

BIOLOGICAL WEALTH

Traditional knowledge of plants and their uses

The Monpa community of Wangling, Jangbi and Phumzur villages in Trongsa district have extensive knowledge about plants. They were able to recognize and use over 270 species of plants. This is a significant number of plant species they recognize and use, considering the small population of 40 households. More than 80 species were recorded as being used as food, 34 species for medicinal purposes, 147 species for household needs, and 15 species for cultural and ceremonial use (Table 4.1). The majority of the plants utilized by the Monpas were trees (55%), followed by herbs (17%), shrubs (10%), climbers (10%), and saprophytes and epiphytes (8%).

Fruits and other parts derived from the wild plants formed a major source of food for the Monpas. It was found that women are mostly involved in collecting non-timber forest products and forest-based food items such as fern, mushroom, and *damburu*, for family consumption.

Table 4.1 demonstrates the rich ethno-botanical knowledge and very high dependence of the Monpa households on forest resources.

Table 4.1: Wild plants, their habit, and parts used by the Monpas

Forest products	Number of species	Plant habit	Parts used
Medicine	34	mostly herbs	root, leaf, stem, bark, flower
Fodder	28	tree	leaf
Timber	17	tree	trunk
Bamboos	20 (8 genera)	tree, shrub	stem, leaf

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Forest products	Number of species	Plant habit	Parts used
Fuel wood	19	tree, shrub	trunk, branch
Wild tubers	10	climber, herb	tuber
Agricultural tools	15	tree	trunk, branch
Pole	10	tree	trunk
Mushroom	10	fungus	whole plant
Shingles	11	tree	trunk
Rope/fibre	13	tree, climber, herb	bark, whole climber
Religious ceremony	15	tree, shrub	leaf, branch, resinous sap, trunk
Tea	15	tree, shrub	leaf, flower, bark
Fruits	12	tree, shrub, climber	fruit, seed
Vegetable oil	10	tree, shrub	seed
Broom	5	tree, shrub	branch, leaf
Leafy vegetable	9	herb, epiphyte	leaf, stem whole plant
Orchids	6	epiphyte	inflorescence
Fern	6	herb	stem
Vegetable dye	4	climber, tree, shrub	stem, leaf, rhizome
Cane	4 (2 genera)	climber	stem, fruit
Resin	1	tree	resinous sap
TOTAL	274		

Table 4.2: Percentage of households harvesting forest products for consumption and sale

Forest products	Uses	% of households
Fuel wood	Cook food	100
Fodder	Cattle fodder	95
Agricultural tools	agricultural tools, handle for tools	95
Vegetable oil	Vegetable oil for cooking	88
Wild tubers	Food, local wine	86
Shingles	Roofing	84
Cane	Lunchbox, baskets, chair, table, stool, rope, handicraft, vegetable (tender shoot) (household consumption as well as sale)	77
Dambru	Vegetable (household consumption as well as sale)	76
Bamboos	Bow, arrow, winnower, roof, mat,	

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Forest products	Uses	% of households
	fence, prayer flag poles, cup, ladle, milk churner, water/ wine container, food/ grain container, basket, handicraft, vegetable (bamboo shoot); (household consumption as well as sale)	70
Tree fern	Local wine, food	68
Timber	Planks, beam, pole, flooring, batten, window	66
Pole	Poles for fence, flags, house construction, batten	57
Rope	Rope, fibre, bowstring, handicraft	54
Betel leaves	Condiment (household consumption as well as sale)	53
Mushroom	Vegetable (household consumption as well as sale)	35
Fern	Vegetable, cattle bedding (household consumption as well as sale)	34
Resin	Resin for sale	26
Resinous wood	Used for lighting purpose	9
Orchids	Vegetable, decoration (household consumption as well as sale)	7
Guli	Fruits eaten	4
Champaka	Religious ceremony	3
Wang pem	Young shoot as vegetable	3
Broom	Clean house	3
Vegetable dye	Colour for thread, cloth, eggs, polish floor	3
Tea	Tender leaves used as tealeaf	1

The three most harvested forest products were:

Edibles: Cane shoot, vegetable oil seeds, and wild tubers.

Non-edibles: Fuelwood, cane, and bamboos.

All these forest products were harvested for household consumption except cane shoot and handicraft items made from bamboos and cane, which are sold in a small scale.

Mapping of forest resources

The study mapped the forest areas as well as the sources of forest products, which the Monpa community harvested (Annexure). This revealed that the Monpas are highly knowledgeable about the location of different forest products and natural resources which they used (Table 4.1). It was also noted that women were more knowledgeable about resource area for minor forest products such as mushroom, fern and *damburu*, whereas men were knowledgeable about resource area for cane, bamboo, and timber. Priority ranking of forest products demonstrated that the priority products for men were fuelwood followed by cane and bamboo, and timber; whereas for women the priority forest products were fuelwood followed by mushroom, fern, and fodder (Table 4.3).

Table 4.3: Forest products availability trend and priority ranking

Forest products	Increasing	Decreasing	No change	Priority Male	Priority Female
Firewood			x	I	I
Cane and bamboo		x		II	VIII
Timber, pole and shingles		x		III	IX
Mushroom, fern		x		V	II
Damburu		x		VIII	IV
Wild tubers		x		VII	V
Tree fern			x	IX	VI
Fodder		x		VI	III
Agricultural tools		x		IV	VII

Seasonal harvest of forest products

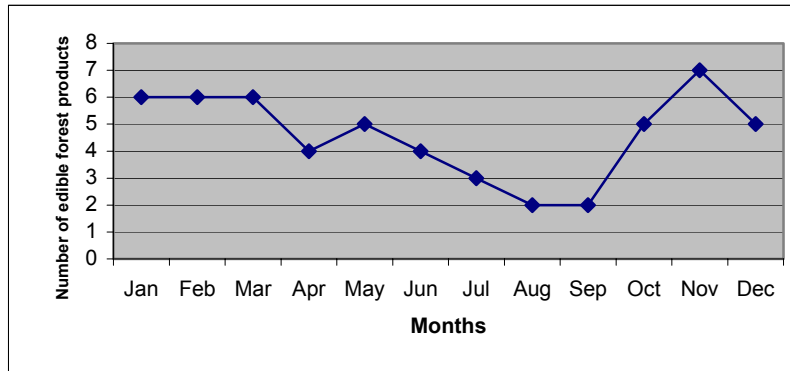
A seasonal harvest calendar was developed during the study in order to become acquainted with the pattern of harvesting forest products. The time of the year when the forest products are harvested is shown in Figure 4.1 and 4.2. It is noted that the largest number of edible plants, especially wild tubers, are

harvested during January, February and March and in October and November. The agricultural cropping pattern of the study area (figure 4.4, page 102) reveals that agricultural harvest occurs mainly in the months of August to October and March. It can be inferred that the forest provides the much-needed supplementary food at the time when crops, especially cereal crops, are in short supply.

Figure 4.1: Seasonal harvesting of forest products (edible and non-edible)

Forest resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
bamboo												
cane												
dambro												
Tree fern												
dye												
fern												
fodder												
fruits												
fuelwood												
mush-room												
resin												
shingles												
timber												
wild tubers												
yika												

Figure 4.2: Seasonal harvesting of edible forest products



Forest resource collection and conservation practices

The Monpas collect a variety of plant resources from the nearby forests. All individuals interviewed revealed that they learned about the forests and plants that they use from their elder family members or other people in their village. The following section describes the different products collected from the forests by the Monpas.

Bamboo

Bamboo grows naturally in Bhutan because of the country's largely undisturbed forests. Bhutan's great range of altitudes and climate account for this diversity. Bhutanese bamboo is principally of Himalayan and Chinese-Japanese origin, with some Southeast Asian and South Indian contributions. Bhutan has 15 genera and 31 species of bamboo [FAO 1996]. Of these, 8 genera and 20 species were found to occur in the forests around the Monpa villages. Bamboos are used by the Monpas for various household purposes as well as sold for cash income (Table 4.4).

Table 4.4: Bamboo species

Local Name	Scientific name	Uses
1. Zhushi D M	i. <i>Bambusa tulda</i> ii. <i>Bambusa nutans</i>	Bow, winnower, roofing, fencing, flag poles
2. Zong M Zang K	<i>Dendrocalamus sikkimensis</i>	Churner (milk and tea), cup, ladle, palang, zipa (butter container), dhop (milk pail)
3. Pa M Pagshi D	i. <i>Dendrocalamus hamiltonii</i> ii. <i>Bambusa clavata</i>	Winnower, fencing, roofing, basket, cup, palang, tying material, shoot edible
4. Rawo M Rawa K	<i>Chimonobambusa callosa</i>	Mats for roofing, wall, floor, fence, (not used for handicraft, very rough)
5. Bangshing M		Weave mat, fencing, basket
6. Yengmethla M Kreng K		Handicraft, winnower, fencing, roofing, bag, basket
7. Uphela M Cupi K		Handicraft, winnower, small basket (not used for fencing, not strong)
8. Pishama M	i. <i>Cephalostachyum capitatum</i> (poisonous variety) ii. <i>Cephalostachyum latifolium</i> (non-poisonous variety)	Weave mats, leaf as fodder, poisonous variety used for making arrow, (stem of the poisonous variety is reddish when chopped, non-poisonous variety has whitish stem)
9. Pamethla M Phan K	i. <i>Drepanostachyum intermedium</i> ii. <i>Drepanostachyum annulatum</i> iii. <i>Drepanostachyum khasianum</i>	Bamboo mats for fencing and roofing
10. Zing M War K	<i>Yushania pantlingii</i>	Used for fencing and roofing (small size bamboo)
11. Dei M Dai K	<i>Pseudostachyum polymorphum</i>	Arrow, weaving basket and for tying (small size bamboo)
12. Ree M Rhui K	i. <i>Borinda grossa</i> ii. <i>Thamnocalamus spathiflorus</i>	Mats for fencing and roofing, used as fodder for cattle and horse
13. Teumetla M Suei K	<i>Bambusa alamii</i>	Handicraft, wine container (palang) basket, small bag
14. Mek M Meg K	<i>Yushania microphylla</i>	Arrow, fencing and roofing (small size bamboo)

M=Monkha, D=Dzongkha, K=Khengkha

Bamboo is widely used by the Monpas for making household items such as: bamboo mat for roofing and making walls of houses, as beams and post for houses, floor mat, fence, prayer flag poles etc. Other household products made out of bamboo are winnower, ladle, milk churners, wine and water containers, cups, food or grain containers, baskets of different sizes, rope, bow and arrow. The Monpas eat the tender shoot of most bamboo species, except *Dendrocalamus sikkimensis* and *Drepanostachyum spp.*

Dendrocalamus hamiltonii with sweet shoot is the most preferred bamboo for consumption. Most of the bamboos are used for household consumption, but the Monpas also weave and sell or barter handicraft for items not available locally. Most commonly made handicraft are baskets of different size, bags, furniture, fruit containers etc. Of the bamboo varieties mentioned in Table 4.4, *Dendrocalamus hamiltonii* is the most commonly found. It is also widely cultivated and has great potential for commercialization due to its popularity for handicraft and sweet shoot.



D. hamiltonii cultivated near houses



Bamboo plantation, established in 2000

Making handicraft and household items from cane and bamboo is a traditional craft of the Monpas. This existing skill has been further enhanced through the UNDP/GEF Small Grants project which helped in further improving local skills, product diversification, and marketing linkages. The project also ensures sustainable supply of resources through better management of existing stock, establishment of cane and bamboo nursery and plantation. The cane and bamboo plantation is currently in the process of being registered as community forest.

Bamboo collection and conservation practices

Collection of bamboo is mostly done by men. Two to three people go together to nearby bamboo forest. Bamboo is cut with *patang* from the base, sized further to required length, piled into a bundle that each individual can carry, and is dragged all the way to their houses. It takes almost a day to complete the process. Bamboo is mostly harvested during the months of January and February. The Monpas follow closed season for bamboo harvesting during the months of May to August which is the shooting season. Harvesting is done mostly on *Migmar* (Monday). The Monpas believe that bamboo harvested on Monday is not infected by insects, and thus it lasts longer.

Dendrocalamus hamiltonii is one of the most widely used bamboo species. Most species of *Dendrocalamus* and *Bambusa* are cultivated by the Monpas to prevent soil erosion and to provide bamboo whenever required by the households. *Dendrocalamus sikkimensis* is conserved because of its use as container for wine, milk and butter container. All bamboo species are protected during new shooting stage. The Monpas practise rotational harvesting of bamboo resources allowing regeneration of the harvested stock.

Cane (ratans)

Six species of cane belonging to two genera have been identified in Zhemgang dzongkhag so far. Overall, it is believed that about ten species of cane might occur in Bhutan [FAO 1996]. In the forests of the three study villages of the Monpas, four species of cane representing two genera, *Calamus* and *Plectocomia*, were identified (Table 4.5). *Calamus* is a common climber, which grows extensively in these areas. It

yields strong cane and is used as substitute for rope and as cable for suspension bridges. It is also used for making baskets and containers. The shoot of this cane is eaten as vegetable. Cane shoot of *Plectocomia himalayana* locally known as *patcha* is the preferred cane shoot for consumption. Thicker cane is used for making furniture and walking sticks, among others.

Life without cane would be very difficult for the Monpas. All the four species of cane are utilized to varying extents. Compared to bamboo, cane resources have become very scarce. Currently, it takes eight to ten hours to reach the resource site of cane.

Table 4.5: Cane species

Local Name	Scientific name	Uses
1. Rey M Ree K Rashak (caneshoot)	i. Calamus flagellum ii. Plectocomia himalayana (patcha)	chair, baskets of different sizes, small bag, rope, container, tender shoot harvested for vegetable, patcha (shoot of <i>P. himalayana</i>) sold in market
2. Hampela M Khran K Pangkha-D	Calamus latifolius	Walking stick, rope, basket, chair, table, stool; tender shoot harvested for vegetable
3. Krath K Cheshala M	Calamus acanthospathus	Chair, table, rope, basket, strongest cane - used to make bridge (solitary stem - shoot not harvested for vegetable but judiciously used for handicraft)

Cane collection and conservation practices

Cane resources are scarce and far away from the three villages. In terms of collection, one member from each household goes in a group to the forest and it takes two nights and three days to harvest cane and reach back home. On the first day, the villagers walk to the cane forest and reach there late in the evening. Once they reach the resource site, they

collect firewood, cook food, eat, and sleep. The next day, early in the morning, they harvest cane and make it into rolls. Mature cane is harvested with *patang*, pulled from tree, debarked and rolled into a bundle. The cane rolls are dried on fire the whole night. The people remain awake the whole night drying the cane in the fire. Early next day, the cane is tied up into rolls and they walk back home with cane rolls on the back. They reach home by evening.

Tender edible cane shoots are also cut for household consumption or sale. Since 2000, the Monpas have introduced a local regulation, which is not to harvest more than ten number of cane shoots at one time. This is because, the Monpas have come to understand that harvesting young cane shoot can be harmful to the plant, and its regeneration is low. Cane is mostly harvested during the winter months (December to March). The Monpas practise selective harvesting, only the best quality and required type of cane is harvested. They also practice rotational harvesting of cane resources allowing regeneration of the harvested stock. People from other villages are not allowed to harvest from their neighbouring forest.

The Monpas harvest only mature stems allowing all stems of clum to reach their maximum size before being cut. There is widespread knowledge of the growth habits of cane species among those people harvesting and utilizing cane. Most people were aware that *C. acanthospathus* (Krath) is solitary and that harvest of this cane necessarily kills the plant. Villagers commonly cite this characteristic as a cause of its rarity and use this cane very cautiously. Similarly, the clustering nature of *P. himalayana* is commonly noted as a reason why the species is less vulnerable and relatively abundant in the forest.

Cane is used by 77 percent of the Monpa households for various purposes and handicraft items. It is used to make rope, bowstring, walking stick, sieve, bangchung, basket of different sizes, chair, table, stool etc. Cane is also used to make various other handicraft items along with bamboo. Young shoot of *Calamus* spp. is eaten as vegetable and also bartered or sold in the market.

Medicinal plants

Langthil *geog* in Trongsa district is the most important collection centre for low altitude (Thro-Men) medicinal plant species used in Bhutanese traditional medicine. The Monpas of Wangling, Jangbi and Phumzur villages, which are in the same range as other villages of Langthil, depend entirely on traditional medicine for their health. Diseases, both human and animal, are identified and treated by traditional healers locally known as *pawo* (male) and *pamo* (female). There are two *pamo* and two *pawo* in Wangling village; one *pawo* in Jangbi; and four *pamo* in Phumzur. More than thirty plant species are collected and used by the Monpas as medicines for various illnesses (Table 4.6).

Table 4.6: Medicinal plants and their use

Local Name	Scientific name	part used	Uses
1. Pemagerserseng M Pemgeser D	Bombax ceiba	Flower Bark	Medicine for lungs, liver and heart; used for dog bites
2. Kuemila M Linglingshuk D		Fruit	Medicinal value, sold to NITM
3. Amtrila M	Phylanthus embilca	Fruit	Medicine for cough, blood purification
4. Wompashakpaseng M		Seeds	Medicine
5. Yongkorma M Yoongkar D		Stem	Medicine, sold to NITM

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Local Name	Scientific name	part used	Uses
6. Yurila M		Bark	Bark boiled and water extract used to heal cuts, fractures
7. Tapseng D M		bark	Bark boiled and water extract used to heal wound; women after delivery are bathed in this water
8. Khalimashing D		Seed	Medicine for diarrhoea; made into zinlap
9. Dungmen M Khenpa D	Artemisia vulgaris	Leaf	Leaves crushed and sap applied to cuts/wounds; wounds cleaned with water boiled with <i>A. vulgaris</i>
10. Soman M		Flower	Flower squeezed and placed between teeth as medicine for toothache
11. Katagpa M	Eupatorium spp.	leaf	Medicine for wound/itching wound
12. Chateu M		Leaf	Leaf crushed and sap fed to children with cough
13. Wampakpaseng M		bark	Bark boiled in water and water applied in affected area (gonorrhoea); used as medicine for body itching
14. Wamngatang M		leaf	Leaf roasted in fire and applied when feet itch (fungal and bacterial infection of toes)
15. Aaru D M	Terminalia chebula	fruit	Medicine for cold and fever
16. Baru D M	Terminalia bellerica	fruit	Medicine for indigestion and to cure swollen parts
17. Thalem D M	Punica granatum	fruit, leaves	Medicine for stomach ache; diarrhoea, eye pain (leaves boiled in water and water applied in eyes)
18. Petsheng sha D M	Dryopteris fragrans	Stem	Treats poisoning
19. Khelmashogsho D M	Erythrina arborensens	Seed	Cures kidney diseases

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Local Name	Scientific name	part used	Uses
20. Tsuath D M	Rubia cordifolia	Stem	Cough and cold; Purifies blood
21. Brongkala D M	Butea monosperma	fruit	Skin diseases, diarrhoea
22. Yongka D Youngkadi M	Curcuma longa	Rhizome	Cures wound
23. Bramseng M	Rhus semilata	Fruit	Diarrhoea
24. Shoewo M Thrawa K	Zanthoxylum spp.	Fruit	Deworming, cough
25. Ailanchi D M	Amomum subulatum	Fruit	Stomach ache, diarrhoea
26. Saga D M	Zingiber officinale	Rhizome	Increases appetite, reduce giddiness, warms body
27. Ngakhagchung M	Asparagus racemosa	Root, shoot	Haematoma, shoot eaten as vegetable
28. Khashila M	Adhoda vasica	Flower stem	Blood purification, steam bath for asthma patient
29. Phising gucha M	Pholidota recurva	Stem	Stops vomiting; skin diseases
30. Pekar M	Canarium spp.	resin	Smoke used to cure giddiness and skin diseases
31. Chang K Guen M	Luffa aegytiaca	fruit	Diarrhoea
32. Kanseng M	Pinus roxburghii	Resin	Cures fresh wounds
33. Chamethla M	Ricinus communis (castor)	seeds	Oil as medicine for wounds, as lubricant
34. Yongkema M		root	Roots crushed and soaked in water, and the water used to treat poisoning

The Monpas identified 34 different species of plants whose different parts including fruit, seed, bark, leaf, root, flower, or resin, are used for medicinal purposes. Although use of medicinal plants is mostly administered by the local healers, elderly members in the community also take part in its dispensing. The traditional healers learn the art of medicine from their ancestors and it is passed on to the younger

generation. Until recently, traditional medicine was the only option for delivering health services in these three Monpa villages. A Basic Health Unit established in February 2002, now provides modern medical service to the local population. However, traditional medicine continues to play an important role among the Monpa population.

Oil yielding plants

The Monpas are one of the very few communities in the country who still use forest plants for vegetable oil production. However, in the recent past, this trend has been changing rapidly and is being replaced by use of oil imported from India. The reasons for this change was reported as - decrease in the availability of these oil producing plants and labour intensive processing. Listed below are vegetable oil yielding forest plants commonly used by the Monpas (Table 4.7).

Table 4.7: Vegetable oil yielding plants

Local Name	Scientific name	Uses
1. KheybasengM Yikashing D	Aesandra butyracea	Olive sized pinkish fruits (fruits peeled off and seeds (white) processed for cooking oil
2. Shingmar M K	Toddalia asiatica	Seed processed into oil, used for cooking; medicine for wounds; feed cattle
3. Aichun M Yongmen K		Seeds processed into oil; used for cooking
4. Polompaseng M		Seed processed into oil; used for cooking
5. Pharjakpo M		Seed processed into oil; used for cooking
6. Domseng M K	Symplocus paniculata	Seeds processed into oil; used for cooking
7. Muram M K		Seeds processed into oil; used for cooking; (less frequently used these days)
8. Semuthla M Kin K		Seeds processed into oil; used for cooking
9. Nga Damang M Dumangla K	Gynocardia odorata	Seeds processed into oil; seeds crushed and fed when cattle have worms
10. Chamethla M K	Ricinus communis	Seeds processed into oil; used as medicine for wounds and constipation, lubricant

The above plants produce oil bearing seed, which are collected and processed into vegetable oil. *Brassica spp.* is cultivated in the dryland and its seeds are pressed to produce edible oil. It was found that 88 percent of the Monpa households collected and extracted oil from wild plants (Table 4.2). Households that have adequate labour to process oil from oil bearing seeds from the forest, do not purchase additional oil from the market to supplement their daily diet. Self-sufficiency in oil could be greatly enhanced through improved oil extraction technology and better resource management.

Collection and conservation practices

Fruits of *Muram*, *Semuthla*, are collected from the tree by sickle tied to a long stick, or by climbing and cutting down small branches with fruits. Seeds are also collected from fruits that have naturally fallen off the tree. Collection is done during the month of October when seeds are completely mature. *Polompaseng* has become rare and it is very difficult to get its fruits. But, unlike other seeds, its fruits do not require intensive processing. The fruit can be just pounded and added to curry.

Indigenous method used to extract *Yikashing* oil

Yikashing (Aesandra butyracea) is a medium sized tree that grows in the wild. Its stem is generally crooked. When the fruits ripen in the months of May through July, they fall down. Fruits are collected and carried home in bags. Fruits are cleaned in water and dried, and then pounded into powder. A big pot with water is placed on fire. A smaller pot with *Yika* powder is placed at the neck and any possible gap is covered with cattle dung or mud. The pot with *Yika* powder is covered with big leaves and the bigger pot is heated using firewood. After heating, the *Yika* flour is transferred into the "so-dalang". Heated *Yika* flour is then placed on a

slab made of wood with channels on it for oil to drain out. The Yika flour is pressed with a wooden plank and stones are placed on top of the plank for increased pressure. After sometime, oil drips down the channel into a container placed below it for collection. "Yika makhu" is used as regular oil for cooking but should be heated slightly for better taste. It looks like Dalda (commercial vegetable oil) and becomes solid when cold. Yika oil is also bartered or sold in the market at the rate of Nu. 100 per kg.

Ornamental plants

Some of the common wild ornamental plants used by the Monpas are: *Rhododendron arboreum*; *Magnolia spp.*; *Dendrobium spp.*; *Cymbidium spp.*; *Cupressus cashmeriana*; and *Daphne spp.* Flowers and stem of these plants are kept in the house for decoration.



Orchids in the wild (*Dendrobium nobile*)

Natural dye

Natural dye plays an important role in traditional Bhutanese fabrics. The Monpas obtain natural vegetable dye from plants and minerals by simple, traditional extraction methods. These dyes can be grouped into four categories: leaf dye, bark dye, stem and root dye, and mineral dye. The household survey revealed that only 3 percent of the Monpa households extracted vegetable dye. However, based on actual observation on use of some vegetable dyes, the actual percentage should be higher than revealed during the survey.

- *Leaf dye*: Different plants are used for colouring hand-woven fabrics. The most commonly used leaf dye include *Symplocos paniculata*, *Strobilanthes flaccidifoliosus*, *Rubia cordifolia*.
- *Bark dye*: Bark of walnut tree and *Berberis* species are used as dye.
- *Stem and root dye*: Stem and root dyes are used for varied purposes. Dye from *Curcuma longa* are used for colouring food and yellow colouring for woven fabric.
- *Mineral dye*: These dyes are obtained from natural mineral salts and oxidized iron. e.g. Mordant (*Praksut (D)*)/*Prosala (M)* which are found in rocky cliffs. This mineral, when added to the natural vegetable dye, makes the colour fast.



Eggs boiled with *Rubia cordifolia*



Turmeric planted in the kitchen garden

The following table shows the different species of plants as well as different parts of those plants used by the Monpas to extract dye.

Table 4.8: Plants producing vegetable dye

Local Name	Scientific name	Uses
1. Semethla M Tshuth K	Rubia cordifolia	Whole plant with leaves used; red colouring of thread/cloth/eggs, monk scarf, floor polish
2. Ram D Joemethla M	Strobilanthes flaccidifolius	Leaves used for blue colouring of thread/cloth
3. Youngkadi M Yongka D	Curcuma longa (turmeric)	Rhizome; yellow colouring of thread/cloth Also edible as spice; cultivated
4. Zim M	Symplocos paniculata	Leaf used for light blue colouring of cloth/thread, earlier used to extract oil from seeds

Edible products from forest

The Monpas depend on wild plants and tubers both during normal and food-scarce seasons. During the food-scarce season, they live on wild tubers. It was found that 86 percent of the Monpa households harvested and used wild tubers as food and for brewing local wine (Table 4.2). There are a number of plant species whose fruits, seeds, tubers, roots, leaves or stem are collected and consumed by the Monpas. The study found that more than 80 different species of plants were used as food in some form or the other (Table 4.1). Considering the small population and area, the number of species utilized by the Monpas is impressive and the importance that these plants play in their nutrition and food security is considerable. The large number of species (10 species) categorized as wild tubers are of particular importance as these plants are a major source of carbohydrate during the food-scarce season (Table 4.9). Some of these edible plants include:

Stem

Fern grows wild in the forest surrounding the Monpa villages. The study population identified six different species of fern that they collect. Edible fern is collected only at a tender stage. It is harvested during the months of March through June. Fern is boiled with cheese and some butter, and eaten with rice.

Mushroom grows wild in the forests surrounding the Monpa villages. Different species, both edible and non-edible, are found in the local forests. The Monpas identified ten different types of edible mushroom. It is collected mostly during summer, June through September. It is also dried for better taste and for longer storage. Mushrooms form an important vegetable item for the Monpas.

Young **shoot** of cane are harvested and used as vegetable. Vegetable made of young tender shoot of cane is a delicacy in the Bhutanese cuisine. Shoot of some species of bamboo is also used for vegetable purposes. Tuber and tender inner part of shoot of *Cythea spp.* (Tree fern) is used for brewing local wine. It is also cooked and eaten during the food-scarce season.



Fern (*Diplazium spp.*): A seasonal vegetable Tree fern (*Cythea spp.*)

Flowers

Forests around the Monpa villages grow abundant variety of orchids. Orchids flower during the months of February through September. *Olachoeto* (young flower buds of *Cymbidium spp.*) is consumed as a vegetable and is a cherished culinary in Bhutan. *Olachoeto* flowers are plucked along with the stem. They are harvested during the flowering season in the months of February through September.

Leaves

Betel leaf is chewed with betel nut, smeared with lime. It is also chewed with the bark of *Poikilospermum lanceolatum* and lime, that gives a similar taste, flavour and stain as betel nut. *Piper betleoides* (betel leaf) grows wild in the surrounding forests which is harvested by the Monpas both for consumption as well as for sale. Leaves of several other species of plants are consumed as vegetables viz. *Elastostema spp.*, *Phylodendron spp.*, *Allium spp.*



A Monpa woman plucking betel leaves

Women chewing betel leaves with bark of *Poikilospermum lanceolatum*

Fruits

Wild fruits are abundant in the nearby forests. The Monpas utilize wild fruits for various purposes like extraction of edible oil, lubricant, direct consumption and for medicinal purposes. The Monpas identified twelve different varieties of fruits from the forest used for consumption, and ten other species of plant fruits used to extract edible oil (Table 4.9, 4.7).

Roots/tubers

Ten different varieties of wild tubers were harvested for consumption by the Monpas. These wild tubers are found in abundance in the nearby forests and form an important food supplement for the Monpas in the lean season. Roots and tubers from the forest are also used for brewing local alcohol for household consumption. Wild roots and tubers are primarily collected in the months of January through March and in October and November.

Wild roots and tubers are collected when plants mature. Roots and tubers are dug out from soil, cleaned, boiled and consumed. Tubers of Tree fern and *Jengpa* are boiled, dried, mixed with barley or wheat for alcohol brewing. Wild tubers play a very important role in maintaining food security and nutrition of the Monpas.

Table 4.9: Edible forest products used by the Monpas

Local Name	Scientific name	Uses
EDIBLE FERN		
1. Ngakey D M	Diplazium spp.	Eaten as vegetable
2. Shama M Ngakey D		Eaten as vegetable
3. Guenshimar M		Eaten as vegetable
4. Wowa Ngakey M Rawo Ngakey K	Diplazium spp.	Eaten as vegetable (bigger size and taste better)
5. Deng MK	Cythea spp.	sliced inner stem after

Biological Wealth

Local Name	Scientific name	Uses
	(Tree fern)	water treatment is boiled and eaten or ground into powder and cooked; also make ara, bangchang after fermentation
6. Kilangma M		Stem cooked and eaten as vegetable
EDIBLE MUSHROOM		
1. Selishamu M D	Pleurotus spp. (Yellow)	Vegetable
2. Khalashamu M D	Pleurotus spp. (Orange)	Vegetable
3. Sejuromo D M		Vegetable
4. Wompokpa M		Vegetable (less used)
5. Yugalamu K Komshu M		Vegetable
6. Legashamu M	Hydnum rapandum	Vegetable
7. Nelangarting M Jelinamcho D	Auricularia auricula	Vegetable
8. Simikangmising K Wombamingsing M		Vegetable
9. Belamu M	Lycopodon spp. (White)	Vegetable, taste good
10. Yongkalamu M		Vegetable
EDIBLE CANE		
1. Rey M Ree K (Rashak - caneshoot)	i. Calamus flagellum ii. Plectocomia himalayana	tender shoot harvested for vegetable, shoot of <i>P. himalayana</i> sold in market
EDIBLE BAMBOO		
1. Pa M Pagshi D	i. Dendrocalamus hamiltonii ii. Bambusa clavata	tender shoot eaten as vegetable
EDIBLE ORCHIDS		
1. Olachoto D M	Cymbidium spp.	Flower buds edible winter (flower white-red)
2. Olachoto D M	Cymbidium spp.	Flower buds edible summer (flower white)
3. Bogpatla M	Coeleogyne spp.	Flower buds edible flower red-white
4. Wangpem M	Calanthe spp.	Buds and flowers edible
EDIBLE PLANTS		
1. Damburu D M	Elatostema platyphyllum	Stem and leaves eaten as vegetable
2. Pan M	Piper betleoides	Betel leaf

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Local Name	Scientific name	Uses
3. Zimchangchung M		Green leaves used as vegetable (grow on trees)
4. Mashay M	Allium spp.	Vegetable
5. Chelampi M	Nasturtium officinale	Vegetable (grow in marshy area)
6. Mentala chok M	Murraya keonigii	Tender leaves cooked with meat and eaten; Fruits eaten when ripe (sweet, black colour)
WILD FRUITS		
1. Guli K M	Persea fructifera (Avocado)	Fruits are eaten (fruiting once in 3 years)
2. Shekila M Amsuguli D	Mangifera sylvatica	Fruits are eaten
3. Khashakorok M K	Phytolacca acinosa	Fruit eaten
4. Kashak M Tagoshing D	Juglans regia (walnut)	Fruits (seed kernel) are eaten; also cultivated
5. Namarip M K	Mahonia spp.	Fruits eaten
6. Numpang M Humpa D	Citrus medica	Fruits eaten in place of lemon
7. Jaga churpo M	Citrus spp.	Fruits eaten in place of lemon
8. Andey M D	Diospyros kaki	Fruits eaten (orange colour)
9. Shing-lam-benda M	Eyphomandra betacea (Tree tomato)	Fruits eaten as vegetable
10. Yangkadi M		Fruits roasted in fire, peel off skin, keep in water for 3 days and consumed
11. Lechila M		Fruits eaten (wild mango)
12. Pataye M Phatey K	Thelypteris multilineata	Fruit eaten, peel skin, cut into pieces, soak in water for 2 days and consumed
WILD TUBERS		
1. Mochela M Mokeh K		Tubers boiled and eaten as food
2. Dawaila M	Dioscorea spp.	Tubers boiled and eaten as food
3. Kokshola M	Dioscorea spp.	Tubers boiled and eaten as food (tuber red colour)
4. Shakpa M Zhugpa K	Dioscorea pentaphylla	Tubers roasted in fire and eaten, boiled and eaten, make wine

Local Name	Scientific name	Uses
5. Jengpa M		Make bangchang, boiled and eaten
6. Kochak M Khawang K	Dioscorea spp. (used to be cultivated in tseri)	Make bangchang, tubers boiled and soaked in water for 2 days and eaten
7. Yoemeka M Blue K		Tubers boiled and eaten as food
8. Chelanki M		Tubers boiled and eaten as food
9. Pakalasha M Paralacha K		Skin peeled off and eaten raw
10. Chee M Kee K	Dioscorea hamiltonii	Tubers boiled and eaten as food

Tea yielding plants

The tea leaves are collected primarily for local consumption. Some of the plant species used for making tea are: *Persia odoratissima*, *Loranthus spp.*, *Juglans regia*, *Viscus nepalensis*, *Osyris lanceolata* etc. The collection of tea leaves from the forest is extremely difficult, as they are found on tall trees. At the same time, it was reported that these plants are becoming rare. Mature leaves of *Persia odoratissima*, *Loranthus* are boiled with ash, dried and used when preparing tea. Flowers of *Juglans regia* (Walnut) are dried and used for preparing tea. A total of fifteen species of plants were identified, the leaves and flowers of which are used in preparing tea.

Table 4.10: Local tea used by the Monpas

Local Name	Scientific name	Uses
1. Samte Dema M		Leaf used for making tea, wood used for making cup
2. Choksengma M	<i>Persea odoratissima</i>	Leaf used for making tea
3. Chalamaseng M Chalam K	<i>Acer cambelli</i>	Leaf used for making tea
4. Tamkharla M		Leaf used for making tea
5. Chemarma M	<i>Osyris lanceolata</i>	Leaf used for making tea
6. Ugyen Guruja/ Sertakshing M		Leaf used for making tea

Local Name	Scientific name	Uses
7. Sengleng M	Morus mucurea	Leaf used for making tea (wood black)
8. Khuchegi meto M	Juglans regia (Walnut tree)	Flowers dried and used for making tea (preferred amongst others)
9. Zekta M		Leaf used for making tea
10. Sela M K		Resinous sap used for making tea
11. Sewa M		Leaf used for making tea
12. Karmapokchija M		Leaf used for making tea
13. Langmaja M		Leaf used for making tea
14. Kesangmetog M		Tea from red flower
15. Ngenshithup M	Viscus nepalensis	Leaf used for making tea

Incense

In Monpa culture, plants play a major role in the rituals of purification through fumigation. Everyday, villagers offer incense to the deities. Some of the common species used as incense by the Monpas are *Cupresses cashmeriana*, *Canarium spp.*, *Rhododendron arboreum*, *Cinamomum grandiliferum*, *Citrus spp.*, *Artemisia spp.* etc. These plants are also regarded as sacred as they are offered to local deities. Leaves or small branches are used for fumigation. Some trees like *Canarium spp.* produce resinous sap which is also used as incense. *Cinamomum grandiliferum* gives very good perfume and the Monpas consider this species as a valuable plant. A total of six species of plants are available in the nearby forests which are used as incense.

Table 4. 11: Plants used as incense

Local Name	Scientific name	Uses
1. Poikala M	Canarium spp.	Wood and resinous sap used as saang for puja (Pawo/Pamo use this saang while performing rituals)
2. Arkaseng M	Cinamomum grandiliferum	Saang, gives good aroma
3. Arnaseng M	Aquilaria agarlocha	Wood used as saang (wood black)
4. Tselu M	Citrus spp.	Wood used as saang, leaves dried and ground for saang
5. Chendenseng M Tshendenshing D	Cupressus cashmeriana	Wood and leaves used as saang
6. Tangmeka M Khenpa D	Artemisia spp.	Used as saang (used commonly earlier)

Fiber/rope

Fiber and rope are used every day for household and farming activities by the Monpas. These are derived from plants such as: *Calamus spp.*, *Dendrocalamus*, *Daphne*, *Giardina diversifolia* etc. *Calamus* is a common climber, which grows in the forests. It yields strong cane and is used as a substitute for rope and as cable for suspension bridges. Thirteen species of plants were identified by the Monpas which they use for extracting fiber (from bark) or making rope [Table 4.12].

Table 4.12: Plants used for rope/ fiber

Local Name	Scientific name	Uses
1. Pagala M Payerla K	Phoenix sp.	Make good rope, fiber used for weaving cloth in the past
2. Nampela K Kulima M	Giardina diversifolia	Used as rope, fiber for cloth and bag
3. Chaksela		Used as rope, fiber for cloth
4. Khasharophi M K		Used as rope for fencing
5. Ngatangtela M		Used as rope, fiber for cloth
6. Taptengma M Marep K		Used as rope, fruits eaten
7. Tokchuma M		Used as rope for fencing
8. Denap	Daphne spp.	Rope, tie bundles of bamboo
9. Nangugla		Bark for making rope, fiber for

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Local Name	Scientific name	Uses
		bag
10. Kesia		Rope, bowstring, fiber for bag
11. Ray (cane)	Calamus flagellum	Rope, tie edge of baskets
12. Yangkati M Yang gali K		Used as rope, fiber, fruits eaten or brewed into alochol
13. Nausengla		Used as rope, fiber



Tree bark being harvested to make rope



Women with cane rope

Fodder trees

Livestock rearing is an important activity of the Monpa community, and fodder plays an important role in maintaining this activity. Almost all the Monpa households rear cattle. Although the Monpas graze their cattle in the forest, *tsamdo*, and their own field, more than 70 percent of households supplement grazing with fodder. Fodder is mostly collected by men from the forest. Farmers need fodder particularly during winter months when the ground herbage is exhausted. More than twenty five plant species are used by the Monpas as fodder for their cattle (Table 4.13). Most of these trees are inferior timber species but are important to the Monpas as fodder.

Table 4.13: Fodder trees used by the Monpas

Local Name	Scientific name
1. Okseng* M Bagushing D	Ficus auriculata
2. Phoseng* M	Ficus oligodon
3. Pong* M Nyashing D	Ficus spp.
4. Sangseng* M Redang K	Ficus spp.
5. Kitlangka* M	Ficus spp.
6. Sipsangla* M	Ficus subincisa
7. Shepen* M	
8. Japkarmo* M	
9. Jerupi* M	Bridelia spp.
10. Krapla* M	
11. Sorsolaseng M	Celtis tetrandia
12. Tompangla M	Tririna politoria
13. Moram M	Keydia calicina
14. Yomngatam M	
15. Kueseng M	
16. Kansengmo M	
17. Youeng M	
18. Ley M	Pyrus pashia
19. Solam M; Sar K	
20. Banpalakpa M	
21. Wormjaptan M	
22. Wamzaptan M	Altingia excelsa
23. Peeseng M	Quercus griffithii
24. Namsengma K M	Grewia optiva
25. Pokseng M	Castanopsis spp.
26. Tompangla M	Trevesia palmata
27. Tomalaseng M	
28. Ledramo M	Crateva religiosa

*Fodder tree that produce milky sap

Collection and conservation practices:

Fodder trees are lopped mostly during the winter season when the ground vegetation is exhausted. Lopping of fodder trees is avoided during the months of April to August and when the trees are coppicing. This is to allow regeneration of fodder trees so that they can provide good forage during winter months when needed most. It was found that 95 percent of the Monpa households used these trees as cattle

fodder (Table 4.2). After the cattle feed on the fodder, the twigs are dried and used as fuelwood.

Broom

Brooms are made from plants collected from the forest. The most commonly used plant species for broom are: *Thysanolaena maxima*, *Artemisia spp.* Besides being used as brooms, some of these plants are also used for thatching. Broom made from these plants are sold in the market (Langthil, Trongsa and Bumthang) for about Nu. 10 each. *Thysanolaena maxima* is harvested only in the month of January and February. If harvested earlier or later, it breaks off and does not last long.

Table 4.14: Plants used for broom

Local Name	Scientific name	Uses
1. Pheksangla M	<i>Trachycarpus fortunei</i>	Broom
2. Pokthela M Tsakhusha D	<i>Thysanolaena maxima</i>	Broom (good quality)
3. Parala K Pakala M		Broom, for thatching
4. Duenkami M		Broom
5. Tangmeka M Khenpa D	<i>Artemisia spp.</i>	Broom, used for mulching

Fuelwood

Fuelwood is one of the most commonly used forest products by the Monpas. It is used daily for cooking, heating and for home lighting (Table 4.15). A large quantity of fuelwood is also used for brewing local wine. More than 60 percent of fuelwood requirement is met from nearby forests and the rest is collected from their own agriculture fields. On an average, each household consumes about one back-load (20 kg dry) of fuelwood per day. While collection of fuelwood is mostly done by male members, cooking is mostly done by female

members. Some of the commonly used fuelwood tree species are: *Quercus spp.*, *Castanopsis spp.*, *Alnus spp.* (Table 4.16). Nineteen species of plants were identified by the Monpas as fuelwood. Besides fuelwood, the Monpas also collect *Meptshi* (torchwood) from Chirpine tree. *Meptshi* was found to be one of the main sources of household lighting in these villages.

Table 4.15: Fuelwood - a major source of energy

Fuel type	Cooking	Lighting	Space heating
Fuelwood	100 %	69 %	92 %
Resinous pinewood (<i>meptshi</i>)	-	15 %	8 %
Kerosene	-	16 %	-

(The above figures include percentage of households)

Table 4.16: Plants used for fuelwood

Local Name	Scientific name
1. Kumaseng M Gamaa D	<i>Alnus nepalensis</i>
2. Peeseng M Sisishing D	<i>Quercus grifithii</i>
3. Kreeseng M	<i>Quercus lamellosa</i>
4. Sagseng M	<i>Pinus roxburghii</i>
5. Gumashing D	<i>Quercus glauca</i>
6. Shokhoiseng M	<i>Castanopsis spp.</i>
7. Chepmala M	<i>Castanopsis spp.</i>
8. Choksengma M	<i>Persea spp.</i>
9. Sheykeyla M	<i>Castanopsis spp.</i>
10. Phangragpa K	
11. Polombaseng M	
12. Tsegpashing	
13. Mekham M K	
14. Bomchusang M	<i>Macaranga denticulata</i>
15. Jakaka M	
16. Kholomaseng M Kholongbashing D	<i>Astrodiodes</i>
17. Orkela K	
18. Olaseng M	
19. Sikpaseng M	

Meptshi used at home for lighting and heating



Collection and conservation practices

Firewood collection is not a problem for many households as they live near the forests. One of the key informants tells that he can collect a back-load of firewood within half an hour from his nearby forest. Some Monpas complained that these days there is restriction (from Forest Department) on firewood collection from the forest. The Monpas cut branches, lops and tops of trees felled for timber. Wood from dead trees is also collected as fuelwood. In the past, the Monpas collected fuelwood as and when required, but these days they collect and store fuelwood for later use as it is becoming scarce.

Agricultural tools

The Monpas make many household items and farming tools from wood. They have gained knowledge about the suitability

and strength of each type of tree based on their experience and knowledge passed on by their ancestors. Wood of *Quercus spp.* and *Toona spp.* are known for their strength and hence are used for making plough. Other farming tools such as axe handles, knives handles, yokes, rice pounders, tools for grinding chilli etc. are also made by the Monpas. The commonly used plant species for farming tools are *Quercus spp.*, *Rhododendron arboreum*, *Schima wallichii*, *Toona ciliatta* etc. Ninety five percent of the Monpa households used wood for making a variety of agricultural tools needed for their farming and other daily use. A total of 15 species of plants were identified by the Monpas which they used for making agricultural tools (Table 4.17).

Locally made tools for use at home



Kitchen items

1. *Dochung* - keep dry meat, food items (made of bamboo)
2. *Umpang* - store fermented cereal for alcoholic drink; store seeds, wild fruits; (this plant grows in *tseri* and is not edible).

3. *Chongke* – used as ladle to pour water, alcoholic drink; (this plant grows in *tseri*).
4. *Pedma dung* – used to store salt, seeds; (made of *D. Hamiltonii*; two pieces of bamboo clamped together).
5. *Chemeling* – Pot stand; (made of cane).



Knife handle made from root of *Dendrocalamus Hamiltonii*

Table 4.17: Trees used for making tools by the Monpas

Local Name	Scientific name	Uses
1. Tsela M K		Plough, axe handle, knife handle
2. Kree M	<i>Quercus</i> spp.	Plough, grinder handle
3. Yai seng M	<i>Toona ciliatta</i>	Plough, grinder handle
4. Metsarma M		plough, axe handle, knife handle, yoke
5. Gumashing M K	<i>Quercus glauca</i>	Used for making plough
6. Keptishing M K		Used for making plough
7. Dektola M		Tool for beating rice, plough

8. Jenseng	Schima wallichii	Tool for beating rice, plough
9. Tekarseng M		Yoke
10. Choksangma M	Persea odoratissima	Knife handle, tool for grinding chilli
11. Shayseng		Grinder handle
12. Arato M	Rhododendron arboreum	Plough, knife handle
13. Tamaseng M		Plough
14. Khebaseng M		Plough
15. Shokhoiseng M Shokoshing D	Castanopsis spp.	Tool for beating grains

Timber, Pole and Shingles

Timber, pole and shingles are the major forest products used by the Monpas particularly for house construction and for fencing. Most of the Monpas use shingles to make roof of their houses. Shingles are readily available and cheaper as compared to the corrugated tin sheets that have to be transported from Gaylegphug or Thimphu, the nearest towns which are about two days journey by road. Trees with straight grains (*Pinus roxburghii*) are generally preferred for shingle. Other trees include *Castanopsis spp.* The shingles are left to dry in the forest for about two months. Both men and women then carry the shingles home. On an average, 500 pairs of shingles are required for roofing of one house, and are changed once in 5 to 10 years. *Castanopsis spp.* is the most preferred species for shingles as it lasts for about 15 years. The Monpas are a cohesive community and follow the traditional culture of labour sharing. Households deciding to change roof shingles, construct a new house, or repair an old house, inform their neighbours. All households contribute labour by assisting in carrying timber and contributing labour for the house construction or repairs.

Poles from trees are mostly used for fencing, house construction, prayer flags, batten, and as tethering poles. Some of the commonly used tree species for poles are: *Quercus spp.*, *Castranopsis spp.*, *Symplocus spp.*, *Rhus spp.*, *Pinus spp.*, *Alnus nepalensis*, etc. Most of these tree species were reported to be decreasing in the nearby forests.

Timber which includes beams and planks is used mainly for house construction. Foundation and walls of the house are often made of stones, but the house itself consists of beams which form the main structure. Often, the walls are made of stones or bamboo mats plastered with clay. The floors are made of wooden planks. The commonly used tree species for plank and beam are: *Michelia spp.*, *Toona spp.*, *Pinus spp.*, *Castanopsis spp.*, *Schima wallichii*. The Monpas believe that trees for beams can be felled anytime of the year but preferably between February and July. It is believed that beams, planks and shingles from trees cut during this period last longer. The Monpas fell trees for timber only on *Migmar* (Monday), as it is believed that the timber harvested on Monday will not be infected by insects and will last longer. The Monpas avoid felling trees on the 15th and 30th day (full moon and no moon), of the Bhutanese month. Beam is made immediately after the felling of trees since fresh wood is easier to split and clean. From an ideal tree, two to three beams can be extracted, though most trees yield only one or two beams. The beams are left in the forest to dry and later, men drag them home.

Table 4.18: Trees used for timber, pole and roofing shingles

Local Name	Scientific name	Uses
1. Saengleng M Sengleng K	<i>Morus macroura</i>	Cham, plank, pole, shingles, tools
2. Kharseng M Kharshing D	<i>Michelia spp.</i>	Cham, plank, pole
3. Yoeseng M	<i>Toona ciliatta</i>	Cham, planks, wooden box

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Local Name	Scientific name	Uses
Chuenshing D		(good timber)
4. Praguli M K	Persea spp.	Cham, planks, fruits edible
5. Lungmarmo M K		Cham, planks
6. Kanseng M Tongphushing D	Pinus roxburghii	Cham, shingles, pole
7. Domseng M K	Eurya japonica,	Roof ceiling, pole
8. Khashak M Tagoshing D	Dalbergia latifolia	Cham, ceiling, fruits edible
9. Shakeyla M Kemala K	Castanopsis spp.	Shingles, pole, timber, fodder
10. Shokhoiseng M Shokoshing D	Castanopsis spp.	Shingles, timber, pole, fruits edible
11. Kemetla M Kuthmeching K		Cham, planks, pole, fruits edible
12. Namsengma M	Grewa optiva	Cham, planks, pole, fruits edible
13. Hepola M Gumangla K		Cham, plank
14. Jansenka M Kangkala K		Planks
15. Yoeshing D	Toona ciliatta	Planks
16. Merang M		House roofing, prayer flags
17. Janseng	Schima wallichii	Cham, batten, rice pounder
18. Kreeseng M Kraye D	Quercus lamellosa	Poles for fencing, teething pole
19. Chokashing D Bramseng M	Rhus spp.	Poles for fencing, teething pole
20. Pisang M Peshing D	Quercus griffithii	Pole for housing and fencing
21. Kumaseng M Gumashing D	Quercus glauca	Pole for housing and fencing
22. Shakeyla M Shakhoi K	Castanopsis spp.	Used as batten, fencing, housing
23. Jagakaseng M Kakashing D	Alnus sp.	Pole for hut, fencing
24. Chekmala M	Rhus spp.	Prayer flag poles, shingles
25. Yakhroe M	Toricellia tillifolia	Flag pole, fencing, shingles
26. Shekeyla M	Castanopsis spp.	Shingles, pole
27. Kemela M		Shingles
28. Sokar M K		Shingles
29. Sona M K		Shingles
30. Sagseng M		Timber, shingles, batten
31. Kankalaseng M Kankalashing D		Shingles

Timber collection

Collection of all timber products such as pole, shingles, planks and beam are conducted collectively on the basis of mutual help. A group of men go to the nearby forest and fell trees when required. A total of 31 species of trees were identified by the Monpas for use as roofing shingles, poles and timber. Prior to 1969, there was no restriction on the harvest of timber for household consumption. But after 1969, the RGOB has enforced strict rules and rationing on timber extraction. Forest permit is required for felling trees. The forest staff at the *geog* level keeps a strict vigilance on extraction of timber and other prohibited produce from the forests.

Forest products contributing to household economy

The Monpas use a variety of forest products for their daily use and some for sale to earn cash income or barter with goods required for household consumption. The forest products sold to generate cash income include: cane and bamboo handicraft items, resin, betel leaf, fern, *damburu*, mushroom, cane shoot, and avocado (Table 4.19 and 4.20). The non-timber forest products play an important role in the household economy of the Monpas. Some improvement in the processing and packaging of the forest products and market linkages would enhance their cash income.

It was observed that as high as 83 percent of households were involved in selling cane shoot and up to 69 percent households in selling cane and bamboo handicrafts. Cane does not regenerate as fast as bamboo. Due to frequent harvest of cane shoot as well as demand of mature and healthy stem, for the purpose of handicraft, it has resulted in significant depletion of this resource. More than 50 percent of

households collected and sold betel leaves and 27 percent tapped resin from Chirpine trees. Only a small percentage of households were involved in sale of other forest produce like fern, mushroom, *dambru* and avocado, for minimal cash generation.

It should be noted that the data reported is based on voluntary revelation of facts as well as observation of day to day activities. There are government regulations against extraction of cane, bamboo, resin, and hence, voluntary revelation of data may be sub-optimal.

Table 4.19: Percentage of households that sell forest products

Cane shoot - 83%	Cane and Bamboo handicrafts - 69%
Betel leaf - 53%	Resin - 27%
Fern -11%	Dambru-7%
Mushroom -3%	Avocado -3%

Table 4.20: Forest products contributing to household economy

Forest products	For sale	For self consumption	Price (Ngultrum)	Remarks
avocado	x	x	Nu. 1 for 5 pieces	mostly home consumption
bamboo shoot	x	x	Nu. 30-40/kg	mostly home consumption
betel leaf	x	x	Nu. 10/ bundle	high demand
cane shoot	x	x	Nu. 10/ piece	high demand
dambru	x	x	Nu. 5/ bundle	good market
dye (different types)	x	x	Nu. 7 to 50/ kg	sold in Bumthang
fern	x	x	Nu. 5/ bundle	good market
handicraft items	x		various	major income
mushroom	x	x	Nu. 50-80/ kg	good market
resin	x		Nu. 8/kg	major income
vegetable oil	x	x	Nu. 60 to 100/ kg	mostly home consumption
walnut	x	x	Nu. 1 for 5 pieces	sold in Langthil

Cane shoot

Cane shoot is considered a delicacy in the Bhutanese cuisine, and thus has a high market demand. Each cane shoot is cut at a length of three feet and fetches a price of Nu. 10 to 15 per piece. More than 80 percent of the households sell cane shoot. This high demand for cane shoot has resulted in harvesting of cane shoot in huge quantities. Recently, realizing the danger of over harvesting, the Monpas have come up with a local regulation that each person can harvest or sell only ten pieces of cane shoot at a time.

Handicraft items

Cane and bamboo are the two most versatile plant materials available to the Monpas. The Monpas of Trongsa are excellent weavers and they have learnt this art from their ancestors. Bamboo is used for a variety of purposes as house building material, for making mats, baskets, rope, winnower etc. Similarly, cane is also used to make high quality household materials and handicraft items. Cane products are much more durable than bamboo but resources are more scarce as compared to bamboo. Young shoots of bamboo and cane are consumed as vegetable. Out of the total 40 households, 69 percent households sell handicraft items made from cane and bamboo (Table 4.19). Handicraft has become an important source of cash income for this community.

The Monpas of Wangling, Jangbi and Phumzur villages collect cane and bamboo from 17 different forest areas. The people of Jangbi collect bamboo from Kumchen, Lamrang, Zangjan, Moktzhola, Ramdichu, Kubhen, Zaeling and Shingkhai, all located between two to three hours walking distance. Bamboo forests are closer to Wangling, within one to two hours walking distance. Monpa of Wangling collect their resources from Duling, Cupiling, Tangkhala and Dungsum. The people

of Phumzur get their bamboo from Kurtog, Zangjan, Ramdichu, Charpang, Lamrang, Lamrak, Thangda, and Lamlang. All these areas are within four hours walking distance.

Resin

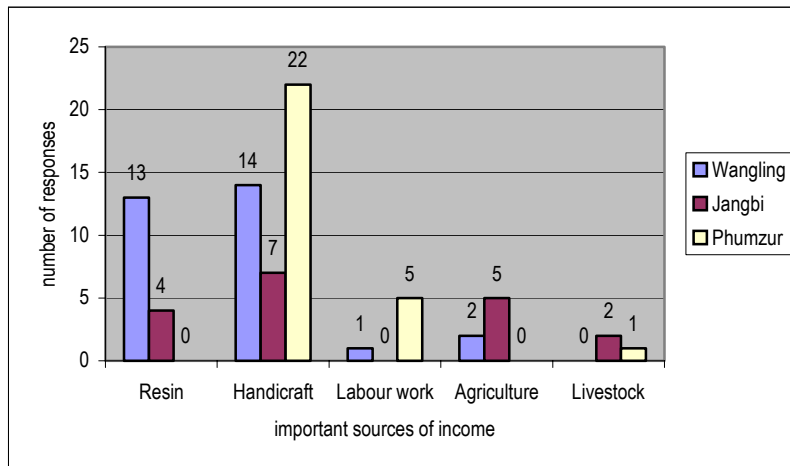
Resin tapping started in Bhutan in the year 1974 with the signing of a fifty-year lease agreement between the RGOB and Dasho Ugen Dorji, Chairman of Tashi Group of Companies. Chirpine forests of five eastern districts were allowed for tapping under this lease agreement. Till the late 1980s, labourers from Himachal Pradesh were engaged for all tapping activities, as Bhutanese did not have the expertise. By the nineties, all tapping activities had been handed over to Bhutanese people trained by Tashi Rosin and Turpentine Industry.

The Department of Forest has developed guidelines and regulations on resin tapping. Deviation from this prescribed regulation has made Chirpine trees more susceptible to damage from fire and wind. In some cases, excessive tapping has led to girdling of trees and ultimately their death. This problem is exacerbated by *meptshi* collection. The oil bearing exposed part of the tree trunk (after resin trapping) is chipped out and these chips (*meptshi*) are used for lighting the houses and as torchwood at night.

Although resin tapping seems harmful to the health and sustainability of Chirpine forests, it is an important off-farm enterprise that contributes significantly to the household income of the tappers [Norbu 2000]. It is evident that 60 percent of the Monpa population practise agriculture, but their main source of income is handicraft made from cane and bamboo, followed by resin tapping (Figure 4.3). The Tashi

company pays a royalty of Nu. 4 per kilogram of resin to the RGOB and Nu. 8 per kilogram to the tappers as the price of resin. Twenty seven percent of the Monpa households tap resin. Figure 4.3 shows that the majority of the people from Phumzur weave handicraft items whereas most people from Wangling tap resin, for income. The Monpas follow the French Cup and Lip method to tap resin from Chirpine trees. Resin is tapped during the month of March to November with a rest period of three months from December to February. It was reported that maximum resin flow occurs during the months of May and June.

Figure 4.3: Important sources of cash income by village



Betel leaf

Betel leaf also forms an important cash earning forest produce for the Monpas. Fifty-three percent of the households collect and sell betel leaf (Table 4.19). Betel leaves (*Piper betleoides*) are collected from the forest and sold in small bundles in Langthil, Trongsa and Bumthang. Each bundle fetches around Nu. 10.

Fern

Fern is an important source of green vegetable to the Monpas. It is also harvested and sold by some households (11 percent) for cash income. It grows abundantly in summer primarily between the months of March and June. Six species of edible ferns were identified by the study population. The tender shoot of fern is plucked, a handful tied into a bundle and sold in the market. Each bundle of fern fetches Nu. 5.

Mushroom

Mushrooms are found in abundance in the forests during the summer months. The Monpas identified ten different varieties of mushrooms that are edible. It is harvested mainly during the months of May through September. Mushroom has good market value and is sold at a cash price of Nu. 60 to 100 per kilogram depending on the variety.

Forests and food security

The edible plants harvested from the forests form a major part of the diet for Monpa households. The Monpas harvest and consume more than 80 edible plant species from the forests. The period when the largest number of edible plants are harvested from the forests coincides with the time of the year when farmers face shortage of food-grains. The health and nutrition of the Monpas appear to be related to the availability of forest food plants, and hence, the biodiversity of their neighbouring forests. The availability of these edible plants in the forests also affects their attitude towards developing and maintaining kitchen gardens. A very few Monpa households have kitchen gardens.

Although all Monpas in the three villages are dependent on forest food to a great extent, this trend is changing. The

Monpas of Wangling and Jangbi have begun extensive cultivation of crops and depend less on forest food, whereas in Phumzur, which is further away from the road-head, people still depend on forest food to a great extent (Table 4.24, page 106). Among the three Monpa villages, Wangling and Jangbi are better off and self-sufficient in food grains as compared to Phumzur. They save grains for seeds, festivities, religious congregations and household consumption.

Forest contributes to self-reliance



A Monpa woman with her child

One can notice how valuable forest products are when we visit any Monpa home. Almost every item available in the Monpa house is associated with forest or forest products. Without the forest resources close to their villages, they would be forced to purchase much of what they currently produce themselves. In view of the limited cash economy in the three Monpa villages, it is not unreasonable to view the forest as a kind of bank account. When all else fails, the forest provides a buffer for the Monpas' self-reliance.

The Vital Link: Monpas and Their Forests

Forest products for household use – house building materials, tools to pound grains, firewood, baskets, bags from nettle plant fiber, ladle, tea & butter churner, big leaves to dry grains



Indigenous knowledge and practice contribute to conservation of forests and its biodiversity

The extensive ethno-botanical knowledge and use of plant diversity by the Monpas (Table 4.1) has grown from generations of sustainable use and conservation of the biodiversity around them. The multiple use of forest products necessary for the survival of such indigenous people, is an important incentive to improve forest management and ensure sustainability by protecting the resource base against excessive extraction and depletion. This is contrary to the modern forest management practice which values timber as the only major resource, thus failing to recognize the complete value of forests.

The three villages of Wangling, Jangbi and Phumzur serve as protective zone for the accessible natural resources in the BMNP area. The Monpas live in harmony with nature. They derive all their daily necessities from the forest which they harvest cautiously and sustainably utilizing their age-old knowledge of the forest resources and their functioning. During the study, some conflict on resource use were discussed (Figure 4.7, page 129). The conflicts occurred over resources such as the cane and bamboo, *tsamdo* and non-timber forest products. The resource conflict matrix indicates that the Monpas have conflicts with neighbouring villages and people of other dzongkhags and none among themselves. There is no conflict regarding the natural resource utilization within themselves as they have devised a mechanism for sharing, which naturally prevents such conflicts. This is also demonstrated by the various traditional institutions and systems for natural resource management followed by the Monpas, in order to promote equal benefit sharing and ensure sustainable supply of resources as explained in chapter five.

The Monpas have conflicts with outsiders, but the conflict as well as local norms of resolution of such conflicts help towards sustainable use and conservation of resources. If these three Monpa villages did not exist, the resources, particularly cane and bamboo, the most sought-after forest resources in this region would have been depleted due to over exploitation by people coming from other villages and dzongkhags in the region.

Farming System

The three Monpa villages, Wangling, Jangbi and Phumzur, fall within the dry sub-tropical agro-ecological zone. The Monpas practise integrated farming system that includes cereal crops, livestock, citrus orchard and kitchen gardens. They believe that nature is given by a superior power. Hence, numerous rituals accompany farming activities, upholding local culture and knowledge. Their traditional land-use systems integrate crops, livestock, and forest in a sustainable manner. Optimum use of local resources is another notable feature in the indigenous farming system of the Monpa community. Various methods of soil and water conservation are practised, with emphasis on fallowing (shifting cultivation) and recycling of plant and animal waste by organic manuring and composting. The cropping pattern of the three villages in the study area is shown in Figure 4.4.

There is a strong link and interaction between the farm and the surrounding forest, especially concerning cattle management practices. Cattle are grazed in the forest throughout the year. In addition, farmers are known to utilize a vast array of forest plants to meet their household needs. The forest and agriculture in the three Monpa villages is characterized by a substantial diversity and a high degree of

self-reliance. There is also a close relationship between the food-scarce season and the collection of forest foods. The Monpas are highly dependent on forest food during the lean agricultural season, which form an important part of their daily diet. However, changes have been observed in the recent years in the traditional agricultural systems and forest food collection habits of the Monpas. These changes are driven by socio-economic and cultural changes, the conservation policies of the RGOB, and reduced availability of natural resources. Change from subsistence farming of traditional food crop agriculture to cash crop-based agriculture is beginning to be noticed in the Monpa villages.

Agriculture practices

Agriculture is the main on-farm occupation of the Monpas with more than 60 percent of the total population involved in farming. All Monpa households except three households own private registered land and are involved in agriculture. Land is inherited from parents. Two Monpa households have received land from the RGOB as a grant. Average land holding is 2.2 hectare per household.

Land is categorized into different groups depending on its use. *Kamzhing* (dryland) is used for cultivating primarily maize and wheat. The Monpas have an average of 0.8 hectare of *kamzhing*. *Chuzhing* (irrigated land) is another important category of land. The Monpas have an average of 0.7 hectare of *chuzhing*. It was found that 17 percent of households do not have *chuzhing*.



Paddy fields at Wangling village

Table 4.21: Land use and land holdings

Land use type	Land area in hectares
Kamzhing	36.1
Chuzhing	30.1
Tseri	23.6
Tsamdo	654 (private)+ 749 (communal)

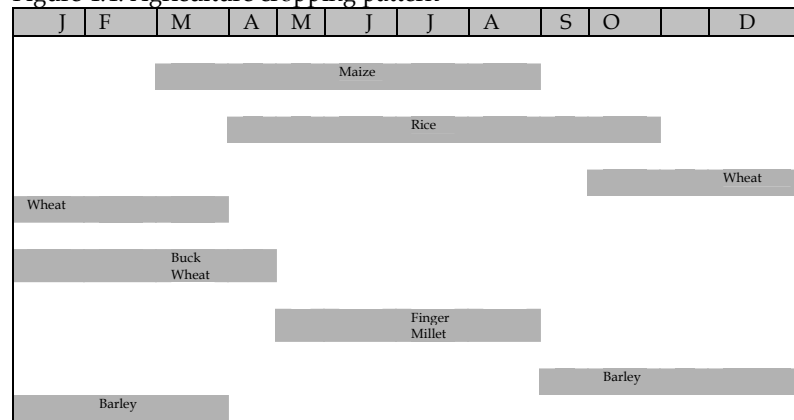
The cropping cycle and type are based on climatic variations. Major summer crops are rice, maize, and millet while wheat, buckwheat, and barley are grown in winter. Rice is the main crop in the irrigated land production system, with some wheat and barley grown in winter. Tall red or white rice varieties are grown following local practices. Cattle manure is by far the most important source of plant nutrient, used by the Monpas who greatly value their livestock for manure production as well as for milk, and other dairy products such as cheese and butter. Additional nutrients are added to the animal waste with lavish use of cattle bedding from the forest or field. This allows most of the nutrients from the livestock urine to be retained in the manure. As cattle migrate from the mountains down to the valley, winter crops are often

inadvertently grazed. Additionally, damage of crops by wild animals was also reported.

Labour utilization and inputs

Average yearly labour input for different household tasks included the following: agriculture (180 days), livestock (90 days), fuel wood collection (30 days), handicraft (30 days) and forest food collection and other works (30 days). The culture of mutually sharing of labour is prevalent in the Monpa villages. Generally, all hard labour work and fuelwood collection are carried out by men. Tasks such as sowing, weeding and harvesting are carried out by women. The head of household and spouse together control and allocate labour requirement and contribution within the households and community. Almost all households own agricultural land and cultivate it.

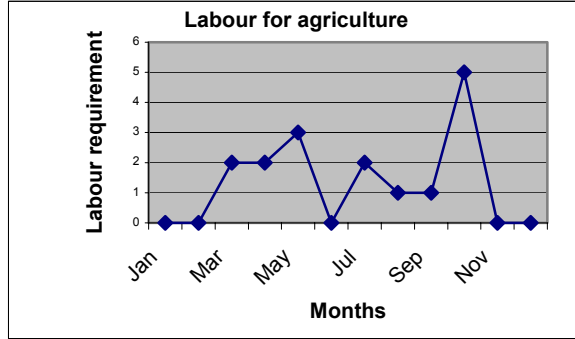
Figure 4.4: Agriculture cropping pattern



Group discussion with villagers demonstrated that maximum labour requirement was felt in the months of October

followed by March, April, May, and June as shown in Figure 4.5. The need for labour during these months is corroborated by the agriculture cropping pattern (Figure 4.4).

Figure 4.5: Agriculture labour requirement



Source: PRA Seasonal calendar

The Monpas also practise *tseri* (shifting cultivation). They have a total of 24 hectares of registered *tseri* land for this purpose, with an average of 0.6 hectare per household (Table 4.21). More than 60 percent of households have registered *tseri* land. Most Monpas find *tseri* better than other types of land-use because, it is less labour-intensive and crop yield is good. On the other hand, *chuzhing* also gives better production but requires intensive labour. The Monpas follow subsistence farming and their staple food is maize and rice. More than 90 percent of the households indicated that rice is the most preferred crop followed by maize. Generally, the choice of crops is determined by the nutritional requirement of crops, socio-economical conditions, and cultural preferences.

The Monpas practise kitchen gardening on a very small scale. The size of the kitchen garden in the three villages is small as compared to other rural villages in the country. The most

commonly grown vegetables are: radish, *Brassica spp.*, pumpkin, chilli, onion, egg-plant, tree tomato, and beans. Limited business knowledge and lack of access to market force the Monpas to sell their surplus agricultural produce at low prices to the traders or shops in Langthil against cash payment or bartered in exchange of food commodities like rice, salt, oil, etc. The traditional barter of agricultural crops or handicrafts is very common among the Monpas.

Tsamdo or grassland is used by the villagers to graze their cattle especially in winter months. *Tsamdo* is either owned by the whole community or by single households with absolute grazing rights. The Monpas have 654 hectares of private *tsamdo* which is completely owned by individual households (Table 4.21). They also have communal *tsamdo* which belongs to the whole Monpa community, and other *tsamdo* that belong to people from outside their village. Some households own as much as 121 hectares of *tsamdo*.

Table 4.22: Land use type by village

Land use type	Wang-ling	Jangbi	Phumzur	Summer crops	Winter crops
Kamzhing (hectare)	10.3	15	10.8	Maize, buckwheat, rice	Wheat, barley, buckwheat, mustard
Chuzhing (hectare)	15.2	9.5	5.4	Rice, buckwheat	Wheat, barley, buckwheat, mustard
Tshoesa (hectare)	0.6	0.5	0.6	chilli, onion, ginger, brassica spp., radish,	brassica, radish, potato, mustard
Tseri (hectare)	5.4	4.4	13.8	Finger millet, buckwheat	Maize, finger millet, buckwheat, rice
Cash crop trees	83 orange	100 orange	42 orange	NA	Orange Cardamom
Tsamdo (hectare)	281	243	130.4	NA	NA

In addition to the traditional farming system, the plantation of cash crops is fast emerging as a progressive system in terms of generation of cash. Two important cash crops of the Monpas are orange and cardamom. However, the Monpas also grow other fruits such as banana, sugarcane, guava, peach and pear mainly for consumption and sometimes also for sale in small quantities. About 65 percent of the Monpa families cultivate orange with maximum households (75%) in Wangling involved in it. All the 16 households in Wangling were involved in cardamom cultivation while a few households in Jangbi (4) and Phumzur (14) cultivated this cash crop.

Table 4.23: Yield levels (kg/hectare) of major crops grown by the Monpas

Season	Crop	Yield national average	Yield Monpa villages
Summer	Rice	2392	1862
	Maize	1358	1240
Winter	Wheat	1123	931
	Buckwheat	883	761
	Finger millet	887	924
	Barley	1100	1050

Source: Author's household survey 2001; CSO 2001 (national yield);

The yield of major cereal crops such as maize, wheat, buckwheat and barley, which account for more than two-thirds of the total cropped area is slightly lower than that of the national average. A more or less similar pattern is seen in the yields of barley and finger millet but the yield of rice varies widely with the national average (Table 4.23). The lower yield of crops could be due to use of local seed varieties, non-use of fertilizers, pesticide and crop damage by wild animals.

All households in Phumzur and Wangling reported food shortage. During the food-scarce season, the Monpas depend

on the forest food, mainly tubers. They also barter handicraft items for food grains from the nearest market (Langthil) or sell their products for cash (Table 4.24).

Table 4.24: Number of households with food grain shortage

village	No. HH with food grain shortage	Food grain shortage coping mechanism			
		Buy from market	Supplement with forest food	Barter with handicraft	Borrow
Wangling	16(100)	16(100)	13(81)	6(37)	10(62)
Jangbi	6(67)	5(55)	3(33)	3(33)	1(11)
Phumzur	15(100)	12(80)	13(87)	14(93)	8(53)

(Percentage in parenthesis)

Determining cropping seasons

It is interesting to note that the sowing time of crops is determined by nature's manifestations, and the farming system is closely associated with local biodiversity. The Monpas believe that call of *Kupthom* (Cuckoo) indicates the time for sowing maize. It is also believed that if *Kupthom* calls at other times, there will be food shortage (crop failure). The time for sowing rice seeds is indicated by the call of *Pengpairung* (Large Hawk Cuckoo). These birds are closely associated to the agricultural cropping pattern of the Monpas.

Additionally, it is sowing time for millet seed when chirpine needles fall down with the wind, and cones are conical in shape. Sowing time of wheat and barley is indicated by the fall of leaves of *Betula alnoides*. Land is prepared in April for summer crops and in October for winter crops. The Monpas believe that black soil is fertile and crops grow well in black soil.

Water Management

Most of the cultivated land is rainfed with little irrigation. Farmers believe “rain” as the indicator for a good harvest. If it rains about two times in the month of January and February, it is a sign of good rainfall for that year. If the mountain peaks do not have snow, it is an indicator of impending drought. The Monpas perform rituals annually at the water source to please the local deity for continued supply of water. Most water sources are culturally protected as they are believed to be the home of local deities (*duth*).

Weed management

Management of weeds is an important agricultural activity and yield of crops and vegetables depends on their efficient management. Weeds compete with crops and vegetables for light, space, moisture, nutrient and reduce crop yield considerably. Weed problems are more serious in the Monpa villages due to heavy rainfall supporting its fast growth. A female farmer from Phumzur expressed concern over the excessive growth and spread of *Eupatorium adenophorum* locally known as “*katakpa*”. This weed was found to grow fast, spread quickly in the field shading crops and result in poor crop production. The most common weed management practices are hand weeding and mechanical methods. Hand pulling of individual weed is a practical and efficient method used in kitchen garden or in smaller areas for eliminating weeds. Mechanical control involves hand pulling, hoeing, tillage, mowing and burning. Burning of naturally matured weeds before land preparation is a common weed control practice. The burnt weed biomass and ash increase soil fertility. Both men and women participate in weeding. It was

reported that barley, buckwheat and wheat, do not require weeding.

Katakpa (*Eupatorium adenophorum*): A weed of concern



Pest and predator management

Wangling, Jangbi and Phumzur are characterized by heavy rainfall, high humidity and mild temperatures that make an ideal environment for the survival and perpetuation of many plant pathogens and pests. However, the pathogen and pest population are under control due to limited land under cultivation and less intensive agriculture, as well as practice of traditional methods of pest control rather than use of chemicals (Table 4.25, page 109). The Monpas have an interesting way of avoiding pests and insects. They believe that if vegetables are planted in the month of September, pests and insects do not infect the vegetables, but, if planted later, the vegetables are highly infected by pests and insects. Pumpkin and beans (climbers) are not grown with other vegetables because they are believed to reduce growth of other vegetables. Generally, if the crops and vegetables are

infected by pests the Monpas perform rituals, apply ash and *Artemisia* plant to repel pests. If problem becomes acute, then they use pesticides as a matter of last resort.

Table 4.25: Indigenous treatment against pests and diseases

Disease	Treatment	Efficacy
cutworm	manual picking	Effective when less
chilli wilt	change site the following season	
trunk borer	application of kerosene into the holes	Effective
Aphids	apply ash and <i>Artemisia</i> plant	
Worm (Kong)	perform puja "Lapsang" for 3 mornings	

Unlike in other parts of the country where potato is widely cultivated, the Monpas reported that they do not plant potatoes because red ants infect the potatoes and harvest is not considered worth the energy invested. Common pests include cutworm, rice wilt, trunk borer, root rot, aphid, and chilli wilt. Besides the pests, most Monpa households also complained of predators such as wild boar, sambar, barking deer, bear, porcupine, and monkey which destroy significant quantities of their crops. When the crop matures and is ready for harvest, people guard the crop day and night until it is harvested.

Soil management

The Monpas use cattle manure and cattle bedding in the field to increase soil fertility. It is believed that, cattle tethered in a land for one year can maintain the soil fertility for three years. The Monpas also grow mustard to increase soil fertility. Sisiseng (*Quercus grifithii*) is believed to increase soil fertility and is retained in the fields. Stone wall and drainage channels are also made to prevent soil erosion.

Biological Wealth



Cattle tethering to increase soil fertility



Harvested paddy field being ploughed for winter crop

Rice, maize and buckwheat give good yield and hence these crops are widely grown. Oxen drawn plough is used for preparing land for sowing. Ploughing is mostly done by men. However, in households that do not have male members, women plough the land. There is no social taboo against women ploughing their land.

Seed selection

The Monpas preserve seed for most of the crops. Improved variety seeds of wheat and rice are bought from the Agriculture Commission Agent in Langthil. Differences in the system of preserving seeds were noted among the three Monpa villages. The Monpas of the Jangbi and Wangling preserve their own seeds except for wheat, whereas the Monpas of Phumzur borrow or barter seeds from neighbouring villages. Among the three villages, Phumzur was found to be less self-sufficient in food grains.

Both men and women are involved in harvesting, processing and storing but women are mostly involved in harvesting crops. Crops and crop variety are selected by both male and female members. However, it was found that female members were extremely knowledgeable about the crop varieties and their characteristics, both the old and newly introduced varieties. One of the local residents of Wangling village stated, "if we do better selection of seed, crop yield is better, but these days, the younger generation does not care to do seed selection and it results in poor yield".

Agriculture and field implements

The Monpas use a variety of locally made tools for their daily farming use. It was observed that women had more

knowledge of agricultural tools, and men used and had more knowledge of the implements used in the forests. A wide range of tools have been developed and used by the Monpas over generations. Some of these tools are described below.

Tools used for agriculture



1. *Kokse* (spade) - to dig soil
2. *Shigula* (smaller spade) - used for weeding
3. *Lageing* (small spade) - to dig wild tubers from forest, also used to dig hole for sowing maize
4. *Sumti* (wooden plate) - used with plough to dig soil

5. *Abu* (oldest tool, sickle) – used for fodder collection
6. *Jhorwa* (sickle) – used to harvest paddy, wheat, millet; (good for cutting field crops from the base of the plant).
7. *Abu* (sickle, new tool) – used to cut bigger herbs/shrubs
8. *Patangla* (big knife) – used to cut trees; knife handle made from *Dendrocalamus hamiltonii* root, knife cover made from *D. hamiltonii* stem
9. *Tachung* (axe) – used to chop firewood, timber for house construction, make plough
10. Plough

Tseri (shifting cultivation)

Shifting cultivation (*tseri*) forms an important part of the agriculture system of the Monpas with more than sixty percent of the households practising it. Although the trend of conversion from shifting cultivation to permanent cultivation is increasing with government discouraging *tseri*, the Monpas feel very positive about *tseri* in terms of energy efficiency and food security. Seventy-six percent of the households expressed that *tseri* cultivation is good for their land because it produces high yield with minimal labour, and burning enhances soil fertility. Only seven percent of the households said that *tseri* cultivation is not good because cutting trees and green vegetation degrades the land and cropping can take place only once in many years.

The Monpas grow maize, finger millet and buckwheat in their *tseri*. Potato and chilli are also grown in *tseri* land. It was reported that yield of potato and chilli is better in *tseri* land and these are not infected by pest and insects as compared to when grown on other types of land. During the monsoon period, increased soil erosion was noticed in permanent cultivated area as compared to shifting cultivation area. This is contrary to the popular belief that one of the main sources

of soil erosion is the practice of shifting cultivation. The Monpas strictly follow the fallow period to maintain soil fertility. Most households (75 percent) maintained fallow period of five to six years. All the Monpa households carry out slash and burn of their *tseri* land before cultivation. The Monpas said that production from *tseri* is good, but fear that they may not be able to continue *tseri* cultivation due to strict national park regulations.



Wheat planted in *tseri*

Tseri cultivation by the Monpas

Cutting and drying of vegetation: After site selection, the standing vegetation is cut and left to dry. The cutting starts in December and the vegetation is left to dry for three months. In the majority of cases, the site is clear felled. Some households retain economically valuable timber trees.

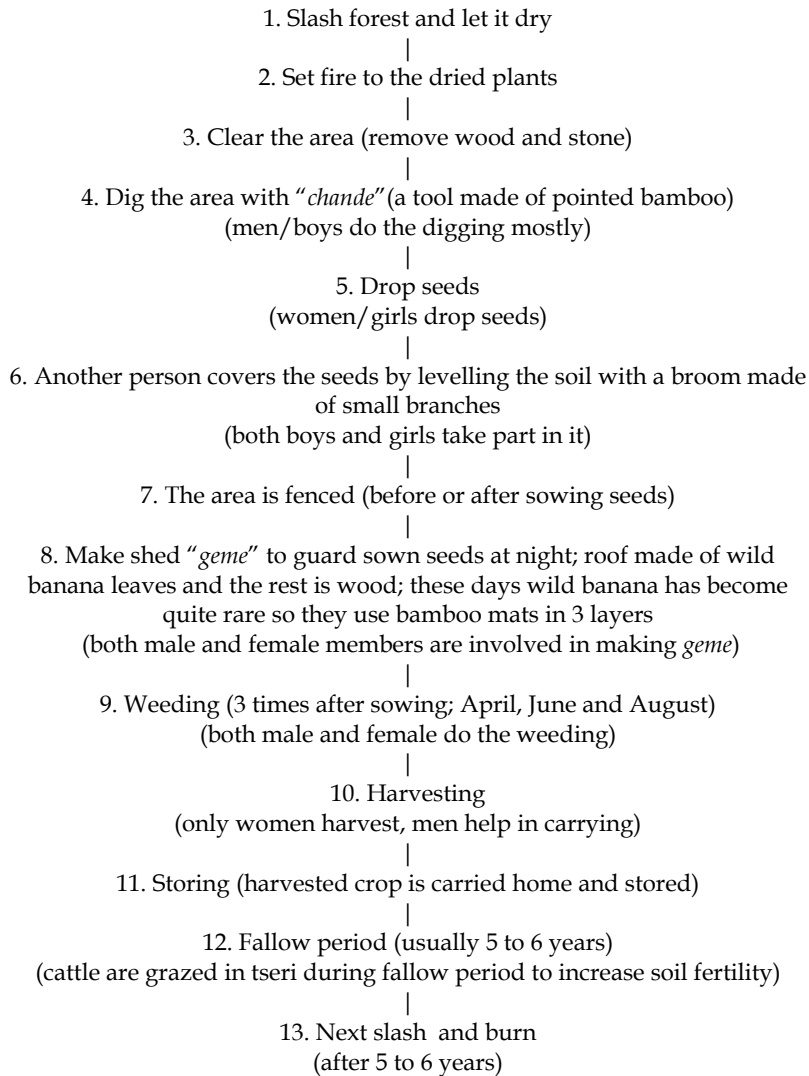
Burning and clearing: Burning is one of the critical elements of *tseri* cultivation. The Monpas pay great attention while

burning the dried vegetation to avoid fire hazards outside their *tseri* land and to achieve maximum burning. The *tseri* owner together with the village *Menyer* (village forest guard) and a few villagers organize the burning operation. It is believed that successful burning results in minimal growth of weed, increases soil fertility and crop yield. The unburnt wood is left at the site to decay or is carried home for use as firewood. Mushrooms are found to grow on the decayed wood which is harvested for consumption.

Sowing, weeding and protection of the crop: Sowing is done immediately after burning with no soil preparation. The Monpas believe that the heat of the ash helps fast germination of seed. The soil is dug with a tool made of pointed bamboo (*chande*) and seed is dropped into the hole and covered with soil. Some Monpa households also fence their *tseri* land if the site is small in area, to protect it from wild animals. The seed is protected from birds and wild animals until it germinates and seedlings are established. A small shed is made at the site and household members guard the crop day and night against birds and wild animals. The Monpas reported increasing crop depredation by wild animals such as wild boar, monkey, sambar and bear.

Fallow period: The Monpas strictly follow the fallow period of five to six years between two cultivations. During the fallow period, the farmers graze their cattle in their *tseri*. This also enhances fertility of the land. Plants such as *Artmesia spp.* and *Cannabis spp.* grow in plenty in the *tseri* land, after it is kept fallow for a couple of years.

Figure 4.6: Steps followed during the process of *tseri* cultivation



The Monpas follow two types of *tseri* cultivation. One type is the slash and burn of *tseri* land with bigger trees. The big trees are felled, and are either collected for fuelwood or left in the field to decay. Mushrooms grow on these decayed trees providing the much-needed additional nutrients for the family. In this type of *tseri*, different crops are cultivated continuously for four to five years after which a fallow period of up to 12 years is maintained allowing the land to regain soil fertility. In the other type of *tseri* with small trees, bushes, and shrubs, the vegetation is slashed and burnt. Crop is cultivated for two subsequent years after which the land is kept fallow for a period of five to six years or more.

Table 4.26: Social performance relating to shifting cultivation

Indicators	Before the park rules were enforced	Now(2001)	Future
Trend of increase/decrease	Tseri was practised extensively in their private tseri land, and sometimes also extended into the government land	The Monpas are practising other forms of land use such as kamzhing, chuzhing and orchard	Decrease in tseri and increase in permanent form of cultivation-kamzhing, chuzhing and orchard; as well as other forms of livelihood such as handicraft
Land use change	Most households depended entirely on tseri production	More tseri land being converted to permanent agriculture and cash crop production	This trend will continue as BMNP management is discouraging practice of tseri and unlike in the past the Monpas face more restrictions

Agricultural biodiversity

The most commonly grown crops by the Monpas are maize, rice, millet, wheat, barley, buckwheat and mustard. Four varieties of maize [*Yangchipa*(1), *Dangphu geyza*(2, 3),

Chempadumbo (4) Photoplate 4.3], three varieties of finger millet [*Makong*(1), *Prakangla*(2), *Losumpa*(3) Photoplate 4.2] two varieties of buckwheat [*Chakama*, *Mhama*], and other crops are planted. Other minor food crops such as *Mudai* (*Amaranthus*), *Hapame* (*Sorghum spp.*), *Shontongka* (*Sorghum vulgari*), *Yangre* (*Fox-tail millet*), and *Sangbo* (*Millet*) were also cultivated. However, the trend is changing.

Other food crops such as beans, soyabean, *Dioscorea spp.* and vegetables are planted in the garden near houses. Crops like large cardamom and orange are grown on a large scale for cash generation. Other fruit trees include guava, banana, peach, pear etc. Ginger and turmeric are also planted on a small scale for home consumption.

Amaranthus



Photoplate 4.1: Sorghum (2 varieties)



Photoplate 4.2: Finger millet (3 varieties)



Photoplate 4.3: Maize (4 varieties)



Wheat grown in kamzhing



Minor food crops

Several minor food crops are cultivated by the Monpas. These crops are mostly grown in *tseri*. Mudai (*Amaranthus*) is cultivated in *tseri*. These days, Mudai is also cultivated near houses in small numbers. It is eaten as food and brewed into local alcohol. Hapame [*Sorghum spp.* Photoplate 4.1(2)] is grown only in *tseri*. Hapame cultivation is decreasing these days and only a few Monpa households cultivate it. It is eaten as food and brewed into local alcohol. Shontongka [*Sorghum vulgari* Photoplate 4.1(3)] is cultivated in *tseri*. They are also grown near houses and in *kamzhing*. Shontongka is fermented and brewed into alcohol. Yangre (*Fox-tail millet*), two varieties, black and white, are cultivated. Sangbo (*Millet*) is grounded and cooked into porridge.

Table 4.27: Important crops and fruit trees cultivated by the Monpas

Field Crops	Botanical name	Sowing time	Harvesting time
Maize	<i>Zea mays</i>	Mar	Aug
Rice	<i>Oryza sativa</i>	Apr	Oct
Finger millet	<i>Eleusine coracana</i>	May	Aug
Fox-tail millet	<i>Setaria italica</i>	May	Aug
Wheat	<i>Triticum aestivum</i>	Oct	Mar
Barley	<i>Hordeum vulgare</i>	Sept	Mar

Biological Wealth

Field Crops	Botanical name	Sowing time	Harvesting time
Sweet buckwheat	Fagopyrum esculentum	Jan	Apr
Bitter buckwheat	Fagopyrum esculentum	Jan	Apr
Sorghum	Sorghum spp.	Sept	Feb
Legumes and vegetables	Botanical name	Spices	Botanical name
Soyabean	Glycine soja	Ginger	Zingiber officinale
Bean	Phaseolus sp.	Large cardamom	Amomum subulatum
Dioscorea	Dioscorea spp.	Turmeric	Curcuma longa
Tree tomato	Lycopersicum esculentum		
Radish	Raphanus sativus	Fruits	
Pumpkin	Cucubita moschata	Orange	Cirtus reticulata
Mustard leaves	Brassica gentia	Guava	Psidium guajava
Egg-plant	Solanum lycopersicum	Banana	Musa spp.
Turnip	Raphanus repa	Peach	Prunus persica
Onion	Allium cepa	Pear	Pyrus pashia

Trend in agriculture practice

Shifting cultivation to permanent cultivation: In the past the Monpas of these three villages practised only *tseri* cultivation and maintained large areas of *tsamdo* (pasture). Later they began to adopt permanent cultivation, mainly dryland (*kamzhing*) farming. In 1983, the Royal Government introduced irrigated land (*chuzhing*) cultivation in these three Monpa villages. The Monpas were trained to prepare their land, irrigate it and plant rice. The Black Mountain National Park was established in 1995, and the three Monpa villages fell within its buffer zone boundaries. After 1995, there has been strict enforcement of forest rules and regulations and people have been discouraged to practice *tseri* which has resulted in increased practise of permanent cultivation.

Subsistence farming to cash crop based farming: The traditional crop diversity of these three Monpa villages is slowly coming under threat. In the past, crops such as maize (4 varieties),

amaranthus, sorghum (2 varieties), fox millet, millet, buckwheat (2 varieties), finger millet (3 varieties), and mustard were cultivated. Of late, crops such as rice, maize, wheat, millet, buckwheat, barley and mustard are grown. This demonstrates that earlier the Monpas cultivated a variety of crops including the minor food crops but subsequently the diversity of crops has been reduced and the Monpas have begun to discard the traditionally cultivated minor food crops. The changing pattern of *tseri* to permanent type of cultivation is one of the main factor resulting in the change of crop diversity. *Hapame* (*Sorghum spp.*) which grows only in *tseri* land is already discarded by the people and may be lost in a few years time.

Maize (*Yangchepa*, *Sharshokpa* variety), wheat and rice are the new crops that have been introduced recently. The Monpas prefer rice and maize because they have now become the staple food. At the same time, it was reported that since rice is preferred by monks during religious ceremonies, they have to keep rice at home. Among others, *Amaranthus* and mustard are crops that used to be grown widely. Vegetables grown in the past were pumpkin, beans and chilies. The newer addition are radish, *Brassica spp.*, and egg-plant. Cash crops such as cardamom and orange were introduced on a small scale as early as the 1960s. But the cultivation of cash crop picked up in 1986 when the Royal Government provided free seedlings and extension services to these three villages.

Some changes in the traditional farming systems are already evident. They have also begun cultivation of newer varieties of vegetables.

Table 4.28: Crop varieties cultivated in the past and at present

Crop varieties	Earlier	Now
Rice	Zongkola; Paraka; Kotongmey; Pongzomo; Bumchi lingbo; Chinangmo Kamthe gormo	Bajo karp, Phinangmo
Wheat	Uekar	Zhungkar (RNR supplied)
Barley	Nemar; Nekar	Pedenla (RNR supplied)
Buckwheat	Chakama (sweet), Mhama (bitter)	Chakama (sweet), Mhama (bitter)
Maize	Changrepa (taller variety); Chempa dumbo (for popcorn) Dangphu geyza	Yangchepa (RNR supplied) Sharshopa (short variety)
Millet	Makong; Prakangla; Losumpa	Makong; Prakangla; Losumpa

Traditional agricultural knowledge and its significance

There are a number of current issues facing the Bhutanese agricultural system. Due to increasing population, particularly the non-farming urban population, and the goal of attaining food self-sufficiency, traditional agricultural practices are yielding to new farming systems, crops and varieties, most of which are alien to the country. This will lead to erosion of native plant genetic diversity. The narrowing of the genetic base could pose greater risk of crop failures as witnessed elsewhere in the world. The greater dependence on a few plant species, about 20-30 in the national context, creates the need to conserve the native genetic resources. The indigenous knowledge and practice of seed selection, pest and weed

management, and soil and water management, should be incorporated into modern farming system to boost agriculture production and prevent from pests and diseases.

Animal husbandry

Livestock rearing is one of the most important livelihood occupation of the Monpas. Ninety five percent of the Monpa households rear livestock. Cattle and poultry are the most common in the three Monpa villages. Unlike other rural communities in Bhutan, the Monpas do not rear pigs. Cattle are kept for ploughing agriculture land, manure for crop production, and dairy products. The Monpas graze their livestock mostly in the forests, farmland, and *tsamdo*. Wangling village was found to have the maximum number of cattle.

Livestock rearing

In the land-locked situation prevailing in these three Monpa villages, field crop production occupies the primary position and livestock plays a supplementary and subsidiary role. The principal objectives of maintaining livestock are to fulfill the need for ploughing agriculture land and provide farmyard manure and not much stress is given to improve livestock productivity in terms of meat and dairy products. The dairy products are by and large utilized domestically and the surplus, if any, bartered in the neighbourhood. The livestock is also utilized as the chief medium of disposal of crop residue and agricultural by-products. Though poor in productivity, due to their multifarious utility value, cattle are maintained in substantial numbers. There is no serious attempt to cull the unproductive animals, not only because of sentimental reasons, social customs and taboos but also because, even well

past the productive age, they may provide manure and are used in ploughing agriculture land.

Most cattle are grazed and kept in the forest. Only milking cows are kept at home. Bulls are kept at home during ploughing season. It was reported that livestock population, particularly cattle, has reduced significantly in the recent years due to lack of fodder and labour shortage. But recently, poultry population has increased due to its demand for eggs, mostly bought by staff of school and the Basic Health Unit in Jangbi.

Feed and fodder management

More than 25 species of trees are used by the Monpas for fodder (Table 4.13). The commonly used fodder trees are *Ficus spp.* The Monpas prefer fodder trees that produce milky sap as they are believed to produce more milk from their cow. About 80 percent of the fodder requirement is met from forests and the remaining 20 percent is met from the agriculture fields and *tsamdo*. Most households supplement fodder with other animal feed such as kitchen waste, *ara* or *bangchang* residue and wheat and maize flour, for the cattle that are kept at home. Fodder trees are kept in the agriculture fields and *tsamdo* as fodder banks to feed cattle during winter when the ground forage is scarce. Rice, wheat and barley straw are also stored as cattle forage for winter.



Cattle forage (rice straw) stored for winter

Livestock health

Livestock diseases are usually diagnosed by household members and treated accordingly. These skills are learnt from parents or grandparents. Occasionally, traditional healers also diagnose and treat livestock diseases. The traditional healers do not receive cash but are compensated in kind - usually rice, and offerings like food, local wine and vegetables. The Monpas also take services from the local livestock extension agent. The nearest livestock extension office based in Tongtongphe is more than two hours walking distance. The most common livestock diseases reported by the Monpas are foot and mouth disease, black quarter disease, diarrhoea and liverfluke infection. The indigenous treatment of livestock diseases practiced by the Monpas are given in the following table.

Table 4.29: Indigenous treatment against livestock diseases

Disease	Animal	Treatment	Efficacy
Foot and mouth disease	cattle	Mix buckwheat flour, honey, mollasses/sugar, Jamirip (chinese medicine) and feed cattle; also tethered in windy slope	Effective
Diarrhoea	cattle	Cardamom seed is ground and mixed with water and fed	Effective
Black quarter disease	cattle	Mix soap, mongoose meat, wild cat meat and grind. Feed this mixture to cattle	Effective
Liver fluke infection	cattle	"zhacho" boiled in water and feed cattle	Effective; cattle become healthy
Blood flowing out from nose (mostly bitten by leech)	cattle	Give water to the cattle to drink and leech comes into the water	Effective
Eye disease	cattle	Local onion and white stone powder mixed and blown through a small bamboo pipe into the infected eye	Effective

Traditional veterinary medicine plays an important role in treating livestock ailments in the Monpa community. Local methods offer simple and familiar use of locally available resources. Since the nearest Monpa village is about two hours walk from the road-head and livestock extension office, ethno-veterinary practice is still the only option for delivering health services to their domestic animals.

Livestock population trend

Forest cover is abundant around Wangling, Jangbi and Phumzur villages. However, the Monpas stated that fodder is decreasing and it takes longer time than before to collect one backload of fodder. This opinion varied from household to household. Some attributed this to the fact that currently more cattle are kept at homes than in the past.

For the cattle kept in the forests, a male member of the household takes care of the cattle. He milks the cow, makes cheese, butter and reaches the items home once a week. Those households which cannot afford a cow-herder provide food to another household's cow-herder to take care of their cattle. Cow-herders live in temporary sheds in the forest and take care of cattle. These days, this trend is changing and more and more cattle are kept at the farm nearby the houses. This is to provide milk and milk products to outsiders (staff of school and Basic Health Unit). At the same time, more households are taking up permanent agriculture (*chuzhing* and *kamzhing*) as compared to *tseri* and therefore cattle manure is required to maintain soil fertility of these fields.

Tsamdo (pasture) and its use

Tsamdo is regarded as a very important resource, since the majority of the Monpa households rear cattle. All the Monpa villages have both communal as well as private *tsamdo*. The three Monpa villages have 654 hectare of private *tsamdo* and 749 hectares of communal *tsamdo*. Only 22 percent of households have their own *tsamdo*. Those households which do not own *tsamdo* graze their cattle in communal *tsamdo* or *tsamdo* owned by other households and follow local regulations for its use. For using others' private *tsamdo* the user has to provide manual help such as making the cow-herder's shed in the forest, taking cattle to the forest and, sometimes paying Nu. 100 as annual tax to the government on behalf of the *tsamdo* owner.

Migration of cattle from the higher altitudes to lowlands in winter is prevalent in the Monpa villages. After the 8th Bhutanese calendar month (September), the Monpas bring their cattle from highland forests to their *tsamdo* around the

villages. The cattle remain in these *tsamdo* for about four months. The Monpas are also allowed to graze their cattle in the Indocholing *tsamdo* provided they offer whatever the owner of the *tsamdo* demands, such as: portering, edible cane shoot, *damru*, vegetables, and handicraft as tax every year. Although cattle numbers in these three Monpa villages are relatively low, it is important to study trends in the herd size, seasonal movements including grazing rights because there is high influx of cattle migrating from Bumthang to the three Monpa villages. Cattle depredation by wild animals, particularly by leopards and wild cats, is very common in these three Monpa villages.

Tsamdo is an important and highly contested resource in all the three Monpa villages. While Phumzur has only 130 hectares of *tsamdo*, Wangling has 666 hectares. On the other hand, Jangbi has very large *tsamdo* 607 hectares considering the small number of households in this village. There is a patron-client relationship in Jangbi and Phumzur that is determined by the *tsamdo* ownership pattern. In Wangling, there is continuous conflict over access to the *tsamdo*. During the winter season, cattle herders from Bumthang migrate to lower valleys and graze their cattle in Wangling and Phumzur area. Given that about 95 percent of the Monpa households own cattle, it becomes difficult for the local people to share their private and communal *tsamdo* without compromising its quality. This puts pressure on the resources and also at times leads to conflicts between the cattle herders of Bumthang and the Monpa people (Figure 4.7). Besides pressure on *tsamdo*, excessive grazing also leads to degradation of nearby forests, which in turn affects the availability of minor forest products for the people of Wangling, Jangbi and Phumzur.

Figure 4.7: Resource Conflict Matrix

Resource	Within Monpa community	With neighbouring villagers	With neighbouring districts	Government
Bamboo, cane				
Resin				
Tsamdo				
NTFPs				