



Potential of Approached Ecotourism Consideration as Part of Patrolling Efforts Responsibility in Pu Hu Nature Reserve, Vietnam

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Abstract

Vietnam, almost special-use forests such as nature reserves (NRs) and national parks (NPs) have continually focused on ecotourism development because the tremendous potential of diversity is available. Combined with patrol ranger efforts information, rangers do not only consider illegal activities but also observe the abundant of biodiversity for ecotourism development in the specific areas. Ecotourism of biodiversity was continuously explored different patrol routes, which might usefully develop the tourist, depends on the visitor's demand. This study considered to find out the flora and fauna in Pu Hu nature reserve for recording location by using Global Positioning System (GPS) based on information of paroling activity and camera traps by law enforcement efforts regularly. The results denoted that there were four tracks that might develop the basis tours in different natural observation depending on visitor requirements. There were 8 animal species encounters in Co Chao track, 13 plants species in Pu Hu mountain track, 11 medical plants species in Nga track, and 9 flora and fauna species in San track. The species were mapped based on their respective tracks. To mapping the different species, it was a part of specific approach on ecotourism in the nature reserve. Further, it is inevitable that law enforcement efforts are more effective in natural resources.

Keywords: Biodiversity; Ecotourism; Patrol

1. Introduction

The establishment of protected areas (PAs) in various countries has conferred benefits and costs to varying degrees on different stakeholders (De Lopez, 2003). Visitors are interested in visiting a nature reserve because of the natural environment and biodiversity that the place can offer (Kamri and Radam, 2013; Sari *et al.*, 2015) and also under increase in pressure to attract more visitors (Arsić *et al.*, 2017) while using biodiversity as the park's main attraction (Moran-Cahusac, 2009). The special-use forest has enormously great value in the ecological, recreational and cultural setting which takes the consideration of the necessity of being continuously organizing (Kamri and Radam, 2013). Improvement of tourism based on forest nature as potentially harmonious with the target of conservation has been affecting a rush to appeal to protected areas to attract the 'ecotourist' public (Cunha, 2010). Ecotourism provides more to conservation than other types and is older and more educated than other tourist types (Hvenegaard and Dearden, 1998). Similarly, it has been contributing to the nature conservation through their living practices (Yi-fong, 2012).

The main objectives of the special-use forest, such as NRs and NPs, are to preserve biodiversity and natural ecosystems and support of public access into protected areas (Hvenegaard and Dearden, 1998). Further, ecotourism activities have contributed to another objective of conservation as well (Hvenegaard and Dearden, 1998; Yi-fong, 2012). Many studies have conducted ecotourism in protected areas due to law enforcement performance, but little research has considered on law enforcement to

contributing ecotourism development in Vietnam. Even, the ecotourism can be profit and the role of local people in promoting conservation awareness and supporting managers. (Ormsby and Mannle 2006). Achievement of increasing conservation benefits from ecotourism are provided (Hvenegaard and Dearden, 1998; Ohl-schacherer *et al.*, 2008).

2. Material and methods

2.1 Description of the area

Pu Hu NR was established in 1999 as a special-use forest area by Vietnam government. It is under the management of Pu Hu management board. It is located 150 km to the Northeast of Thanh Hoa city and the two districts of Quan Hoa and Muong Lat districts, Vietnam with the coordinates of latitude 20°30' to 20°40'N and longitude 104°40' to 105°05'E as presents the geographical location of its (Figure 1). The highest point of altitude has 1,468 m compared to the sea level. And it covers a mountain area of 28,000 hectares. Due to its scientific value, Pu Hu has an enormous attraction for its various flora and fauna species live together in the Pu Hu area. It has a marvelous commixture of the different forest with composed mountain areas in northeast Vietnam. However, local living in and around NR often impact the ability of the PAs to meet conservation objectives (Ormsby and Kaplin 2005) due to forest exploitation and commercial logging (Schulze *et al.*, 2008). Most residents living in fringe villages adjoining to the NR have respected the outstanding benefits of ecotourism regardless of giving up harvest to natural resources inside nature reserve boundaries during the period (Appiah-Opoku, 2011) and because of the strictly protected area (Müller and Job 2009).

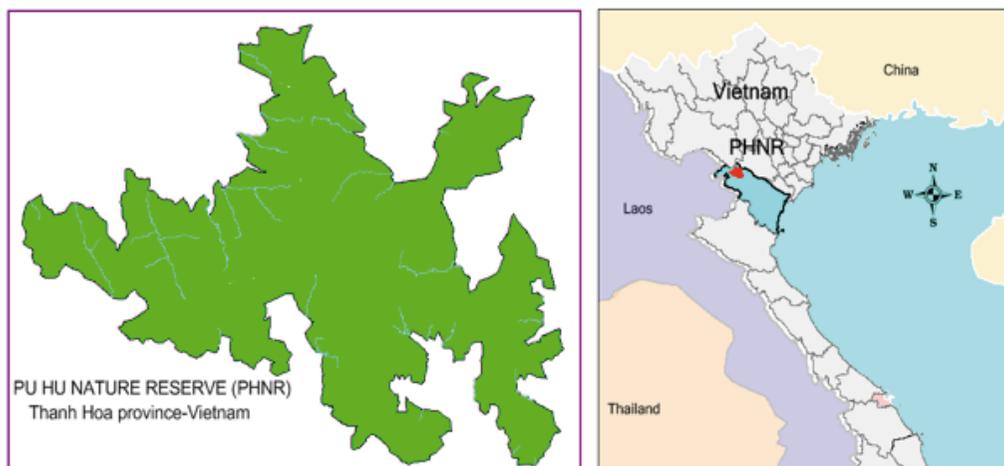


Figure 1. Location of case study

2.2 Data collection

In nature reserve, rangers have been patrolling in different areas where they could find illegal activities and might have the threat to the forest ecosystem. Furthermore, they have also considered on recording the richness of biodiversity for ecotourism development. The study was conducted from October to November 2011 reserve rangers who frequently carried out in each forest plot. Processing and data selection implemented is supported by the Science and International Cooperation Department, Pu Hu. The data was directly attained and selected from working field based on the form of foot patrols that carried out from different forest stations based on patrolling routes. The documentation of flora and fauna encountered on the surrounding location coordinates collected.

3. Results and discussion

In the total, four patrol-tracks have been found in amongst patrolling routes, which were potentially interesting visitors in sub-area forest in Pu Hu NR, due to the different view of the natural ecosystem in each track in the sub-area forest plots (Figure 2).

The track_1 is called Co Chao Track as the local name of a small river where encountered a variety of wildlife animals. The list of wildlife animals that could be found on this track was presented in Table 1. It connected between Nam Tien and Hien Chung communes, crossed through Thien Phu commune. This track is 13,395 m long and needs about 9 hours walking (Figure 2). The beginning point of the track was about 7 km from Trung Thanh FS which crossed Trung Son commune and finished in Ta Com FS. This track was the most interesting for visitors who have plenty of time on exploring the wildlife animal (Figure 3). However, visitors should bring the local guide who could help to get the suitable location for wildlife activity if they are

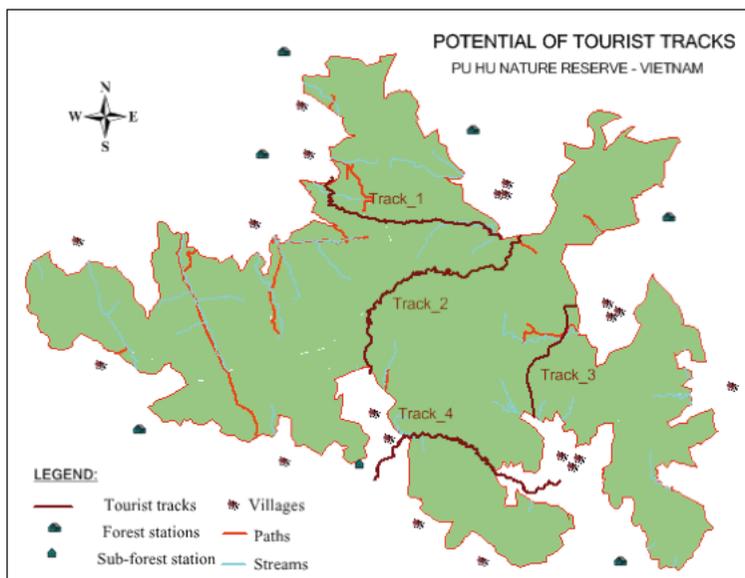


Figure 2. Details of potential of tourism tracks

interested in seeing the wildlife animals in the nighttime like *Ursus thibetanus*, *Chrotogale owstoni*. And, it found bear's and wild boar's footprint (Figure 3a). Based on the priority of patrolling activity, Pu Hu NR should consider on implementing law enforcement efforts anytime. So, tourist activity in this area may convince the density of rangers and visitors to reduce the number of animal poaching in the dry season

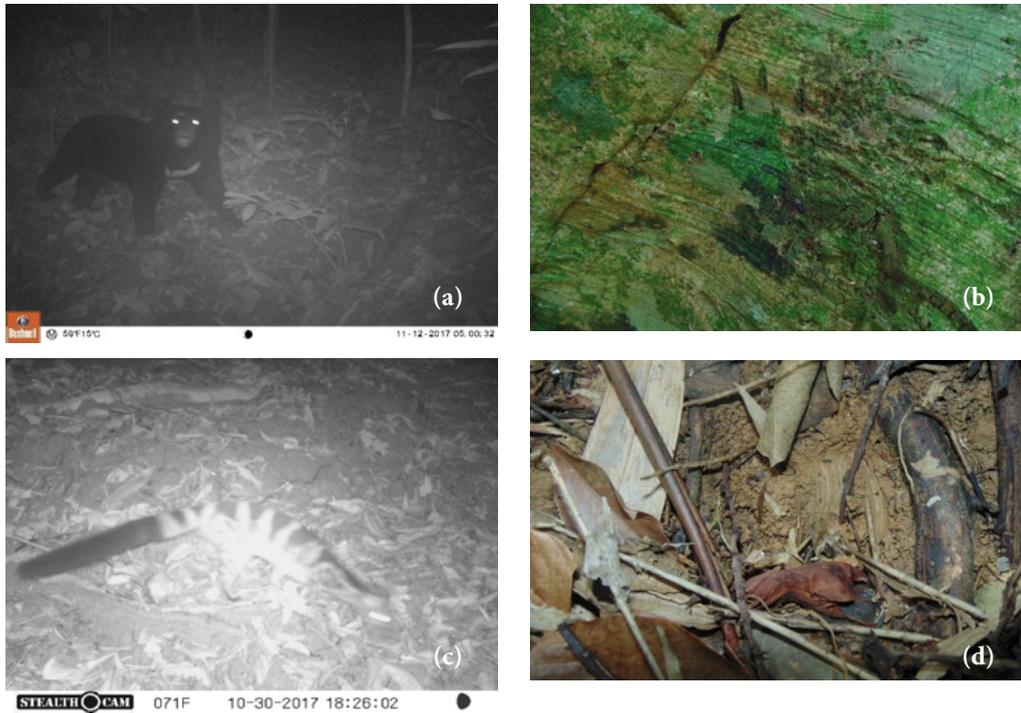
The so-called Track_2 is Pu Hu mountain route with the height of 14,468 m (Puhu, 2014). The track had a distance as far as 17.484 m and about 11 hours long journey (Figure 2). The starting point of the track was 7 km from Hien Chung sub-forest station and passed through two villages, namely Chieng and Yen in Hien Chung commune. The end of the track is Trung Thanh commune and also finishes in the same

Table 1. The list of wildlife animals found on Track_1

No.	Local name	Scientific name	Noted points	Coordinate point	
				x	y
1	Cây văn bắc	<i>Chrotogale owstoni</i>	Camera trap	488 884	2271 053
2	Lợn rừng	<i>Sus scrofa</i>	Footprint	488 173	2270 461
3	Gấu ngựa	<i>Ursus thibetanus</i>	Camera trap	488 055	2271 112
4	Gấu ngựa	<i>Ursus thibetanus</i>	Footprint	487 700	2270 698
5	Mang trường sơn	<i>Muntiacus vuquangensis</i>		488 943	2270 639
6	Gà tiền mặt vàng	<i>Polyplectron bicalcaratum</i>	Heard	484 919	2271 585
7	Rùa hộp trán vàng	<i>Cuora galbinifrons</i>	Trap	487 996	2271 112
8	Rùa hộp trán vàng	<i>Cuora galbinifrons</i>	Trap	487 937	2270 520

place as the starting point for Track_1. Along with this track, visitors have observed rare plant species (Figures 4 and 5) and the list of other species (Table 2). There were the variety of big trees like *Dipterocarpus retusus*, *Parashorea chinensis*, and *Manglietia fordiana*. Moreover, visitors walk through the various types of the

tropical forest such as lowland rainforest, montane rainforest. Addition to this, the mixture of bamboo nature evergreen broadleaf trees have been found. Admittedly, this track is the farthest and most difficult amongst tracks, so travelers should strictly combine with forest ranger or local guide. Furthermore, it needs to hire porters, sleeping tents, and bringing food.



△ Source: Pu Hu NR and author

Figure 3. Pictures of wildlife animals: (a) *Ursus thibetanus* (b) bear's scratch (c) *Chrotogale owstoni*; (d) *Sus scrofa*'s footprint

Table 2. The list of various forest plants found on Track_2

No.	Local name	Scientific name	Noted points	Coordinate point	
				x	y
1	Chò nâu	<i>Dipterocarpus retusus</i>		486 043	2266 674
2	Lan kim tuyến	<i>Anoetochilus setaceus</i>	2 units	485 451	2266 260
3	Chò chỉ	<i>Parashorea chinensis</i>		486 221	2266 496
4	Sáo đen	<i>Hopea odorata Roxb.</i>	2 units	485 747	2267 385
5	Vàng tâm	<i>Manglietia fordiana</i>	4 units	486 063	2267 029
6	Sến mật	<i>Madhuca pasquieri</i>		486 339	2267 857
7	Lát hoa	<i>Chukrasia tabularis</i>	2 units	486 872	2267 857
8	Trường mật	<i>Amesiodendron chinense</i>		486 694	2268 035
9	Thông tre lá dài	<i>Podocarpus neriifolius</i>	8 units	487 404	2267 857
10	Gội nếp	<i>Amoora gigantea</i>		487 049	2268 449
11	Giổi xanh	<i>Michelia mediocris</i>		488 529	2268 863
12	Vối thuốc răng cửa	<i>Schima superba</i>		489 475	2268 745
13	Lan một lá	<i>Nervilia aragoana</i>	2 units	490 245	2268 627



Δ *Podocarpus neriifolius*



Δ *Nervilia aragoana* Gaudich

Figure 4. Pictures of rare plant encounters



△ *Anoetochilus setaceus* before blooming



△ *Anoetochilus setaceus* while blooming

Figure 5. The *Anoetochilus setaceus* species on this track

As consideration on Track_3 as the name of San track as the same name of the river, it was the easiest and the shortest distance of 4,937 m. It took about 2.5 hours walking. The beginning of the track started about 10 km from Phu Son station and crossed through fourth villages in Phu Son commune (Figure 2). In the end of the track in Nam Tien commune, there was a long Nga river and ends up in the Coc 3 village. The list of potential medical forest plants was presented in Table 3. There were not various big trees such as *Polyscias fruticosa* and *Ficus racemose*. However, this track was interesting in richness and abundant as medical species.

The name of Track_4 is San as the name of the river in Nam Tien commune. The total

of the distance of 4 covered around tour of 12, 862 m with took 8 hours by walking. It started in Coc 2 village in Nam Tien commune to the end of Chieng village in Hien Chung commune. Travelers passed the waterfall with the height of 30 m. There was not only a variety of wildlife animal in this track but also observation of different types of legal activities in forest products that are lied in the buffer zone. The various forest plants and animals during the way of this track were encountered 9 species, including medicinal plants (*Fallopia multiflora*), big trees (*Parashorea chinensis*), rare animal (*Polyplectron bicalcaratum*), and bamboo plantation (Lim, 2014) as presented in Table 4. Interestingly, the bamboo reforestation was planted before establishing Pu Hu NR from local people (Table 4).

Table 3. The list of medicinal plants found on Track_3

No.	Local name	Scientific name	Noted points	Coordinate point	
				x	y
1	Ngũ gia bì	<i>Acanthopanax lasiogyne</i>		494 209	2267 325
2	Thông mộc	<i>Aralia chinensis</i>		494 268	2266 851
3	Sâm thơm	<i>Heteropanax fragrans</i>		494 209	2266 437
4	Đinh lăng	<i>Polyscias fruticosa</i>	3 units	493 973	2266 082
5	Chân chim núi cao	<i>Schefflera alpina</i>		493 795	2265 845
6	Rau má	<i>Centella asiatica</i>		493 558	2265 550
7	Lan kim tuyến	<i>Anoectochilus setaceus</i>		493 144	2265 313
8	Lan một lá	<i>Nervilia aragoana</i>		492 789	2264 958
9	Săng máu lá to	<i>Horsfieldia amygdalina</i>		492 552	2264 484
10	Long não	<i>Cinnamomum camphora</i>		492 907	2263 952
11	Sung	<i>Ficus racemosa</i>		492 375	2264 011

Table 4. The list of adventure Track_4

No.	Local name	Scientific name	Noted points	Coordinate point	
				x	y
1	Rừng Luông	<i>Bamboo plantation</i>		491 310	2260 105
2	Gà tiền mặt vàng	<i>Polyplectron bicalcaratum</i>	Heard	490 836	2259 987
3	Thông mộc	<i>Aralia chinensis</i>		490 659	2261 052
4	Chò chỉ	<i>Parashorea chinensis</i>		490 185	2260 993
5	Sổi phẳng	<i>Lithocarpus cerebrinus</i>		490 067	2261 407
6	Rau dền gai	<i>Amaranthus spinosus</i>		489 594	2261 111
7	Hà thủ ô đỏ	<i>Fallopia multiflora</i>		489 534	2261 585
8	Lan kim tuyến	<i>Anoectochilus setaceus</i>		489 179	2261 348
9	Gà rừng	<i>Gallus gallus</i>	Observed	488 884	2261 230
4.	Conclusion				

The biodiversity that was explored on fourth tracks in Pu Hu NR is very diverse both diversity species and the profits that still require being inspected further regards to protect the natural forest. The number of wildlife animals mainly explored in Track_1, while the big forest plants were found on Track_2. Interestingly, human know that more than 25 percent of modern medicines originate from tropical forest

plants (Rainforest, 2008), thus 11 medicinal species were identified along the Track_3. Basically, the observation on the main flora and fauna in each track was explored. However, Pu Hu NR should focus on the specific visitors who are satisfied with the nature reserve observation and good service. The nature reserve has continually played the significant role in shaping the content of ecotourism in remote

areas (Yi-fong, 2012). Further, these are their primary reasons which motivate them to visit a national park (Kamri and Radam, 2013; Sari et al., 2015). Additionally, ecotourism activities could influence the local's knowledge and perceptive and exchange for conservation actions (Ohl-shacherer et al., 2008) and promotes conservation (Hvenegaard and Dearden, 1998). It is an important instrument used for contribution to preservation of the natural reserve and convince rangers to patrolling and working in the core zone of Pu Hu NR (Aciksoz et al., 2010; Arsić et al., 2017) and other PAs. Thus, Pu Hu managers should consider on opening ecotourism development as a part of forest protection and law enforcement efforts (Ohl-shacherer et al., 2008).

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