barn). The stream is not very wide (~4 m at its widest). It is primarily rocky-bottomed, but complex, having three distinct habitat types (above the highway). The first is a cascade habitat, rock-bottomed with high, steep banks composed either of mossy rocks or mud (with low woody growth and an herbaceous underlayer). Rarely, the banks are flat, with low woody and herbaceous growth. There are a few palms and rattans, along with some larger hardwoods and tree ferns along the cascade portion of the stream, which is dominated by a high, closed canopy. The cascades drop into pools, only a few of which exceed 1 m in depth, otherwise, the water is always fast and shallow (<0.25 m), with some glides.

Higher upstream, the stream becomes flatter, a little wider (~3 m) and slower. The bottom of the stream here is mud and/or sandy, with small stones and a thick layer of detritus. The banks are almost all flat and muddy. The canopy here is lower than in the cascades and more herbaceous - rattan, bamboo, banana.

The third habitat type is associated with the slower, flatter streams - these are forest seeps and still waters that feed the stream. There are some small pools inside the forest close to main stream. These still waters are muddy-bottomed, with a deep detritus layer. They are thickly overgrown with bamboo and palms.

Below the highway, the stream is deforested and muddy. Although there is certainly a large amount of silt carried downstream, the water, when not raining, still runs clear. During rains, however, it runs very silty.

Site 3: “Goat barn forest”, directly above and to the southeast of Stream 2. We walked on the ridge to the east of the stream. The forest here consisted of hardwoods, maximum dbh ~1 m, and a closed canopy, out on a ridge running approximately north-south. There are some woody vines and a thinner understory than at the river below.

Site 4: “Cha Linh Stream”. This stream is located right on the HCM. This stream is very steep and narrow - a cascade for almost its entire length. It is entirely rocky-bottomed and the banks are sheer, either with rock or mud with low vegetation. The entire stream bed is no more than 10 m wide. There were some feeder streams here. From what we saw, the stream had a closed canopy, but the trees were small - very large (some >2 m diameter) fallen trees and logs clogged the stream, however.

Site 5: “Lower Stream”. The stream is very small (~3 m wide), and runs low (<0.15 m). It is almost all rocky cascades followed by pools (the largest ~4 m in diameter, 1 m in depth). Glides are rocky bottomed, with few side pools and little detritus. The canopy is very closed, mostly herbaceous growth: rattan, bananas, tree ferns, and only a few hardwoods.

Site 6: “Steep Stream - A Roang. Above the HCM, this stream is very steep for ~50 m (height). Water falls as a cascade over solid rock. Although there has been heavy rain, the water runs fairly shallow. Above the cascades is a flatter stream, ~4 m wide, running low, <0.10 m deep. The stream bed is composed of small stones - with sandy-muddy bottom in some places. The forest surrounding the stream is varied; at the top of the cascades are enormous hardwoods (>30 m high) and the understory is very open. Many fallen trees and branches cross the stream as well. The forest opens to rattan, palms, tree ferns, banana, and other broadleaved, herbaceous vegetation. Paths, cut branches and an abandoned hut are evidence that wood and/or rattan cutting occurred here at one point. Upstream the stream splits into two arms. One arm leads, after a few meters, to a small pool at the base of a 15 m cascade. At the top of this cascade, the stream continues for about 50 m before being overgrown with bamboo and palm. The other arm of the stream continues for few hundred meters, and ends in a precipitous waterfall (~ 30 m high) that we could not cross. At the flat portions of the stream there are sections where the banks are flat and shallow or gently sloping on mud. On these banks, herbaceous ‘trees’ and ‘shrubs’, as well as small hardwoods (dbh 15 cm) can be found. The stream also has a few portions of slow, almost totally still pools - shallow, the bottom covered by a thick layer of detritus.

3.1.3 Forest Area 3: Thuong Lo Commune, Nam Dong District, on the Cha Mang River

Site 1: Base camp on the Cha Mang: The river is wide (~10 m), deep (>3 m) and fast flowing with rapids, and glides (no side pools). The bottom is sandy bottomed with small smooth stones and the rapids have large boulders in the middle of them. The forest on the camp side

of the river is second growth, with small woody trees and a nearby field that was recently cultivated. The opposite side of the river is steep and rocky with disturbed primary growth. Streams in the area (all tributaries to the Cha Mang) are homogenous - all are fast flowing cascades and/or rapids, with very fast glides. They are almost entirely rocky-bottomed. The banks are almost always steep, sometimes completely rock, and sometimes with low herbaceous and woody growth on mud.

Site 2: Stream downriver from camp. It is a series of fast flowing cascades with few glides or side pools, almost entirely rocky-bottomed. The banks are almost always steep, sometimes completely rock, and sometimes with low herbaceous and woody growth on mud. The forest is almost all secondary hardwood with a few patches of large buttress trees.

3.1.4 Forest Area 4: Duong Hoa Commune, Huong Thuy District, on the Dau River

Site 1: Khe Dau Station (Nam Hoa SFE): This is an open grassy field at the confluence of the Dau River and a smaller stream. The open area is all grassy - water buffalo keep the grass shorn short. The forest all around is recently planted (5-10 years ago). There is some naturally occurring secondary forest across the small stream. On the visible peaks of the surrounding hills there appears to be disturbed primary forest and/or older secondary forest.

Site 2: Stream 1 - Khe Huong. Downriver from the Station. The head of the stream is very narrow (~3 m) and relatively deep (~1.5 m). The forest around it is scrubby/reedy (banana, bamboo, tall grasses). Upstream, the stream has many more cascades, flowing quickly over rocks, glides and pools (some >3 m deep). The banks are very steep, consisting of rock or mud with a thick tangle of woody and herbaceous undergrowth. At this point in the stream, the forest also becomes thicker, with larger hardwoods, some buttress trees (dbh >1 m), thick woody vines - this appears to be disturbed primary forest. Near the top of the ridge the growth again is secondary scrub (bananas, grasses) and the ridge itself is totally denuded.

Site 3: Stream 2 - South of the Station. This stream, a tributary to the small stream that runs by the Station is reedy, marshy, and sandy bottomed at its head. Further upstream, the stream consists of almost continuous cascades over rock, with very few glides, but many pools, some of which are very large (diameter >20 m) and deep. The banks are sheer, either of solid rock or mud with low woody and herbaceous undergrowth. The surrounding forest is entirely secondary (banana, bamboo, spiny tangle vines). There are some areas that have small hardwoods (dbh <10 cm). The canopy alternates between closed and wide open. Near the top of the stream, old logging trails remain as well-used footpaths. The forest along this path is older secondary forest with some vestiges of uncut primary growth. On the way back to the Station, two other small streams were also surveyed. Main habitat is secondary forest with hardwoods and scrubs.

Table 1.0 Location, elevation and habitat types for herpetological survey sites in the Green Corridor area, Thua Thien Hue province

Site	Coordinates	Elevation (m asl)	Habitat type
Area 1: Huong Nguyen Forestry Station, Huong Nguyen Commune, A Luoi District			
Site 1: A Lieng Stream	16°14.185'N 107°27.669'E	~ 162	Secondary forest
Site 2: Liet Si Stream	16°13.922'N 107°27.796'E	~ 160	Secondary forest
Site 3: Bomb crater pond	16°14.529'N	~ 150	Secondary forest

Site	Coordinates	Elevation (m asl)	Habitat type
	107°27.354'E		
Site 4: Da Stream	16°15.625'N 107°26.634'E	~ 160	Secondary forest Small patches of primary forest
Site 5: Khe Coi Stream	16°15.530'N 107°27.264'E	~ 100	Secondary forest
Site 6: A Bong Stream	16°14.285'N 107°27.177'E	~ 152	Secondary forest
Site 7: Vu Vu Stream	16°14.502'N 107°27.833'E	~ 120	Grassland, secondary forest Small patches of primary forest
Site 8: A Ma Stream	16°15.007'N 107°27.771'E	~ 120	Secondary forest
Site 9: Logging road	16°15.282'N 107°26.976'E	~ 90	Secondary forest
Area 2: A Pat Ranger Station, A Roang Commune, A Luoi District			
Site 1: A Roang 1 Stream	16°04.636'N 107°29.290'E	~ 680	Primary forest
Site 2: A Roang 2 Stream	16°04.636'N 107°29.290'E	~ 650	Primary forest
Site 3: Goat barn forest	16°04.449'N 107°28.931'E	~ 850	Primary forest
Site 4: Cha Linh Stream	16°05.333'N 107°27.564'E	~ 780	Primary forest
Site 5: Lower Stream	16°04.285'N 107°29.499'E	~ 680-820	Primary forest Secondary forest
Site 6: Steep Stream = A Roang 3	16°04.877'N 107°28.424'E	~850-950	Primary forest
Area 3: Cha Mang, Thuong Lo Commune, Nam Dong District			
Site 1: Base camp	16°07.113'N 107°44.910'E	~220	Secondary forest Old agricultural land
Site 2: Stream downriver from camp	16°07.664'N 107°44.734'E	~200-270	Secondary forest
Area 4: Khe Dau, Duong Hoa Commune, Huong Thuy District			
Site 1: Khe Dau Station	16°17'995'N 107°33.307'E	~109	Grassland, Plantation forest Secondary forest Small patches of primary forest
Site 2: Stream 1 = Khe Huong	16°18.404'N 107°32.640'E	~100	Grassland Secondary forest
Site 3: Stream 2	16°17.816'N, 107°32.801'E	~100-200	Grassland Secondary forest

3.2 Topography

The topography at each area was unique. Huong Nguyen is natural secondary lowland forest, with forest surveyed between 90-150 m asl; A Luoi was very steep, with hills on either side of the HCM, with forest surveyed between ~680 m to ~900 m; Thuong Lo is low altitude and fairly flat (~200-270 m); Duong Hoa is also low altitude, with hills approximately 100-150 m surrounding low riverine areas.

3.3 Climate

All areas visited are monsoon tropical climate with cool winters, summer-autumn-winter rains (Climatic sub-zone II*.2a) (Nguyen Khanh Van *et al*, 2000). Table 2 below contains data from two near by weather stations in A Luoi and Nam Dong. Our records at Huong Nguyen daytime highs hit 34°C (+90% humidity); evening lows hit 23°C (84% humidity). There was heavy rain on three of the five days that we stayed there. A Luoi had daytime highs of 29°C (78% humidity) evening lows of 21°C (84% humidity), and daily downpours - either in the

late afternoon, early evening, late evening, or at any and all of these times. Nam Dong District was very hot in the daytime (36°C; 69% humidity), falling to night lows of 24°C (89% humidity). It rained everyday in Nam Dong; the final three nights of the survey here, the rain was so intense that the Cha Mang River rose >1.5 m on each occasion. We also experienced daily rains at Duong Hoa, where maximum temperatures reached 38°C (59% humidity) and evening lows hit 24°C (90% humidity).

Table 2.0 Meteorological data from A Luoi and Nam Dong weather stations, Thua Thien Hue province

Meteorological Data	A Luoi Station	Nam Dong Station
Annual mean temperature (°C)	21.6	24.5
Highest monthly mean temperature (°C)	25.1 (June)	27.9 (June)
Monthly lowest mean temperature (°C)	17.3 (January)	19.9 (January)
Total annual rainfall (mm)	3,405	3,442
Annual mean humidity (%RH)	86	84

3.4 Sampling Methodology

We employed opportunistic searching along streams, open areas (roads, fields, ponds, forest), and forest wherever possible. The bulk of our search effort was carried out in the evening from 19:00h - approximately 23:00h, the time when the majority of herpetofaunal species are most active. We collected some voucher specimens of each species and possible cryptic species. Amphibians were euthanized using a solution of 20% ethanol, while reptiles were euthanized with a dilute concentration of sodium pentobarbital. All animals were euthanized within 24 hours of collection, and fixed in 10% buffered formalin after preserving tissue samples of muscle and liver in 95% ethanol and/or a specific lysis buffer. Specimens were transferred to 70% ethanol. Voucher specimens will be housed in the IEBR, AMNH, and Thua Thien Hue FPD. Tissues will be stored in vaporized liquid nitrogen upon arrival at the AMNH. All collecting and euthanasia methods were performed in accordance with the AMNH Institutional Animal Care Needs Committee, and the standards of the Society for the Study of Amphibians and Reptiles (Simmons, 2002).

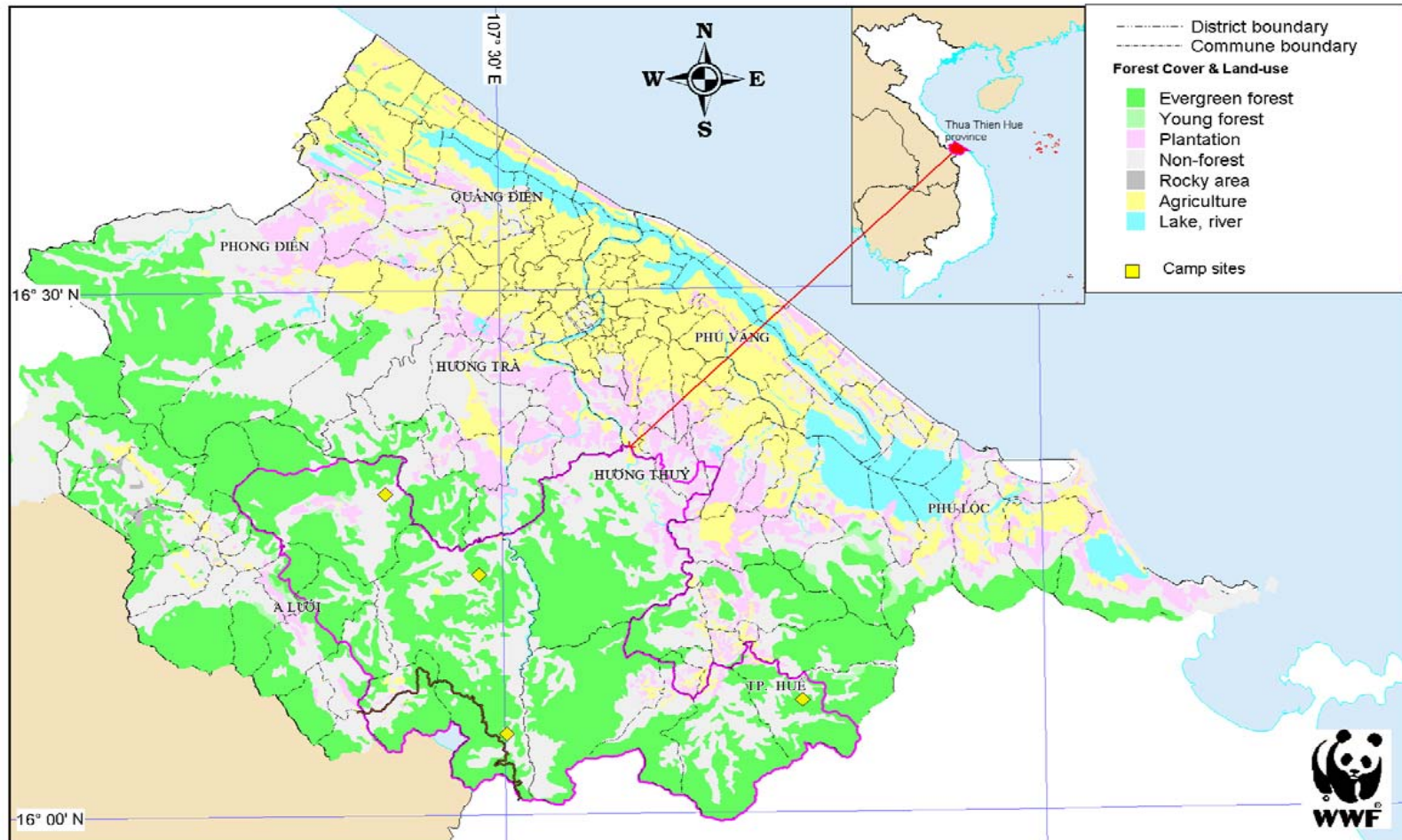
3.5 Interview Surveys

Interviews of local people were conducted augmented by photographs of wildlife in Vietnam. As interviewers, we endeavored not to lead the interviewees or show any more interest when 'important' species were being mentioned. Species recorded through interview usually have high economic value (often be hunted), large size or specifically identifiable features.

3.6 Taxonomy and Literature Used

Taxonomy of the amphibians follows the taxonomy by Frost (2004) and taxonomy of reptiles follows Uetz *et al.* (2004). We also refer to Nguyen Van Sang, Ho Thu Cuc, and Nguyen Quang Truong (2005) for Vietnamese common names of taxa. In addition to the references cited in the text, reference was also made to Nguyen Van Sang *et al.* (2005) and Stuart *et al.* (2001), and for previous records to (Birdlife International 2000a, b, 2004). For the evaluation of threatened species, we referred to the IUCN Red List (2004), the Red Data Book of Vietnam (Anon, 2000), Governmental Decree No.48/2002/ND-CP (2002), and the Appendices of CITES (CITES, 2005).

Figure 2.0 Map showing location of herpetological surveys sites in the Green Corridor Project Area, Thua Thien Hue Province



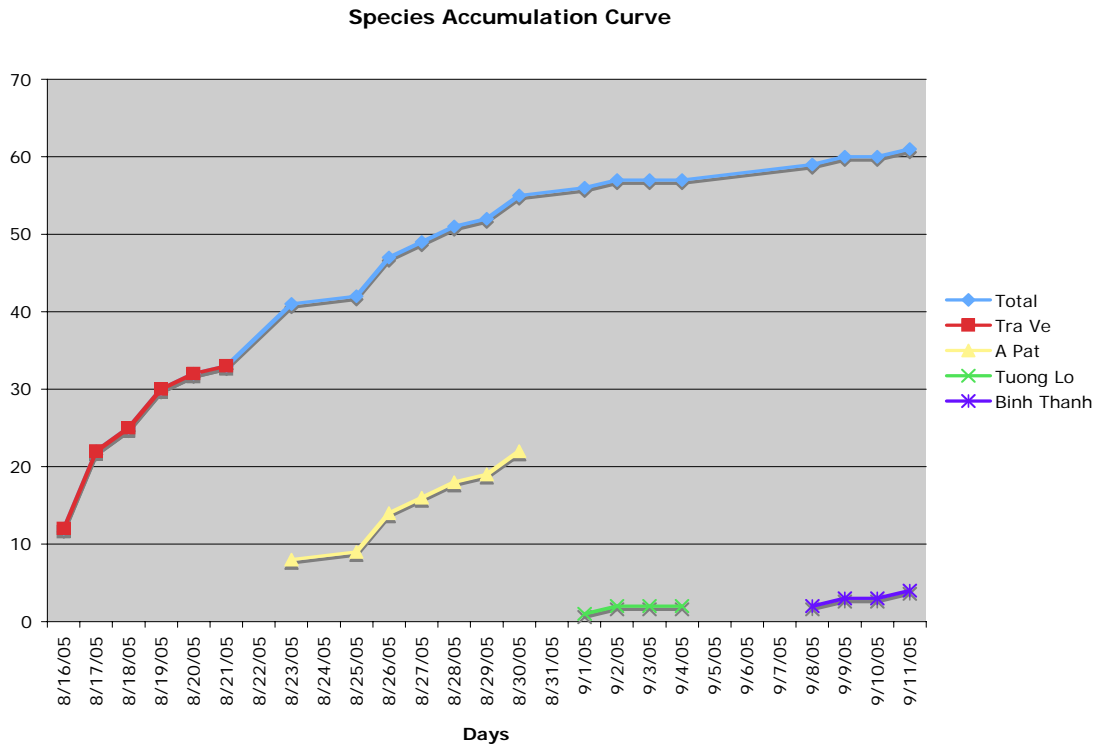
4.0 RESULTS

4.1 Survey Effort

A total of 191.5 people hours of survey time was undertaken during the study. This was subdivided as follows: 63 hours at area 1; 64 hours at area 2; 25.5 hours at area 3; and 39 hours at area 4. All surveying was done via active searching. The rapid nature of the survey prevented us from employing other searching techniques (e.g., pitfall trap line, or turtle traps).

The species accumulation curve is shown in Figure 3.0 the curve for the combined results, as well as those for each area, does not reach a sustained plateau. Therefore, we can suggest that the results of this survey are incomplete, and should only be treated as preliminary. Additional survey would yield further species records. This is particularly noteworthy for the surveys at A Roang and Huong Nguyen, where the species accumulation curves show no plateau, despite the fact that more time was spent at each of these areas than at the remaining areas. This suggests that more species remain unreported here than from the other two areas. It should be noted that the amount of time, as well as the order in which areas are surveyed, might also affect the reported species diversity and rate of species discovery. Furthermore, it should be noted that each curve on the graph is underrepresented, as no survey effort was made on August 22, 24, 31, and September 5, 6, 7, 10.

Figure 3.0 Species accumulation curve for herpetofauna from survey sites in Green Corridor area, Thua Thien Hue Province



4.2 Herpetofauna of Green Corridor Area

The survey resulted in the identification of 93 species of amphibians and reptiles (68 observed directly): 43 species of amphibians (40 observed directly); 27 species of snakes (16 observed

directly); 16 species of lizards (12 observed directly); and seven species of turtles (none observed directly). The total number of species recorded from our survey of the Green Corridor area represents 44% (93/210) of the known herpetofaunal diversity of the CTS: 64% of the known amphibians (59% observed directly); 30% of the known snake diversity (17% observed directly); 32% of the known lizards (26% observed directly); and 77% of the known turtle diversity (0% observed directly). Of these species, most are known to be obligate forest inhabitants: i.e. all six megophryid frog species; *Microhyla bermorei*, *Microhyla marmorata*, *Huia absita*, *Limnionectes hascheanus*, *Paa sp.*, *Rana attigua*, any of two to four species of ‘cascade’ ranids recorded, *Chirixalus supercornutus*, *Philautus cf. banaensis*, *Philautus truongsongensis*, *Rhacophorus annamensis*, *Rhacophorus bipunctatus*, *Rhacophorus calcaneus*, *Rhacophorus exechopygus*, *Rhacophorus reinwardtii*; all six species of agamid lizard, *Goniurosaurus sp.*, *Cyrtodactylus sp.*, both species of varanid lizard, *Ahaetulla prasina*, *Cyclophiops multicinctus*, *Dendrelaphis ngansonensis*, *Lycodon fasciatus*, *Oligodon fasciolatus*, *Pareas hamptoni*, *Psammodynastes pulverulenta*, all three species of *Trimeresurus*, and all species of turtles (except *Pelodiscus sinensis*).

The survey also recorded the occurrence of four species only known from CTS: *Leptolalax tuberosus*, *Rana attigua*, *Chirixalus supercornutus*, and *Rhacophorus exechopygus*; and five species only known from the Truong Son Range: *Brachytarsophrys intermedius* (CTS, STS), *Microhyla marmorata* (CTS, NTS), *Huia absita* (CTS, NTS), *Rhacophorus annamensis* and *Rhacophorus calcaneus* (CTS, STS).

Our inability to interview at A Roang, and thus include all interview data could have had an effect on the priority area selection since the records for A Roang only include those species that were directly recorded. This contrasts to the results from Duong Hoa where we were able to interview some knowledgeable local community members which increased the total species list, making Duong Hoa the most species rich site. It is suggested that the availability of interview data for A Roang would have made this the most species rich site.

Table 3.0 Richness of herpetofauna for survey areas in the Green Corridor, Thua Thien Hue province

Survey sites	Orders	Families	Genera	Species Richness			
				Total Species	Species recorded through collection/observation	Species recorded through interviews	Threatened Species
Huong Nguyen	4	15	35	46	35	11	13 (5)
A Roang	4	10	30	46	46	0	6 (6)
Thuong Lo	5	16	35	45	30	15	16 (6)
Duong Hoa	4	17	40	50	27	23	17 (3)
GCP area	5	19	62	91	66	35	33 (15)

Notes:

Data for Table 3 includes interview data

Number of species observed directly given in ()

Note that no interviews were conducted from A Roang (A Luoi)

These numbers do not include the locality data for the herp-photos of the previous surveys.

4.3 Species List Results from Direct Observations and Collections

4.3.1 Huong Nguyen

Thirty-five species of amphibians and reptiles were recorded. For amphibians the dominant families were Ranidae and Rhacophoridae, each with nine species represented. For reptiles, the dominant families were Agamidae, Gekkonidae, Scincidae, and Colubridae, each with three species found. The species of amphibians that were most in evidence were *Fejervarya limnocharis*, *Limnonectes poilani*, *Occidozyga martenseni*, *Paa verrucospinosa*, *Rana attigua*, members of the *Rana chloronota* complex, *R. nigrovittata*, *Chirixalus vittatus*, *C. cf. gryllus*, *Polypedates leucomystax*, *Rhacophorus bipunctatus*, *Rhacophorus cf. exechopygus*, and *Theloderma asperum*. The species of reptiles that were most in evidence were *Acanthosaura lepidogaster*, *Physignathus cocincinus*, *Tropidophorus cocincinus*, *Hemidactylus frenatus*, and *Sphenomorphus* sp.

4.3.2 A Roang

Forty six species of amphibians and reptiles were recorded. The dominant families of amphibians were Ranidae (13 species), Rhacophoridae (nine species), and Megophryidae (five species), and reptiles were Colubridae (six species) and Agamidae (five species). The species of amphibians that were most in evidence were *Leptolalax tuberosus*, *Microhyla heymonsi*, *Microhyla marmorata*, *Fejervarya limnocharis*, *Limnonectes hascheanus*, *L. poilani*, *Paa verrucospinosa*, *Rana attigua*, members of the *Rana chloronota* complex, *R. nigrovittata*, *Chirixalus cf. gryllus*, *Polypedates leucomystax*, *Rhacophorus bipunctatus*, *Rhacophorus calcaneus*, and *Theloderma asperum*. The species of reptiles that were most in evidence were *Acanthosaura lepidogaster*, *Physignathus cocincinus*, *Hemidactylus frenatus*, and *Cyrtodactylus cf. irregularis*.

We did not survey habitat below the HCM due to time and weather constraints. It is evident however, that the streams below the HCM are much more degraded in adjacent forest cover and have much more silt below the road. This likely have a negative impact on the ability of amphibians to successfully breed in the waterways below the road.

4.3.3 Thuong Lo

Thirty species of amphibians and reptiles were recorded. The dominant families of amphibians were Ranidae (eight species) and Rhacophoridae (six species), and reptiles was Agamidae (three species). The species of amphibians that were most in evidence were *Microhyla heymonsi*, *Fejervarya limnocharis*, *Limnonectes poilani*, *Paa verrucospinosa*, *Rana attigua*, members of the *Rana chloronota* complex, *R. nigrovittata*, *Chirixalus cf. gryllus*, *Polypedates leucomystax*, *Rhacophorus bipunctatus*, and *Theloderma asperum*. The species of reptiles that were most in evidence were *Acanthosaura lepidogaster*, *Physignathus cocincinus*, *Tropidophorus cocincinus*, *Hemidactylus frenatus*, *Cyrtodactylus cf. irregularis*, and *Sphenomorphus* sp.

4.3.4 Duong Hoa

Twenty seven species of amphibians and reptiles were recorded. The dominant families of amphibians were Ranidae (eight species) and Rhacophoridae (seven species), and reptiles was Agamidae (three species). The species of amphibians that were most in evidence were *Microhyla heymonsi*, *Limnonectes hascheanus*, *L. poilani*, *Paa verrucospinosa*, members of the *Rana chloronota* complex, *R. nigrovittata*, *Chirixalus cf. gryllus*, *Polypedates leucomystax*, *Rhacophorus bipunctatus*, and *Theloderma asperum*. The species of reptiles that were most in evidence were *Physignathus cocincinus*, *Tropidophorus cocincinus*, *Hemidactylus frenatus*, and *Cyrtodactylus cf. irregularis*.

4.4 Interview Survey Results

In addition to the species list derived from observation and collection methods, additional species were added through local interviews, more details are outlined in Appendix 3. An additional 11 species were added to the Huong Nguyen Species list, and 15 and 23 for Thuong Lo and Duong Hoa respectively; no interviews were conducted for A Roang, as they were not permitted.

In Huong Nguyen: We interviewed a local metal collector and hunter, Mr. Tran Van Mong and some SFE staff from Huong Nguyen Station. Mr. Mong recognized this big-headed turtle *Platysternon megacephalum* as aquatic and present in the area, but very rare. It fetches ~200,000 VND/kg. *Cuora bourreti*: Although shown a picture of a closely related species, *C. galbinifrons*, Mr. Mong was able to distinguish accurately describe the carapace color pattern of *C. bourreti* (i.e. he stated that “*C. galbinifrons*” was present, but in a different color pattern than pictured). He stated that this species was not rare during its active season, when it wanders the forest looking for mushrooms (~140,000 VND/kg). *Cyclemys tchepoensis* is so cheap, that no hunters bother to collect it. Both *Pelodiscus sinensis* and *Palea steindachneri* are present in rivers. *Acanthosaura nataliae* is present, high in trees. *Goniurosaurus* sp. is known to be present, eating small insects on rocks near streams. He described a species of *Goniurosaurus* that is black with yellow-white transverse lines. *Varanus salvator* is present in Khe Lanh streams (~2 hour walk downriver from the Station). It fetches about 80,000 VND/kg. It is more common than *V. nebulosus*, which was last seen in 2001 (a 1.5 kg juvenile). He insisted that a ‘small species’ of *Python* was present in the trees *Python molurus* was last seen seven years ago (1998). Mr. Mong confirmed that green *Trimeresurus* is present, along with *Naja*, *Ophiophagus*, *Bungarus fasciatus*, possibly *B. candidus* (or perhaps *Lycodon* sp., or *Dinodon septentrionalis*). Mr. Mong also collects large frogs (e.g. *Limnonectes poilani*) for consumption. All species for trade are sold through a middle man near Binh Dien Commune Market.

In Nam Dong: We interviewed our guide, Nguyen Van Phuc, as well as the guide of an accompanying gibbon survey team member, Nguyen Van The. Both guides recognized *C. bourreti* as a forest species, pointing out that it looked like a published image of *Cuora galbinifrons*, but had a yellow plastron (120-180,000 VND/kg). Phuc saw two specimens in Hot Sot Stream in June, 2004. They also recognized *P. megacephalum* from the same stream in which Mr. Mong indicated that they were present in Khe Lanh (Thuong Quang Commune). In June, 2005 they saw a 1 kg specimen close to camp, stunned with an ichthyologist electro-fisher (200-250,000 VND/kg). They also recognized a third turtle species, possibly *Cyclemys tchepoensis* which was found by someone from Thon 1, Huong Loc Commune in 2003 (50-70,000 VND/kg). They recognized *P. sinensis* from marshy areas and streams. Phuc said that *Palea steindachneri*

was last seen in the rivers 20 years ago. Phuc found *V. bengalensis (salvator)* (4-5 kg) in April 2004. He also recognized blue tail skinks, *Draco sp.*, *G. gecko*, green *Trimeresurus*. *Python reticulatus* is very rare, last seen in 1982 (22 kg specimen). Likewise, *Bungarus fasciatus* and *B. multicinctus* are very rare due to hunting (60-70,000 VND/kg). They recognized the difference between *Bungarus multicinctus* and *Lycodon sp. / Dinodon septentrionalis*. *Ophiophagus hannah* is still present (200,000 VND/kg). Cobras (*Naja sp.*) are rare, last seen in 2003 (80-100,000 VND/kg). *Physignathus cocincinus* is also hunted for food and trade (50-70,000 VND/kg). *Ptyas korros* is well known around the village for hunting rats. *Kaloula pulchra* is also well known around the village. *Icthyophis sp. (bananicus)* is known from forest leaf litter. All trade species are sold through a middleman in Khe Tre Township.

In Huong Thuy: We interviewed Nguyen Trung Dinh (our guide) and Dang Cong Khoi (SFE Ranger). *Indotestudo elongata* was last seen in June 2005 in the forest by rattan collectors in Bo Hon (near Khe Lat Station, A Luoi FPU); ~1.8kg, 120,000 VND/kg. *Palea steindachneri* and *Pelodiscus sinensis* are both known from the area, but are both rare. *Palea steindachneri* was last seen before 2000 (a 3-3.5 kg specimen); *P. sinensis* last seen in 2000/2001, a 1.5-2 kg specimen from Khe Day. *Cuora galbinifrons bourreti* was identified as being present in the area. In March 2005 rattan collectors collected 3 or 4 individuals (0.6-1.2 kg); ~160,000 VND/kg. All of these specimens went to a middle man at Binh Dien Bridge. *Platysternon megacephalum* was last seen in 2000/2001 in Bo Hon (near Khe Lat Station, A Luoi FPU); 200-300,000 VND/kg. *Enhydryis plumbea* is also known from waterways in the area. *Brachytarsophrys intermedius* was accurately described in form and behavior; calling from under rocks and leaves in the forest at this time. *Rhacophorus calcaneus* and *R. bipunctatus* were also identified by our guides. *Lycodon fasciatus* was also identified, both by sight and smell. *Ptyas korros* and *Elaphe radiata*, are known from open areas and around villages as a rat hunters and possibly *Amphiesma stolata* from the rice fields. *Kaloula pulchra* was also identified as being present in the rainy season. *Sinonatrix percarinata* was identified as a water snake in the area. *Rhabdophis subminiatus* was also identified as being present. Both *Python reticulatus* and *P. molurus* are known from the area, although the latter is much more rare. *Python reticulatus* was last seen in April 2005 by metal collectors in Khe Rom (Huong Thuy District); 2 individuals 4 and 6 kg. *Trimeresurus cf. vogeli* was also identified as being present (i.e., green tree viper with red tail). Two species of *Bungarus*, *B. fasciatus* and *B. candidus* are present in the area, as is *Naja sp.*, and *Ophiophagus hannah* (the latter last seen in April 2005 very close to this station). *Dendrelaphis ngansonensis* was also identified from this area. *Varanus salvator* was last seen in June 2005 by a fisherman who collected a 5 kg specimen that was later confiscated by FPD. *Varanus nebulosus* is also known from the area, but is considered very rare.

4.5 Key Species Accounts

Species reported from the survey were considered significant for three reasons: they are threatened; they have been described only recently (within the past 10 years) and so little is known about their range and natural history; and/or they are part of a complex of species, a group of species that look superficially similar and have only recently been detected. Finally, we mention those species that remain unidentified or only provisionally identified, as they may represent poorly known or previously undescribed taxa.

4.5.1 Threatened Species

A total of 33 threatened species were recorded during the survey, including ten species of amphibians and 23 species of reptiles. Among these species, 14 are listed in Decree No 48/2002/ND-CP (1 in Group IB and 13 in Group IIB); 15 are listed in the Red Data Book of Vietnam (1 endangered, seven vulnerable, two rare, and five threatened); 17 are listed in IUCN Red List (one critically endangered, four endangered, seven vulnerable, and five near threatened); and nine are listed in CITES Appendices (two in Appendix I, six in Appendix II, and one in Appendix III).

Table 4.0 List of threatened reptile and amphibian species recorded in the Green Corridor area, Thua Thien Hue province

Scientific Name	Decree. 48	Red Book VN	IUCN	CITES
Amphibians (Amphibia)				
<i>Bufo galeatus</i>		R		
<i>Brachytarsophrys intermedius</i>			VU	
<i>Leptolalax tuberosus</i>			VU	
<i>Limnonectes poilani (blythii)</i>			NT	
<i>Paa verrucospinosa</i>			NT	
<i>Rana attigua</i>			VU	
<i>Rhacophorus annamensis</i>			VU	
<i>Rhacophorus calcaneus</i>			NT	
<i>Rhacophorus exechopygus</i>			VU	
Reptiles (Reptilia)				
<i>Gekko gekko</i>		T		
<i>Acanthosaura lepidogaster</i>		T		
<i>Physignathus cocincinus</i>		V		
<i>Varanus bengalensis (nebulosus)</i>	IIB	V		I
<i>Varanus salvator</i>	IIB	V		II
<i>Python molurus</i>	IIB	V	NT	I
<i>Python reticulatus</i>	IIB	V		II
<i>Pryas korros</i>	IIB	T		
<i>Bungarus candidus</i>	IIB			
<i>Bungarus fasciatus</i>	IIB	T		
<i>Bungarus multicinctus</i>	IIB			
<i>Naja sp.</i>	IIB	T		III
<i>Ophiophagus hannah</i>	IB	E		II
<i>Trimeresurus mucrosquamatus</i>	IIB			
<i>Trimeresurus vogeli</i>	IIB			
<i>Trimeresurus stejnegeri</i>	IIB			
<i>Cuora galbinifrons bourreti</i>		V	CR	II
<i>Cyclemys tcheponensis</i>			NT	
<i>Pyxidea mouhotii</i>			EN	
<i>Palea steindachneri</i>			EN	
<i>Pelodiscus sinensis</i>			VU	
<i>Platysternon megacephalum</i>		R	EN	II
<i>Indotestudo elongata</i>	IIB	V	EN	II
Total number of species	14	15	17	9

Notes:

Dec. 48 = Governmental Decree No 48/2002/ND-CP: IB = Group IB, IIB = Group IIB

Red Data Book of Vietnam (2000): E = endangered, V = vulnerable, R = rare, T = threatened

IUCN Red List (2004): CR = critically endangered, EN = endangered, VU = vulnerable, NT = near threatened

CITES (2004): I, II, and III = appendix I, II and III.

4.5.1.1 Amphibians

Brachytarsophrys intermedius: The IUCN Red List status of this species is Vulnerable. Presence was indicated by an interviewee from Duong Hoa area.

Leptotalax tuberosus: The IUCN Red List status of this species is Vulnerable. Described in 1999, this is only the third known record of this species, and it is a new provincial record. It is currently known only from the CTS. We were able to collect new natural history data on this species, including color in life and call data from A Roang area.

Microhyla marmorata: Described in 2004, this is a new provincial record. This species is currently only known from the CTS. We were able to obtain new natural history data including call and breeding information from A Roang area.

Huia absita: Described only 2004, this is a new provincial record. It is currently only known from the CTS. We were able to collect some more information on this species' color in life from A Roang area.

Limnonectes poilani: This species is Listed (under *L. blythii*) as Near Threatened in the IUCN Red List because it is in significant decline (but at a rate of less than 30% over ten years), it is being over-harvested for food, and its habitat is shrinking, making the species close to qualifying for Vulnerable (IUCN). Specimens of this species were directly observed in all areas.

Rana attigua: The IUCN Red List status of this species is Vulnerable. It was first described in 1999. Known from the CTS and NTS, this new provincial record fills in the known range of this species. We were able to collect new natural history data on this species, including color in life and call data from Huong Nguyen, A Roang and Thuong Lo areas.

Chirixalus supercornutus: Described in 2004 from Bach Ma NP (Thua Thien Hue Province) and Kon Plong Forest (Kon Tum Province), this species is currently known only from the CTS. This is the most westerly record, and its presence at A Roang and Huong Nguyen, not far from the Laos border indicates that it is probably also part of the fauna of that country.

Philautus truongsoneis: This species was only just described in September of 2005 from Ba Na NP (Da Nang Province), Bach Ma NP (Thua Thien Hue Province), Huong Hoa District (Quang Tri Province), and Phong Nha-Ke Bang NP (Quang Binh Province). Although it is expected in the Green Corridor because of its range, this locality record is new and its presence at A Roang and Duong Hoa, not far from the Laos border indicates that it is likely part of the fauna of that country.

Rhacophorus annamensis: The IUCN Red List status of this species is Vulnerable. Some specimens were collected in Duong Hoa area.

Rhacophorus calcaneus: The IUCN Red List status of this species is Vulnerable. The species is restricted to undisturbed forest, and the extent and quality of its habitat is declining, thus making the species close to qualifying for Vulnerable (IUCN). This species was found in Tra Ve, A Roang, and Thuong Lo areas.

Rhacophorus exechopygus: The IUCN Red List status of this species is Vulnerable. This species was described in 1999 and is known only the CTS. This is a new provincial record for this species. Both male and female specimens were collected from Huong Nguyen area.

4.5.1.2 Reptiles

Varanus nebulosus: Both monitor species were recorded through interview in all survey areas. Vietnam Government Decree 48 listed as Group IIB. CITES recognizes this species as Appendix II, since it is not necessarily now threatened with extinction but may become so unless trade is closely controlled. In Vietnam, this species is exceedingly rare due to overharvesting.

Varanus salvator: Vietnam Government Decree 48 listed as Group IIB. CITES recognizes this species on their Appendix I, the appendix of species that are most threatened with extinction among CITES-listed flora and fauna. In Vietnam, this species is exceedingly rare due to overharvesting. Indochinese mangrove populations of this species are especially threatened with habitat loss.

Python sp.: Vietnam Government Decree 48 listed as Group IIB. CITES recognizes species of this genus to be either on Appendix I (*P. molurus*) or II (*P. reticulatus*). All species of *Python* are rare in Vietnam, due to aggressive hunting for local consumption and trade, as well as habitat alteration. The two above species, however, have significant ranges outside of Indochina and *P. reticulatus* has the ability to adapt to altered habitat. Information of python occurrence was collected from Huong Nguyen and Duong Hoa areas.

Ophiophagus hannah: Vietnam Government Decree 48 listed as Group IIB. CITES recognizes this species as Appendix II, due to aggressive hunting for trade and medicine purposes. In Vietnam, this species is exceedingly rare due to overharvesting. This species has a very wide south and southeast Asian distribution, although it is possibly extirpated in northern Vietnam. This species were recorded in Huong Nguyen through observation, and in Thuong Lo and Duong Hoa through.

Naja sp.: Vietnam Government Decree 48 listed as Group IIB. CITES recognizes this species as Appendix III, due to the aggressive hunting of cobras for trade and medicine purposes. *Naja kaouthia*, the Monocellate Cobra, has had severely impacted local populations throughout Indochina, but its wide distributional range and high adaptability to habitat alteration reduce its vulnerability. *Naja siamensis*, the Indochinese Spitting Cobra, is probably also heavily traded throughout its Indochinese range. Information of *Naja* sp. was reported by local people from Thuong Lo and Duong Hoa.

Trimeresurus mucrosquamata: Vietnam Government Decree 48 listed as Group IIB. This species was found in Thuong Lo and Duong Hoa.

Trimeresurus vogeli: The Vietnam government, in Governmental Decree No 48 listed this species in Group IIB. This species was only recently described (2001), although as a cryptic form, it is widespread from Thailand across to the CTS and NTS. Our records fall within the known range, but very little about the natural history of this species is known. Several specimens were collected and also observed in A Roang Area.

Cuora bourreti: Due to serious threats from hunting, all species of *Cuora* are recognized by CITES as Appendix II. In Vietnam, this species is exceedingly rare due to overharvesting for trade. This species is known from only a few localities in the wild, as well as from market surveys (Stuart and Platt, 2004). Understanding the true distribution of this species, as well as finding viable wild populations is critical to any conservation program for this vulnerable species.

Cyclemys tcheponensis: This is the fourth highest traded species of turtle in Vietnam (Hendrie, 2000). This species was recorded in Huong Nguyen and Thuong Lo areas through interviews.

Platysternon megacephalum: Considered to be Endangered on the IUCN Red List and App. II of CITES due to specific trade demand in Laos and Vietnam. The high price for this species in Thua Thien Hue indicates that it is locally rare. Local people reported that the occurrence of this species in Huong Nguyen, Thuong Lo, and Duong Hoa.

Pyxidea mouhotii: Recognized as Endangered on the Red List, this species is widely known from markets and seizure of illegal wildlife throughout the country (Hendrie, 2000). A picture of this species was taken from a previous survey in GCP area.

Palea steindacheri: This species is recognized as being Endangered on the IUCN Red List since it is a highly valuable species in the food trade. It is uncommon in international trade seizures and may be more frequent in domestic trade routes, as it is a common dish in Vietnam (Hendrie, 2000).

Pelodiscus sinensis: Recognized as vulnerable by the IUCN Red List, due to heavy harvesting for consumption. This species, however, is the principal aquaculture softshell species of turtle, so it has been difficult to assess the impact of trade upon wild populations (Hendrie, 2000).

Indotestudo elongata: This is the most heavily traded turtle in Vietnam, and so its trade is restricted by the Vietnam Governmental Decree No 48 - Group IIB (Hendrie, 2000). For this reason, it is also recognized as Endangered by IUCN and as on Appendix II by CITES. Information of this species was collected from Duong Hoa through interview.

4.5.2 Species Complexes

Several species complexes have also been identified within the Green Corridor. Species complexes are groups of similar-looking species that in the past have been recognized as only one species. Most species complexes are widespread, although the member species can have only limited ranges within this broad range (Bain *et al.*, 2003). Recognizing species 'hidden' within

species complexes, therefore, not only increases the known diversity of the region, it has significant consequences for conservation evaluations, particularly if past evaluations for one species have been made based on the range of the group as a whole.

We found species of cascade ranids, known to be part of the *Rana chloronota* (*R. livida*) species group: (i.e. *R. cf. morafkai*, *R. cf. banaorum*, *R. cf. chloronota*, and *R. sp.*). This complex ranges across mainland southeast Asia and is composed of over 20 species, most of which have been described or brought out of synonymy within the past 8 years (Inger and Chan-ard, 1997; Bain *et al.*, 2003; Bain and Nguyen, 2004a, b; Orlov *et al.*, 2004). Some of these species appear to have small ranges, putting them at greater risk (Bain and Nguyen, 2004). Similarly, we found other species known to be part of complexes, but whose species boundaries have not yet been adequately delimited *Fejervarya limnocharis* (Inger, 1999), *Limnonectes poilani* (Emerson *et al.*, 2000), *Rana nigrovittata* (e.g. Matsui *et al.*, 2002), *Polypedates leucomystax* (Inger, 1999). A new species of *Acanthosaura* allied to *A. capra* were found in A Roang. This species was described by Orlov *et al.* (2006) as *A. nataliae* Orlov, Nguyen and Nguyen, 2006.

4.5.3 Provisionally Identified Species

We have several species that we collected whose identity is either unknown or provisionally known as of this writing. The positive identification of these will follow with additional work-up at the IEBR and AMNH. These specimens may represent previously undescribed species, species not included in this list, or variants of species already included in this list. These poorly identified species include: *Bufo sp.*; *Leptobrachium cf. banae*, *Ophryophryne cf. pachyproctus*, *Occidozyga cf. martensii*; *Chirixalus cf. vittatus*; *Philautus cf. banaensis*, *Rhacophorus cf. exechopygus*, *Rhacophorus cf. calcaneus*; *Rhacophorus sp.*; *Cyrtodactylus cf. irregularis*; *Sphenomorphus sp.*

5.0 THREAT ASSESSMENT

We identified two main threats to the herpetofauna of the project area during our survey: hunting and habitat alteration.

Results of our interviews, indicates that herpetofaunal harvesting for consumption and wildlife trade is common in the project area. Interview results also suggested that well established trade routes exist in the area, including wildlife animal collectors, and middlemen in commune/district centres and at higher levels.

Large amounts of habitat alteration have occurred in the area, both from large scale commercial logging and small scale harvesting (such as for rattan and firewood).. These activities have resulted in forest fragmentation and changed the composition of the forest such that it may have negative impacts on the herpetofauna.

New road construction for logging and of the HCM have resulted in forest fragmentation, erosion, and increased siltation. On the HCM road, the resulting denuded cliffs from rock cuts make overland communication between the forest above and below the road impossible for forest species of amphibians and reptiles. Erosion is evident above and below the highway, not just in stream beds, but in unstable slide areas. Swaths of forests have been wiped out by erosion resulting from road construction. Siltation is particularly obvious in streams that run under the

HCM. Whereas these streams run clean above the highway, they are noticeably cloudier, and have less forest cover, below. Measuring the scale and effect of the impact of hunting and habitat alteration is beyond the scope of this survey.

Electric fishing also is the cause of tadpole decline on the streams in Nam Dong and Duong Hoa areas.

6.0 DISCUSSION

6.1 Evaluation of Sites and Species for Conservation

We used a tally technique to rank the quality of each of the four areas visited during this survey (Table 5). In each category, a higher number represents a better score (ranking score from 1 to 4). According to our methodology, the relative value of each site is ranked as follows: A Roang, Thuong Lo, Huong Nguyen, and Duong Hoa. The *diversity* (relative amount of diversity per area) and *number of rare and/or threatened species* rankings are based on the number of species found in each area (see Appendix 2 and Table 4). It should be noted that these did not include species reported by interviewees, since we were unable to carry out interviews at A Roang (see comments and Table 5 below). The *forest area* ranking is made based on a satellite image (available to us in hard copy in GCP office).

Habitat quality and *human disturbance* rankings were based on qualitative assessments of forest conditions. Huong Nguyen is a degraded and the oldest second growth area of the four areas visited. Although the area continues to be commercially logged, the large extent of intact lowland (secondary) forest makes this area an important site in the CTS. A Roang contained the largest expanse of primary growth that we encountered on the survey. Areas above the HCM were especially rich, although we did encounter many foot trails and evidence of small mammal trapping, and illegal logging. Some areas below HCM have terrible siltation problems: both from pre-existing streams that have been altered, and from new landslide areas formed by highway construction activity (i.e. unconnected with streams), but there were large tracts of undisturbed forests far from the highway itself. We also felt that this was a very important site for conservation. The parts of Thuong Lo that we visited had degraded, older secondary growth. Although the forest patches of Thuong Lo communicating with A Luoi were unsurveyed by us, we consider these to be potentially important areas for conservation for high quality forest corridor, since they also border Bach Ma NP. Our final area, Duong Hoa contained young plantation growth, with open scrub, and some vestiges of disturbed primary forest. For this reason, this latter area was given the lowest rating for forest quality.

Table 5.0 Evaluation of the survey sites for Herpetofauna conservation value

Criteria	Huong Nguyen	A Roang	Thuong Lo	Duong Hoa
Diversity	3	4	2	1
Rare/threatened species	1	3	3	2
Forest area	2	4	3	1
Habitat quality	2	3	2	1
Human disturbance	1	3	2	1
Total	9	17	12	6

6.2 Evaluation of Sites in Regional and Provincial Context

To our knowledge, this survey represents the fourth known herpetological survey in Thua Thien Hue Province (unpublished results by a team from Hanoi University of Education; and only unpublished results by foreign teams). Because the known herpetofaunal diversity of Thua Thien Hue is only now emerging it is difficult for us to compare the diversity of the Green Corridor within a Provincial, or Regional context. The resolution of patterns of herpetofaunal diversity is just not fine enough yet. This is evidenced in the number of new records we found in our rapid survey.

However, overview of the herpetofauna diversity in some near by localities was addressed in Table 6.0. The diversity of the herpetofauna in GCP area is almost two-times higher than DakrongNR, Bach Ma NP, Phong Dien NR, and Ngoc Linh Proposed NR but lower than Phong Nha - Ke Bang NP. As such it is fair to state that the herpetofauna of the GCP area is diverse, contains a high number of threatened species and supports a number of CTS endemics.

Table 6.0 Comparison of amphibian and reptile species richness in survey areas and other sites in Central Vietnam

Locality (Province)	Area (ha)	Number of species		Data source
		Reptiles	Amphibians	
GCP Area (Thua Thien Hue)	134,000	50	41	Field survey, 2005
Phong Nha-Ke Bang NP (Quang Binh)	85,754	90	38	Ziegler <i>et al.</i> , 2004
DakrongNR (Quang Tri)	40,526	32	17	Le Nguyen Ngat, 2005
Bach Ma NP (Thua Thien Hue)	22,031	32	24	Le Vu Khoi <i>et al.</i> , 2003 Ho Thu Cuc, 2004
Phong Dien NR (Thua Thien Hue)	34,406	32	17	Nguyen Van Sang, 2000
Ngoc Linh Proposed NR (Quang Nam)	18,430	17	28	Nguyen Quang Truong, 2004

Notes: Area data of above protected areas from the Source Book (Birdlife International, 2004)

6.2.1 Conservation Threats

We identified two main threats to conservation in our rapid field survey: hunting; and habitat alteration and loss.

6.2.1.1 Hunting

We noted evidence of hunting in all of the areas that we surveyed. Interviews revealed that there is a well established trade route, with middle-men working freely near populated centers. Prices per kg of wildlife were widely known, including those of herpetofauna. Even in the one area in which we were unable to carry our interviews (A Roang), we saw ample evidence of human activity in the forest (i.e. small mammal trapping and excellent footpaths - see Appendix 4).

6.2.1.2 Habitat Loss

Huong Nguyen was the area with the greatest amount of active commercial logging that we visited. In addition, we encountered, on an almost daily basis, woodcutters harvesting rattan and

large timber products by hand. There was evidence of small scale rattan processing centers at A Roang and Thuong Lo, as well as a medium-sized wood cutting and milling operation ~800 m from the FPD Ranger Station at A Roang. There was also daily movement of small scaled rattan cuttings and milled logs from upriver of Cha Mang (Nam Dong).

New road construction for logging and of the HCM have resulted in forest fragmentation, erosion, and increased siltation. Swaths of forests have been wiped out by erosion resulting from road construction. Siltation is particularly obvious in streams that run under the HCM.

6.2.2 Recommendations

Based on the results and impressions of our rapid survey, we make the following recommendations:

Engage in more survey and ecology research in the area: This area requires future research. Because the herpetofaunal diversity of the project area is still poorly known, long term herpetofaunal surveys in areas with the most extensive forests (A Roang, A Roang Commune; Thuong Quang Commune, and the area bordering with Huong Tra District) need to be conducted. This will be essential to a full understanding of the project area in a regional context. In addition, the poor state of ecological knowledge of the herpetofauna of the region necessitates long term population and ecology studies for the project area.

Carry out an evaluation of wildlife trade in the area: The prevalence of hunting in the project area is high enough to warrant an evaluation of its wildlife trade status within the, particularly for threatened reptiles (turtles; snakes: king cobra, cobra, rat snakes; and big lizards: monitor lizards, Indochinese water dragon). This will be essential to any future conservation plan for the project area.

Study extent and effects of forest fragmentation: The highly fragmented nature of the forests in this area warrant studies on the impact and effect upon local populations. Fragmentation within the project area is caused by very discreet factors: i) HCM construction separating upper and lower forests from each other, as well as fragmenting the lower forests with silt and run-off; and ii) large primary-forested areas versus new secondary growth, old secondary growth, and fragmented primary growth.

Define local areas of conservation importance: Several studies have been carried out in the GCP area (e.g. botanical, mammal, ornithological, herpetological, and ichthyological surveys). Therefore, an overall ranking for conservation value should be carried out to define important sites (hot-spots) in the project area. The same categories can be used to rank the conservation value included here: diversity of species, number of rare and/or threatened species, forest area, habitat quality, and human disturbance. Identified hot-spots should then be considered to have high priority for GCP.

Create appropriate conservation areas (small size) within the project area (e.g. Species and Habitat Conservation Area) in order to protect the flora and fauna and facilitate communication of floral faunal communities within the Green Corridor. Protecting these areas immediately will make it easier to protect the Green Corridor as a unit in the future. These conservation areas

should be made under the direction of a Management Plan to ensure that they are viable for the Green Corridor. Special attention should be focused on the forests of A Roang (especially below HCM) and downstream from Huong Nguyen Station.

7.0 CONCLUSION

The project area appears to be an important area for several reasons:

It is located on the eastern slopes of the CTS, which currently has the highest known diversity of herpetofaunas in the Truong Son. The CTS also appears to be a biogeographic transition zone between the NTS and the STS. Therefore, the CTS would be an important area for conservation.

Large expanses of uninhabited lowland and upland forest give this area great potential for conservation efforts, particularly the large expanses of primary forest.

Despite the rapid nature of our survey, we were able to record 43% of the known herpetofaunal diversity of the CTS. Our results included five new provincial records, as well many new records from close to the Laos border. These results indicate that the project area probably already houses a significant represent of the herpetofaunal diversity of the CTS. These results also indicate the area remains undersurveyed (see comments below).

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Appendix 1.0 Schedule of herpetological survey activities, Green Corridor area, Thua Thien Hue province

Area survey	August															September														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Huong Nguyen																														
A Roang																														
Thuong Lo																														
Duong Hoa																														

Note

- Moving day
- Moving day and rest day, preparing for specimens
- Working day

Appendix 2.0 Annotated list of amphibian and reptile species recorded in the Green Corridor area, Thua Thien Hue province

Scientific Name	Evidence	Abundance	Huong Nguyen	A Roang	Thuong Lo	Duong Hoa
AMPHIBIA						
GYMNOPHONIA						
1. Ichthyophidae						
<i>Ichthyophis cf. bananicus</i>	I				[6]	
ANURA						
2. Bufonidae						
<i>Bufo galeatus</i>	S	i	2	2	2	
<i>Bufo melanostictus</i>	O	ii	16; A		2	9
<i>Bufo cf. macrotis</i>	S	ii	2,9	2	6	
3. Megophryidae						
<i>Brachytarsophrys intermedius</i>	I					[6]
<i>Leptolalax tuberosus</i>	S	iii		4; C		
<i>Leptobranchium cf. banae</i>	S	i		2		
<i>Ophryophryne hansii</i>	S, P	ii	2	2,4		1
<i>Ophryophryne sp.</i>	S	i		4		
<i>Megophrys major</i>	S	i		2,6; L		2,6
4. Microhylidae						
<i>Kaloula pulchra</i>	I				[6]	[6]
<i>Microhyla berdmorei</i>	S	i				6
<i>Microhyla heymonsi</i>	S, P	iii		9,16,17; C	6	6,9
<i>Microhyla marmorata</i>	S	iii		10,11,12,17;C		
5. Ranidae						
<i>Fejervarya limnocharis</i> (complex)	S, P	iii	9,6; C	9,16; C	4,6,9,14;C	
<i>Huia absita</i>	S	ii		4		
<i>Limnonectes hascheanus</i>	S	iii		17 (in burrows); C		6; C
<i>Limnonectes poilani</i> (complex)	S	iii	1,2,6,9,15; C, A, L?	1,2,6,9,14,15; C, L?	1,2,6,9,14,15; C, L?	1,2,6,9,14,15; C, L?
<i>Occidozyga cf. martensii</i>	S	iii	10; C, A			
<i>Paa verrucospinosa</i>	S	iii	15	2,15; C	15	2,15; C
<i>Rana attigua</i>	S	iii	1,2,3,4,5,14; C	4, 9; C	1,4,11;C	
<i>Rana cf. banaorum</i>	S	iii	1,2,3,4,5,6,15	4,15; C	4,15; C	4,15

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Scientific Name	Evidence	Abundance	Huong Nguyen	A Roang	Thuong Lo	Duong Hoa
<i>Rana cf. chloronota</i>	S	iii	1,2,3,4,5,6,15	4,15; C	4,15; C	
<i>Rana johnsi</i>	S	i		2		
<i>Rana nigrovittata</i> (complex)	S, P	iii	1,2,3,4,5,6,7,9; C	4; C	1,4;C	9
<i>Rana cf. megatympanum</i>	S	iii	1,2,3,4,5,6,15	4,15; C	4,15; C	
<i>Rana cf. morafkai</i>	S, P	iii	1,2,3,4,5,6,15	4,15	4,15; C	4,15
Cascade ranid sp.	S	i		4		
6. Rhacophoridae						
<i>Chirixalus vittatus</i>	S	iii	12; C,E,A			
<i>Chirixalus supercornutus</i>	S	iii	5	5		
<i>Philautus cf. banaensis</i>	S	i				8; C
<i>Philautus cf. gryllus</i>	O	iii	7/8; C	7/8; C	7/8; C	
<i>Philautus truongsoneensis</i>	S	i		4		4 (observe only)
<i>Polypedates leucomystax</i> (complex)	S, P	iii	2,3,4,10,11,12,13,14;C, A	4,10;C	4,9,10,12,13;C,E	2,3,4,9,10, C, E
<i>Rhacophorus annamensis</i>	S	i				4
<i>Rhacophorus bipunctatus</i>	S	iii	3,4,7,8,10,11,12,13; C	4,11,12,13;C	3,4,5,7,8; C	3,5; C
<i>Rhacophorus calcaneus</i>	S	iii	3,4,7,8,10,11,12,13; C	3,4,7,8,11,12,13; C	3,4,5,7,8; C	
<i>Rhacophorus calcaneus</i>	S	ii		4,5; C		
<i>Rhacophorus exechopygus</i>	S	iii	2,3,7; C,A			2
<i>Rhacophorus cf. exechopygus</i>	S	i	11; C,A			
<i>Rhacophorus reinwardtii</i>	S	ii		5		
<i>Rhacophorus sp.</i>	S	i			1	
<i>Theloderma asperum</i>	O	iii	7/8; C	7/8; C	7/8; C	7/8; C
REPTILIA						
SAURIA						
1. Agamidae						
<i>Acanthosaura capra</i>	S, P	i		7		
<i>Acanthosaura lepidogaster</i>	S	iii	7,8	7	7	
<i>Calotes versicolor</i>	S	i		6		4
<i>Draco sp.</i>	O,I	i		8	[8]	
<i>Physignathus cocincinus</i>	S, O, P	iii	3,4,5	3,4,5	3,4,5	3,4,5
<i>Tropidophorus cocincinensis</i>	S	iii	1		1,2	1,2
2. Gekkonidae						

Scientific Name	Evidence	Abundance	Huong Nguyen	A Roang	Thuong Lo	Duong Hoa
<i>Gekko gecko</i>	O,I	i	7/8; C			
<i>Goniurosaurus sp.</i>	I		[2]			
<i>Hemidactylus frenatus</i>	O	iii	16	16	16	16
<i>Cyrtodactylus cf. irregularis</i>	S	iii		4	4	4
3. Scincidae						
<i>Mabuya multifasciata</i>	O	i	9		9	9
<i>Mabuya longicaudata</i>	O	i	9		9	9
<i>Sphenomorphus sp</i>	S	iii	2,6,7,8,9,16		2,6,7,9	
<i>Lipinia vittigera</i>	S,I	i	16		[I]	
4. Varanidae						
<i>Varanus bengalensis (nebulosus)</i>	I		[1,4,5]		[I]	[1,4,5]
<i>Varanus salvator</i>	I		[1,4,5]		[I]	[1,4,5]
SERPENTES						
5. Boidae						
<i>Python molurus</i>	I		[4,5]			[4,5]
<i>Python reticulatus</i>	I		[4,5]		[I]	[4,5]
6. Colubridae						
<i>Ahaetulla prasina</i>	S, I	i		4,5	[7]	
<i>Amphiesma stolata</i>	I					[9,10]
<i>Amphiesma cf. khasiense</i>	S, P	ii	3			3,4
<i>Calamaria septentrionalis</i>	P					
<i>Cyclophiops multicinctus</i>	S	i		5		
<i>Dendrelaphis ngansonensis</i>	I					[7,8]
<i>Elaphe radiata</i>	I					[9]
<i>Enhydryis plumbea</i>	I					[1,10]
<i>Lycodon fasciatus</i>	S	i		2	2	[2]
<i>Oligodon fasciolatus</i>	S, P	i	9			
<i>Pareas hamptoni</i>	S	i		4,5		
<i>Psammodynastes pulverulenta</i>	S	i		4,5		
<i>Ptyas korros</i>	I, P		[16]		1	[9]
<i>Rhabdophis subminiatus</i>	I					[4]
<i>Sinonatrix percarinata</i>	S	ii	3 (observed only)	3		[1]
<i>Xenochrophis piscator</i>	O	i				1

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Scientific Name	Evidence	Abundance	Huong Nguyen	A Roang	Thuong Lo	Duong Hoa
7. Typhlopidae						
<i>Typhlops sp.</i>	S	i		6		
8. Elapidae						
<i>Bungarus candidus</i>	I				[I]	[I]
<i>Bungarus fasciatus</i>	I				[I]	[I]
<i>Bungarus multicinctus</i>	I				[I]	
<i>Naja sp.</i>	I				[I]	[I]
<i>Ophiophagus hannah</i>	O,I, P	i	9 (juvenile observed only)		[I]	[I]
9. Viperidae						
<i>Trimeresurus mucrosquamatus</i>	S	i			4	4
<i>Trimeresurus vogeli</i>	S, P	ii		4,5		[I]
<i>Trimeresurus stejnegeri</i>	P					
TESTUDINES						
10. Bataguridae						
<i>Cuora galbinifrons bourreti</i>	I, P		[6]			[6]
<i>Cyclemys tcheponensis</i>	I		[1]		[1]	
<i>Pyxidea mouhotii</i>	P					
11. Trionychidae						
<i>Palea steindachneri</i>	I		[1]			[1]
<i>Pelodiscus sinensis</i>	I		[1]		[1]	[1]
12. Platysternidae						
<i>Platysternon megacephalum</i>	I,P		[1]		1	[1]
13. Testudinidae						
<i>Indotestudo elongata</i>	I					[6]

Notes:

Evidence: S = specimen, O = observed by Herp field crew, I = recorded in an interview, P = recorded by a previous survey crew (pictures)

Abundance: i = 1-5 individuals, ii = 6-10 individuals, iii = > 10 individuals (evidence of abundance should not be used as a measure of population size)

Habitat types: 1 = In stream, 2 = on stream bank, 3 = on vegetation over stream, 4 = on vegetation beside stream (<1m), 5 = on vegetation beside stream (>1m), 6 = on forest floor, 7 = on vegetation in forest (<1m), 8 = on vegetation in forest (>1m), 9 = in open area, 10 = in pond, 11 = on vegetation over pond, 12 = on vegetation beside pond (<1m), 13 = on vegetation beside pond (>1m)

C = calling, L = Larvae, E = eggs, A = amplexus

[] indicates that they have only been deduced from interviews, not observed first hand.

Appendix 3.0 Incidental birds and mammal records observed during the herpetological survey, Green Corridor area, Thua Thien Hue province

Birds photographed on Herp Survey, as identified by Paul Sweet, AMNH (image name in parentheses):

1. *Harpactes erythrocephalus*
2. *Cyornis* sp.
3. *Garrulax leucolophus*
4. *Copsychus malabaricus*
5. *Pitta sroror annamensis*
6. *Enicurus* sp.
7. *Pycnonotus finlaysoni*
8. *Otus bakkamoena*
9. *Garrulax milletii*
10. *Sturnus nigricollis*

Mammals photographed on Herp Survey, as identified by Darrin Lunde, AMNH (image name in parentheses):

pending:

1. *Aonyx cinerea* (Otter)
2. *Sus scrofa* (Wild pig)
3. *Macaca* sp. (Monkey)
4. *Chrotogale owstoni* (Owston's civet)

Appendix 4.0 Photographs of reptile and amphibian species from the Green Corridor area, Thua Thien Hue province

Primary forest in A Pat Parcel (A Luoi District)	Stream A Pat 2 (A Luoi District)
Evergreen forest in A Pat Parcel (A Luoi District)	Secondary forest in Tra Ve (A Luoi District)
Habitat in A Lieng Stream (Tra Ve Parcel, A Luoi District)	Old secondary forest in Thuong Lo Parcel (Nam Dong District)
Secondary forest near by agricultural field in Nam Dong District	A Lieng Stream (A Luoi District)
Isolated secondary forest on the top of the hill in Binh Thanh Parcel (Huong Thuy District)	Plantation forest and grassland in Binh Thanh Parcel (Huong Thuy District)
Collecting specimens in the forest	Preserving specimens in the field
Gamboja toad <i>Bufo galeatus</i>	Spadefood toad <i>Leptobrachium banae</i>
Anderson's spadefood toad <i>Megpophrys major</i>	Berdmore's narrow-mouthed frog <i>Microhyla berdmorei</i>
Taiwan rice frog <i>Microhyla heymonsi</i>	Marble pigmy frog <i>Microhyla mamorata</i>
Grass frog <i>Fejervarya limnocharis</i>	Huia frog <i>Huia absita</i>
Hill forest frog <i>Limnonectes hascheanus</i>	Blyth's frog <i>Limnonectes poilani</i> (complex)
Marten's oriental frog <i>Occidozyga cf. martensii</i>	Granular spiny frog <i>Paa verrucospinosa</i>
Similar frog <i>Rana attigua</i>	Green frog <i>Rana cf. chloronota</i> (complex)
Bana green frog <i>Rana cf. banaorum</i> (complex)	Green frog <i>Rana cf. chloronota</i> (complex)
John's frog <i>Rana johnsi</i>	Black-triped frog <i>Rana nigrovittata</i>
Striped Asian treefrog <i>Chirixallus vittatus</i>	Horned bubble-nest frog <i>Chirixallus supercornutus</i>
Bana bubble-nest frog <i>Philautus cf. banaensis</i>	Langbian bubble-nest frog <i>Philautus cf. gryllus</i>
Truongson bubble-nest frog <i>Philautus truongsonensis</i>	Four-lined treefrog <i>Polypedates leucomystax</i>
Annam flying frog <i>Rhacophorus annamensis</i>	Himalaya flying frog <i>Rhacophorus bipunctatus</i>

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Vietnam flying frog <i>Rhacophorus calcaneus</i>	Tramlap flying treefrog <i>Rhacophorus exochypagus</i>
Green flying frog <i>Rhacophorus reinwardtii</i>	Capra tree lizard <i>Acanthosaura cf. capra</i>
Scale-bellied tree lizard <i>Acanthosaura lepidogaster</i>	Garden fence lizard <i>Calotes versicolor</i>
Indochinese water dragon <i>Physignathus concincinus</i>	Cochinchinese water skink <i>Tropidophorus cocincinensis</i>
Large-spotted slender-toed gecko <i>Cytodactylus irregularis</i>	Striped tree skink <i>Lipinia vittigera</i>
Oriental whip snake <i>Ahaetulla prasina</i>	Khasi keelback snake <i>Amphiesma cf. khasiensis</i>
Munticincted green snake <i>Cyclophiops multicinctus</i>	Common wolf snake <i>Lycodon fasciatus</i>
Kukri snake <i>Oligodon fasciolatus</i>	Mock viper <i>Psammodynates pulverulentus</i>
Mountain water snake <i>Sinonatrix percarinata</i>	Cheekered keelback <i>Xenochrophis piscator</i>
Chinese habu viper <i>Trimeresurus mucrosquamatus</i>	Volgel's pit viper <i>Trimeresurus vogeli</i>
Indochinese box turtle <i>Cuora galbinifrons bourreti</i> (picture from previous survey)	Keeled box turtle <i>Pyxidea mouhoti</i> (picture from previous survey)
Isolated forest above Ho Chi Minh Road (A Luoi District)	Illegal timber transport in Cha Mang River (Nam Dong District)
Siltation in the stream below Ho Chi Minh Road (A Luoi District)	Erosion from A Pat 1 Stream after the rain (A Luoi District)
Trap and wild pig skull (<i>Sus scrofa</i>) in the forest (A Pat Parcel, A Luoi District)	Owston's civet <i>Chrotogale owstoni</i> was trapped in Tra Ve Parcel (A Luoi District)
Small-clawed otter <i>Aonyx cinerea</i> found in Binh Thanh Parcel (Huong Thuy District)	Macaque <i>Macaca</i> sp. was kept as a pet in Khe Day (Huong Thuy District)