

Non-Timber Forest Products in Cat Tien: Local Use and Sustainable Management

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Abstract

Rural ethnic minority groups in Cat Tien National Park (CTNP) have relied heavily on non-timber forest products (NTFPs) and threatened its natural forest environment. Still, the real context of the NTFP consumption between indigenous peoples (IPs) and migrant ethnic minority group (MEs) has been poorly comprehended. Also, the participatory rural appraisal (PRA) and the “walk-in-the-wood” method were applied to analyse the NTFP consumption between these IPs and these MEs. The study results indicated that the two local groups had a high or a relatively high dependence on the NTFPs and there was a shifting trend from subsistence to cash income (p -value = $0.000 < 0.05$). Also, these IPs had a better knowledge about edible forest plants than these MEs, whilst various more MEs consumed forest fauna for medicinal demand. These MEs harvested and consumed those NTFPs more intensively, but these IPs did the resources for more self-consumption related to the indigenous traditions. Based on the local context, NTFP use patterns, cultural dissimilarity, and local capacity empowerment remain needed in park administration strategies. Similarly, culture-based arrangements would contribute to positive outcomes and sustainable management of the park.

Keyword: culture-based arrangements, ethnic groups, forest dependence, potential species, sustainable use

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Introduction

Conventionally, non-timber forest products (NTFPs) in tropical forest areas have played an essential role in rural residents' livelihood. Also, rural population growth and local poverty in many tropical countries have been the root cause of harvesting available NTFPs under unsustainable conditions (Knapp, 2012; Gladman et al., 2012; Wikle & Le, 2013; Oliva et al., 2014; Scales, 2014; McElwee, 2016; Pham et al., 2018; Dinh, 2020; Dinh & Pham, 2020a; Budiman et al., 2020). Likewise, poor residents as well as ethnic minority groups (EGs) in tropical countries have relied much on NTFPs from natural forests or protected areas (Dinh et al., 2010; Knapp, 2012; Karki, 2013; Dinh, 2019; Utami et al., 2020; Dinh & Pham, 2020b; Masyud et al., 2020; Figel et al., 2021). Consequently, this negative tendency has caused biodiversity loss and habitat degradation in various national parks as well as protected areas (Wikle & Le, 2013; Pham et al., 2018; Dinh & Pham, 2020b; Figel et al., 2021; Dinh, 2022).

With reference to Cat Tien National Park (CTNP), this protected area has high biodiversity and its NTFPs have been threatened mainly by encroachment of forest land, uncontrolled extraction of edible flora, poaching, illegal logging, and grazing in its core zones (Dinh et al., 2012; Nguyen & Hoang, 2013; Emerton et al., 2014; Dinh, 2022). Also, various families of the migrant ethnic minority groups

(MEs) and the indigenous peoples (IPs) in this park have relied heavily on these NTFPs (Dinh, 2020). Likewise, similar to the other cases in other tropical countries (Utami et al., 2020; Figel et al., 2021), the local consumption in CTNP has raised the major challenge on the natural forest administration and conservation.

In spite of forest management efforts by the local authorities, the biodiversity loss and the forest habitat degradation in Cat Tien have been recorded (Dinh et al., 2010; Nguyen & Hoang, 2013; Pham & Vu, 2013; Dinh, 2020; Dinh, 2022). Thus, the sustainable development goal has not yet been achieved in this protected area. Some scholars (Dinh et al., 2012; Nguyen & Hoang, 2013; Emerton et al., 2014; Dinh, 2019) highlighted the NTFP contribution to the livelihood of the local people or the IPs in the park. Besides, the attitudes towards biodiversity conservation were significantly different between the IPs and the MEs in CTNP (Dinh, 2020). Still, the local context in the NTFP consumption between the two groups in Cat Tien has been poorly comprehended. Hence, understanding constraints caused by the NTFP use between the IPs and the MEs in CTNP is needed. Consequently, the paper was to analyse the NTFP consumption context between the IPs and the MEs and to provide the recommendations for managing sustainable NTFPs and livelihood in CTNP.

Methods

Study area Located in southern Vietnam, CTNP covers an area of approximately 82,597.4 ha and is the home of about 204,000 persons (Figure 1). This park is a special-use forest and includes 1,618 vascular plant species and 1,521 fauna species. Interestingly, 93 mammal species and 47 forest plant ones of CTNP are recorded in IUCN Red List of Threatened Species. Historically, the IPs have been residing in CTNP for various generations. Conversely, the MEs and Kinh group have moved to the areas and settled there since about 48 years ago.

Data gathering The study data were gathered in accessible places where the EGs were residing and there was the wild forest. Moreover, the local households depended on these NTFPs in CTNP. Based on the criteria, 6 hamlets in the park were selected. The IPs and the MEs made up nearly 88.1% of the population in the survey areas. The local authority permissions were sought before the field surveys. The Participatory Rural Appraisal (PRA) method (Chambers, 1994) was employed to collect primary data initially through household interviews, filling out 188 questionnaires and focus group discussions. Approximately 7–12 respondents participated in a group meeting. The questionnaires concerned socio-economy and NTFP consumption of the IPs and the MEs. The language used in the questionnaires and interviews was Vietnamese. Before gathering the field data, the questions were tested on few households in a pilot site to remove those that proved unsuitable for the study area. Triangulation was applied in the data collection in order to gain the validity and reliability of the study results. The

technique for collecting the study information complied with the Helsinki Declaration.

Also, the “walk-in-the-wood” method (Prance et al., 1987) was used. Each survey in the forest was organised with about 2–3 local elders knowing about the NTFPs. A scientific name of a NTFP species was recognized by crosschecking the local people's wisdom and matching the vernacular name with the one in these following documents: Medicinal plants and traditional medicines in Vietnam (Do, 1995) and an illustrated flora of Vietnam (Pham, 2000).

Data analysis A number was used to code for each information category collected (Jehn & Doucet, 1996). The extraction intensity of a product was covered as (2) high – a large quantity of the NTFP gathered on account of high demand, more than 10 kg of NTFPs per trip; and (1) medium – a moderate quantity of those collected thanks to moderate abundance or harvesting difficulty, more than 5 – 10 kg per trip. Local demand was categorised as (2) high – easy to sell a large quantity of the NTFPs, (1) low – subsistence and sometimes the NTFPs sold in the rural markets. For the purpose in terms of local income generation, the level range categorised (0) – never, (1) – 1 to 25%, (2) – 26 to 50%, (3) – 51 to 75%, and (4) – 76 to 100%. On the basis of the local harvesting, frequency – (0) never, (1) rarely, (2) sometimes, (3) very often, (4) always – and the number of the NTFP use classification, the scales ranged from low to high: (1) low dependence (1–7 times per month, up to 5 kg of NTFPs per trip and mostly for subsistence), (2) – medium dependence (8–15 times per month and more than 5 – 10 kg per trip), (3) relatively high dependence (16–22 times per month), and (4)

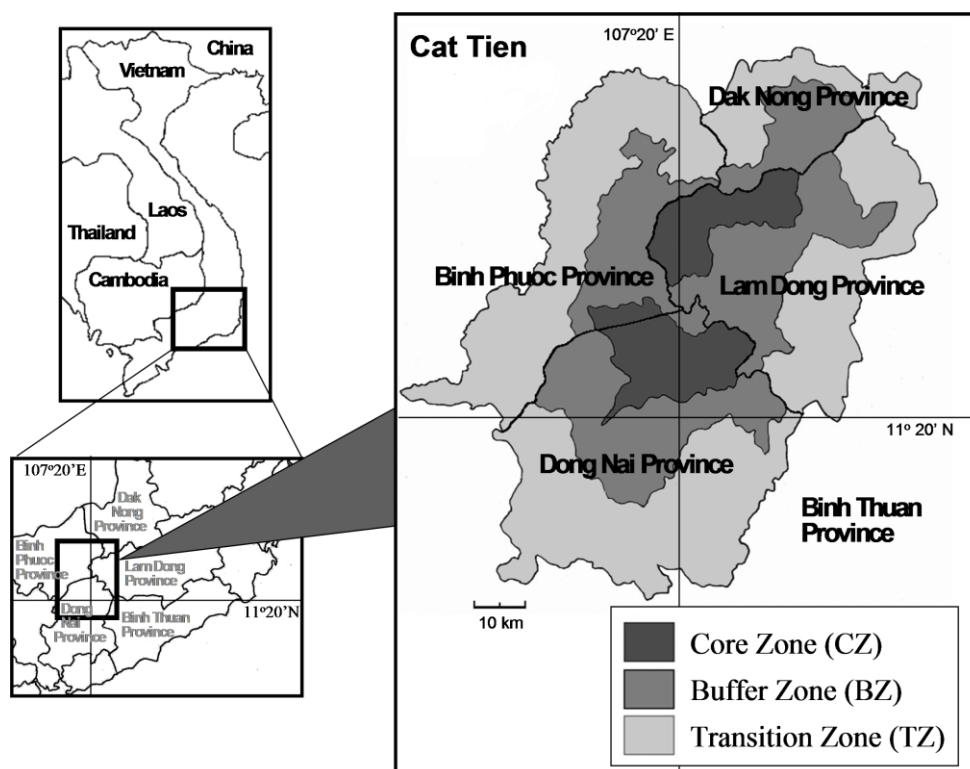


Figure 1 Location of CTNP (Dinh et al., 2010).

high dependence (more than 23 times per month, more than 20 kg per trip and mostly for cash income).

In order to figure a use index (UI) for a NTFP species, the equation was applied: $UI = U_s/N$ (Phillips & Gentry, 1993), where U_s was the respondent number utilising the NTFP species s in the core zone in Cat Tien, N was the total study households. Also, Paired sample t -test and Pearson's chi-square test were applied for this study.

Results and Discussion

Demography Approximately 63.1% of the population in the selected sites was the IPs. 100% of the IPs have resided in CTNP for various generations. Besides, 87.2% of the MEs moved to the areas and settled there between about 27 and 48 years. 100% of the interviewees identified themselves primarily as farmers who raised paddy, vegetable, maize, peanut, cassava, and other perennials like cashew, coffee, and fruit crops. Only 1.1% of the respondents formally had non-farm jobs like hamlet officials or foresters. About 17.0% of the informants who were farmers involved in off-farm activities such as seasonal wage earnings, trade and handicraft. The percentage of the very poor and poor families in the areas was high: 30.9% and 31.9% of the total interviewees, respectively. Moreover, the EGs faced challenges like low yields and low agricultural production, low financial and produced capitals (Dinh, 2022). They were not involved in domestication techniques of potential species or sustainable extracting practices.

Of the interviewees in the study sites, 118 (62.8%) were male and 70 (37.2%) were female. Their mean age was 48.2 (median 47.0 year) and that of males and females were accounted for 49.1 years and 46.6 years, respectively. Most of the respondents had low education levels and more than 22.3% of them had no formal education. Half of the interviewees (50.0%) had completed 1–5 years of formal education, whilst 0.0% of the respondents had higher education. The interviewees who had completed 10–12 year formal education accounted for only 4.8%, and approximately 22.9% had 6–9 years of education.

NTFP utilisation 100% of the two group respondents extracted and consumed some or a lot of edible forest flora species. On the whole, the findings indicated that 118 species of edible forest plants and fungi (EFPF) belonging to 60 families in CTNP were used by the IPs, whilst 76 EFPF were extracted by the MEs (Table 1). Moreover, the two groups' use of EFPFs for food as well as vegetable was more common than the medicinal use and others (Figure 2). The use pattern

of the EFPFs in terms of medicine and pickle between the MEs and the IPs was different. Several EGs in the areas mentioned that the local utilisation of the EFPF such as bamboo species and *Scaphium macropodum* had been much more important for income generation than for self-consumption. The most frequently extracted NTFPs consumed by the MEs included some bamboo species, *S. macropodum*, *Peperomia pellucida*, *Willughbeia cochinchinensis*, and *Auricularia polytricha*. Conversely, all of the IPs stated that rattan shoots and young leaves of *Gnetum gnemon* were really familiar with their daily meals.

The IPs and the MEs (59.4%) both logged poles for the construction of their traditional houses, warehouses, breeding facilities, farming tools, fences, and wooden bridges. Both of the groups used various species of bamboo and rattan for construction, furniture, handicraft, and other home instruments. Also, all of the indigenous households and about 94.6% of the MEs harvested and consumed a lot of forest plants as fuelwood. Most of the IPs gathered fuelwood and carried it in a dossier (Gùi in Vietnamese) on their backs, whilst the MEs did not use dodders to carry this product or others. They harvested approximately 20 kg of fuelwood each time.

According to the study result, the use ratio of leaves and fruits among the IPs were much more than the others, 24.7% and 19.1% respectively (Table 2). All of the indigenous respondents agreed that various leaves and fruits from CTNP had been their traditional foodstuffs. Interestingly, leaves of 46 forest plant species was used to make their indigenous alcohol called “tube wine” (Rượu cần in Vietnamese). According to Dinh (2019), the plant resource in CTNP became a vital part of the indigenous food culture. Instead, the most common parts used by the MEs were plant stems (21.3%) (Table 2). They used stems for home appliances, construction materials, and agricultural amenities. It appeared that their different histories and cultures were closely linked to the NTFP use.

Both of the EGs have poached forest animals for income generation and subsistence. Still, this has caused a serious conflict between the EGs and the foresters. Nearly 21.3% of the respondents poached wild animals and 16.0% of them extracted natural honey. The fauna conservation impact of this activity was likely to be high, so more forestry law enforcement should be made. The EGs poached many common forest animals such as bamboo rats, birds, eels, fish, frogs, gecko, jungle fowls, monkeys, pythons, pangolins, snails, snakes, weasels, and wild boars. Like the case in Bu Gia Map special-use forest (Dinh & Pham, 2020a), the EGs

Table 1 Ratio of EFPF species used by the MEs and the IPs in CTNP (Source: Field surveys)

Taxon	Family		Species			
	Number	Proportion (%)	Used by the IPs		Used by the EMs	
			Number	Proportion (%)	Number	Proportion (%)
Basidiomycota	3	5.8	4	3.4	3	3.9
Magnoliophyta	46	88.5	105	89.0	69	90.8
Pinophyta	1	1.9	7	5.9	3	3.9
Polypodiophyta	2	3.8	2	1.7	1	1.3
Total	52	100	118	100	76	100

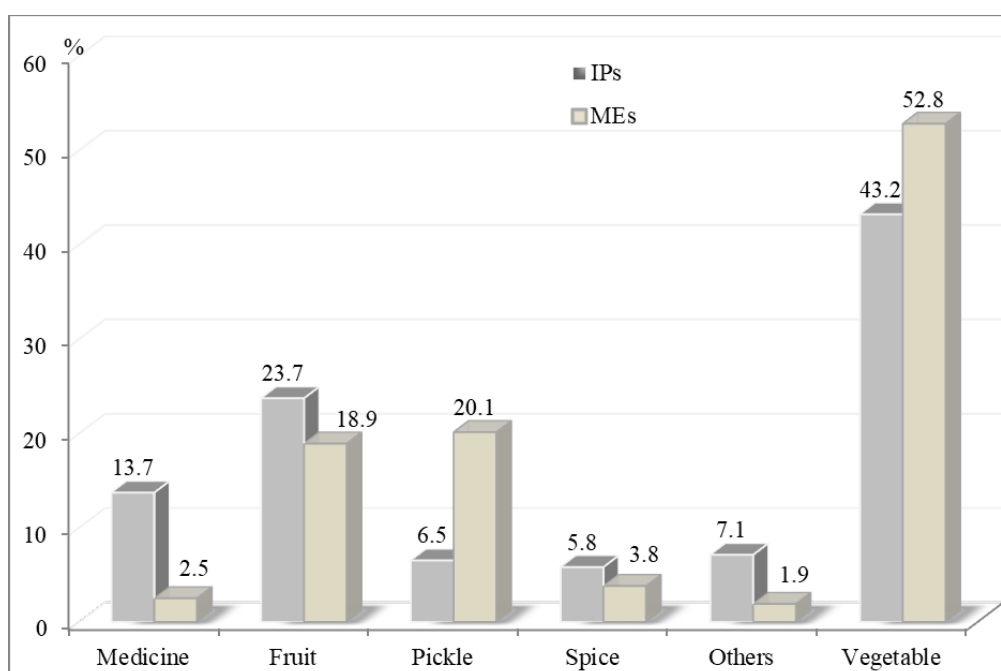


Figure 2 Use pattern of edible plants and fungi by the IPs and the Mes.

Table 2 Use ratio of NTFP parts by the MEs and the IPs in CTNP (%) (Source: Field surveys)

Group	Leaf	Fruit	Whole plant	Stem	Shoot	Bark	Flower	Tuber	Root	Seed	Petiole	Rhizome	Resin
IPs	24.7	19.1	11.8	10.7	9.0	5.6	4.5	3.4	2.8	2.8	2.2	2.2	1.1
MEs	15.7	10.1	13.5	21.3	15.7	4.5	3.4	1.1	2.2	5.6	1.1	3.4	2.2

in Cat Tien also poached forest fauna in conjunction with harvesting of other forest resources in the core zone. The patterns of poaching did not differ significantly between the MEs (23.6%) and the IPs (20.3%) ($\chi^2 = 0.258, p\text{-value} = 0.611 > 0.05$). Yet, the percentage of the two group households making and consuming forest fauna for medicinal use was significant, 21.1% and 56.4%, respectively ($\chi^2 = 22.529, p\text{-value} = 0.000$). Especially, the MEs made and used various medicinal products like scales of pangolins; monkey glue; python fat; and animal wines made from venomous snake, scorpion, gecko; and so on. Like the study case in Papua (Pangau-Adam et al., 2012), about 97.5% of the study poachers stated that poaching in Cat Tien had changed from “wild meat” to “bush meat”, or from subsistence to cash income. Clearly, the biodiversity conservation impact of the tendency remained likely to be really high.

The local fishing activity in this park has been the most common livelihood strategy among the EGs because this has been considered as their customary utilisation of NTFPs. Approximately 79.3% of the study households involved in harvesting natural fish in the sites. These forest products have been the common food of these EGs in this park. Regrettably, electric shockers have been used to catch natural fish and other aquatic products by 25.0% of the study households. There was no difference in the ratio of this fishing method between the IPs and the MEs ($\chi^2 = 0.009, p\text{-value} = 0.926 > 0.05$).

The EGs in the park harvested and consumed various

categories of the NTFPs consisting of edible forest plants (100%), fuelwood (98.4%), medicinal plants (58.5%), and folder for grazing (58.0%), forest animals (21.3%), and wild fish (79.3%). According to Figure 3, the percentage of the NTFP consumption in terms of rattan was significant difference between the two groups ($\chi^2 = 1.004, p\text{-value} = 0.000$), but that of the various others did not differ significantly. Using the forest product for self-consumption was one of the most essential livelihood strategies among the IPs. Thus, the impact on park management and policy was likely to be dissimilar between the IPs and the MEs.

Approximately 59.0% of the study families were highly dependent on the NTFPs. According to Figure 4, about 18.1% of the interviewees belonged to the relatively high dependence, the medium dependence accounted for 11.2%, and the low dependence had 11.7%. There was no difference in ratio of NTFP consumption between the two groups ($\chi^2 = 2.891, p\text{-value} = 0.409$).

As shown in Figure 5, the purposes of NTFP consumption changed from subsistence to cash income and the shifting tendency was significantly different (Paired sample *t*-test, $p\text{-value} = 0.000$). Particularly, nearly 53.8% of the families interviewed consumed 76–100% of these NTFPs for income generation, whilst that figure was 21.3% in 1998 (Figure 5). Besides, the figure of 51–75% of the NTFP utilisation for the purpose between 1988 and 2022 was different: 17.5% and 28.7%, respectively. In addition, in 2022 only 10.1% of the informants did not utilise these NTFPs for income

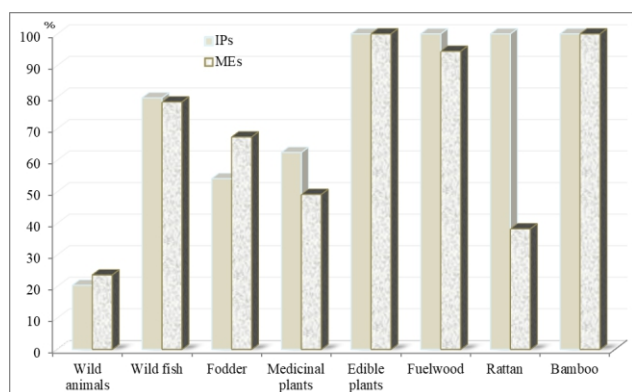


Figure 3 Frequencies of the NTFP use between the IPs and the MEs.

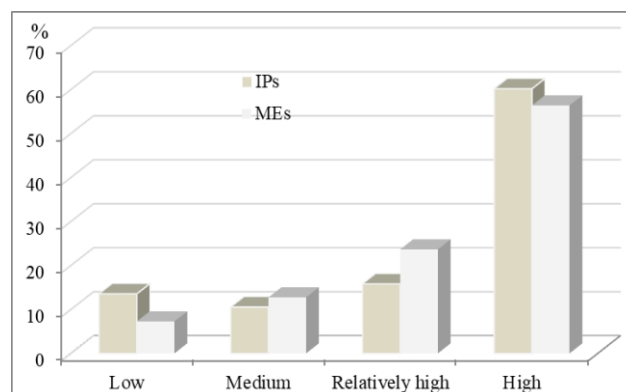


Figure 4 NTFP use patterns between the IPs and the MEs.

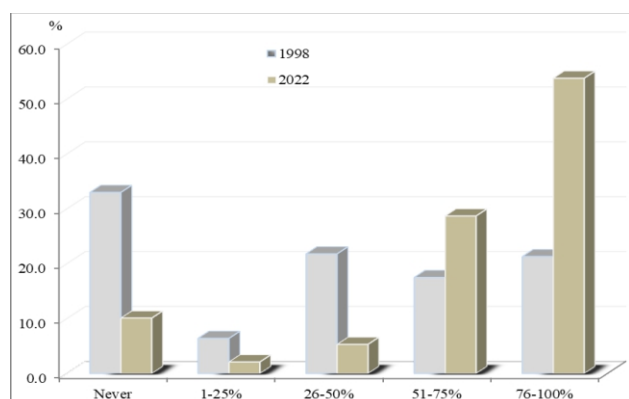


Figure 5 NTFP use patterns between the IPs and the MEs.

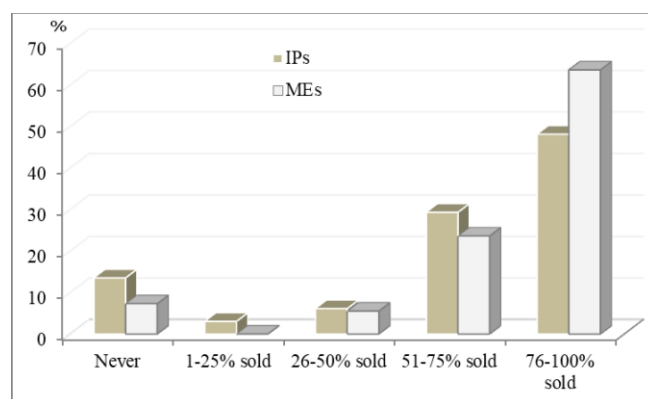


Figure 6 Ratio of the NTFP use for cash income between the IPs and the MEs in 2022.

generation, but in 1998 this figure was 33.0%. According to in Figure 6, the percentage of NTFP utilisation for cash income did not differ significantly between the MEs and the IPs ($\chi^2 = 5.212$, p -value = 0.266). In summary, it appeared obvious that the local utilisation patterns of NTFPs in this park had a shifting tendency from self-consumption to cash income purpose. The biodiversity management impact of the tendency was likely to be really high. Thus, sustainable living strategies for the EGs in CTNP are needed.

Management implications Like various case studies in Southeast Asia (Dinh et al., 2012; Pangau-Adam et al., 2012; Pham & Vu, 2013; Dinh & Pham, 2020a; Dinh, 2020; Figel et al., 2021), with the large population in and around Cat Tien, the two local groups' demand on those NTFPs remained at a really high intensity (Figure 7). The study indicated that both of the EGs living in the park relied much on its NTFPs like edible forest plants (Figure 8), fuelwood, construction poles, medicinal wild plants, wild meat; and materials for agricultural tools, shelters, furniture, handicrafts, and indigenous instruments. Certainly, the reason for the really high consumption of those NTFPs was that 62.8% of the interviewed families were very poor or poor and most of them had low schooling levels. Particularly, similar to the

other studies in Papua and Jambi (Pangau-Adam et al., 2012; Masyud et al., 2020), the poaching purposes in Cat Tien had a change from subsistence to income generation. According to Dinh (2020), all of the study households stated that CTNP did not have more wild animals at that time than a decade before. Thus, the poaching tendency had the highly negative influence on the natural forest conservation. These IPs and these MEs have lived in a finite region, while these NTFPs inside the park could not be maximised at the same time. As a result, the tragedy of the commons (Hardin, 1968) happened as the NTFPs in CTNP were harvested under unsustainable conditions (Dinh, 2022). In spite of park administration efforts, the most challenges in Cat Tien forest was the violation of Vietnam forestry law. To overcome the park tragedy, participatory special-use forest management has ever been one of the effective solutions as it has raised a positive influence on national parks and local socio-economic strategies (Dinh et al., 2010; Huynh et al., 2016; Pham, 2018; Dinh & Pham, 2020a; Dinh, 2022). Moreover, the IPs and the MEs should be motivated in income generation programmes.

These IPs were far more likely to consume those NTFPs for more subsistence related to customary use than these MEs. Moreover, these IPs in Cat Tien have an indigenous



Figure 7 Bamboo shoots harvested and carried from the core zone by a ME in CTNP (Source: Photo by the author).



Figure 8 Bamboo shoots harvested and pre-processed by an IP in Ta Lai, CTNP (Source: Photo by the author).

culture related to the NTFP consumption for various centuries. Among the edible forest flora consumed by the EGs, the IPs used shoots of various rattan species like *Calamus poilanei*, *C. tetradactylus*, *Plectocomiopsis geminiflora*, and *Korthalsia laciniosa* as a traditional food, while the MEs disliked the bitter taste of the rattan. In

particular, all of the IP interviewees were really fond of the bitter taste of *P. geminiflora*, whilst 100% of the MEs did not actually like that taste. Interestingly, the IPs were so familiar with the rattan resource that the products appeared almost in their common food as well as domestic appliances or indigenous handicrafts like traditional dossers. Conversely,

the MEs utilised resource canes as ropes. According to Dinh (2019), thanks to the ecological knowledge, the IPs could collect the NTFPs more efficiently. In addition, NTFPs consumed as vegetable by S'tieng IPs in Cat Tien made up nearly 60.0% of the total use. Among them 12.8% species had $UI \geq 0.8$ (Dinh, 2019). As shown in Vietnam forestry law, human intervention in the resource integrity inside special-use forest area is strictly prohibited (NASRV, 2017). Still, it is really hard to exclude the IPs from using various vital NTFP species since most of these households have resided in this park for various generations and natural forest flora used by these people has closely linked to their indigenous culture. Besides, under decree 75 (GSRV, 2015), EGs participating in protection and development of forest have the right to collect some kinds of forest products under sustainable rates.

This research indicated that the dependence on the NTFPs in term of the local cultural purpose differed between the two groups. Similarly, these IPs consumed many different species of Arecaceae and Gnetaceae for more subsistence related to the indigenous meals, whilst these MEs were not familiar with these for common food. The flora conservation impact of extracting the natural forest plants for indigenous food seemed high. Hence, the most potential species should be domesticated for the IPs' subsistence demand. Besides, similar to the other case studies in Vietnam and Zimbabwe (Tarakini et al., 2018; Dinh, 2019; Dinh, 2022; Dinh & Pham, 2020a), the IPs' knowledge of should be applied to local NTFP utilisation, domestication and forest management. Also, the MEs and the IPs could be involved in domestication techniques of potential species; agriculture practices; ecotourism; sustainable extracting practices; and capacity empowerment.

Conclusion

The results indicated that IPs and the MEs had a high or a relatively high dependence on the NTFPs in CTNP and tended to shift from self-consumption to cash income. In addition, the MEs harvested and consumed these NTFPs more intensively, whilst the IPs utilised the resource for more subsistence related to the indigenous culture. Still, unsustainable harvesting in the face of increasing income generation and self-consumption was endangered the NTFP management and presented challenges for nature conservation of the park.

Recommendation

On the basis, sustainable strategies for efficient NTFP management and sustainable park administration are proposed. To put it simply, participatory programmes could be designed more specific for different study EGs. Culture-based arrangements might contribute to sustainable extraction, planned utilisation and management of the NTFPs. The two EGs should be engaged in capacity empowerment. Also, the IPs should be motivated to take part in forest protection and planned harvest of NTFPs. In order to lighten the EGs' dependency on these NTFPs, income generation-based programmes, fitting solutions of the NTFP utilisation and education of biodiversity value should be required. Particularly, it is vital to domesticate really potential NTFP species retained on their indigenous

traditions and meet the two groups' demand for nutrition. Besides, eco-industrial parks and farms of potential NTFPs should be established in the buffer zone of Cat Tien. More research should focus on the wildlife trafficking context inside the core zone. Moreover, enforcement of Vietnam forestry law and regular monitoring of NTFP utilisation would contribute significantly towards the forest protection and sustainable conservation in Cat Tien.

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