

Natural Resource Management in Eastern Himalaya: A Case Study of Fringe Villages of Shergaon Forest Division, Arunachal Pradesh

GOVINDA PANGGING*, MADHUBALA SHARMA,
CHAMAN LAL SHARMA and ARIBAM SANDEEP SHARMA

Department of Forestry, North Eastern Regional Institute of Science and Technology,
Nirjuli-791109, Arunachal Pradesh, India.

*Corresponding author E-mail: gpangging@gmail.com

<http://dx.doi.org/10.12944/CWE.11.3.15>

(Received: October 13, 2016; Accepted: November 22, 2016)

ABSTRACT

The natural resource management (NRM) practice has been considered as an important aspect of ethnic communities. The present study emphasized on the documentation of NRM practices of the Sherdukpen tribe of Arunachal Pradesh. The study was done in the three fringe villages Membachur, Mukhuthing and Thongre of Shergaon Forest division, West Kameng district of Arunachal Pradesh. The data was collected from 97 informants through questionnaire. The NRM practices of Sherdukpen tribe consisted of traditional maize cultivation, management of individual forest, community forest, etc. About 90% of the tribe are involved in farming practice. The average agricultural land holding and average individual forest land holding per HH that range from 0.72 ha to 1.2 ha and 0.6 ha to 0.8 ha, respectively.

Keywords: NRM, Sherdukpen, West Kameng, Panchayat, Village Council, Forest.

INTRODUCTION

Natural resource management (NRM) has been considered as one of the important socio-cultural practices of the local community since time immemorial. It has been practiced worldwide for meeting the social, cultural and economic needs. The eastern Himalaya is world widely renowned as a biodiversity hotspot¹. The traditional knowledge system (TKS) of local people is unique and is used for managing the valuable natural resources^{2,3}. However, resource utilization is mostly done at sustenance level^{4,5}. Traditional forest management is an important aspect of NRM that has direct or indirect link with other land use systems like farming system, agroforestry, etc⁴. The informal institution, locally known as village council, plays a significant role in the management and resolving inter/intra village conflict in NRM practices^{6,7}. The

traditional knowledge of ethnic community helps in the utilization & conservation of natural resources⁸.

Arunachal Pradesh is one of the 29 states of India, which is an integral part of eastern Himalaya⁹. It has diverse ethnicity, biological diversity, endemism and unique natural resource management practices. The Sherdukpen tribe is one of the tribes of Arunachal Pradesh and mainly settled in the West Kameng district of Arunachal Pradesh¹⁰. The agriculture is the main occupation of Sherdukpen tribe¹¹ and they also practice terrace cultivation for agriculture¹². The main agricultural and horticultural crops raised are tomato, potato and apple¹¹. The faunal resources are conserved at the regional level through imposing taboos, totem and establishment of sacred sites^{13, 14}. The religious practices of the tribe also help in the conservation of biological diversity by utilizing certain plants¹⁵. The village council of Sherdukpen is called

Jung and it play an important role in the management and conservation of natural resources¹⁰. Hunting has been considered as a traditional practice of Sherdukpen tribe and the village council played an important role in its regulation at village level¹³. The forest has been classified into five types: Blu dongsek (Community forest), khik donsek (Village forest), Sangthing dongsek (Individual forest), Donsek achok (Sacred groves) and Nyor see (Grazing land)¹⁰.

The present study aims to document the NRM practices of Sherdukpen tribe of Arunachal

Table 1: Land use pattern of West Kameng district (2011-12)

Sl. no.	Land use pattern	Area (,000 ha)
1.	Geographical area	742.3
2.	Cultivable area	13.49
3.	Forest area	575.3
4.	Land under non-agricultural use	0.88
5.	Permanent pastures	0.85
6.	Cultivable wasteland	4.02
7.	Land under Misc. tree crops and groves	1.06
8.	Barren and uncultivable land	0.65
9.	Other fallow	1.64

Source: Directorate of Economics and Statistics, Ministry of agriculture, Govt. of India

Pradesh, which may help in the conservation of biological resources and also assist in finding the gap in the existing NRM practices, which will collectively contribute in the attainment of sustainable development through NRM^{16,17,18}.

MATERIALS AND METHODS

Three fringe villages of Shergaon Forest Division, Arunachal Pradesh viz. Membachur, Mukhuthing and Thongre have been selected for the study. The study site is located in the West Kameng District of Arunachal Pradesh. It is situated between 91°30' to 92°40' E longitude and 26°56' to 28°01' N latitude. The land use pattern of the West Kameng district consisted of cultivable land, forest land, pastoral land, etc. (Table 1). The household survey was done with standardized questionnaire through random sampling and 97 households were interviewed. The information related to social aspect, economical aspect and ecological aspect were collected from the respondents based on age groups, educational status, gender, village head (Gaon Bura), etc. The data was collected for a period of 4 months i.e., December, 2011 to April, 2012.

RESULTS AND DISCUSSION

Socioeconomic condition

Sherdukpen tribe is found to be the dominant tribe among the selected villages viz., Membachur, Mukhuthing and Thongri. About 90% of the respondent follows the Buddhism religion. The

Table 2: Socio-cultural status of Shedukpen tribes of fringe villages of Shergaon Forest division

Particular	Village		
	Membachur	Mukhuthing	Thongri
Family size	6	5	5
Buddhism	90%	90%	89%
Other religion	10%	10%	11%
Sherdukpen tribe	100%	100%	100%
Literacy rate	40%	35%	61%
Joint family	82%	78%	86%
Nuclear family	18%	22%	14%
Gaon bura	Yes	Yes	Yes
Anchal Samiti	Yes	Yes	Yes
Panchayati raj	Yes	Yes	Yes

prevalent family type found is joint family that ranges from 78% to 86%. The highest number of family members per household is found in Membachur village, which is 6 (six), followed by Thongri (5) and Mukhuthing (5). The highest literacy rate is found in Thongri village, which is 61%, followed by Membachur (40%) and Mukhuthing (35%). In all the selected villages, traditional village council and Panchayati raj institution are co-existing and plays an important role in the management of natural resources (Table 2).

The average annual income of the household of the selected fringe villages varies from Rs. 47,000 to Rs. 1,35,000. Farming is the main occupation of the tribe that ranges from 90% to 95%. However, merely 5% to 15% of the populations are under government job (Table 3).

The highest average agricultural land holding per household (HH) is found in Thongri village, which is about 1.2 ha, followed by Membachur village (0.8 ha) and Mukhuthing village (0.72 ha). The highest average forest land holding per HH is found in both Mukhuthing village and Membachur village which is about 0.8 ha (Table 4).

Documentation of Natural Resource Management of Sherdukpen tribe

The NRM practices of the Sherdupen tribe consists of traditional maize cultivation, community forest, individual forest management, etc. (Table 5).

In the present study, agriculture is reported as the main occupation of Sherdukpen tribe, which is similar to the findings of Shimrah *et al.*¹¹. The leaves of *Quercus sp.* is traditionally utilized for *Zea mays* cultivation, which help in replenishing the nutrient loss, mulching, etc., and similar finding was reported by Dollo *et al.*¹⁰. Forest played an important role in meeting the needs of social, cultural and religious aspect of Sherdukpen tribe. It has been classified based on ownership, such as (i) community forest and (ii) individual forest. The community forest (CF) is further classified into two sub-types based on the function such as (i) CF (exclusively for religious purposes) and (ii) CF (meeting the requirement of the local people). However, five types of forest have been reported based on land use viz., community forest, village forest, individual forest, sacred groves and community grazing land by Dollo *et*

Table 3: Economic aspect of the Shedukpen tribe.

Particular	Village		
	Membachur	Mukhuthing	Thongri
Annual income	Rs. 65,000	Rs. 47,000	Rs. 1,35,000
Government jobs	8%	5%	15%
Farming	92%	95%	90%
LPG	70%	65%	90%
Animal husbandry	75%	75%	45%
Hunting	60%	65%	30%
Fuelwood collection	95%	95%	80%
Fishing	45%	50%	30%

Table 4: Landholding of the villages.

Village name	Household (nos.)	Individual forest land (ha) per HH	Agricultural land (ha) per HH	Total land holding (ha) per HH
Membachur	26	0.6 ha	0.8 ha	1.4ha
Mukhuthing	19	0.8 ha	0.72 ha	1.52 ha
Thongre	52	0.8 ha	1.2 ha	2ha

Table 5: Documentation of traditional natural resource management practices of Sherdukpens tribe

Traditional NRM practices	Particular	Description
Traditional maize cultivation	Traditional method	After sowing of maize, oak leaves are broadcasted on the farm land.
	Importance of oak leaf	It helps in mulching, checking weeds growth, replenishment of soil nutrients, protecting sown seeds from birds, etc.
Vegetable cultivation	Present status	Presently, Zea mays are traditionally cultivated relatively lesser in proportion in studied villages.
	Types of vegetables raised.	This practice is largely depends upon the availability of oak leaves. <i>Brassica</i> sp. (Lapatta), <i>Solanum melongena</i> , <i>Capsicum</i> spp. (Chilli), <i>Zingiber officinale</i> (ginger) etc.
Cash cropping	Place	Farmland and homestead garden
	Subsistence/Commercial	Subsistence
Horticulture	Cash crop species	<i>Solanum lycopersicum</i> , <i>Solanum tuberosum</i> and <i>Brassica</i> sp.
	Place	Farmland and Community forest
Forest management	Subsistence/Commercial	Commercial
	Use of Pesticide and Fertilizer	Yes
Community Forest	Type of crops	Apple (<i>Malus pumila</i>), kiwi (<i>Actinidia chinensis</i>), peach (<i>Prunus persica</i>), Amla (<i>Phyllanthus emblica</i>), etc.
	Subsistence/Commercial	Commercial
Forest	Types	Community forest and individual forest
	Types of CF:	1. Community forest (religious purposes) 2. Community forest (daily needs of the people)
Forest	Who controls it?	Controlled by Panchayat and village council
	Distance of CF from the villages.	1-2 km (Membachur); 1 km (Mukhuthing) and 2 km (Thongri)
Forest	Species composition.	<i>Pinus wallichiana</i> , <i>P. roxburghii</i> , <i>Rhododendron arboretum</i> , <i>Quercus serrata</i> , <i>Q. alba</i> , <i>Taxus baccata</i> , etc.
	Management practices.	Community forest (Religious purposes): <ul style="list-style-type: none"> • The village council and Panchayat assist in the protection of the forest resources. • Trespass in the forest is prohibited. • Felling of trees for personal use are not allowed viz., fuelwood, small timber etc. • The forest resources are allowed to extract only in case of conducting the religious ritual / ceremony and festivals at village level.

Community forest (to meet the daily needs of the people):

- The village council and Panchayat assist in the protection of the forest resources.
- The forest is managed through traditional methods, and however no scientific interventions are done.

- The forest resources are extracted solely for meeting the sustenance requirement such as fuelwood, small timber, etc. However, no commercial extraction is allowed.

- Village council plays an important role in the management of CF.

- In CF, encroachment of land is prohibited.

- Involvement of community in the protection of growing stock of CF especially against forest fire.

- Sherdukpen tribe observes 8th, 15th and 30th days of a month as a rest day and they do not involve in any activities in the forest such as hunting, logging, etc. Unfortunately, if anyone breaks the rules either by accident or intentionally then penalties are imposed in the form of fine.

- The extraction of forest resources for commercial purposes is prohibited and if done, then the penalty is imposed, which may be extended to Rs. 15000 by the village council.

This type of forest is owned by individual household. It plays a significant role in meeting the needs of the family and also improves the socioeconomic conditions of household.

0.5 to 3 km

Pinus wallichiana, *Rhododendrons* spp., *Quercus serrata*, *Q. alba*, etc.

- The management and protection of individual forests are done solely by the individual owner. However, in case of forest fire, the community helps in extinguishing uncontrolled forest fire.

- Trespass is prohibited in such forest.

- Forest resources are extracted to meet household requirement. However, in certain cases, extraction of forest resources allows for meeting forest resource requirement of the monastery (Gumpas) and also for community level rituals, ceremonies, festival, etc.

- The forest resources are extracted both at subsistence & commercial level.

- The village council & Panchayat plays an important role in resolving dispute related to forest resources within village jurisdiction.

The following penalties imposed:

- Illicit felling and removal of forest resources without the permission of the owner, in such cases, the offender has to return the harvested forest produces viz., fuelwood, timber, etc. or have to pay in cash equivalent to the price of forest resources.

- Encroachment is prohibited in individual forest, if it is done, then penalty imposed on offender based on village council decision.

Role of customary laws.

Individual forests

Ownership

Distance of forest from the village

Species composition.

Management practice

Penalty

Fishing subsistence	Technique	Fishing is also an important traditional practice of resource extraction, which is done at level. The fishing practice is mostly done in Mukthung village (50%), followed by Memachur village (45%) and Thonri (30%).
Forest utilisation	Forest resources extraction	Fuelwood, mushroom, wild edible plants, edible insects, timber, medicinal plants, dye, grazing, etc.
Fuelwood	Management	The small trees are felled in the forest for fuel wood purposes, which are left for a few days for drying. In case of medium size trees, logs are converted into smaller sections of size like 1m to 2 m length with saws and axes. After complete drying, fuelwoods are collected manually or with small truck.
	Species composition.	Hingpu (<i>Quercus serrata</i>), hingmahing (<i>Q. alba</i>), etc.
	Quantity of fuelwood consumption	pr HH. The fuelwood requirement per household per day are varies from 30kg to 40kg. The highest consumption is found in Membachur (40kg per HH), followed by Mukthung (35 kg per HH) and Thongre (30 kg per HH).
	Consumption at village level	The highest fuelwood collection from forests is recorded from Membachur village and Mukthung village, which is about 95%, followed by Thongri (80%).
Mushroom	Edible species	<i>Morchella esculenta</i> (Bubungurok), <i>Peziza</i> sp. (Migorji), <i>Armillaria</i> sp. (Krepoyomi), <i>Dacryopinax spathularia</i> , <i>Agaricus</i> sp. (Jhilikmi), etc.
	Collection time.	April to May.
	Market price per kg.	<i>Morchella esculenta</i> (Rs.1,500-2,000), <i>Peziza</i> sp. (Rs.500), <i>Armillaria</i> sp. (Rs.50-70), <i>Agaricus</i> sp. (Rs.150).
Wild vegetable	Edible species.	<i>Houttuynia cordata</i> , <i>Diplazium esculentum</i> , <i>Zanthoxylum</i> sp., <i>Colocasia</i> sp., etc.
Edible insects	Edible species.	<i>Bombyx mori</i> , <i>Dinoderus minutus</i> , etc.
Timber	Species.	<i>Pinus roxburghii</i> , <i>P. wallichiana</i> , <i>Quercus alba</i> , <i>Quercus serrata</i> , etc.
Medicinal plants	Species.	<i>Swertia</i> sp., <i>Taxus</i> sp., <i>Rhododendron</i> sp., <i>Illicium</i> sp., etc.
Dye	Species.	<i>Rubia cordifolia</i>
Grazing	Mode of grazing.	Free grazing in forest.
	Livestock.	Oxen and cows (200), sheep (130) and goat (60) in the studied villages.
	Value added products.	Ghee and shurpi obtained from the cow milk.
	Consumption at village level	Livestock rearing is a common practice among Sherdukpen tribe that range from 45% to 75% in the studied village.
Bamboo	Species.	<i>Bambusa tulda</i> , <i>B. balcooa</i> , etc.
	Uses.	Construction purposes, fencing material, food, etc.
Hunting	Village wise	Hunting is considered as a traditional practice and it is found higher in Mukthung village i.e., 65%, followed by Membachur village (60%) and Thungri (30%).

*al.*¹⁰. Hunting has been reported to be traditional practices of Sherdukpen, which is similar to the finding of Mazumdar *et al.*¹³. The village council is a traditional institution, which plays an important role in the management and conservation of forest resources, which is similar to findings of Mazumdar *et al.*¹³.

The NRM practices of the Sherdukpen tribes are diverse and this practice not only helps in meeting the basic needs of the community but also helps in the protection of biological diversity. At present, the traditional land use systems are under constant anthropogenic pressure due to change in land use pattern. In Arunachal Pradesh, the area of maize cultivation has been declining gradually from 15.1% (1990-91) to 12.07% (2013-14)¹⁸. A similar trend has been found in the studied fringe villages of the Shergaon Forest Division. Although, the traditional maize cultivation provides various goods and environmental services viz. staple food, supplements the fodder requirement during the winter, soil and water conservation, conservation of *Quercus sp.*, etc. This form of farming need to be preserved and restored as it fulfills all the aspects of sustainable development principle. At present, the area under horticultural crop in Arunachal Pradesh has tremendously increased from 7.4% (1990-91) to 22.86% (2013-14)¹⁸. Both cash cropping and horticultural crop are also exerting pressure on the Community forest land, which are gradually

converted due to better economic return and scarcity of land resource. Moreover, the use of inorganic chemical inputs in these land use systems is a matter of concern, which needs to be replaced with organic farming and complimentary land use systems.

CONCLUSION

The NRM practices of Sherdukpen tribe consist of traditional maize cultivation, cash cropping, horticultural crop, individual forest and community forest management. These natural resource management practices meet all the needs of the community viz., social, cultural and economic needs. However, change in forest and traditional agricultural land use system to cash cropping and horticulture may affect the traditional NRM practices of Sherdukpen tribe in the long run and is a matter of concern from the conservation of biological diversity point of view. At the transaction stage of state development, the interlinking of sectoral policies should be emphasized and there should be a synergy between development activities and conservation of biological diversity at all levels.

ACKNOWLEDGEMENTS

The authors are grateful to the villagers of Membachur, Thongri and Mukhuthing village of Rupa, West Kameng district and DFO, Shergaon Forest Division, Arunachal Pradesh for extending their cooperation.

REFERENCES

1. Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G.A.B. and Kent, J. Biodiversity hotspots for conservation priorities. *Nature*, **403**(24) : 853-858 (2002)
2. Farooquee, N. A., Dollo, M. and Kala, C.P. Traditional Wisdom of Apatani Community in the management and sharing of natural resources in North Eastern India. In Misra, K.K. (ed.), *Traditional Knowledge in Contemporary Societies: Challenges and Opportunities*. Pratibha Prakashan, Shakti Nagar, Delhi, India, 110-126 (2007)
3. Dollo, M., Chaudhury, S. and Sundriyal, R.C. Traditional farming and land tenure systems in West Kameng district, Arunachal Pradesh. In Ramakrishnan, P.S., Sexena, K.G. and Rao, K.S. (eds.), *Shifting agriculture and sustainable development of North-Eastern India*. UNESCO-MAB series, Oxford & IBH, New Delhi, India, 293-315 (2006)
4. Pangging, G., Arunachalam, A., Mawphlang, I.S.L. and Biswas, S. Traditional management practices of natural resources of forest dependent communities in Arunachal Pradesh- A case study of fringe villages in Banderdewa forest range. *Indian Journal of Traditional Knowledge*, **10** (2) : 269-275 (2011)

5. Ramakrishnan, P.S., Purohit, A.N., Saxena, K.G. and Rao, K.S. Himalayan Environment and Sustainable Development. *Indian National Science Academy*, New Delhi, **84** (1994)
6. Chatterjee, S., Saikia, A., Dutta, P., Ghosh, D., Pangging, G. and Goswami, A.K. Background paper on "Biodiversity Significance of North East India. WWF-India, New Delhi, 29 (2006)
7. Hedge, S. N. Arunachal Pradesh state Biodiversity Strategy & Action Plan (Final Report). State Forest Research Institute, Arunachal Pradesh, Itanagar (2002)
8. Medhi, R.P. & Chakrabarti, S. Traditional Knowledge of NE people on conservation of wild orchids. *Indian Journal of Traditional Knowledge*. **8**(1): 11-16 (2009)
9. Rodgers, W. A. and Panwar, H.S. Planning a wildlife protected area network in India. WII, Dehradun (I), 339 (1998)
10. Dollo, M., Samal, P.K., and Megejee, D. Biodiversity linked value system of the Monpas and Sherdukpens of Arunachal Pradesh. In Ramakrishnan, P.S., Saxena, K.G., Rao, K.S. and Sharma, G (eds.), Cultural Landscape The basis for linking biodiversity conservation with the sustainable development, UNESCO, NIE, New Delhi 59-82 (2012)
11. Shimrah, T., Bharali, S., Rao, K.S., and Saxena, K.G. Cultural Landscape: The basis for linking biodiversity conservation with the sustainable development in West Kameng, Arunachal Pradesh. In Ramakrishnan, P.S., Saxena, K.G., Rao, K.S. and Sharma, G (eds.), Cultural Landscape The basis for linking biodiversity conservation with the sustainable development, UNESCO, NIE, New Delhi 105-147 (2012)
12. Choudhury, M. Land and Forest in the Eastern Himalayas: A critique on Agriculture and Agroforestry in Arunachal Pradesh. *Dialogue*. **10**(4) (2009)
13. Mazumdar, K., and Samal, P.K. Conservation, Management and Hunting of Faunal Resources among Monpas and Sherdukpens in Arunachal Pradesh, Eastern Himalaya. In Ramakrishnan, P.S., Saxena, K.G., Rao, K.S. and Sharma, G (eds.), Cultural Landscape The basis for linking biodiversity conservation with the sustainable development, UNESCO, NIE, New Delhi **92**-103 (2012)
14. Bharali, S and Khan, M.L. Religious taboo among the tribes of West Kameng – an excellent traditional system of conserving biodiversity. *Current Science*. **103**(8) (2012).
15. Samal, P.K., Mazumdar, K., Megejee, D., and Dollo, M. Culture linked biodiversity conservation values of Monpas and Sherdukpens of Arunachal Pradesh. In Ramakrishnan, P.S., Saxena, K.G., Rao, K.S. and Sharma, G (eds.), Cultural Landscape The basis for linking biodiversity conservation with the sustainable development, UNESCO, NIE, New Delhi **92**-103 (2012)
16. Convention on Biological diversity. Rio de Janeiro (Brasil), 5th June 1992.
17. Kunte, K., Joglekar, A., Utkarsh, G., and Padmanabhan, P. Patterns of butterfly, bird and tree diversity in the Western Ghats. *Current Science*, **77**: 577-586 (1999).
18. Lama, M. Crop diversification and farm income in the hills of North East India: A Case study of Arunachal Pradesh. *International Journal of Food, Agriculture and Veterinary Sciences*, **6** (2) 15-21 (2016).