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Traditional Knowledge Based Forest Management: the Case of War Tribe of Meghalaya, India

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Introduction

Forest resources encompass all products and services emanating from forests that satisfy the needs and wants of humans. Over-exploitation of forest resources by humans is the rootcause of many environmental problems the humanity is facing today. Traditional resource management systems often favour equitable sharing of benefits and integrity of forest ecosystems (Hunnam *et al.*, 1996; Nongbri, 2003; Fitzpatrick, 2005). The modern practice of setting aside legally protected areas for conservation can be seen as an articulation of traditional sacred groves/forests (Gadgil *et al.*, 1993). Traditional resource management systems impose a variety of restraints on nature, intensity, time and quality of products harvested from the forests and on age, sex and social class of people carrying out the harvesting tasks (Gadgil *et al.*, 1992). There are many examples of the norms of prudent resource uses framed by local communities (Krishnan, 2000).

In the hill region of north-east India, large tracts of lands are under the control of local communities, which are predominantly tribal societies, since historical times (Gurdon, 1975; Poffenberger, 2007). Ethnic groups across the globe including those of north-eastern region of India possess a rich traditional knowledge (TK), which is poorly documented and hence lesser known to the wider community. The scope of TK in biodiversity conservation and climate change mitigation and adaptation is getting more

and more recognized in recent years. The traditional knowledge related to health-care, fisheries, forest management and pest management possessed by some tribes of Meghalaya has been documented by Tynsong and Tiwari (2008) and Tynsong *et al.* (2009). This article is an attempt to showcase the traditional forest management related knowledge of War community of south Meghalaya.

Study area and methods

The study was conducted in south Meghalaya, locally known as the War area (25°6'25"-25°18'29" N latitude and 91°57'38"-92 ° 1'26" E longitudes) (Figure 1) named after the local inhabitants, the War Khasi tribe located in the vicinity of Cherrapunjee-Mawsynram plateau, one of the wettest spots of the planet. The altitude varies from 100 m to 1200 m amsl. The mean annual maximum and minimum temperatures are 23°C and 13°C, respectively. The area is dominated by south-facing slopes of 10^0-40^0. Horticulture, forestry and fisheries are the principal occupations of people. Tuber crops are grown in small patches of valley land. Arecanut, orange, betel leaf, jack fruit, bay leaf, honey and broom grass are the major produce of the region. People gather a variety of wild edibles including fish, frog, crustaceans, mollusks, bushmeat, tubers, fruits, medicinal plants and vegetables. Non-timber forest products (NTFPs) are crucial to local livelihood (Tiwari, 2000, 2005).

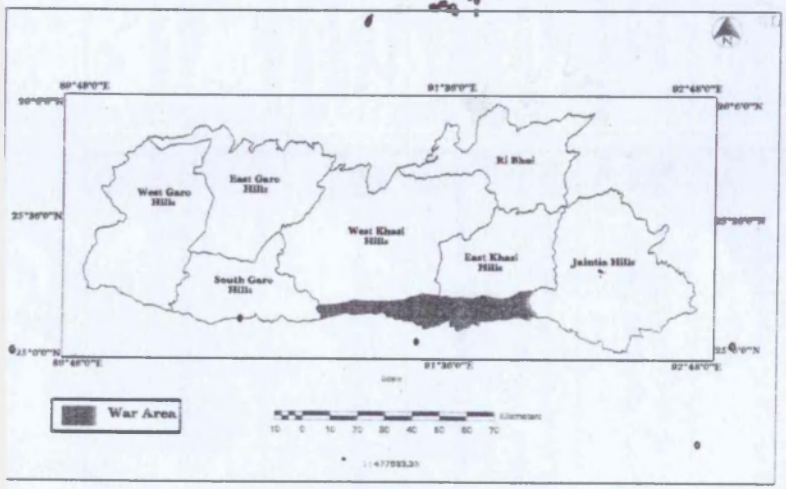

Figure 1. Location of the study area

The potential vegetation of south Meghalaya has been classified as tropical/subtropical evergreen forests (Balakrishnan, 1981-1983). *Cinnamomum tamala*, *Daphniphyllum himalayanse*, *Myrica esculenta*, *Sarcosperma griffithii* and *Syzygium tetragonum* are the important evergreen and *Betula alnoides*, *Cedrela toona*, *Engelhartia spicata* and *Ficus roxburghii* are some of the dominant deciduous tree species. The shrub layer is quite dense comprising *Ardisia griffithii*, *Boehmeria malabarica*, *Goniothalamus sesquipidalis*, *Mahonia pycnophylla* and *Wallichia densiflora*. The herbacesous vegetation 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 tree trunks and branches are covered with a variety of mosses, epiphytic ferns and orchids. The invasive weedy species like *Artemisia* spp., *Eupatorium* spp. and *Mikania micrantha* are quite common too.

Details of resource management practices and related institutional arrangements were collected from government records and through interviews with the officials of government forest department, autonomous district councils and traditional forest institutions. Participatory research tools were used to acquire insights into traditional management practices in villages viz., Lyting Lyngdoh, Mawkria, Mawlat, Mawpran, Mawshun, Mawriang, Myllat, Nohron, Nolikata, Nongkhlieng, Nongkwai, Nongsder, Pongtung, Pynursla, Ranikor, Siatbakon, Umkrem, Wahumrem, Wahlakhia and Wahlyngdoh. Plant species were identified based on the available flora (Balakrishnan, 1981-1983; Haridasan and Rao, 1985-1987; Kanjilal *et al.*, 1934-1940). The birds and fishes were identified based on the specimens available with the Zoological Survey of India.

Results

Forest management practices

Seven different types of community forests were identified in the area (Table 1).

Law Raid (Village cluster forest)

These forests are jointly owned by a cluster of neighboring villages (the cluster is locally called as Raid). The forest patches are large in size, often stretching into two or more villages and are managed by a council consisting of the headmen of all villages as members and the Sordar, the head of village cluster, as its chairperson. All people of the Raid can utilize

Table 1. Community forest types in the study area (Durbar and Raid are the traditional supervisory institutions operating at the levels of individual villages and village-cluster, respectively)

Name of the forest	Area	Managing institution	Dominant species.	Products utilized	Remarks
***Khar**ai Law **L**yngdoh Nongkhlieng* (Sacred forest)	1.5 km²	Raid	*Ficus* spp., *Toona* spp. , *Lithocarpus elegans*, *Artocarpus heterophyllus*, *Sarcosperma griffithii* and *Bischofia javanica.*	Extractions are not allowed.	About 20 years ago a *Lyngdoh* (a priest who would never cut his hair) performed many rituals inside the forest. The forest was looked after earlier by Khongtyngkut clan but now by Raid Nongkhlieng. It is believed that any human disturbance in forest would invite devastation of the dwelling of the disturbance creator.
Law Lyngdoh Mawshun (Sacred forest)	1 km²	Clan	*Bambusa* spp., *Quercus* spp., *Schima wallichii*, *Castanopsis hystrix*, *Oroxyrum indicum* and *Sarcosperma griffithii.*	Extractions are not allowed.	Originally this forest was owned by 5 clans (Khongdkhar, Rynjah, Khongbuh, Massar and Nongsteng) and now by 10 clans, with Khongdkhar or Rynjah performing rituals on behalf of all clans. The belief system as in the case of *Kharai Law Lyngdoh Nongkhlieng*
Law Lyngdoh Lyting Lyngdoh (Sacred forest)	1 km²	Raid	*Quercus* spp. *Schima wallichii*, *Castanopsis hystrix*, *Machilus khasyana*, *Bridelia retusa* and *Calicarpa arborea.*	Extractions are not allowed.	This forest earlier under the control of Dkhar clan now falls under the Raid Lyting. Even entering the forest is prohibited. The belief system as in the case of *Kharai Law Lyngdoh Nongkhlieng*
***Law** Kyntang Mawkliaw* (Sacred forest)	2 km²	Durbar	*Castanopsis* spp., *Quercus* spp., *Schima wallichii*, *Calicarpa arborea*, *Sarcosperma griffithii* and *Glochidion thomsonii*	Extractions are not allowed.	This forest is under the control of Mawkliaw village Durbar. The belief system as in the case of *Kharai Law Lyngdoh Nongkhlieng*
Law Shnong Mawshun (Village forest)	2.5 km²	Durbar	*Bambusa* spp., *Quercus* spp., *Schima wallichii*, *Castanopsis hystrix*, *Oroxyrum indicum* and *Sarcosperma griffithii*	Firewood, bamboos, medicinal plants	This forest is protected with the main aim of meeting the local subsistence needs.
Law adong Pynter (Protected forest)	3 km²	Durbar	*Schima wallichii*, *Quercus* spp., *Calicarpa arborea*, *Bischofia javanica*, *Sarcosperma griffithii* and *Glochidion thomsonii*	Utilisation of NTFPs is allowed only under special circumstances.	This forest belongs to Pynter village. Utilization of forest products permitted only in the events of devastating fire and other natural calamities
Law adong Pongtung (Protected forest)	1 km²	Durbar	*Castanopsis* spp., *Schima wallichii*, *Actinodaphne obovata*, *Quercus dealbata*, *Quercus dilatata* and *Syzygium tetragonum*	Utilisation of NTFPs is allowed only under special circumstances	As in the case of *Law adong Pynter* above
Law adong Wahtyrjut Raid Nongkhlieng (Protected forest)	2.5 km²	Raid	*Castanopsis* spp., *Myrica esculenta*, *Schima wallichii*, *Quercus dealbata*, *Quercus dilatata* and *Syzygium tetragonum.*	Medicinal plants, fruits, firewood	This forest is under the control of the Raid Nongkhlieng

Law adong Wahumrem (Protected forest)	500 m²	Raid	*Castanopsis* spp., *Quercus* spp., *Actinodaphne obovata, Sarcosperma griffithi* and *Glochidion thomsonii.*	Medicinal plants, fruits, firewood	This forest is under the control of Raid Nongkhlieng and at present managed by Wahumrem Durbar.
Raid Shabong Law adong (Protected forest)	7 km²	Raid	*Syzygium* spp., *Castanopsis* spp., *Quercus* spp., *Myrica esculenta,Schima wallichii* and *Glochidion thomsonii.*	Medicinal plants, mushrooms, fruits, nuts.	This forest is looked after by Wahpathew-Urksew Durbar, while the rituals are performed by Raid Shabong.
Law adong Siatbakon (Protected forest)	9 km²	Durbar	*Castanopsis* spp., *Schima wallichii, Actinodaphne obovata, Quercus dealbata, Quercus dilatata* and *Syzygium tetragonum*	Medicinal plants, poles, firewood, fruits, nuts	The rituals are performed by the Raid Shabong.
Lawadong Wahphadar (Protected forest)	500 m²	Durbar	*Syzygium* spp., *Castanopsis* spp., *Quercus* spp., *Myrica esculenta,Schima wallichii* and *Glochidion thomsonii.*	Medicinal plants, poles, firewood, fruits, nuts	This forest is managed by Umkor Village Durbar.
Ri Tynsong (Private forest)	10 km²	Family	*Ficus* spp., *Toona* spp. , *Lithocarpus elegans, Artocarpus heterophyllus, Sarcosperma griffithii* and *Bischofia javanica.*	Poles, medicinal plants, brooms	This forest belongs to a family of Tynsong clan.
Law Raid Mawja (Common forest of a village cluster)	4 km²	Raid	*Syzygium* spp., *Castanopsis* spp., *Quercus* spp., *Myrica esculenta,Schima wallichii* and *Glochidion thomsonii.*	Firewood, fruits, medicinal plants	Any extraction from this forest requires prior permission from the *Sordar* (the chief) *of Raid Mawja.*

Ri Sawkur Nonglyngdiang Mawpran (Clan forest)	6 km²	Clan	*Castanopsis* spp., *Schima wallichii, Ostodes paniculata, Quercus* spp. and *Myrica esculenta.*	Firewood, fruits, medicinal plants	This forest is jointly owned by 4 clans viz., Khongmawloh Diengdoh, Khongmawloh Syntiew, Khongmawloh Khongiar and Khongmawloh Khongthngan.
Khlaw Khongmawloh Nongmadan Mawpran (Clan forest)	2 km²	Clan	*Castanopsis* spp., *Schima wallichii, Actinodaphne obovata, Quercus dealbata, Quercus dilatata* and *Syzygium tetragonum*	Firewood, medicinal plants, fruits	This forest is jointly owned by Khongmawloh clan.
Sohlong arecanut agroforest (Forest garden)	2-4 km²	Individaual families	*Areca catechu, Cinnamomum tamala, Piper peepuloides, Artocarpus heterophyllus, Quercus dilatata* and *Syzygium tetragonum*	*Cinnamomum tamala, Piper peepuloides*, fuelwood, *Phrynium* leaf	Managed by individual families since historical times.

resources with prior permission from the Sordar if they are not protected or sacred forests. These forests mainly benefit the poor section of the society. The forest land can be allocated to poor families for shifting cultivation if such families do not have any land for cultivation.

Law Shnong (Village forest)

These forests are common property of a village set aside to meet day to day local needs. Villagers can collect both timber and non-timber forest products (NTFPs). Collection of timber and fuelwood is restricted to subsistence needs only, whereas NTFPs, e.g., mushrooms, wild vegetables and fruits, can be collected for sale in local markets too. Village forest is divided into blocks and a block is opened 5-10 years followed by an equally long closure period for regeneration.

Law Adong (Village/Raid restricted forest)

Law Adong is either under the control of a particular village or of a *Raid* (group of villages). These forests are similar to village forests in respect of overall management, except for a higher degree of protection. They are reserved particularly for the poorer families. Extraction of timber is allowed only when acute needs arise, e.g., for construction of houses for the poor, making coffins, for construction of community facilities (a hall or school, for example) or following natural calamities. Mature trees are cut following selection felling system. If abundant, timber is extracted for raising funds for community welfare activities or income is equitably shared by all families. In all such cases the integrity of the forest is maintained and, under no circumstances, conversion of forest to other land uses is allowed.

Law Kur (Clan forest)

This type of forest belongs to one or more clans of a village. All families of the clan(s) are entitled to a share of benefits but a family can not sell or transfer its customary forest rights. Management decisions are taken by a clan council headed by the eldest uncle (from the maternal side) of the clan. In some cases, people from outside the clan(s) are allowed collection of deadwood but only for their subsistence.

Law Ri-Kynti (Private forests)

Generally small in size, these forests are owned by individuals. Most of the forests in Meghalaya fall in this category. These forests are often over-exploited. Poorly stocked forests following over-exploitation are

used for agriculture/forest gardens or charcoal making. A few families allowed fellow villagers to collect NTFPs from their private forests.

Law Lyngdoh or Law Kyntang (Sacred forests)

These forests, set aside for religious purposes, may belong to village, clan(s) or Raid. They are managed by the Lyngdoh (religious head). Forest products are utilized only for religious functions as decided by the Lyngdoh. Sacred forests are mostly well preserved and are very rich in biodiversity. In the past, almost every village in the Khasi Hills had a sacred forest (Gurdon, 1975).

Forest Gardens

Economically valuable trees (such as *Cinnamomum tamala*, *Piper peepuloides* and *Phrynium capitatum*) are maintained within natural forests. These complex agroforests serve high levels of provisioning services and their species richness is comparable to that in legally protected and sacred forests (Tynsong and Tiwari, 2010).

Betel leaf is grown on slopes under the shade of forest trees. The growers prune the tree canopy at right time for adequate light penetration. In some places, the growers make bamboo channels (often measuring kilometers in length a kind of traditional bamboo drip irrigation), to water betel vines, arecanut and orange trees. Depending upon the size of bamboo (*Bambusa vulgaris*), water flow rate is about 18-20 liters per minute. Bamboos of smaller diameters (*Bambusa tulda*) are used for diversion and distribution of water from the main channel to individual plants. Agrochemicals are not used at all. These forest gardens are highly profitable in terms of economic returns (Tynsong, 2009).

Traditional Health Care System

The War communities are highly dependent on herbal products for treatment of most of their common ailments and diseases. A total of 85 medicinal plants have been recorded by Tynsong *et al.* (2006) that are used by the community. Around 70% of medicinal plants are collected from natural forests and 30% from forest gardens/homegardens. The use of herbal medicines cut across social and economic strata (Tiwari *et al.*, 2004).

Community Forests as Source of Water

Villagers pay ample regard to springs and streams, the principal source of potable and irrigation water (Table 2). They avoid cattle wandering near these water sources and garbage disposal around them. Some community

forests, e.g., *Ri Sawkur* Nonglyngdiang Mawpran (Clan forest) and *Law Adong* Siatbakon (community protected forest) at Siatbakon, cover the sources of government water supply system.

Table 2. Community forests and number of associated water sources.

Name of community forest	Number of water sources		Number of water supply systems		Benefeciary villages
	Springs	Streams	Managed by individual households	Managed by government agencies	
Law Lyngdoh Mawshun	3	-	4	-	Mawshun
Law Kyntang Mawkliaw	2	2	4	-	Mawkliaw
Law adong Pynter	1	-	6	-	Pynter
Law adong Pongtung	1	-	2	-	Pongtung
Raid Shabong Law adong Pynursla	3	-	15	-	Urksew, Wahpathaw
Law adong Siatbakon	3	2	14	1	Siatbakon
Lawadong Wahphadar	1			-	Umkor
Ri Sawkur Nonglyngdiang Mawpran	4	-	10	2	Nongmadan Mawpran and Nonglyngdiang Mawpran
Khlaw Khongmawloh Nongmadan Mawpran	10	-	12	-	Nongsder, Pynter and Nongmadan Mawpran
Khlaw Khongmawloh Nongmadan Mawpran	10	-	12	-	Nongsder, Pynter and Nongmadan Mawpran
Sohlong arecanut agroforest	1	-	5	-	Sohlong and Mawriang

Fishery

Community forests of War area are impregnated with a network of streams and rivulets harbouring a variety of animals of food value

(Table 3), with fishes making the highest contribution to local diet. The communities also have a good understanding of plants that can be used as sedatives or as baits for catching fishes. The community has banned use of any chemicals or explosives and fishing during breeding seasons. The fishing is done mostly for local consumption. Thus the fishes, together with forests, are considered as a community resource.

Table 3. Fishes and other edible animals collected from forest streams and rivers in south Meghalaya

Scientific name	English Name	Local name	Season/ month of collection	Names of rivers/streams supporting the species
Neolissocheilus hexagonolepis (McClelland)	Katli	Kha-saw	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Neolissocheilus sp.	Not available	Kha shi-iar	Dec-January	Umsong and Umsi
Anguilla bengalensis bengalensis (Gray)	Indian longfin eel	Kha bsein	Whole year	Umsong, and Umsi
Cyprinus carpio (Linnaeus)	Common carp	Kha bten	May-August	Umsong and Umsi
Garra lamta (Hamilton-Buchanan)	Lamta Garra	Dohkew	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Garra lissorhynchus (McClelland)	Khasi Garra	Doh sher	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Lepidocephalus caudofurcatus (Tilak & Husain)	Tilak loach	Syngkai	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Channa orientalis (Bloch &Schneider)	Asiatic snakehead	Doh thli	Whole vear	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Pseudecheneis sulcatus (McClelland)	Sulcatus catfish	Briang	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat

Crangon crangon (Linnaeus)	Brown Shrimp	Shymbrong	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat
Uca sp.	Crab	Ka thani	Whole year	Umsong, Umsi, Umshrei, Durit, Umjar and Umkhat

Birds

Local people have been hunting birds since time immemorial (Table 4). The choice of hunting technique depended mainly on the specificities of habit and habitat of the bird species. The local people are of the opinion that disturbed areas and secondary forests harbour fewer species than primary forests in the same locations which is supported by scientific evidences too (Alves *et al.*, 2009). Although hunting might be detrimental to biodiversity, it is important to note the hunter's perspective of the problem too. The hunter's 'guild' felt that shifting cultivation, commercial logging and conversion of natural forests to agroforests have led to the depletion of bird populations more than that by sporadic hunting events.

Table 4. Bird species hunted by by War Khasi community in south Meghalaya

Scientific name	English name	Local name	Purpose of hunting capturing
Alcippe vinipectus (Hodgson)	White-Browed Fulvetta	Ruria	Food
Alophoixus sp.	-	Sim Ad	Food
Aprosmictus erythropterus (Gmelin)	Red-Winged Parrot	Khlung	Food, Pet, sale
Arachnothera longirostra (Latham)	Little Spiderhunter	Jiriak Padung	Food
Arachnothera magna (Hodgson)	Streaked Spiderhunter	Jiriak Padung	Food
Athene noctua (Scopoli)	Little Owl	Dkhoh Rit	Food, pet
Blythipicus pyrrhotis Hodgson)	Bay Woodpecker	Kumpiat	Food
Cettia flavolivacea (Blyth)	Aberrant Bush-Warbler	Sim Um	Food
Chalcophaps sp.	-	Lyngtliew	Food
Chloropsis cochinchinensis Gmelin)	Blue-Winged Leafbird	Sim Jalaeit	Food, pet
Chloropsis hardwickii Jardine& Selby)	Long-Tailed Minivet	Jala Eit	Food, pet

Dicrurus leucophaeus (Vieillot)	Ashy Drongo	Shyrwai	Food
Dicrurus sp.	Racket-Tailed Drongo	Risei	Food
Lonchura punctulata (Linnaeus)	Scaly-Breasted Munia	Pdit	Food, Pet
Macropygia sp.	-	Shiiar	Food
Megalaima asiatica (Latham)	Blue-Throated Barbet	Pohrong	Food
Megalaima virens (Boddaert)	Great Barbet	Jyllup	Food
Niltava sundara (Hodgson)	Rufous-Bellied	Thabalong	Food
Otus sunia (Hodgson)	Oriental Scops-Owl	Dkhoh Heh	Food
Pericrocotus ethologus (Bangs & Phillips)	Long-Tailed Minivet	Jaraitsiaw Stem	Food
Pericrocotus sp.	-	Jaraitsiaw Saw	Food
Picus canus (Gmelin)	Grey-Faced Woodpecker	Kynjar	Food
Psarisomus dalhousiae (Jameson)	Long-Tailed Broadbill	Lakadia	Food
Psittacula columboides (Vigors)	Malabar Parakeet	Kyrkhiah	Food, Pet
Psittacula himalayana (Lesson)	Slaty-Headed Parakeet	Shynrang	Food, Pet, Sale
Pycnonotus leucotis (Gould)	White-Eared Bulbul	Pait Puroi	Food
Pycnonotus melanicterus (Gmelin)	Black-Crested Bulbul	Sim Klong	Food
Seicercus sp.	-	Sim Rit	Food
Treron apicauda (Blyth)	Pin-Tailed Green Pigeon	Kuwo	Food
Unidentified species 1	-	Sim Kdait	Food
Unidentified species 2	-	Sim long	Food
Unidentified species 3	-	Phreit	Pet

Conclusions

Forests contribute direct benefits to local people in terms of income, food security, health care and availability of drinking water along with global benefits such as biodiversity conservation and ecosystem services. Traditional forest management system is built upon active participation of people, with equity and social justice as its key dimensions. The system needs little external inputs, is flexible and therefore has been able to adapt

to changing socio-economic and environmental conditions. Striking a balance in fulfillment of spiritual, social, economic and ecological needs is another distinguishing feature of the traditional system. Most hunters and fishermen feel that un-sustainable activities, such as introduction of modern agriculture, conversion of natural forests to agroforests and cash crop cultivation, have caused loss of habitats of wild species. People's participation in conservation of bioresources of north-eastern hill region of India will better serve the conservation objectives than merely establishing legally protected areas. Further research is required to analyse the strengths and weaknesses of traditional forest management practices.

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