For. Stud. China, 2012, 14(1): 1–**
DOI 10.1007/s11632-012-0104-7

RESEARCH ARTICLE

Contribution of NTFPs to cash income of the *War Khasi* community of southern Meghalaya, North-East India

H. TYNSONG[1*], B. K. TIWARI[2]

[1] Regional Centre National Afforestation and Eco-Development Board, North-Eastern Hill University, Shillong-793022, India
[2] Department of Environmental Studies, North-Eastern Hill University, Shillong-793022, India

Abstract Ever since their emergence on this planet, human beings have depended on forest resources for much(??) of their requirements, ranging from food, fuel to shelter. Sustainable extraction of forest resources has been promoted by conservationists and development agencies as a feasible strategy for forest dwellers that does not diminish the resource base. Yet surveys of actual resource use suggest that for poorer resource-dependent communities without access to markets, non-timber forest products (NTFPs) can only act as a safety net and a supplementary income source. In southern Meghalaya, India, NTFPs and medicinal and aromatic plants (MAPs) have become an important source of cash and subsistence income for poor people living in or near forests. People in this region have traditionally been collecting different forest products from private forests as well as community conserved forests. The study reveals that NTFPs contribute significantly towards the annual cash income of the local population. The contribution of NTFPs to their income was highest in the case of poor families (9.89%), followed by middle income families (3.34%) and the least for the higher income families (1.34%). Our household survey revealed that 100% of the population is directly or indirectly dependent on NTFPs. Household response indicates diversity in both the types and uses of products collected.

Key words forest products, cash income, management, livelihood

1 Introduction

Every year around 13 million hectares of tropical forests worldwide are cleared for timber and land for cultivation (FAO, 2005), with the result that services derived from these forests are either severely impacted or lost completely. These services include watershed management, soil nutrient retention and erosion control, habitat for threatened and endangered species, biodiversity, climate regulation, carbon sequestration and recreation (Howell et al., 2010). While the population of the world as a whole bears the costs of losing global forest services, local populations suffer the loss of local forest services and products which often directly impact the physical, economic and cultural well being of rural households (Shankar et al., 1998; Cavendish, 2000). Tropical forests provide a large number of forest products such as fruit, seed, resin, medicine, bush meat and their by-products known as non-timber forest products (NTFPs). It has been argued that NTFP extraction can contribute positively to sustainable forestry management because it provides tangible economic benefits to poor rural communities while simultaneously conserving biodiversity (Kaushal and Melkani, 2005; Mahapatra et al., 2005). In India for example, sustainable harvesting and management of NTFPs, together with improved market structures, have been endorsed as a strategy to help in improving the economy and nutrition of the rural poor (Mahapatra and Mitchell, 1997; Hiremath, 2004; Shankar et al., 2004; Mahapatra et al., 2005). It has been assumed that the extraction of non-timber forest products from natural forests could serve as the goal of biodiversity conservation and poverty alleviation (Ros-Tonen et al., 1995; Ruiz Perez, 1996). It is estimated that roughly 80% of the developing world, including nearly 60 million indigenous people, depend on wild fruits, seeds, poles for construction and medicinal plants to meet subsistence and supplemental income needs and they play a significant role in providing subsistence and cash income to local populations of the world (FAO, 2005; Belcher et al., 2005; Belcher and Schreckenberg, 2007; Wunder, 2001). Because of the low entry barriers to trade, in terms of skills and capital requirements, and open or semi-open access to NTFP resources, increased trade in NTFPs seemingly opens a window of opportunity for livelihood improvement and poverty alleviation (Neumann and Hirsch, 2000; Sunderlin et al., 2005). Commercial use of non-timber forest products is thus seen as one way to poverty alleviation of the rural poor (Neumann and Hirsch, 2000; Sunderlin et al., 2005).

*Author for correspondence. E-mail: herotynsong@yahoo.com

Careful planning and accurate information is required for any forest policy concerning NTFPs since these might unintentionally impair conservation efforts and the well being of forest-fringe communities, specifically during periods of economic hardship (Byron and Arnold, 1999). For instance, a policy of no protection would likely result in reduced forest cover, leading to decreased availability of NTFPs and causing a loss of NTFP benefits to local communities. At the same time, restricting forest access completely would protect forest species and services, but at a cost to local people, whose livelihoods depend on their ability to appropriate NTFPs freely. As well, if clearing activities are restricted yet access for hunting and gathering is allowed, then NTFP services will continue to be provided as long as the products themselves are not over-harvested. From a conservation point of view by studying the method of harvesting, we may be able to identify those NTFPs that are threatened with over-harvesting and thus aid in conservation efforts. From a development perspective, knowledge of forest dependence by rural poor may add to our grasp of the full range of consequences associated with forest-clearing at one extreme, or restricted access at the other (Musters et al., 2000. Finally, awareness of how resource draw and income dependence may be influenced by market access and income may prove useful to the efforts of policymakers to design both efficient forest management and effective poverty alleviation programs in rural areas. In order to maintain a balance between the twin goals of biodiversity conservation and livelihood enhancement, wider understanding of NTFP usage patterns by forest dwelling communities, their degree of dependence and how it is affected varies among the people belonging to various income categories, is a prerequisite. The objectives of this research is (a) to identify the types of NTFP collected by an indigenous forest-fringe community living in south Meghalaya, (b) to illustrate the extent to which this community relies on these products and (c) to know how benefits from NTFP resources differ among the higher income, middle income and poor families.

2 Study area

In the months of March–May 2008 we organized a research survey in two villages of southern Meghalaya, India, viz., Nongkwai (25°20′N, 91°54′E) and Umkrem (25°14′N, 91°55′E) in the East Khasi Hills District (Fig. 1). The area forms part of the Indo-Burma Global Biodiversity hot spot and the Eastern Himalayas, recognized for its exceptionally rich biodiversity (Myers et al., 2000). The surveyed villages are located close to the Cherrapunjee-Mawsynram Plateau, one of the wettest places in the world. The elevation varies from 350 to 811 m a.s.l. The mean annual maximum and minimum temperatures are 23°C and 13°C, respectively. The mean annual rainfall is 11,565 mm. The slope of the area is predominantly towards the south and the angle of the slope varies between 10°–40°. The area has a large number of rivers and rivulets, which drain into the plains of Bangladesh. At times, narrow and deep river valleys separate one hill range from the next. The population density is sparse. Horticulture, forestry and fisheries are the principal occupations of the people. Agriculture is limited to some small valleys where mainly tuber crops are grown.

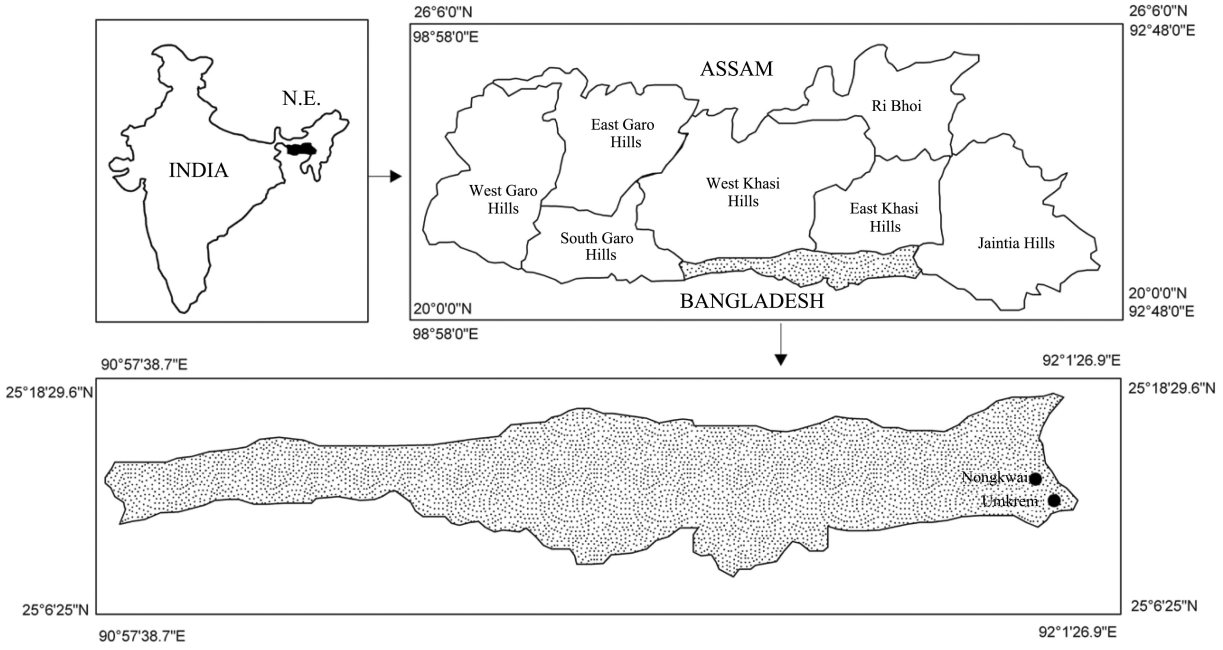

Fig. 1 Map of study area

Arecanut, orange, betel leaf, jack fruit, bayleaf, honey and broom grass are the important produce of the region. The area is inhabited by the *War Khasi* people (approximate population 160,000), a tribal community with a long tradition of forest conservation. People gather a variety of edibles from forests and water bodies including fish, frogs, crustaceans, mollusks, bush meat, tubers and wild vegetables. The staple diet of the local inhabitants is rice, fish and meat. People collect, process and market a large variety of non-timber forest products and medicinal and aromatic plants (MAPs), such as *Cinnamomum tamala*, *Piper peepuloides*, *Phrynium capitatum*, bamboo, honey, mushrooms, nuts, tubers, edible worms, insects and leafy vegetables from the forests.

The natural vegetation of the study area ranges from tropical evergreen to sub-tropical evergreen forests (Balakrishnan, 1983). The plant species in the forests are distributed in distinct vegetation layers. The important evergreen trees found in the south of Meghalaya include *Cinnamomum tamala*, *Daphniphyllum himalayanse, Myrica esculenta, Sarcosperma griffithi,* and *Syzygium tetragonum*. The deciduous elements include *Betula alnoides*, *Cedrela toona, Engelhartia spicata* and *Ficus roxburghii*. The shrub layer is thick and predominantly composed of *Ardisia griffithii, Boehmeria malabarica, Goniothalamus sesquipidalis, Mahonia pycnophylla* and *Wallichia densiflora*. The ground vegetation (herbal layer(?)) is dominated by *Borreria pilosa, Commelina benghalensis, Impatiens* spp., *Ophiorrhiza hispida*, *Sonerila khasiana* and a large number of ferns. There are a good number of lianas and other climbers seen twining on the trees. The tree trunk and branches are covered with large number of mosses, epiphytic ferns and different varieties of orchids. Invasive weed species, such as *Artemisia* spp., *Eupatorium* spp. and *Mikania micrantha,* are also present in large numbers.

3 Methods

Household-level data were collected from the two villages viz., Nongkwai and Umkrem by means of interviews and through household questionnaires during the months of March–May 2008. Interviewers (researchers from North-Eastern Hill University, Shillong, India) generally targeted the male head of households and one adult woman household member also was present to answer questions. Women gave information about certain household production practices of which only they possess knowledge (Wollenberg, 2000). In some households, in which the head of the house was not available, an adult household member with sufficient knowledge of household income and activities was interviewed. The survey was administered to a random sample of 30 households in each of the two villages. The basic demographic information of both the village is presented in Table 1.

Several cash income and subsistence-generating activities were pursued to varying degrees by the *War Khasi* community. These activities include cultivation of cash crops (*Piper betle*, *Thysanolaena maxima* and *Areca catechu*), wage jobs (e.g., harvesting of cash crops, weeding of farms, tree lopping and sorting), contract work (plantation, house construction), odd jobs (head load of cash crops to roadside, shop, work in NREGS) and NTFPs collection (plants, bush meat and aquatic species). Respondents were asked to indicate the type of NTFPs collected (for sale or home consumption) and then were asked to estimate the quantity collected. NTFPs included all types of leaves, fruits, flowers, seeds, nuts, legumes, reptiles, frogs and bush meat collected from the community forest as well as from private forests. There was no minimum quantity criterion for inclusion of a specific NTFP resource in the analysis. Our interest was to find out how collection level and income from NTFP based activities differ among the higher income, middle income and poor families (wealth category). Table 2 summarizes the characteristics of these three income categories based on their approximate average annual income. It was noted that families with greater cash incomes had a better social status, as opposed to that of the poor.

4 Results

The percentage of the sample reporting income (cash or subsistence) from different activities practised by the *War Khasi* community of Meghalaya is shown in Table 3. After cash crop, gathering NTFPs was the most prevalent economic activity in this area. In both study sites, the level of dependence on NTFPs was more or less the same. At Nongkwai village, people derived 9.83% of their cash income from NTFPs, while at Umkrem village the NTFPs contribution towards people cash income was slightly more, i.e., 9.95 %. Therefore, the mean contribution of NTFPs towards cash income in both the villages was 9.89%. In Nongkwai village, the percentage contribution of NTFP to cash income was affected slightly by a lack of road connectivity as gatherers have to pay head

Table 1 Basic demographic features of the study sites

Feature	Village	
	Nongkwai	Umkrem
Total household	201	131
Total population	1608	1048
Average family size	8	8
Average age	35	34
Sex ratio (male: female)	1:1.03	1:1.06
Literacy rate (%)	49.75	79

loaders for transporting products to the road side. For *War Khasi* households, cash income from hunting activities (bushmeat) i.e., hunting income, supplied only 0.16% and 0.26% of the total income at Nongkwai and Umkrem respectively.

All households from the two villages reported collection of NTFPs and many households reported collecting multiple types of forest products. These households represented approximately 480 individuals that are, to some extent, dependent on NTFPs for their livelihoods. All the households collect edible NTFPs for subsistence, indicating that the forest acts as a source of food in their daily life. A range of forest products was collected at the two research sites. The NTFP collected by the *War Khasi* along with their uses are listed in Table 4. The number of households that collect and sell in local and regional markets of Meghalaya are also shown in Table 4. Collection rates were the highest for packing leaves (*Phrynium capitatum*), mostly for sale. Most leafy vegetables, fruits, medicinal plants, mammals and mushrooms were collected primarily for household use. In term of market prices, latex and wild pepper (*Piper peepuloides*) fetched the highest prices.

The households at Nongkwai and Umkrem collect NTFPs both for sale and for their own consumption. The products solely collected for sale were *Cinnamomum tamala, Thysanolaena maxima* and *Piper peepuloides*. Of the total 53 NTFPs collected, only one species at Nongkwai and two species at Umkrem were collected for sale only, 35 and 27 for own consumption and 16 and 19 for own consumption as well as for sale at Nongkwai and Umkrem respectively (Table 5).

To make our analysis easier, Non-Timber Forest Flora were further subdivided into fruits, leafy vegetables and others, while Non-Timber Forest Fauna were divided into bush meat (mammals and birds), aquatic products (fishes and frogs) and insects (Giant Asian honeybee and Honeybee). This classification is based on their shared characteristics. Table 6 summarizes collection participation, the mean number of collection trips per person per year and mean annual income per household. The overall mean annual income per household from NTFPs is Rs. 10,008; fruits (Rs. 4,800) were the main contributor, followed by others (Rs. 2,400) and leafy vegetables (Rs. 1,127).

The percentage of household incomes, based on wealth ranks, from non-NTFP income and NTFP income is presented in Table 7. NTFPs contributed the highest percentage towards the annual income of poor families (9.89%), followed by middle families (3.34%) and the least was for rich families (1.34%). This is true because poor families collect large quantities of NTFPs both for household consumption as well as for sale, whereas middle and rich families collect smaller amounts and mostly for household consumption, except for a few species which have regional market demand viz., *Cinnamomum tamala*, *Piper peepuloides* and *Phrynium capitatum*.

Table 2 Summary of characteristics of wealth ranks by income and method of participation

Parameter	Category		
	Higher income families	Middle income families	Poor families
Number of households	Nongkwai = 2; Umkrem = 12	Nongkwai = 120; Umkrem = 80	Nongkwai = 68; Umkrem = 39
Average annual income (Rs)	> 100,000	50,000–1,00,000	< 50,000
Participatory wealth ranking criteria	i) Large plantations (5–6 plantations of approx. 40 ha each); ii) hire labor; iii) higher level of cash income; iv) houses made of concrete cement; v) good standard of living; vi) rely on NTFPs mostly for own consumption.	i) Small plantations (2–3 plantations of approx. 40 ha each); ii) lower level of cash income; iii) houses made of wood covered by tin; v) collect NTFPs; vi) rely on forest; vii) work as laborers for few months.	i) Do not have plantation; ii) generally laborers; iii) very low level of cash income; iv) houses made of bamboo covered by straw/tin; v) collects NTFPs; vi) heavily dependent on forest; vii) work in NREGS scheme.

Approximate currency conversion 1 USD = Rs. 45 (INR).

Table 3 Per cent annual income from different sources reported by *War Khasi* households of southern Meghalaya (March-May 2008)

Research site	Cash Crop/%	Off-farm employment/%			NTFPs collection/%			Non-NTFP income/%	NTFP income/%
		Wage job	Contract work	Odd job	Plant	Bushmeat	Aquatic species		
Nongkwai	58.34	12.43	5.43	13.98	7.32	0.16	2.35	90.18	9.83
Umkrem	63.24	10.57	5.79	10.45	8.50	0.26	1.19	90.05	9.95

Note: N=30 per village. NB: define N !!

Table 4 Non-timber forest flora and fauna collected by *War Khasi* people of Meghalaya

Common name	Scientific name	Part collected	Use	*N* collection (selling)	Market price (INR·kg^{-1})
Plant origin					
Jackfruit	*Artocarpus heterophyllus*	Fruit, Seed	Income, Food	45 (6)	8
Burmese grape	*Baccuarea sapida*	Fruit	Income, Food	31 (14)	15
Bamboo	*Bambusa tulda*	Young Stem	Handicraft, Income	48 (13)	6
Bamboo	*Bambusa vulgaris*	Stem, Young Shoot	Construction, Food	28 (0)	5
Begonia	*Begonia palmata*	Young Leaves, Rhizome	Food, Medicine	30 (0)	15
Thatch leaf	*Calamus arboresence*	Leaves	Roof Thatching	17 (0)	10
Small rattan	*Calamus gracilis*	Stem, Ripe Fruits	Handicraft, Food	26 (0)	15
Large rattan	*Calamus latifolius*	Stem, Ripe Fruits	Handicraft, Food	20(0)	25
Medium rattan	*Calamus tenuis*	Stem	Handicraft.	17 (0)	10
Asiatic pennywort	*Centella asiatica*	Leaves	Medicine	12 (0)	35
Bayleaf	*Cinnamomum tamala*	Leaves	Income, Spice	24 (24)	10
Hatkora	*Citrus macroptera*	Fruit	Income, Food, Medicine	19 (3)	15
Bagflower	*Clerodendrum colebrookianum*	Young Leaves	Food, Medicine	37 (0)	20
Tree turmeric	*Coscinium fenestratum*	Bark, Stem	Medicine	8 (0)	40
Black musale	*Curculigo capitulata*	Leaves	Fibre	29 (0)	35
Mackay bean	*Entada scandens*	Seeds	Income, Food, Shampoo	36 (14)	150
Spirit weed	*Eryngium foetidum*	Leaves	Medicine, Food	27 (0)	35
Weeping fig	*Ficus benjamina*	Latex	Income, Bird's Trapping Glue	33 (5)	250
Not available(???????)	*Ficus infectoria*	Bark	Fibre	3 (0)	10
Giant Indian fig	*Ficus roxburghii*	Young Leaves	Food	33 (0)	15
Indian plum	*Flacourtia jangomas*	Ripe Fruits	Food	9 (0)	50
Chaulmoogra	*Gynocardia odorata*	Fruit, Bark	Income, Food, Fish Poisoning	30 (18)	150
Hemidesmus	*Hemidesmus indicus*	Leaves	Medicine	22 (0)	15
Chinese lard plant	*Hodgsonia heteroclita*	Seed	Food	9 (0)	50
Not available	*Merremia hedereaca*	Roots	Medicine	30 (0)	150
Shame plant	*Mimosa pudica*	Leaves	Medicine	21 (0)	20
Banana buds	*Musa* sp.	Buds	Food	39 (0)	25
Bayberry	*Myrica esculenta*	Ripe Fruits	Food, Income, Medicine	28 (3)	50
Packing leaf	*Phrynium capitatum*	Leaves	Income, Packing	49 (46)	7
Wild pepper	*Piper peepuloides*	Fruits	Income, Medicine	14 (14)	200
Not available(???)	*Sterculia roxburghii*	Ripe Fruit	Food	6 (0)	15
Broomgrass	*Thysanolaena maxima*	Infloresence, Stem	Income, Broom, Medicine	41 (41)	25
Bamboo shoot	Varied	Young Shoot	Food	48 (0)	40
Ferns	Varied	Young Leaves	Food	11 (0)	15
Animal origin					
Giant Asian honeybee	*Apis dorsata*	Honey	Food	14 (0)	150
Honeybee	*Apis mellifera*	Honey	Income, Food	33 (3)	70
Asiatic snakehead	*Channa orientalis*	Meat	Income, Food	15 (0)	20
Brown shrimp	*Crangon crangon*	Meat	Income, Food	36 (0)	50

To be continued

Table 4 (continued)

Common name	Scientific name	Part collected	Use	*N* collection (selling)	Market price (INR·kg^{-1})
Common carp	*Cyprinus carpio*	Meat	Income, Food	11 (0)	150
Flying reptile	*Draco norvilli*	Skin	Medicine	24 (0)	45
Lamta garra	*Garra lamta*	Meat	Income, Food	29 (7)	50
Khasi garra	*Garra lissorhynchus*	Meat	Income, Food	33 (12)	70
Tilak loach	*Lepidocephalus caudofurcatus*	Meat	Income, Food	16 (0)	20
Katli	*Neolissocheilus hexagonolepis*	Meat	Income, Food	37 (10)	50
Termite	*Reticulitermes* sp.	Meat	Food, Bait	38 (0)	15
Mammal	Varied	Meat	Income, Food	32 (15)	150
Bird	Varied	Meat	Income, Food, Pet	28 (12)	250
Frog	Varied	Meat	Income, Food	30 (8)	50
Mushrooms					
Mushroom	*Agaricus campestris*	Mushroom	Income	27 (2)	60
Mushroom	*Auricularia auricula-judae*	Mushroom	Income, Food	29 (3)	40
Mushroom	*Pleurotus petaloides*	Mushroom	Income	32 (3)	50
Mushroom	*Pleurotus* sp.	Mushroom	Income	29 (3)	50

Note: *N* = 60 (total for both villages(??)); approximate currency conversion 1 USD = Rs. 45 (INR).

5 Discussion and conclusions

War Khasi households participate in more than one income-generating activity. On average, the contribution of NTFPs to annual cash income in our study was 9.89%, which resembles the estimates of 14% reported by Mahapatra et al. (2005) in the states of Orissa and Jharkhand, India, 12.78% reported by Howell et al. (2008) on contribution of NTFPs towards the annual cash income of *Jah Hut* households in Malaysia, but much(?) lower than the contribution of NTFPs reported in studies by Ganesan (1993) in Tamil Nadu (24%), and Gunatilke et al. (1993) in Sri Lanka (21%). The data demonstrate that sales of NTFPs and NTFP-based products are an important source of cash income. In our study, fuel wood, fodder and many other products were not sold for cash income but were collected for household use. In addition, in the surveyed villages, 100% of households were directly or indirectly involved in collecting NTFPs.

Based on wealth ranks there was a wide difference in degree of dependence on NTFPs. The data shows wide variation in the relative contribution towards annual cash income of higher income (1.34%), middle income (3.34%) and poor families (9.89%). This lead us to the question: " Do poor people depend on forest resources because they are poor, or are they poor because they depend on forest resources?" As we have seen the rich and middle class families have other livelihood options, mainly cash crops which are more productive, which the poor families lack. Poor people depend on forest product because they do not have any alternative source of livelihood. In the absence of any other job opportunity, poor families have more time to go to the forests to collect these forest products. By and large, the answer is that they depend on forest resources because they are poor.

The study clearly shows that forests serve as a safety net from where people obtain free available food, medicine, shelter, fuel and meat. The presence of large amounts of NTFPs today shows that the traditional mode of harvesting which people learnt from their forefathers did not adversely affect the survival of most of these species. The *War Khasi* community is quite knowledgeable in management of the forest which is the habitat of these species (Tiwari et al., 2010). People have also domesticated a large number of wild plant species which are in high market demand such as *Cinnamomum tamala*, *Citrus macroptera*,

Table 5 Purpose of NTFP collection in two research sites

Purpose of collection	Number of products	
	Nongkwai	Umkrem
Sale only	1 (1.92%)	2 (4.16%)
Own consumption	35 (67.31%)	27 (56.25%)
Sale plus own consumption	16(30.77%)	19 (39.58%)
Total collected NTFPs	52	48

Table 6 Household participation, mean number of annual collection trips and mean annual income per household from NTFP collection

Parameters	Non-timber forest flora			Non-timber forest fauna			Total NTFP
	Fruits	Leafy vegetables	Others	Bushmeat	Aquatic products	Insects	
Participation rate (%)	40.92	39	49.62	50	42.77	47.22	100
Mean number oftrips per collector per annum	63	41	45	53	64	12	278
Mean annual income per household (INR)	4800	1127	2400	142	1200	339	10,008

Note: $N = 60$ (total for both villages); approximate currency conversion 1 USD = Rs. 45 (INR).

Table 7 Per cent income based on wealth ranks from different sources reported by *War Khasi* households (March-May 2008)

Source	Nongkwai			Umkrem		
	Higher Income/% ($N = 4$)	Middle Income/% ($N = 18$)	Poor/% ($N = 8$)	Higher Income/% ($N = 6$)	Middle Income/% ($N = 16$)	Poor/% ($N = 8$)
Cash crops	92.80	65.00	0.00	89.74	61.44	0.00
Wage jobs	1.89	7.46	36.12	5.84	7.78	32.64
Contract work	1.32	11.06	19.89	1.81	10.49	19.95
Odd jobs	3.06	13.21	34.15	0.86	16.86	37.46
NTFP income						
Plant	0.50	2.20	7.00	1.50	1.45	7.50
Bushmeat	0.09	0.07	0.33	0.02	0.32	0.35
Aquatic species	0.34	1.00	2.50	0.23	1.65	2.10
Total non-NTFP income	99.07	96.73	90.16	98.25	96.57	90.05
Total NTFP income	0.93	3.27	9.83	1.75	3.42	9.95

Note: N=30 per village. Source: survey data in 2008. Again N.??

Phrynium capitatum, *Thysanolaena maxima* and *Gynocardia odorata*. The domestication and cultivation of NTFPs is carried out so that people can produce them in larger quantities and also to protect these species from over exploitation in their natural habitat (Tynsong and Tiwari, 2010). The study shows that the *War Khasi* community has often been very creative in devising traditional techniques in which production of economically important NTFPs are actively promoted. The important non-timber forest fauna with good market values includes *Apis mellifera*, *Garra lamta*, *Anguilla bengalensis bengalensis*, *Cyprinus carpio*, *Garra lissorhynchus*, *Neolissocheilus* sp. and *Pseudecheneis sulcatus*. The study also reveals that the region is rich in NTFP resources and villagers, in particular poor households, are dependent on the NTFPs for their livelihood.

Acknowledgements

We are thankful to the Head of the Department of Environmental Studies, North-Eastern Hill University, Shillong for providing necessary laboratories facilities. We are also deeply indebted to Dr. (Mrs.) S. J. Phukan, Scientist (D) Deputy Director, BSI, Eastern Circle, Shillong, for allowing us to consult the herbaria and deputing her staff to help in the identification of plant specimens.

References

Belcher B, Schreckenberg K. 2007. Commercialisation of non-timber forest products: A reality check. Dev Pol Rev, 25: 355–377

Belcher B, Ruiz-Perez M, Achdiawan R. 2005. Global patterns and trends in the use and management of commercial NTFPs: Implications for livelihoods and conservation. World Dev, 33: 1435–1452

Cavendish W. 2000. Empirical regularities in the poverty-environment relationship of rural households: Evidence from Zimbabwe. World Dev, 28: 1979–2003

FAO. 2005. Global forest resources assessment. http://www.fao.org/forestry/site/28699/en. Accessed 13 November 2006

Ganesan B. 1993. “Extraction of non-timber forest products

including fodder and fuelwood in Mudumulai, India". Econ Bot, 47: 268–274

Gunatilke H, Senaratne M, Abeygunawardena M A H P. 1993. "Role of non timber forest products in the economy of peripheral communities of Knuckles National Wilderness Area of Sri Lanka. Econ Bot, 47: 275–281

Hiremath A J. 2004. The ecological consequences of managing forests for non-timber products. Conser Soc, 2: 211–216

Howell C J, Schwabe K A, Samah A H A. 2010. Non-timber forest product dependence among the *Jah Hut* subgroup of Peninsular Malaysia's Orang Asli. Envi Dev Sus, 12:1–18

Kaushal K K, Melkani V K. 2005. India: achieving the Millennium development goals through non-timber forest products. Inter For Rev, 7: 128–134

Mahapatra A, Mitchell C P. 1997. Sustainable development of non-timber forest products: implication for forest management in India. For Eco Man, 94: 15–29

Mahapatra A K, Albers H J, Robinson E J Z. 2005. The impact of NTFP sales on rural households' cash income in India's dry deciduous forest. Envi Man, 35: 258–265

Musters C J M, de Graaf H J, ter Keurs W J. 2000. Can protected areas be expanded in Africa? Sci., 287:1759–1760

Neumann R P, Hirsch E. 2000. Commercialisation of Non-timber Forest Products: Review and Analysis of Research. CIFOR, Bogor, Indonesia

Ros-Tenen M, Dijkman W, Lammerts van Bueren E. 1995. Commercial and sustainable extraction of non-timber forest products: towards a policy and management oriented research strategy. The Tropenbos Foundation, Wageningen, the Netherlands

Ruiz Peres M. 1996. Current issues in non-timber forest product research. CIFOR, Bogor, Indonesia

Shaanker R U, Ganeshaiah K N, Rao M N, Aravind N A. 2004. Ecological consequences of forest use: from genes to ecosystem: a case study in the Biligiri Rangaswamy Temple Wildlife Sanctuary, South India. Cons Soc, 2: 347–363

Shankar U, Lama S D, Bawa K S. 1998. Ecosystem reconstruction through 'taungya' plantations following commercial logging of a dry, mixed deciduous forest in Darjeeling Himalaya. For Eco Manage, 102: 131–142

Sunderlin W D, Angelsen A, Belcher B, Burgers P, Nasi R, Santoso R, Wunder S. 2005. Livelihoods, forests and conservation in developing countries: An overview. World Dev, 33: 1383–1402

Tiwari B K, Tynsong H, Lynser M B. 2010. Forest management practices of the tribal people of Meghalaya, North-East India. J Trop For Sci, 22: 329–342

Tynsong H, Tiwari B K. 2010. Diversity of plant species in arecanut agroforests in the tropical evergreen forest of south Meghalaya, north-east India. J For Res, 21: 281–286

Wunder S. 2001. Poverty alleviation and tropical forests—What scope for synergies? World Dev, 29: 1817–1833

(Received October 10, 2011 Accepted Decemeber 22, 2011)