

A booming trade? How collection of war residues affects livelihoods and forest in Vietnam

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SUMMARY

We investigated how demand for war derived scrap metal influenced livelihoods, forest use and environmental outcomes near the biodiverse Annamite Mountains in Central Vietnam. We focused on one community, Khe Tran, and interviewed local villagers, active collectors from other communes, traders and officials. We also visited the forest. Collection is illegal during the dry season due to concerns about fires. Despite the threat of unexploded ordnance, villagers did not judge metal collection especially dangerous. Though metal is declining, scrap collection remained the principle reason people entered the forest. Though many Khe Tran villagers had past experiences as metal collectors most now favoured cultivation and plantation management. In contrast many collectors from elsewhere lacked such options. Collectors often sought other products when looking for metal, thereby facilitating trade in these forest products (e.g. bamboo and rattan). Alternative livelihood options are required for those reliant on this finite and declining resource.

Keywords: alternative livelihoods, metal collection, NTFP, forest degradation, Vietnam

Un commerce en pleine explosion? Impact de la collecte de vestiges de guerre sur les moyens d'existence et la forêt au Vietnam

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La demande en métaux provenant des vestiges de la guerre du Vietnam a un impact sur les villageois et sur leur environnement forestier. Notre recherche s'est déroulée dans le village de Khe Tran, en marge des montagnes Annamites, abritant une riche biodiversité. Nous avons enquêté auprès de villageois, de collecteurs venant d'autres communes, de commerçants et des autorités locales sur l'importance de la collecte de métal, une activité considérée illégale seulement pendant la saison sèche, en raison du risque d'incendies. Malgré la menace que représente la mise à jour, durant la collecte, d'obus et mines non explosés, les villageois ne considèrent pas cette activité comme particulièrement dangereuse. Bien que le métal se raréfie, sa collecte représente encore la principale raison pour eux de pénétrer dans la forêt. Cependant, si de nombreux villageois de Khe Tran ont collecté du métal dans le passé, la plupart préfère désormais cultiver la terre et gérer leurs plantations. En revanche, bon nombre de collecteurs extérieurs n'ont pas ce choix et sont contraints de poursuivre cette activité. Lorsqu'ils cherchent du métal, les ramasseurs sont souvent en quête d'autres produits forestiers non ligneux (bambou, rotin). Le commerce de ces produits est facilité par la collecte de métal. Parce que cette ressource est en déclin, il est nécessaire de trouver d'autres moyens de subsistance pour les collecteurs dont l'économie en est encore dépendante.

¿Un negocio pujante? Cómo la recolección de desechos de guerra afecta los medios de vida y los bosques en Vietnam.

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Esta investigación explora cómo la demanda de chatarra de metal proveniente de la guerra armada ha influenciado los medios de vida locales y el uso de los bosques cerca de las montañas Annamite en el centro de Vietnam. Para esto, nos enfocamos en una comunidad llamada Khe Tran donde visitamos el bosque y a su vez entrevistamos a los aldeanos, recolectores activos de otras comunidades, comerciantes y personal oficial. Aunque el riesgo de explosión de la munición no detonada es alto, los aldeanos no consideran la recolección de chatarra de metal especialmente peligrosa. Si bien las existencias de metal se encuentran en declive, su recolección continúa siendo la razón principal por la cual las personas se adentran en los bosques. A pesar de que muchos de los aldeanos de Khe Tran habían tenido experiencias pasadas como recolectores de chatarra de metal, la mayoría prefiere hoy cultivar la tierra y ocuparse del manejo de plantaciones. Por el contrario, muchos recolectores de otras partes no cuentan con estas mismas opciones y a menudo tratan de encontrar otros productos (bambú, ratán) cuando buscan chatarra de metal, estimulando así el comercio de estos productos forestales. El estudio concluye que se necesitan opciones alternativas de sustento para aquellos que dependen de estos recursos limitados.

INTRODUCTION

Tropical forest resources support millions of rural people (Arnold and Ruiz Pérez 1999, Arnold 2001, Angelson and Wunder 2003, Fox 1995). Forest products often determine livelihood choices and how people interact with their landscape (Lynam *et al.* 2006, Belcher *et al.* 2005). Environments and livelihoods are affected by warfare in various ways. The ecological footprint of war is a recognized environmental and conservation concern and has given rise to a multi-faceted research literature (e.g. Jarrett 2003, Stone 2005, Orians and Pfeiffer 1970, Hanson *et al.* 2008, Machlis and Hanson 2008, McNeely 2003a, 2003b, Dudley *et al.* 2002). Nonetheless the significance of war debris in forests remains undocumented.

In some post-conflict regions metal war residues support a significant local trade (Recycling International 2005), yet war debris is still considered primarily a hazard (Landmine Monitor 2005, Landmine Monitor 2006, Clear Path International 2005, Westing 1996). Little attention has been given in the literature to social and economic aspects or to the environmental implications (Tran Dinh Thanh Lam 2003, Moyes 2004, 2005).

We previously conducted multidisciplinary surveys in and around Khe Tran village, Central Vietnam, asking what matters to local people (results in Boissière *et al.* 2006, 2009). During this study we realized that metal collection was the main reason people entered the forest. We decided to investigate this in more detail as we suspected this was an important factor in understanding local livelihoods and how people use and impact forests. Ruiz-Perez (1995) noted that some high value forest products or “backbone products” facilitate the collection and marketing of others. We suspected that scrap metal may have been playing a similar role.

The Vietnam Government’s policy on reducing community reliance on forests by encouraging plantation crops (such as Eucalyptus, rubber and Acacia) has been relatively successful in some places, such as the village of Khe Tran considered here (Boissière *et al.* 2006). While these villagers used to be swidden cultivators and hunter gathers, at the time of this study they placed much less emphasis on the forest than they used to. This was not, however, the case for everyone in the region. For example land scarcity remained a problem in the neighbouring Phong Son Commune and many people continued to access the Khe Tran forest in search of livelihood benefits (Boissière *et al.* 2006).

In this paper, we investigate the role of war derived scrap metal in local livelihoods. Though a limited resource it generated a considerable network of traders and played a significant role in the local economy. We also consider how this influenced forest use and degradation in and around Khe Tran and the nearby forests. We examine how metal facilitated the collection and marketing network for other forest products. To our knowledge, there have been no previous studies addressing these relationships.

BACKGROUND

Location and conservation significance

Khe Tran village is situated within the buffer zone of Phong Dien protected area (Phong My Commune [a commune is an administrative unit between village and district], Phong Dien District, Thua Thien Hue Province, Central Vietnam) in the southeastern Annamite Mountains. At the time of the study the village had 20 households in an area of about 200 hectares, but villagers often went beyond their village’s limits to look for NTFPs. They claimed to have traditional rights to a larger territory than the official village limits. In our 2006 census, 117 villagers were from the *Pahy* ethnic minority group while 23 were *Kinh*, the ethnic majority in Thua Thien Hue Province, who had married into the community. Most villagers cultivated rice and mixed gardens of tubers and fruit trees for their own consumption, and black pepper, acacia and rubber for cash. Khe Tran’s surroundings are mainly agricultural, with areas of acacia and rubber plantations, grasslands and scrub replacing degraded forest (Boissière *et al.* 2006).

This part of the Annamite Mountains harbours the last readily accessible lowland forests in the province (TT Hue Provincial Forest Protection Department 2003). Endangered animals include tigers (*Panthera tigris*), Saola (*Pseudoryx nghetinhensis*) and Annam Partridge (*Arborophila merlini*). Due to its globally significant flora and fauna, the region has become a focus for conservation planning (Le Trong Trai *et al.* 2001, Birdlife International and FIPI 2002). Threats include hunting, timber cutting, fires and forest clearance (Le Trong Trai *et al.* 2001, Birdlife International and FIPI 2002).

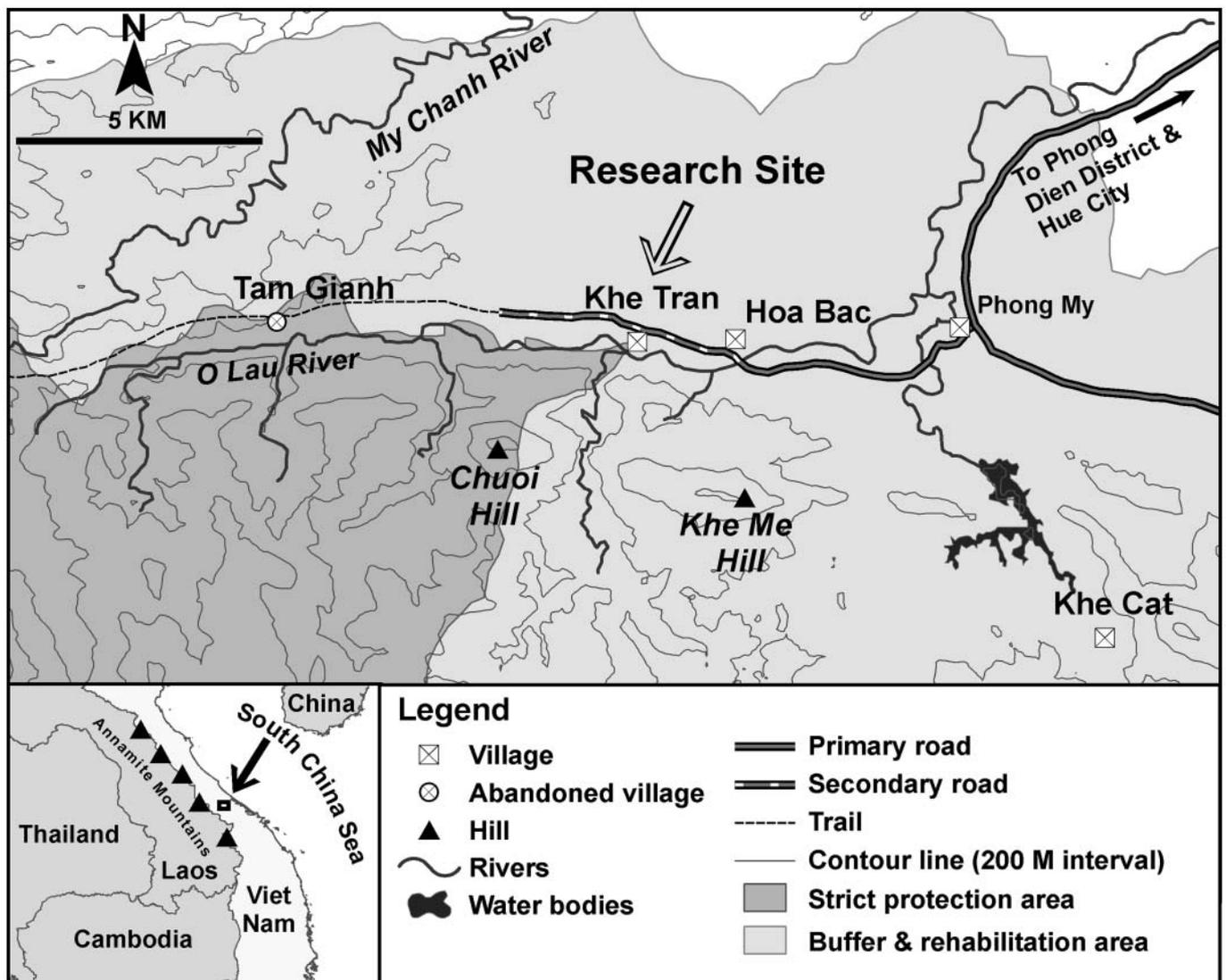
History

Vietnam’s economy and environment have both been transformed over recent decades (Meyfroidt and Lambin 2009). Prior to the Vietnam War (1955–1975) the study area was forested and sparsely inhabited (Le Trong Trai *et al.* 2001). During the war, most local people fled to the surrounding Annamite Mountains, or crossed into Laos (Figure 1). Many returned after 1975.

During the war many US military facilities were stationed in the region. It was an area of fierce fighting and was heavily mined. Bombs and defoliants caused significant environmental degradation in the wider region (Orians and Pfeiffer 1970, Young *et al.* 2004) and also around Khe Tran (Boissière *et al.* 2009, Le Trong Trai *et al.* 2001). Considerable hardware and debris remained when the US withdrew (Landmine Monitor 2004, Sensamaust and Robertson 2005).

Between 2002 and 2005 Australian Volunteers International (AVI, <http://www.ngocentre.org.vn/node/5209>) in collaboration with the Mine Advisory Group (MAG, <http://www.mineaction.org>) helped clear mines in Phong Dien district including Khe Tran (Landmine Monitor 2004). They trained a local team to continue the work and provided metal collectors with basic safety training.

FIGURE 1 Map of Khe Tran village and surroundings. (Based on: Shuttle Radar Topography Mission (SRTM) Elevation Data NASA 2000; Department of Planning and Investment, TT-Hue province, 2005; and reworked by CIFOR 2006). Inset: site location in Vietnam



Since 1992, logging and hunting are officially forbidden in the protected forest, but extraction of NTFPs, such as rattan, bamboo and honey, as well as metal collection, is allowed. Since 1993, when the Vietnam’s National Assembly passed the land law (Sikor 2001), the government has discouraged shifting cultivation and supported permanent agriculture and plantations to reduce reliance on forests (Meyfroidt and Lambin 2008).

In 2001, the forest became a Strict Nature Reserve (IUCN category 1b), however, the official change in status to “Special Use Forest” (the category for Nature Reserves in Vietnam) has yet to be ratified by the People’s Committee. Notably, forest degradation has continued both inside and outside the protected area (Boissière et al. 2009, Le Trong Trai et al. 2001).

The government exercises its authority through the Provincial People’s Council (PPC), which intervenes at the

local level by means of the Phong My Commune. Staff members of both the commune and the Forest Protection Department visit Khe Tran several times a year during the dry season (April to June) to monitor extractive activities and explain regulations to local people. In practice, the forestry department is overstretched with only eight rangers patrolling the 40,000 ha protected area (Boissière et al. 2009).

METHODS

The initial survey (methods in Sheil et al. 2003a) identified and characterised what natural resources and related livelihood activities were important to local communities. Aside from addressing general questions related to livelihoods, and the importance of natural resources, we also visited the forests with local informants questioning them on

local resource use. We established a series of small representative plots to assess plant diversity and forest condition. This acted as a basis for more detailed discussions and assessments of local uses and perspectives when discussing what we saw with local informants. This process led us to recognize the significance of metal collection – we then conducted a number of more focused activities to clarify this.

Discussion groups and interviews

During the initial survey, we used focus group discussions to examine general perceptions of environmental threats in Khe Tran. We worked with four groups, two male and two female, divided by age into young and old. Each was composed of five or six villagers.

Later, during the follow-up set of activities, specifically investigating metal collection, we worked with an additional “expert group” of informants. This group, comprised of three women and five men of different ages selected by the villagers to represent those households involved in metal collection. We asked them about legal issues, dangers and know-how related to the collection, impact on forest, contribution to household economy, and role of outsiders in the trade. We specifically identified and interviewed collectors in 19 households. We also intercepted and interviewed three groups of collectors (5–10 per group) from other villages passing through Khe Tran going to or from the forest. We sought out and interviewed three brokers in the commune; three traders in the city of TT Hue and three officers from Phong My Commune in charge of enforcing the rules, including the head of commune People’s Committee. Our questions focused on the amount collected (sought or found), time of last collection, methods and equipment used, importance compared to other cash generating activities, and the presence of unexploded devices near the village.

Forest survey

During the initial survey we visited a variety of locations and vegetation types around the village (see Boissière *et al.* 2006). To better understand forest condition and provide a basis for discussion with local informants, we established 11 plots in different land uses including plantations, rice fields, home gardens, young forest regrowth, and natural forest. Plot locations were selected with local guidance with the aim of covering the typical range of conditions encountered. We were not focusing on metal collection, at that time.

Each plot consisted of a 40 m transect 5 m wide for herbs, lianas and other smaller “non-tree” plants. Trees were measured and recorded in a variable area plot (including a maximum of 40 stems over 10 cm diameter at 1.3m above the ground) (Sheil *et al.* 2003b). Random numbers were used to define a number of meters to offset the starting point of the transect, to ensure a random offset and reduce biases due to subjective plot location. One plot was located in the most intact natural forest we could find (over two hours walk from the village) and three in more typical forest. Surveys involved tree measurements (height and diameter), specimen

collection, local names and uses, and collection of general information on the context, ecology and history of each site.

Obstacles and communication

Commune officers placed constraints on our activities and followed our work closely. To go to the forest, we had to request permission a day ahead. We were prohibited from staying in the village overnight. Officials nearly always accompanied us except during household surveys; villagers were thus reserved regarding some issues. During group discussions, commune officers sometimes lectured respondents when they felt an answer reflected poorly on the official viewpoint or was inaccurate.

Respondents may also have been concerned that we wished to abolish metal collection – as this has been advocated by the local government and international NGOs, when AVI and MAG were operating in the District, between 2002 and 2005. Most informants spoke Vietnamese, but some required local translators.

Analysis

Data were summarized and analyzed with MS-Excel and SPSS 9.0 software. We used Mann-Whitney U test to compare households.

RESULTS

We organized our results by the major themes.

Legal issues

According to commune officers, collection of scrap metal is permitted during the wet season, from October to December. No permit is required and the trade is neither taxed nor monitored. Collection is banned during the dry season to prevent fire – it appeared that collectors sometimes use fire to clear the understory and make searching easier – but this ban is seldom enforced.

Dangers

According to the commune officers there have been about 50 accidents in Phong My Commune since 1975. Only a few occurred during metal collection with most occurring soon after the war. The last recorded accident in Khe Tran was in 2000 when a Hien Thuc villager (Phong My Commune) detonated an anti-tank mine while digging in his garden.

According to both villagers and commune officers, villagers are required to report unexploded ordnance to the commune. An official task force is then supposed to remove it. However, villagers said the task force might not come. Explosives have no practical value: there is no market for them and collectors don’t extract explosive devices to use as artisanal bombs for fishing as reported to occur in Cambodia (Moyes 2004).

Interviews and focus group discussions indicated that the hazards of metal collection are well recognized. Respondents explained that they considered metal collection relatively safe for skilled collectors like themselves and likened it to “raising cattle or farming”. They believe that they can usually distinguish dangerous unexploded ordnance from other metal.

Out of the 19 households asked about the main threats to human life in the region, only two proposed unexploded ordnances. This is in contrast to 11 households, which mentioned poverty and 14, disease. None of the villagers voiced concern about children finding explosive devices.

Accidents usually occur before the metal is visible and (in the past) when trying to disarm them. When dangerous ordnance is found, respondents confirmed that they leave it and report it to the commune.

Interviews and field observations revealed that there is unexploded ordnance within the village territory and farmlands. The commune officer said that in 2005 about 20 unexploded ordnances were reported. Usually they are discovered while farming. Villagers showed us several unexploded mortar shells, which had not yet been dealt with by the local authorities.

Collection

This section is based on our interviews with the villagers.

Metal collectors fall into two categories: those who find metal by chance, mainly while cultivating their land, and those who search for it; the latter are those we refer to here as collectors. The first metal collectors started around 1976 and were mostly Kinh people from the neighbouring commune of Phong Son. It wasn't until much later, around 1994, that Khe Tran villagers started collecting metal themselves. When they could afford it, collectors used metal detectors as this made searching more effective. These were bought from brokers in the provincial capital for between 50 000 and 350 000 Vietnam Dong (VND) depending on the type (i.e. between USD 3-22, one USD = approximately VND 16 000 (2006)). Detectors typically use four RS20-D batteries, costing about VND 8 000 each, which last for about one-week of daily use. Villagers generally search for metal in groups of two to 10. Women sometimes accompany their husbands but seldom use metal detectors (Figure 2). Young children rarely go to the forest, but occasionally find and collect metal near the village.

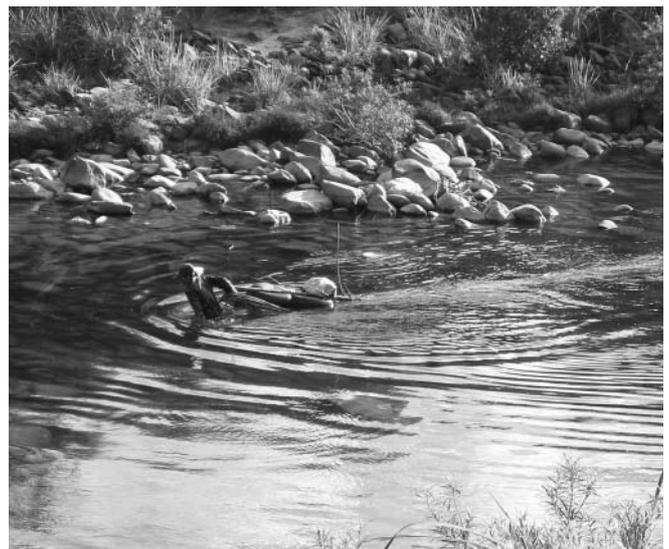
Collectors may devote from a few hours to several weeks a year collecting metal, usually between October and December, during the rainy season and when people have time available. Using a pickaxe, they carefully dig towards any detected metal from the side, avoiding contact until they are sure it is not live. Up to about 30 kg of metal per man or around 20 kg per woman may be carried out in one trip. Large finds are moved to rivers and then rafted out. We observed collectors using inner tubes to float heavy pieces down the river; even 200 kg appears possible using this technique (Figure 3).

The commune officers informed us that collectors sometimes use fire to clear the forest understory; this increases visibility, eases access, and might detonate (rendering harmless)

FIGURE 2 Women use metal detectors less often than men (Photo: M. Boissière)



FIGURE 3 Inner tubes, used to float heavy metal and rattan down the river, allow collectors to bring up to 200kg of metal back to their village (Photo: M. Boissière)



any live ordnance near the surface. While no collector admitted using fire in this manner themselves they acknowledged that it happens.

From 1994 to 1997 metal was readily found around Khe Tran. By 1997 it took a few hours walk to get to an area where metal was easily found. From 2002 there was a noticeable decline in the availability and collectors from Khe Tran had to search at least one day's walk from the village. But this didn't seem to discourage small-scale collectors from seeking small quantities of metal. During our short field activities, we encountered three groups of such collectors looking for scrap in these areas.

At the time of our study, collectors looking for larger quantities of metal stayed a week or more in the forest and sometimes failed to locate much metal. Instead, they often collected rattan (various *Calamus* species, including *C. walkeri* Hance) and other forest products. These other forest products were sold, following the same market networks as for metal – i.e. traders buying metal from collectors, also buy NTFPs.

Villagers remained knowledgeable about a wide range of forest products some of which have a market value. In our field study, we distinguished 246 species in the four forest plots of which 159 were recognized as useful species by the informants, and 4 marketable species. From all 11 plots, our informants identified 318 useful species.

While metal was clearly declining in relevance for the majority of Khe Tran villagers, due to both declining availability and the option of other more lucrative farming and plantation related activities, there was a lot of collection by others from outside Khe Tran who still came in relatively large numbers to access the forest. During our study in the village territory, over the course of several weeks, we frequently noticed groups of five to more than 20 collectors from other villages going in and out of the forest. Discussions with these collectors revealed how important metal collection still was for many people from neighbouring villages and communes, especially Phong Son Commune.

According to our informants, and our own observations, up to 50 non-resident collectors passed through Khe Tran every day, going to and from the forest. Since 2006, non-local collectors accounted for the vast majority of those entering the forest. From our discussions with these collectors, we discovered that most are of Kinh ethnicity and have no land, relying on scrap and forest products for cash. They expressed pride in this activity, which they consider a real job. They explained that in Phong Son, a commune of 1800 households (official census results for April 1999, in Le Trong Trai *et al.* 2001), almost every household was involved in metal collection though only some collected in this specific area of forest.

Degrading the forest

Forest degradation was visible during our initial field visits (before we fully realised the role of metal collection). All areas visited, including the study plots, showed signs of degradation (open canopy, cut stems etc.). Even the best forest had only a few large emergent trees remaining per hectare (Table 1). Basal area in plot 1, which represented the "best" preserved part of the forest, was 13.6 m² ha⁻¹ (Table 1)

or less than half that expected for natural forest (e.g. 25–45 m² ha⁻¹ see global data in Huston and Wolverton 2009). The three remaining forest plots were even more degraded. We had extensive discussions with our field informants about these plots and the many other sites that we passed through together. These informants explained that exploitation and fires, both accidental and deliberate, were responsible. All these sites were said to have been subject to intensive searches for scrap metal in recent years. We were told that metal collection was occurring in or around the plots even at the time we were measuring them. Indeed we encountered metal collectors in the forest during the plot measurement.

The Khe Tran community recognizes a link between metal collection and forest damage – though other factors were also considered important. Of the 19 households asked about the main threats to forests and biodiversity, six indicated metal collection, six slash-and-burn (to prepare the land for cultivation), eight forest fires (without distinguishing the causes of the fires), and 17 households noted logging. In all cases, people from outside the village were blamed for these practices. Metal collection is therefore still considered an important driver of forest degradation though logging is now considered more important.

During group discussions, villagers suggested they should be given a role in addressing these threats. They proposed that they could help the authorities to monitor who was entering the protected forests around the village, and for what reason.

Trade and traders

Interviews, and more general enquiries, revealed established provincial trade networks for scrap metal. Traders visited the village less often than they used to, but still came intermittently to purchase whatever was available. Prices depended on the metal, size and sometimes the condition of each piece. Traders, and sometimes collectors too, took pieces to brokers located near the village or in the commune. Brokers sold to traders who transported it to the provincial capital (TT Hue), Ho Chi Minh City, or foundries outside the country, for processing (Figure 4).

Villagers and brokers said they recognized distinct types of metal. Copper was the most valuable and was divided into three grades according to size. According to the villagers prices varied between VND 6 000 and 30 000/kg (USD 0.4 - 2); brokers provided slightly different prices from VND 20 000 to 70 000/kg (USD 1 - 4). Villagers recognized two grades of aluminium: big pieces (> 0.5 kg), for which collectors can expect around VND 5 000/kg, (USD 0.3) and from VND 8 000 to 18 000/kg according to brokers, (USD 0.5 - 1); smaller pieces went for half this price. The most common and cheapest metal was iron, with only one recognized grade at VND 2 000/kg (USD 0.12) from VND 2400 to 4 000/kg according to the brokers (USD 0.15 - 0.25). Recycled copper was chiefly used in handicrafts and tools (e.g. cooking utensils), whereas aluminium and iron were exported or processed in factories specializing in construction materials. Local metal prices, linked to international recycled metal markets, fluctuate accordingly. In June 2006, when this study was

TABLE 1 Forest plots, evidence of use, basal area, history, current use, tree and herb species and useful species according to informants

	plot 1	plot 2	plot 3	plot 4
Evidence of use/ degradation	Trail, rubbish (old lamp), few emergent trees	Cut stems, stumps, trail, low vegetation, shrubs	Cigarette ends, litter, cut stems, stumps, trail, plastic bags, small trees	Cigarette ends, litter, trail, old batteries, small trees only, water-pipeline,
Basal area m² ha⁻¹	13.6	15.4	17.3	11.0
History (from informants)	-Big fire in 1983, -Forest resource collection during the war (e.g. timber, rattan, honey, wood for tools)	Bombs and napalm during the war.	-Big fire in 1983 -Bombs and napalm during the war.	-Frequent fires between 1975 and 1980 -Big storm in 1983 -Agent orange during the war -Shifting cultivation until 1995
Current local use (from informants)	Timber cutting. Collection of rattan, honey, hunting (pigs and birds), and metal	Wood for tools, leaves for hat, rattan, illegal logging, metal collection	Wood for tools, metal collection	Collection of rattan, bamboo, firewood, some timber, water pipeline
Tree species	35	33	27	35
Herb species	33	52	35	36
Useful tree species †	18	11	7	22
Useful herb species †	10	17	12	15
Firewood only species	10	20	20	10

Note: † Uses as identified by local informants in the field but excluding grazing and firewood.

FIGURE 4 Scrap metal bought by a trader. (Photo I. Basuki)



conducted, international prices per ton of recycled copper, aluminium and iron were USD 6 600, 2 700 and 220 respectively (<http://www.metalprices.com/FreeSite/>, consulted online November 18, 2008).

Local brokers did not rely on metal alone. The Pahy broker's main occupation was farming. The two Kinh brokers we interviewed had shops selling food and groceries and also traded in forest products, including bamboo and rattan. These

forest products were brought by collectors for trade when they could not find metal.

Household economy

Interviews clarified that only six Khe Tran households still regularly sought scrap metal, even during the dry season, despite the interdiction by the Commune (Table 2). Eleven other households had experience searching for metal but no longer considered it worthwhile – though two still kept a metal detector.

In 2006, seven of the 19 households had actively searched for metal within the last year. Six owned metal detectors and three others had sold theirs (Table 2). Those still collecting were mainly young people looking for a source of fast cash, during their spare time. Apparently, all households collected and sold metal if they found it by chance in their fields or gardens.

Only two households had never searched for metal. These two households had the highest income per capita.

When we asked villagers why they had stopped collecting metal they said that they gained a better income from agriculture and plantations. They explained that collecting metal was hard work, hazardous and involved going increasingly long distances. In short, the amount of time and the risks involved outweighed the returns. They noted that metal prices had also declined in recent years, which corresponded to the international trend at the time of the survey (Recycling International 2005).

TABLE 2 Results from household (hh) survey on scrap metal

	Number of households		
	Never sought scrap	Used to seek but no longer	Still seek scrap
Number of hh	2	11	6
Average hh size (n)	3.5	6.4	6.2
Average hh income ($\times 10^6$ VND)	8.65	11.25	13.32
Average income per person in hh ($\times 10^6$ VND)	2.47	1.77	2.16
Households possessing a metal detector	0	2	4
Seeking scrap predominantly near the village (less than 2 hours walk)	0	6	5
Seeking scrap predominantly far from the village (more than 2 hours walk)	0	5	1
Finding UXO† near the settlement during the last 6 years	2	7	3
Possessing scrap at time of survey	0	5	1

Note: † *Unexploded Ordnance*

Who gains what?

The 19 households had a reported mean annual income – from all source of income – of 11.6 million VND (USD 725), or about two million per head (USD 125). However, there was considerable variation in wealth with a maximum–minimum range of 3.6–25 million VND (USD 225–1 562) per year per household and nearly tenfold 0.7 to 5 million VND (USD 44 to 312) per capita.

According to our Khe Tran informants, when conducted on a regular basis, collectors could earn about one million VND (USD 62) a year from gathering metal. This compared with earnings, for example, 900 000 VND (USD 56) for clearing and planting acacia plantations, and 400 000 VND (USD 25) for plantation maintenance, according to the same sources.

Combining data from the various interviews we examined whether we could find any characteristics, such as wealth, that might distinguish households that continued searching for metal from those that did not (Table 2). We specifically examined mean household income, and per capita income of the collectors and non-collectors (Figure 5a and b). The six households that continued collecting metal had a smaller income range both overall (Figure 5a) and per capita (Figure 5b) than the 13 households that stopped collecting. The average total household income was slightly higher for collectors; while the per capita income was slightly lower (Table 2). But the difference between household groups is not significant for either factor (Mann-Whitney U test: $z = -.528$ and $-.614$, and $p = .639$ and $.579$ respectively). Additional information regarding collectors who had ceased collecting (Figure 5c) showed no clear or significant pattern (Kendall's rank correlation coefficient $\tau_{a-b} = -.154$, $p = 0.381$). Thus, although the wealthiest household in the village was one of only two that had never sought metal, there was no clear relationship between income and metal collection. Similarly, family size does not explain the pattern with both collectors and non-collectors averaging six members per family (6.2 versus 5.9,

Mann-Whitney tests, $z = -.037$, $p = 0.88$). While young men (15 to 45 years old) were the primary collectors we found that all except two non-collector households had members strong enough to search for metal. Thus this was not a key factor distinguishing these two groups (exact probability that these two households would be non-collectors if male age had no relevant influence would be $13/19 \times 12/18 = 0.46$, i.e. non significant).

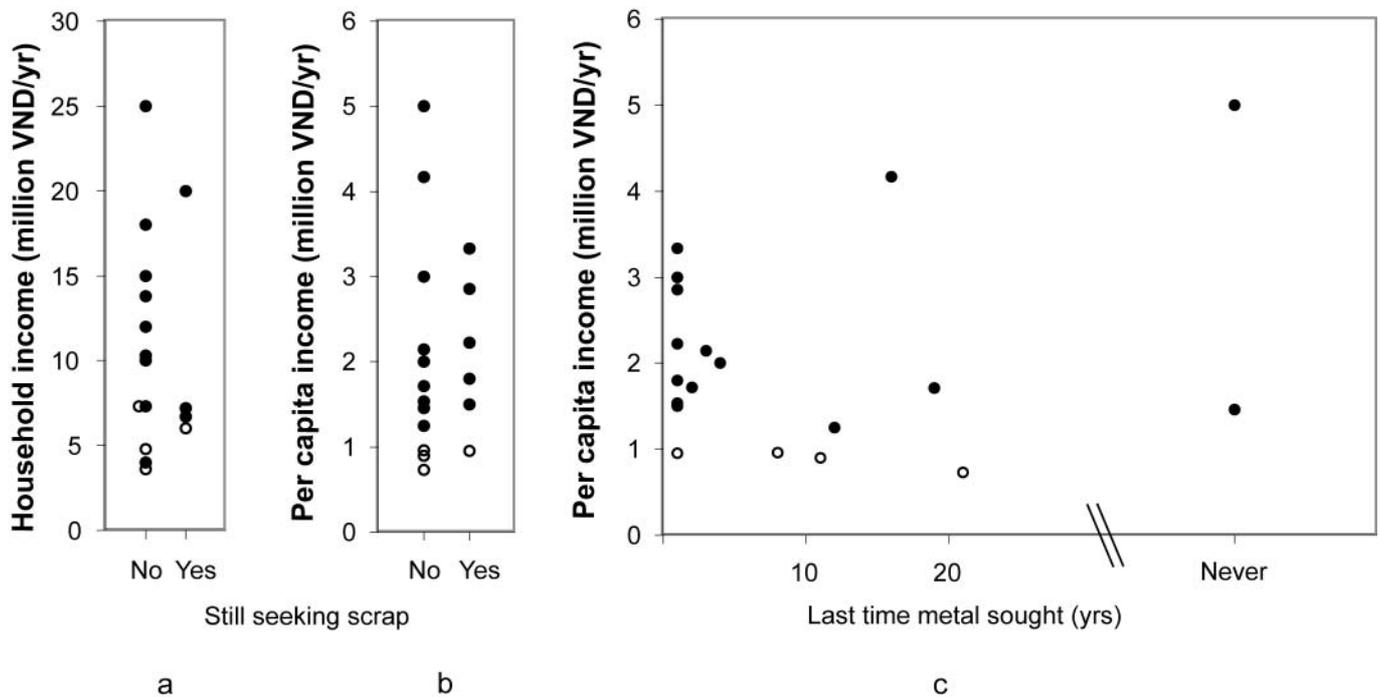
DISCUSSION

Dangers

Vietnam is still living in the aftermath of war. About three million landmines may still remain in Vietnam, in addition to an estimated 350 000 to 800 000 tons of other unexploded ordnance (Landmine Monitor 2005). Over the last 30 years in Vietnam more than 40 000 people have been killed from accidental explosions (Clear Path International 2005). Several international conventions have addressed mines and how they are handled. But none have provided mechanisms to regulate the collection and trade in war-derived metal. Khe Tran villagers were aware of the dangers posed by war scrap but did not feel greatly threatened by them. They considered hitting unexploded ordnances while tilling land a greater threat than the direct dangers of collecting metal – and the local records appear to back this claim. They never tried to disarm live munitions themselves as explosives had no local value (this is unlike other cases in the region, such as Cambodia, see Moyes 2004). Indeed any trade in explosives would also be illegal (Government Decree No. 47/CP dated August 12, 1996; and Decree No. 100/2005/ND-CP on the list of goods and services banned as a form of business).

Many international agencies emphasize the dangers of collecting war scrap (Clear Path International 2005, Land Monitor 2004, Wells-Dang 2006). Coupled with the local importance of war scrap this has encouraged an equivocal

FIGURE 5 Reported household income (a) and per capita income (b) of scrap metal collectors versus non-collectors in Khe-Tran. The last time scrap metal was sought (by households) versus household per capita income (c). Open circles show households below the official poverty line (The value VND 1.04 million/person/year was proposed by the World Bank for Vietnam since 1992. Source: http://www.unescap.org/Stat/meet/povstat/pov7_vnm.pdf)



official position in which metal collection is neither banned nor approved (Wells-Dang 2006, Landmine Monitor 2006, Durham *et al.* 2005). The sensitivities involved mean that the livelihood and development implications of war scrap collection remain poorly recognized.

Trends and implications for people

It is widely recognized that the poorest and most vulnerable are often the most dependent on forest resources (Belcher *et al.* 2005, Arnold and Ruiz-Perez 2001, Sheil and Wunder 2002, Ruiz-Perez *et al.* 2004). Our information suggests that scrap metal follows the same pattern. The availability of excess labour, especially young men, may encourage collection but it clearly isn't the only factor. Our analyses show that no one simple relationship offers a dominant explanation but the data sets are too small to claim anything more categorical at this stage. The dependence of many collectors from outside the commune is clearly about a lack of competitive alternatives. This raises the question as to what happens when the scrap finally runs out as it must.

The regular presence of commune officers may have influenced the way local people answered some of our questions during the focus group discussions (e.g. about the legality of metal collection, or activities during the dry season), but not to the extent we obtained misleading information. We checked information collected during these discussions, while conducting the household surveys, to which no commune officer attended. Our results show that the role of metal collection was decreasing in Khe Tran and there was little

direct dependency within this community. On the other hand, many full-time metal collectors, mainly poor landless people from outside regularly passed through Khe Tran before entering the forest. The number of people involved in this area (40 000 ha) might well run into the thousands.

The role of war scrap remains largely invisible in the formal economy – and it remains unclear the extent to which decision makers are aware of its significance. Any effort to restrict this trade, which remains important in the areas most affected by war, will certainly have a significant impact on local people, more especially those lacking lands for developing better income-generating activities. In the longer term, this trade cannot be sustained; collectors will be forced to seek alternative sources of income, e.g., plantations with government support for those with land, while others might collect NTFP such as rattan, bamboo and eaglewood, or be forced to migrate to find paid work.

Implications for conservation

Some reviews note that warfare has both negative and positive conservation outcomes (McNeely 2003a, 2003b, Dudley *et al.* 2002). These evaluations are significant, for example in justifying the establishment of transfrontier reserves as demilitarised “no-contact” zones (Westing 1998). But metal collection has been neglected from discussion of such developments.

The land and forests around Khe Tran, including much of the protected area, are relatively degraded (Boissière *et al.* 2009). Forest fires and destructive NTFP gathering both

appeared intimately associated with metal collection. Details remain uncertain due to the role of illegal activities. Metal collection was and remained the main pretext for people entering the protected forest though other factors must have contributed. Our data showed numerous plants that people used, and collectors likely hunted during their stays in the forest. We note that these patterns are common elsewhere in the world when high value resources, such as gold, attract people into a forest; these populations then have a variety of direct and indirect environmental impacts (e.g. Hammond *et al.* 2007).

We were struck by the interest shown by Khe Tran's population in helping achieve conservation outcomes. These villagers see the ongoing degradation of the forest and recognise that the authorities have limited capacity to regulate and control what is happening. They seemed sincere in suggesting they could help monitor and patrol these areas. This would suppose their rights on the area are formally recognized (see also Boissière *et al.* 2009).

A Non Biological Forest Product?

Forest resources are generally thought of as natural biological products (FAO 1999, Belcher 2003). Non-biological resources such as water and minerals are certainly significant in some circumstances but what about processed resources? Scrap metal falls outside the typical products addressed by forest professionals but this is an oversight.

The presence of non-biological resources – scrap metal and valuable minerals, like gold – brings people into many regions that might otherwise sustain far lower human impacts. While we are used to seeing such resources as very distinct from biological products, which might be managed sustainably, there are parallels. The value of sharply bounded categories become increasingly unclear when we see biological resources so often unsustainably exploited, while other resources including water (at least in rain forest climates), volcanic sulphur and others seldom suffer permanent depletion and can be collected on a regular basis.

Scrap metal simply adds to this diversity. Excluding metal from the forest products discussed would exclude the motivation for how and why people use and impact Khe Tran's forests. We propose calling significant products such as scrap and alluvial gold "NBFPs" (Non-Biological Forest Products).

Key resources can determine how people search and interact with their environments. Such collection patterns are known for resources like ivory and rhino horn (Bulte 2003) as well as with forest products like eagle wood (*Aquilaria* spp.) (Wollenberg 2001, Donovan and Puri 2004). Those searching for these resources often gather a wide range of other products for personal use or sale. Likewise, broad trade patterns can be determined by specific "backbone" products that facilitate the market of others (Ruiz-Perez 1995). If the trade in a backbone product ends, this will affect the availability of other forest products. Scrap metal in Vietnam is clearly influencing both the collection and trade of biological forest products. Most traders who buy metal from collectors will also buy other

forest products (rattan, bamboo) from the same persons. It is a backbone product.

CONCLUSION

The availability of metal, and the attractiveness of other livelihood choices, determines how many people live and how they use forest. For some people metal collection remains the principal occupation. The Government's policy of reducing reliance on forests by encouraging plantation crops has been successful in Khe Tran. At the time of this study villagers went to the forest less often than they did in the past, because of the higher and relatively reliable income from plantations and the decreasing and unreliable revenues that could be obtained from metal collection. Some still searched for metal in the forest when they needed cash or had time to spare, but no longer depended on it for regular income. This was not, however, the case for the many people from Phong Son Commune who passed through Khe Tran to access the lands beyond. These people had few livelihood alternatives and metal collection remained a preferred livelihood choice. More research would help clarify who is involved in this activity and how they rely on it.

Researchers and NGO need to focus more on the importance of metal collection in local livelihoods, and not solely on the implied risks. Prohibiting collection would make some of the poorest people even worse off, might force the trade underground, likely increasing the risks people take, and might affect the collection of other forest products.

Villagers in Khe Tran desired formal recognition of their rights to use the forest and its resources (Boissière *et al.* 2009). As the official status of metal collection is still ambiguous, government institutions managing the protected area could use this to negotiate local participation in managing and protecting the reserve. The Khe Tran villagers could also play a valuable role in regulating forest access – a topic we have detailed elsewhere (Boissière *et al.* 2009).

Whether the government seeks to reduce metal collection or not, metal will become harder to find over time. This may encourage collectors to find other occupations, possibly with migration from the region, or if these options are limited it may also intensify trade in other forest products and increase the threat of other lucrative activities such as timber-cutting and animal trading. Much will depend on the options available and the effectiveness of forest protection. In any case, the hardships of dependent metal collectors will intensify in the years to come and alternative livelihood options are needed.

When we first arrived in Khe Tran we were unaware of the importance of scrap metal. By asking what mattered to the people themselves, we identified a topic neglected in the research literature. In this region, even if scrap metal is fading in importance for some villages and villagers (as in Khe Tran), the search for metal still takes many people into the forest (notably the landless collectors from Phong Son Commune) where as well as collecting metal they also impact and harvest other forest products (including some that may be rare or threatened). These practices still affect human wellbeing,

conservation and the environment. We underline the value of working with local guidance and input and advocate wider application of such approaches.

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