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Traditional management practices of natural resources of forest dependent communities in Arunachal Pradesh - A case study of fringe villages in Banderdewa forest range

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Forest dependent tribal communities in Arunachal Pradesh have acquired the wisdom on natural resource management through vigorous interacting with the nature and through continued growth of indigenous knowledge system. Fringe village of Banderdewa forest range harbour human who perform NTFP extraction and other livelihood options such as traditional farming, fisheries, cattle rearing, etc. The similarity and differences of traditional management practices of forest dependent community were studied to know the socio-political dynamics as our sites were classified into two categories, i.e. settled and encroached villages.

Keywords: Natural resource management, Forest dependence, Tradition, Arunachal Pradesh

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Traditional management practices of natural resources have sustained the tribal societies in the hilly areas of Northeast India[1, 2]. Notwithstanding, certain tribes such as the *Angami*, *Chakesang* and *Konyak* practise *jhum* (local name for slash and burn agriculture) cultivation by retaining *Alnus nepalensis*, a nitrogen fixing non-leguminous species tree that replenishes soil fertility[3]. The *Apatani* tribe of Arunachal Pradesh practice traditional irrigation system in the terraced paddy field, practicing fish-cum-paddy cultivation, bamboo garden, etc. [3]. This practice is attributed to traditional knowledge system that is the outcome of a intimate relationship humans with their environment[4].

Village council has been considered one of the traditional institutions, which plays an important role in managing natural resources in the Northeast India and particularly in Arunachal Pradesh. Most village institutions follow customary laws that promote conservation of nature[5]. After the extension of Panchayati raj in the Northeast India, most of the forest resources are under their control. Moreover, the state has attempted to recognise the customary law by introducing protection of Customary Laws and Social Practices Bill 1994[6].

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Arunachal Pradesh being rich in bioresources vis-à-vis ethnic diversity, different pattern and systems of resource utilization is perceived. The present study, thus, attempts to have some preliminary insights in the over all paradigm of resource assessment for meeting various requirements of people residing closer to biological resources *per se*, particularly in resource rich areas. This study gains further importance as the Banderdewa forest range is part of the Greater Itanagar Complex where the population density is increasing day-by-day and threatening the mere existence of such protected areas owing to greater pressure on land. Further, the range is surrounded by an array of villages whose inhabitants had migrated a decade back, from various other parts of the state to secure their livelihood.

Material and methods

The Banderdewa forest range of Banderdewa forest division of Papum Pare district in Arunachal Pradesh is located near national highway-52 that extends from Banderdewa to Kharsingasa (Fig. 1). The range cover an area of about 96.68 sq km inhabiting a lush green tropical moist deciduous forest dominated by tree species such as *Terminalia spp., Castanopsis indica*, *Daubanga grandiflora, Tectona grandis, Mesua*

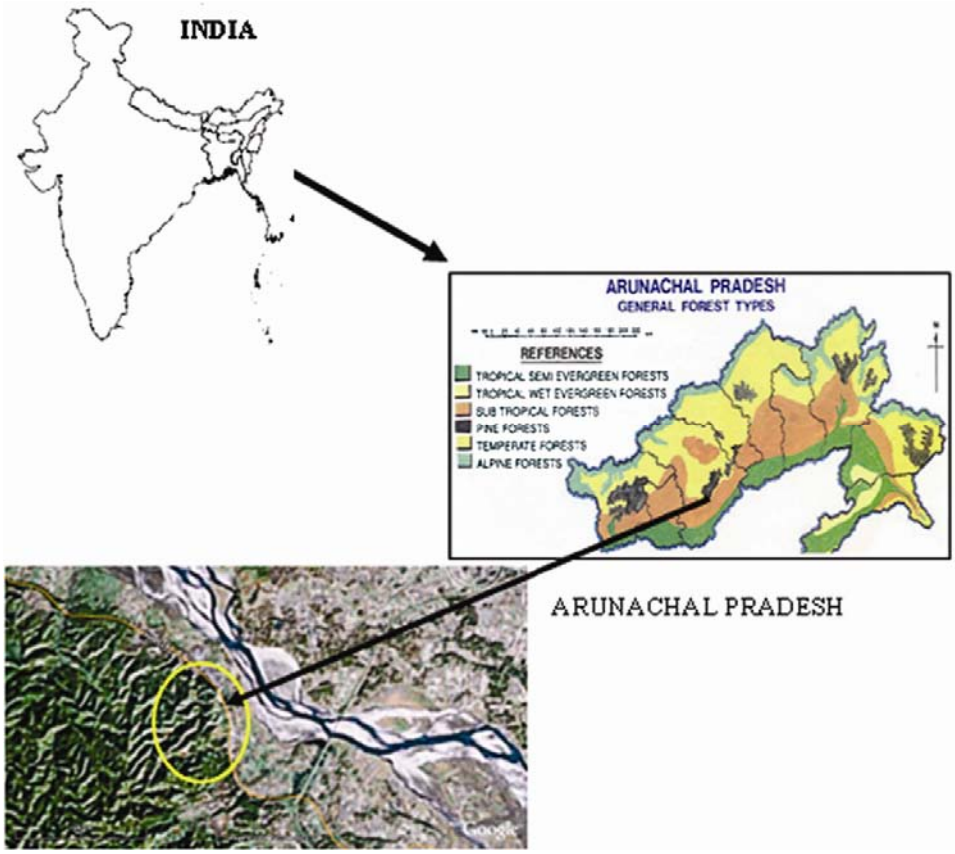

Fig.1—Map of the study area

ferrea, etc. The range falls under the territorial entry point of Arunachal Pradesh as the state is restricted area of Indian Union. Hence, the forest range is subject to lesser trespassing and encroachment. Evidently there are about 10 villages in the fringe area and 4 villages have been selected for the detailed study, out of which, 2 are politically recognised settlements and another 2 are encroached/illegal villages. The total population of the fringe village is about 5,706. The dominant community in fringe village is *Nyishi*, who have migrated mostly from districts such as Kurung-Kumey, West Siang and Lower Subansiri.

The study was conducted in 4 fringe villages of Banderdewa forest range (2 fringe villages with 1 km from the periphery of the range; 2 settlements/villages encroaching the forest range up to 1 km inside the boundary of the range). Personal interviews were held with individuals and with the community to document the culture and forest dependence through a standardized questionnaire. The questionnaire was prepared covering various anthropological, ecological and economic parameters. Although the questionnaire was in English, the questions were translated to local dialect to facilitate the respondents in the study villages. The consultations were conducted during the post-noon hours, because most of the villagers get on with their routine livelihood activity including agriculture in the morning hours. Enough care was taken to distribute the questionnaire across different age groups in the adulthood category to draw more reliable information. Forest officials including the Range Officer were interviewed to have some insights in to the policy matters on the approach to natural resource management in the forest reserve. The information collected were compiled in to appropriate categories to suit the requirements of the study and cross-checked with the field information as well to validate the data.

Results and discussion

Socio-cultural aspects

Nyishi tribe is the dominant community in study villages. Traditionally they worship sun and moon, which is locally called as *Doyni* and *polo*, respectively. However, Christianity is practiced in

most of the study villages (Fig. 2). Generally, the literacy rate is greater in settled villages such as Banderdewa and Kharsingasa villages, which is 65% and 85%, respectively. Amongst fringe villages, joint family is prevalent in settled villages, which is above 60% than in the encroached villages. As a result, the family sizes of settled villages are higher than in the encroached villages (Table 1).

The settled (Banderdewa and Kharsingasa) and encroached villages (Dobam and Nobanga) have been residing since 1980's and late 1990's, respectively. They originated from various district of the state such as Kurung Kumey, West Siang and Lower subansiri (Table 2).

Economical aspects

It has been observed that the average annual income of people is above one lakh in settled villages than in the encroached villages. Although some villagers have Government jobs, at house hold level they still follow their tradition system of farming and forestry. It has been found that encroached villages are more dependent (>60%) on farming as compared to that in settled villages. Almost all the fringe villages are raising bamboo plantation to meet their sustenance needs as well as commercial purpose, which is above 60%. Agroforestry system is abundant in all the villages, which is above 80% (Fig. 3). Bio-diesel plantation was only found in the encroached village, i.e. Dobam village.

Traditionally, rearing of *Bos frontalis,* a semi-domestic animal, which is locally known as *Mithun* was found common among *Nyishi* tribal groups. It is a symbol of a social status as well and also is a means of economy. Though hunting is prohibited in most of the villages by the village council is still observed in some villages. The collection of fuel wood from the reserve forest is also higher (> 80%) in both settled as well as encroached villages. Liquefied Petroleum Gas (LPG) connections were more in settled villages than in the encroached villages. The land holding per family is > 1 ha. Fisheries has been a new alternative livelihood option that was observed more in settled villages; the common fishes raised are grass carp, common carp and *rohu*.

Traditional management practices

The forest dependent communities of Banderdewa forest range are still continuing their traditional management practices (TMP) of natural resources both in settled and encroached villages. Some of the TMP that has been practice to meet their daily requirement without dependence on the adjoining forest such as wet rice cultivation, traditional farming system, tree and bamboo plantation, etc. whereas some of the practices are fully depend upon forest resources such as *jhum* cultivation, fuelwood collection, traditional *mithun* rearing, etc. which have been summarised in Table 3

The forest dependent community of the Banderdewa forest range are fully based on the available natural resources. They follow about 15 traditional management practices of natural resources since time immemorial. The study has able to detect various common practices among the forest dependent communities, which may be due to their common tradition and belief system. However, certain practices are relatively higher in the encroached villages such as *jhum* cultivation, which is due to lack of alternative livelihood option. Traditional practices

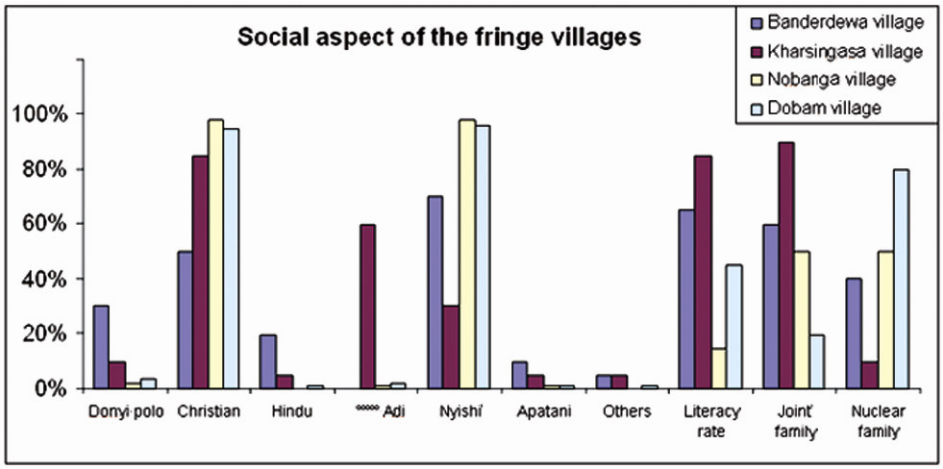

Fig.2—Social aspect of fringe village

Table 1-Location and population of selected villages in and around of Banderdewa forest range

Village	Settled village		Encroached village	
	Banderdewa	Kharsingasa	Dobam	Nobanga
Latitude	27º06´48N	27º07´17N	27º06´33N	27º07´08N
Longitude	093º48´52E	093º47´06E	093º47´51E	093º47´30E
Elevation	113 M	119 M	115 M	114 M
Dominant tribe	Nyishi	Nyishi	Nyishi	Nyishi
Population	3006*	2400	175	125
No. of house holds	623*	515	32	25
Rural health centre (Nos.)	1	1	0	0
Schools (Nos.)	0	2	0	0
Animal dispensaries(Nos.)	1	0	0	0
Government project (Y/N)	No	Yes	0	No
Water supply (Y/N)	Yes	Yes	No	No
Electricity (%)	95%	98%	80%	80%
Churches(nos.)	1	2	1	1

* Census of India 2003

Table 2- Other social aspects of the fringe villages of Banderdewa forest range

	Settled villages		Encroached villages	
	Banderdewa village	Kharsingasa village	Nobanga village	Dobam village
Average family size (Nos.)	7	9	5	6
Goan bura	Yes	Yes	Yes	Yes
Panchayati raj (%)	Yes	Yes	Yes	Yes
Origin	Kurung-Kumey, West Siang and Lower Subansiri.	Kurung-Kumey, West Siang and Lower Subansiri.	Kurung-Kumey and West Siang	Kurung-Kumey and West Siang

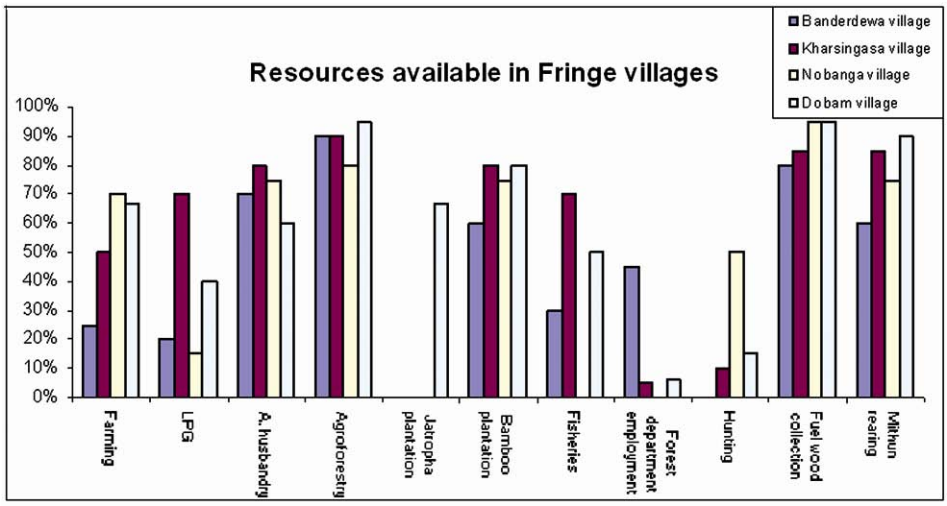

Fig.3—Resources available in fringe villages of Banderdewa forest range

like indigenous slope water harvesting system and tree-cum-bamboo plantation are more prevailing in encroached village as community don't have succession right on the forest resources of forest range like in case of the settled villagers. Moreover, being an encroached village Government facilities are poor that has resulted in poor literacy, and lack of medical facility has enriched the people to follow traditional ecological knowledge bared healthcare using locally available plant and animal resources.

At household level, most in the encroached villages follow nuclear family system due mainly to the pattern of human migration that was mostly nuclear and not joint family basis. However, settled village still have joint family system wherein the family size of Kharsingasa village is about 9, and that of Banderdewa is 7.

Table 3- The traditional practices of resources in encroached and settled village of Banderdewa forest range

Traditional practices	Village(s)	Description
Traditional farming system	Encroached and settled	*Zea mays* Linn., *Dioscorea spp, Solanum tuberosum* Linn., *Capsicum sp., Brassica sp., Zingiber officinale* Rosc, *Raphanus sativus* Linn., *Cucumis sativus* Linn. etc.
Wet rice cultivation (WRC)	Encroached and settled	Settled villages: The variety of *Oryza sativa* Linn. found are *Aho, Joha, Joybangla, Motesa, Ranjit* and *Tinin*. Encroached villages: The variety of *Oryza sativa* Linn. found are *Joha, Kileng*, and *Tinin*.
Jhum cultivation	Relatively higher in encroached	*Jhum* cycle: 7 years Felling of tree and other vegetation: November (*Gmelina arborea* Linn., *Tectona grandis* Linn.f., *Mallotus sp., Dendrocalamus hamiltoni* Nees & Arn., *Ageratum conyzoides* Linn., *Mikania micrantha* H.B.K., *Oxalis corniculata* Linn., etc.) Burning of biomass: April to May Cultivation: Mid May to June Variety of *Oryza sativa* Linn. : *Aho, Amth, Tinin* Vegetables: *Zea mays* Linn., *Solanum tuberosum* Linn.,*Capsicum* spp., etc.
Indigenous slope water harvesting system	Encroached	Water sources: Spring Protection mode: No clear felling at the water sources as per village council or by the owner. Supply mode: Bamboo half clump length is used as pipe. Use pattern: Either village use or individual use
Traditional fuel wood management system:	Encroached and settled	Species: *Terminalia myriocarpa* Heurch & Muell., *Gmelina arborea* Linn., *Terminalia belerica* Bedd., *Dendrocalamus sp., Bauhinia variegate* Linn., etc. Origin: Reserve forest Collection basket: *Tukri* or *igin* Gender role: Felling of trees and collection of fuel wood is done by male and female members of the family, respectively. Uses: Bonafide use + Commercial purposes. Dimension of fuel wood: 1m to 1.5m Cost of fuel wood: Rs. 20 per bundle. Each bundle consists of 4 - 5 pieces. Fuel wood requirement per day: 10 - 25kg. Protection mode: Village council prevent outsiders from trespass in side the forest. Mode of punishment: Penalties as per village council.
Tree cum bamboo plantation	Encroached	Species raised: *Anthocephalus chinensis* Hassk., *Daubanga grandiflora* (Roxb. ex DC.) Walp., *Gmelina arborea* Linn., *etc.* along with *Dendrocalamus hamilton* Nees & Arn., and *Bambusa tulda* Roxb. Planting pattern: Bamboo in culm form and trees in random manner. Protection mode: Owner + Villages council Requirements: House construction + commercial purposes
Toko plantation	Encroached and settled	Species raised: *Livistona jenkinsiana* Griff. Uses: Bonafide + commercial purposes (Roofing) Cost of toko leaf: Rs. 4 - 5 / leaf
Bamboo plantation	Encroached and settled	Species raised: *Dendrocalamus hamiltonii* Nees & Arn., *Bambusa tulda* Roxb. and *Bambusa balcooa* Roxb. Location: Near traditional hut boundaries and farmland boundaries. Cost per clump: *Bambusa tulda* Roxb.(Rs.15 to 35) and *Bambusa balcooa* Roxb. (Rs. 40 to 60) Cost of bamboo shoot: *Dendrocalamus hamiltonii* Nees & Arn. Fresh shoot (Rs. 10 per packet) Dried shoot (Rs. 20 per packet)
Traditional agro forestry system	Encroached and settled	Types: (i) Agrosilvicultural system, (ii) Agro-silvi-horticultural system and (iii) Aqua forestry.
Agro silvicultural system	Encroached and settled	*Vegetables*: *Spinacea oleracea* Linn, *Capsicum* spp., *Raphanus sativus* Linn., *Cucumis sativus* Linn., *poto* (*Clerodendron sp.*), *Zingiber officinale* Rosc., *Solanum tuberosum* Linn. *Brassica sp*., *Brassica oleracea* Linn. , etc. Trees: *Gmelina arborea* Linn., *Melia azedarach* Linn., *etc.*
Agro-silvi-horticultural system	Encroached and settled	Vegetables : *Solanum tuberosum* Linn., *Capsicum sp., Brassica spp., Zingiber officinale* Rosc., *Cucumis sativus* Linn., etc. Trees: *Mallotus sp., Erythrina sp., Melia azedarach* Linn., etc. Horticultural trees: *Areca catechu* Linn., *Carica papaya* Linn, *Citrus sinensis* Linn., *Ananas comosus* Linn. Mer., *Artocarpus heterophyllus* Lam., *Musa* spp., etc.

Contd.

Table 3- The traditional practices of resources in encroached and settled village of Banderdewa forest range *Contd.*

Traditional practices	Village(s)	Description
Aqua forestry	Encroached and settled	Area: 100m^2 to >1000 m^2, *Depth:* upto 2m. Source of water: Streams and drilled water. Feed by inlet as well as outlet pipes. Trees: *Musa* spp., *Mesua ferrea* Linn., *Psidium guajava* Linn., *Ananas comosus* Linn. Mer., *Carica papaya* Linn., etc. Other components: Piggeries are also integrated along with fisheries. Fishes: *Carassius auratus* Linn., *Ctenopharyngodon idellus* (C. & V.), *Labeo rohita*(Ham.) and *Clarias batrachus* Linn. Fishlet sourced: Emchi villages (nearest village) + Assam. Production: 500 to 600 fishes per fisheries. Price per kg: Rs.100 to 150.
Traditional edible plants	Encroached and settled	Species: *Colocasia sp.* (*Kachu*), *Spilanthes sp.* (*Marchang*), *Pteris sp.* (*Dakhia*), *Agaricus bisporus* Linn. (Lolam,inya/mushroom), etc. Source of collection: Forest
Traditional edible insects	Encroached and settled	Species: *Bombyx mor* Linn. (*Eritapum*), *Chlorophorus annularis* Fab. (*Tachung*/ bamboo borer), *Leptocorisa varicornis* Fab. (*Tarj/Gandhi puk*), *Bombyx mori* Linn. (*Yapung*), etc.
Ethno botany	Relatively higher in encroached.	

Botanical name	Local name	Diseases cures	Part used
Clerodendron sp	*Poto*	Hypertension	Leaf
Clerodendron sp.	*Toi*	Wound	Leaf
Ageratum sp.	Ageratum	Wound	Leaf
Azadirachta indica A. Juss.	Neem	Constipation and skin diseases	Leaf
Averrhoa carambola Linn.	Star fruit	Jaundice	Fruit
Ocimum sanctum Linn.	Tulsi	Cold and fever	Leaf, stem
Curcuma longa Linn.	Turmeric	Fracture	Rhizomes

Traditional *mithun* rearing	Relatively higher in settled	Species: *Bos frontalis* Lam. Nature of rearing: Semi domestic. Significance: Socio economical significances. Possession per family: 3 to 5 *mithun*. Contribution in annual income: Rs. 15,000. Price of *mithun*: (i) Male: Rs.15,000 (ii) Female: Rs. 20,000 (iii) Calf: Rs. 5000
Poultry management	Encroached and settled	Species: Hen Feed: Paddy Possession of poultry: 6 to 15 per family. Price per hen: Rs.100 to 120 per kg. Price of egg: Rs.2.50 Cultural significance: Sacrifice purposes
Livestock rearing	Encroached and settled	Species: pig, goat, cow and sheep Nature of rearing: cow+sheep+ goat (free grazing) and pig (stall feeding).
Banana plantation	Encroached and settled	Species: *Musa* spp. *Varities viz., Jahaji*, *Athiya* and *Chani kol*. Raised: At the farm boundary and homestead garden. Production: 250 to 280 bunch per year; (1 bunch=12 banana). Price: Rs.15 to 20 per bunch
Traditional forest management	Encroached and settled	Protection mode: Villages council (20 members) and village welfare committee. Restriction on: Hunting, fishing, bleaching, cutting of natural resources like bamboo, fire wood, timber, etc. are not allowed for out siders. Insect attack prevention: application of ashes.

Over all, the present study revealed that the natural resource management practice of same tribe do vary due to territorial status vis-à-vis household level family system that is governed by infrastructural support and employment opportunity in the area. Nonetheless, the traditional knowledge base of the tribal communities drive the pace of resource utilization and management practices that has a bearing on the overall biodiversity conservation and land management.

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