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Research Article

Some Marketing Aspects of Important Non-Timber Forest Products in a Proposed UNESCO Heritage Site of Arunanchal Pradesh, India

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Abstract

Ziro valley in Arunanchal Pradesh is a designated heritage site of UNESCO which has been inhabited by the *Apatani* tribe for centuries. They have perfected the indigenous knowledge based use of non-timber forest products for various purposes. In the last few decades they have been marketing some of these products in order to improve their livelihood. The objective of the present study is to identify potential products, prevailing marketing aspects, commercialization impact on natural resources, and to explore future strategy. Qualitative methods of research like questionnaire survey, semi-structured interview, focus group discussion etc. were used for data collection. Altogether 127 products were recognized as marketable, potentially marketable and products with meager potential used for supplementing food, medicine, house construction etc. At the time of survey, 55 products were sold in local (*Antiitari ayi, Baching ayi, Biiling, Byako; Solanum kurzi, Byako; S. myricanthum* etc.) and regional (*Ginseng*, *Nikhe*, *Paris*, *Eppane naniii*, *Tapyo*, *Taxus*, *Tiiming*, and *Yaso*) markets. Around 40 products were identified as commercially important (*Samper ayi >Salyo ayi >Hiipey hamang >Baching ayi >Byapu >Kung ayi >Biiling >Taro ayi >Mepi hamang >Siya hamang* etc.). Short and long value chain products were traded in informal markets. Price spreads of 20 short value chain products are recorded. Research need and value addition to some products, improvement in market information system and change in market nature from informal to formal has been suggested as possible strategy for better return. NTFP extraction should be well organized and coordinated with harvest guidelines for the sustainability of extraction and supply to the market.

Keywords: Commercial NTFPs; Market channels; Value chains; Value addition; Commercialization impact

Introduction

Ziro Valley in Lower Subansiri district of Arunanchal Pradesh is one of the proposed heritage sites of UNESCO on account of uniqueness in culture, tradition, knowledge about agriculture, forest management system and conservation techniques adopted by its inhabitants [1-3]. This valley is inhabited by the Apatani tribe which has the distinction of being the only non-nomadic and area confined tribe out of 26 different tribes spread over the whole of the easternmost Himalayan region of India [4,5]. Although the people are totally dependent on settled agriculture and aquaculture for subsistence, unlike other tribes which practice shifting cultivation, they have perfected forest management based on traditional knowledge developed during many centuries [6-8]. Most of them are dependent on forest resources for their livelihood and income generation. They extract timber and small wood from forests for house construction and energy need. Non-Timber Forest Products (NTFPs) are also extracted from these forests, which are a rich repository of NTFPs, and are used on day to day basis [3,9]. These NTFPs fulfilled the requirement of food supplement, herbal medicine and other sociocultural needs.

Initially, the use of NTFPs was limited to local consumption, but as the society grew in numbers and the population moved outside the valley, the local populace got exposed to the outside world. Consequently, the pressure grew on them to change to a new lifestyle. Simultaneously, a new regime of development arrived along with improved agriculture and other practices. This had some influence on Apatani practices related to NTFPs as well. They started selling green as well as semi-processed products for local and outside consumption so that their livelihood conditions could improve. There are a few reports on the use of NTFPs by the Apatani, like Kala [10] on ethno botany, especially the use of medicinal plants, Srivastava [5] on biocultural knowledge of plant resources, Yakang et al. [9] on the use of traditional and common products, Bamin and Gajurel [11] on the cultural and ritual use of plants, Tilling et al. [12] on indigenous utilization of medicinal plants. However, none of these has explored the marketing aspects of medicinal, food and other plant items, which otherwise have a tremendous potential in regional as well as national markets.

In this context it feels pertinent to record the current practices and procedures related to NTFP marketing in this unique site. Marketing refers to the products that bring revenue by enhancing quality, giving brand, improving business linkages, networking market places etc. [13]. Therefore, the present study aimed at studying

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Figure 1: Location of Ziro valley (inset; google image) and different markets for the Ziro Valley produced NTFPs.

some of the current aspects of marketing of NTFPs in Ziro valley like, (i) identifying marketable, potentially marketable and commercially important NTFPs (ii) understanding some of the marketing practices like existing market channels, value chains, value addition etc. and (iii) exploring the impact of commercialization on local resources.

Materials and Methods

Study site

Main location of this research study was Ziro valley (27°33'59" N and 93°49'53" E), of Lower Subansiri District in Arunanchal Pradesh (Figure 1). The valley has an area of more than 1058 km^2, of which 33 km^2 is under cultivation and much a smaller area is under settlement. However, a majority of the area is covered by forests of different ownership and plantations [14]. The climate is humid sub-tropical to temperate with 235 cm annual rainfall and 1.9 to 28.1°C temperature variation [1]. Research was further expanded to different commercial locations like, markets of Naharlagun and Itanagar in Arunanchal Pradesh, and Lakhimpur in Assam which are the independent but nodal market points for Ziro valley NTFPs.

Data collection

Qualitative research methods like, reconnaissance survey, questionnaire survey, semi-structured interview, focus group discussion, informal discussion etc. were employed for data collection and validation. Altogether 65 resource persons were involved in providing information. They were dispersed over 20 working sites (16 villages and 4 urban centers) as 24 farmers at home, 17 vendors in the market and 24 professionals working in forest, horticulture, education and business organizations. August 2014, March 2015 and October 2015 were the periods of field research. The first visit was used for reconnaissance survey while the second and third visits were used to capture data related to the subject matter and seasonal variation of the product-entry into the market. All the informants were either interviewed directly or with the help of language interpreters. Primary questions were asked to collect data on the products used for marketing or self-consumption, quantity of collection and selling price, processing of raw materials, end users, difficulties in the trade

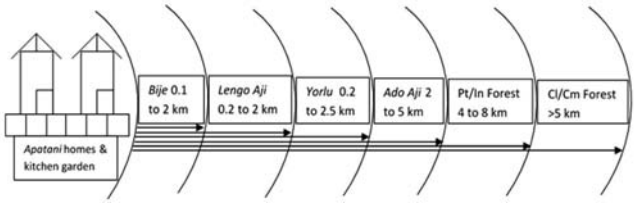

Figure 2: Shows NTFP related land use pattern in Ziro valley (Dutta village). Distance of the parcel is from the settlement and indicated by arrow (not scaled). Pt = private, In = individual, Cl = clan, Cm = community. Adopted from Jha [14].

of NTFPs etc. with the help of pre-decided questionnaire and semi-structured interview. Secondary questions were asked to fill in the gaps remaining during preplanned data collection.

The respondents identified marketable and potentially marketable NTFPs of priority during interactions. The commercial importance of different species (NTFPs) was determined by using total turnover value of the product. This was derived by multiplying price of the product to annual production. Information on production quantity was collected from farmers and market price was collected from vendors. Additionally, key informants, generally traders, were also contacted to get both the data. More than one response on the same item was averaged out. A decreasing product value indicated lesser commercial importance of the NTFPs.

Vegetable and fruits were sold in the local market by volume, pile volume in the case of fruits and bundle volume in the case of vegetables, not by weight. Therefore, selling rate was derived by converting pile/bundle volume price to green weight price and extrapolating it to per kilogram. Resource persons for this information were the vendors as well as buyers. Rates given by them were validated for each other. Rates were collected in March 2015 (Pre-rainy season) and October 2015 (Post-rainy season). Minimum 5 to 10 vendors or buyers were contacted both the times. More than one value for any item was averaged out.

Results and Discussion

Historically, the *Apatani* were dependent on indigenous plants for their daily requirement. Later, they adopted the marketing of some tree products for improvement of their livelihood conditions. This was revealed by almost all resource persons. Proportional distribution of resource persons in the present study was 37% farmers, 26% vendors and 37% other professionals including traders. They also informed during interviews and informal interactions that more than 95% *Apatani* were using local products grown in forests, home garden and agriculture field. Sequential location of NTFP yielding land parcels studied in a different village was the same as reported by Jha [14] but the tentative distances varied in Dutta village (Koj Rinya, Pers. Comm.) which is presented in Figure 2. This could be due to topographic variation of the landscape among the villages and availability of land types. However, the villagers identified the marketable and potentially marketable NTFPs of different categories extracted from these parcels. Some of these products were sold to earn their livelihood in the local village and urban markets directly but sometimes through agents even to distant state capital market. Many products which had low marketable value due to lower popularity

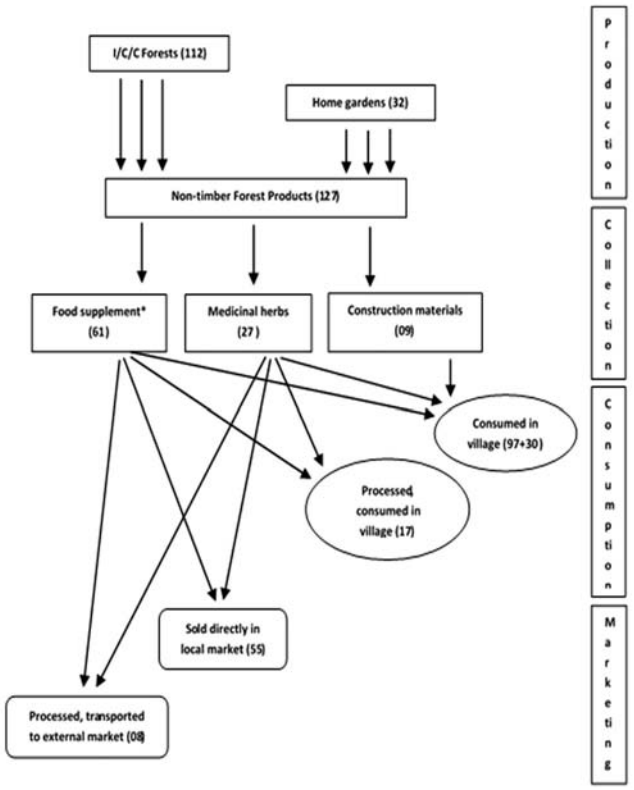

Figure 3: Value Chain of NTFPs in Ziro valley. I/C/C = Individual/Clan/Community. *Includes salt making herbs. Numbers in the parentheses are minimum recorded NTFPs during the study.

and demand were consumed by them along with products which were to be marketed. Sometimes some of the products were gifted or exchanged among the kin and neighbor. Altogether 127 priority NTFPs belonged to 100 scientifically identified and 11 unidentified plant species. All the important products from marketing point of view are listed in Table 1 which is the updated version from Jha [14]. Vernacular names of the Apatani products are used in the text along with scientific names at least once except for those which could not be identified e.g. *Diiran sankhan*, *Haliyan*, *Hulu taro*, *Kung ayi*, *Luli hamang*, *Niiming*, *Nikhe*, *Payinglamu hamang*, *Rhyiing ayi*, *Samo* and *Senko*.

From the overall picture given by Ziro valley residents about the origin to endpoint use of NTFPs it was evident that the value chains of such NTFPs could be distinguished into different stages like, Production/Extraction/Collection, Consumption and Marketing (Figure 3). Altogether 127 well recognized NTFPs were produced in forests, homegardens and field-bunds of the valley. They were categorized into food supplements (61), medicinal products (27), construction materials (09), fuel or energy products (07) and others (23). Almost all of these products were collected and consumed fresh or unprocessed, but some of them (17) were semi-processed or dried and consumed. Out of these, 55 products were sold in local markets and eight were transported and sold in external markets at different places, currently. On the basis of data analysis, all these 127 NTFPs could be categorized as marketable, potentially marketable and products with meagre potential. Some of them were found to be commercially important products also.

Tribal communities (subsistence food gatherers and traditional healers) have been engaged in the collection of various NTFPs historically. While in the initial stage the collection was meant for self-consumption, later they started to extract more NTFPs for commercial purpose to meet their livelihood needs as a result of increased demand and urbanization [15,16]. Katewa [17] also reported that the Apatani tribe used a large number of wild NTFPs to meet their diverse requirement which was possible largely due to the prevalence of a diversity of vegetation in that area. They managed their forests while aiming directly at NTFP collection along with timber production. This was intended at maintaining health, vitality and social need. Simultaneously they were indirectly achieving environmental functions like carbon storage, nutrient cycling, erosion control and hydrological regulation [18,19].

Marketable *Apatani* NTFPs

There were 55 currently marketable NTFPs which were formally sold in the urban markets of the state (*Antiitari ayi*, *Baching ayi*, *Biiling*, *Byako*; *S. kurzi*, *Byako*; *S. myricanthum* etc.). Out of this, as many as eight (*Ginseng*, *Nikhe*, *Paris*, *Eppane nanii*, *Tapyo*, *Taxus*, *Tiiming*, and *Yaso*) were also sold outside the state. Another 41 important products were consumed by the *Apatani* but not sold in the markets at the time of data collection (Table 1). Occasionally they were shared or exchanged (*Bije*, *Byukhu*, *Genda hamang*, *Giyang hamang*, *Hiibyo hamang*, *Imyo* etc.) by the people among themselves. The key informants identified these 41 species as marketable products for the future with anticipated increase in production along with market demand. These 96 products could also be classified as high potential (08) and potential (47), and less potential (41) marketable products as they were in demand on an inter-regional, regional and local scale, respectively. The rest of the products had meagre potential due to their endemic use by the *Apatani*. However, all these products are responsible for economic development of the valley.

The role of NTFPs in the economic development of local communities, especially the tribals, has been addressed by many workers [3,20,21]. Several researchers [5,9-12] have given an account of NTFP use by Apatani but only Yakang et al. [9] reported the marketing potential of 18 species which could be used for socioeconomic development of the community. These species could be cultivated and managed in various systems, such as homegarden, community forests and agriculture. Fourteen species (*Allium tuberosum*, *Cerasus cerasoides*, *Clerodendrum colebrookianum*, *C. glandulosum*, *Litsea cubeba*, *Magnolia champaca*, *Myrica esculenta*, *Phyllostachys manii*, *Piper pedicellatum*, *Pyrus pashia*, *Rubia manjith*, *Solanum kurzi*, *S. myriacanthum* and *Zanthoxylum armatum*), out of 18 reported by them, are common to the present study.

Although NTFPs have attracted considerable interest as a basic component of sustainable development initiatives due to their ability to support and improve rural livelihood, large scale harvesting poses a serious threat of extermination to several popular species and continued supply of the product [22]. Therefore, before promotion of NTFP marketing, their conservation status must be borne in mind as many of them are currently facing different degree of vulnerability [14].

Commercially Important NTFPs

Importance of the NTFPs lies not only in their value or price but

Table 1: List of currently marketed (local and external or inter-region level), potentially marketable and meagre potential NTFPs used by *Apatani*. *marked products are semi-processed and consumed or sold locally. **marked products are semi-processed and consumed or sold externally and unmarked products are consumed or sold unprocessed or green.

SN	Locally Marketed		
	Apatani name	**Scientific name**	**Use**
1	*Antiitari ayi*	*Actinidia chinensis*	Fruit
2	*Biiling*	*Choerospondias axillaris*	Fruit
3	*Byako*	*Solanum kurzi*	Vegetable, Medicine
4	*Byako*	*Solanum myricanthum*	Fruit, Medicine
5	*Byapu*	*Phyllostachys manii*	Vegetable
6	*Diiran sankhan*	Unidentified	Medicine (berry)
7	*Enging*	*Dioscorea hamiltonii*	Vegetable, Medicine (tuber)
8	*Giyang hamang*	*Brassica juncea* var. *rugosa*	Vegetable
9	*Hari ayi*	*Elaeagnus latifolia*	Fruit
10	*Harkhu ayi*	*Actinidia callosa*	Fruit
11	*Henchi*	*Rubus niveus*	Fruit
12	*Hiigu hamang*	*Oenanthe javanica*	Vegetable, Medicine (leaf)
13	*Hiika hamang*	*Diplazium esculentum*	Vegetable
14	*Hiipe*	*Elatostema platyphyllum*	Vegetable
15	*Hiipe hamang*	*Gonostegia hirta*	Vegetable
16	*Hiiro hamang*	*Solanum nigrum*	Vegetable, Medicine (leaf)
17	*Kheyi*	*Cinnamomum verum*	Vegetable
18	*Lase*	*Dioscorea bulbifera*	Vegetable, Medicine (tuber)
19	*Mepi hamang*	*Plantago erosa*	Vegetable
20	*Ngiilyang khiiko*	*Centella asiatica*	Vegetable, Medicine (leaf)
21	*Niiming*	Unidentified	Others
22	*Padii hamang*	*Cardamine hirsuta*	Vegetable
23	*Pato hamang*	*Clerodendrum colebrookianum, Clerodendrum glandulosum*	Vegetable
24	*Raru hamang*	*Piper pedicellatum*	Vegetable, Medicine (leaf)
25	*Rhyiing ayi*	Unidentified	Fruit
26	*Samo*	Unidentified	Others
27	*Sanko ayi*	*Schefflera elliptica*	Fruit
28	*Santero*	*Litsea cubeba*	Vegetable, Medicine (fruit, leaf)
29	*Siya hamang*	*Houttuniya cordata*	Vegetable
30	*Subutute*	*Duchesnea indica*	Fruit
31	*Taro ayi*	*Ficus auriculata*	Fruit
32	*Tapyo*&**	*Cyanthillium cinereum, Dicranopteris linearis, Phragmites karka, Clerodendron colebrokianum, Cirsium interopositum*	Vegetable (salt from leaf)
33	*Tayi hamang*	*Amaranthus tricolor*	Vegetable
34	*Yakho hamang*	*Acmella paniculata*	Vegetable
35	*Baching ayi**	*Myrica esculenta*	Fruit
36	*Hiyi**	Dry bamboo shoot	Vegetable
37	*Hiibyo lima**	*Hydrocotyle javanica*	Vegetable
38	*Kiira ayi**	*Castanopsis hystrix*	Fruit
39	*Kung ayi**	Unidentified	Fruiting body
40	*Miiji**	*Sageretia filiformis*	Medicine (bark, stem)
41	*Pecha**	*Pyrus pashia*	Fruit
42	*Riiko**	*Gymnostemma pedata*	Medicine (stem, root)

43	*Salyo ayi**	*Magnolia oblonga*	Fruit
44	*Samper ayi**	*Phoebe goalparensis*	Fruit
45	*Tarko**	*Phyllanthus* sp	Medicine (whole plant)
46	*Yabing**	*Eremocaulon capitatum*	Vegetable
47	*Yorkhung**	*Zanthoxylum armatum*	Vegetable, Medicine (fruit)
Externally marketed			
	Apatani name	**Scientific name**	**Use**
48	*Eppane nanii***	*Thysanolaena maxima*	Household item (inflorescence, broom)
49	*Ginseng***	*Panax pseudoginseng*	Medicine (rhizome)
50	*Nikhe***	*Cinnamomum spp.*	Medicine (spice)
51	*Paris***	*Paris polyphyla*	Medicine (rhizome)
52	*Tapyo***	*Cyanthillium cinereum etc.*	Salt, Medicine
53	*Taxus***	*Taxus wallichiana*	Medicine (fruit)
54	*Tiiming***	*Rubia manjith*	Medicine (root)
55	*Yaso***	*Calamus floribunda*	Household item (stem)
Potentially marketable			
	Apatani name	**Scientific name**	**Use**
56	*Byukhu*	*Begonia roxburghii*	Dye (tuber)
57	*Genda hamang*	*Crassocephalum crepidioides*	Vegetable, Medicine (leaf)
58	*Hiibyo hamang*	*Hydrocotyle javanica*	Vegetable
59	*Imyo**	*(Acoitum ferox)*	Animal poison (tuber)
60	*Imyo**	*(Aconitum heterophylla)*	Animal poison (tuber)
61	*Jiling ayi*	*Rubus ellipticus*	Fruit
62	*Jojuru ayi*	*Coccinia grandis*	Vegetable (fruit)
63	*Kukulyu hamang*	*Artemisia indica*	Vegetable
64	*Lam hamang*	*Croton roxburghii*	Medicine (leaf)
65	*Luli hamang*	*Persicaria bartata*	Vegetable, fodder
66	*Okhui hamang*	*Oxalis corniculata*	Vegetable, Medicine (leaf)
67	*Piirii*	*Laportia crenulata*	Medicine (leaf)
68	*Piitta ayi*	*Pyrus calleryana*	Fruit
69	*Salyo*	*Magnolia champaca*	Vegetable, Medicine (fruit)
70	*Sanii tero*	*Zanthoxylum rhesta*	Medicine (fruit)
71	*Sankhe*	*Quercus griffithii*	Fruit
72	*Santotero*	*Litsea citrata*	Fruit
73	*Semo ayi*	*Cerasus cerasoides*	Fruit
74	*Taaming*	*Mahonia napaulensis*	Fruit
75	*Tagging hamang*	*Strobilanthes helictus*	Vegetable
76	*Taku ayi*	*Cucumis sativa*	Vegetable
77	*Takung ayi*	*Prunus persica*	Fruit
78	*Tale hamang*	*Allium tuberosum*	Vegetable
79	*Tamen*	*Mahonia acanthifolia*	Fruit
80	*Tamo ayi*	*Rhus chinensis*	Fruit
81	*Tape hamang*	*Cucurbita moschata*	Vegetable
82	*Tiiming*	*Rubia manjith*	Dye
83	*Tiipe Tiire*	*Berberis wallichiana*	Medicine (fruit, leaf)

84	*Yodey*	*Plectranthus japonicus*	Medicine (leaf)
85	*Yoyo*	*Vibrunum foetidum*	Fruit
86	*Bije**	*Phyllostachys manii*	Shelter, Energy
87	*Kiira**	*Castanopsis hystrix*	Energy
88	*Pepu**	*Phragmites karka*	Shelter
89	*Saati* (resin)*	*Pinus wallichiana*	Medicine (resin)
90	*Sankhii**	*Eurya accuminata*	Dye (leaf)
91	*Sankho**	*Ligustrum ovalifoliaum*	Cultural
92	*Santi**	*Quercus lamellosa*	Energy
93	*Tajar**	*Neomicrocalamus manii*	Shelter
94	*Takho**	*Dicranopteris linearis*	Cultural (stem trap)
95	*Tibe**	*Saccharum* sp.	Shelter
96	*Yaso**	*Calamus floribunda*	Fruit
Meagre marketing potential			
	Apatani name	**Scientific name**	**Use**
97	*Miiji*	*Sageretia filiformis*	Energy
98	*Saati*	*Pinus wallichiana*	Energy
99	*Salyo*	*Magnolia champaca*	Energy
100	*Salyo*	*Magnolia oblonga*	Energy
101	*Kiira*	*Quercus dealbata*	Religious, Shelter
102	*Pepu*	*Phragmites karka*	Salt
103	*Salyo*	*Magnolia champaca*	Shelter
104	*Salyo*	*Magnolia oblonga*	Shelter
105	*Sankhe*	*Quercus griffithii*	Shelter
106	*Sankhii*	*Symplocos paniculata*	Shelter
107	*Tiire*	*Berberis wallichiana*	Tattooing
108	*Yabing*	*Eremocaulon capitatum*	Religious
109	*Takung ayi*	*Prunus persica*	Religious
110	*Talan papi*	*Hedychium sp*	Medicine (flower)
111	*Haliyan*	Unidentified	Others
112	*Hulu taro*	Unidentified	Others
113	*Payinglamu hamang*	Unidentified	Vegetable
114	Palm grass	*Molineria capitulata*	*Tapyo* wrapper

also the quantity of production. Commercial importance of selected species determined on the basis of data of their production and market price is presented in Table 2. Production wise ranking of the NTFPs was in the following order from higher to lower: *Samper ayi >Salyo ayi >Hiipey hamang >Baching ayi >Byapu >Kung ayi >Biiling >Taro ayi >Mepi hamang >Siya hamang >Hiigu hamang >Padii hamang >Antiitari ayi >Hari ayi >Lase >Yaso > Tiiming (Rubia) >Raru hamang >Hiibyo hamang >Sanko ayi >Ngilyang khiko >Jiling ayi >Piirii >Paris >Yabing >Hiiro hamang >Semo ayi >Jojuru ayi >Hiika hamang >Pato hamang >Pecha >Kiira >Taaming >Henchi >Tarko >Giyang hamang >Riiko >Subutute >Hibiyo lima >Diiran sankhan >Haliyan >Hulu taro >Payinglamu hamang* > Luli hamang. However, production of certain NTFPs like, *Enging, Kheyi, Kiira ayi, Miiji, Niming, Rhiihingi ayi, Samo, Santero, Senko, Takung, Tapyo and Yorkhum* was not ascertained due to lack of information. When the NTFPs were assessed on price ranking, the order was changed as follows: *Paris>Riiko >Niming >Kiira >Subutute >Tapyo >Yorkhum >Byapu >Henchi >Salyo ayi >Tarko >Samper ayi >Kung ayi >Sanko ayi >Tiiming (Rubia)>Hiibyo hamang >Hibiyo lima >Diiran sankhan >Hiigu haman >Ngilyang khiko >Yabing >Yaso >Padii hamang >Kheyi >Hiiro hamang >Pato hamang >Hiipey hamang >Mepi hamang >Raru hamang >Antiitari ayi >Hari ayi >Kiira ayi >Miiji >Rhiihing ayi >Samo >Santero >Baching ayi >Senko >Siya hamang >Takung >Enging >Taaming >Lase >Biiling >Hiika hamang >Pecha >Taro ayi >Giyang hamang >Semo ayi*. However, actual price of *Haliyan, Hulu taro, Jiling ayi, Jojuru ayi, Luli hamang, Payinglamu hamang* and *Piirii* could not be ascertained, again due to lack of information. Finally the index ranking (total value of the product = quantity times price) to find out the commercial importance of these NTFPs resulted in again following changed order: *Samper ayi >Salyo*

Table 2: Commercially important NTFPs of Ziro valley based on estimated annual production and price.

SN	NTFP (*Apatani* names)	Price (INR)	Quantity kg per annum	Total value (INR)	NTFP (*Apatani* names)	Price (INR)	Quantity kg per annum	Total value (INR)
1	*Antiitari ayi*	50	5000	250000	*Paris polyphylla*	2000	1000	2000000
2	*Baching ayi*	40	30000	1200000	*Padii hamang*	80	5000	400000
3	*Biiling*	20	20000	400000	*Pato hamang*	70	600	42000
4	*Byapu*	200	25000	5000000	*Payinglamu hamang*	na	100	na
5	*Diiran sankhan*	100	100	10000	*Pecha*	20	500	10000
6	*Enging*	30	na	na	*Piirii*	na	2000	na
7	*Giyang hamang*	10	150	1500	*Raru hamang*	60	3000	180000
8	*Haliyan*	na	100	na	*Rhiihing ayi*	50	na	na
9	*Hari ayi*	50	5000	250000	*Riiko*	750	100	75000
10	*Henchi*	200	200	40000	*Salyo ayi*	200	45000	9000000
11	*Hibiyo lima*	125	100	12500	*Samo*	50	na	na
12	*Hiibyo hamang*	150	2500	375000	*Samper ayi*	180	55000	9900000
13	*Hiigu hamang*	100	5000	500000	*Sanko ayi*	175	2000	350000
14	*Hiika hamang*	20	700	14000	*Santero*	50	na	na
15	*Hiipey hamang*	60	30000	1800000	*Semo ayi*	10	1000	10000
16	*Hiiro hamang*	70	1000	70000	*Senko*	40	na	na
17	*Hulu taro*	na	100	na	*Siya hamang*	40	10000	400000
18	*Jiling ayi*	na	2000	na	*Subutute*	300	100	30000
19	*Jojuru ayi*	na	1000	na	*Taaming*	30	250	7500
20	*Kheyi*	75	na	na	*Taku*	50	na	na
21	*Kiira*	400	250	100000	*Takung*	35	na	na
22	*Kra ayi*	50	na	na	*Tapyo*	250	na	na
23	*Kung ayi*	175	25000	4375000	*Tarko*	200	150	30000
24	*Lase*	25	4000	100000	*Taro ayi*	20	20000	400000
25	*Luli hamang*	na	20	na	*Tiiming*	150	3500	525000
26	*Mepi hamang*	60	10000	600000	*Yabing*	100	1000	100000
27	*Miiji*	50	na	na	*Yaso*	100	3000	300000
28	*Ngilyang khiko*	100	2000	200000	*Yorkhum*	215	na	na
29	*Niming*	450	na	na				

na = not available

ayi >Byapu >Kung ayi >Hiipey hamang >Baching ayi >Mepi hamang >Hiigu hamang >Biiling >Taro ayi >Siya hamang >Padii hamang >Paris >Hiibyo hamang >Sanko ayi >Yaso >Antiitari ayi >Hari ayi >Ngilyang khiko >Raru hamang >Lase >Yabing >Kiira >Riiko >Rubia (Tiiming) >Hiiro hamang >Pato hamang >Henchi >Tarko >Subutute >Hiika hamang >Hibiyo lima >Semo ayi >Pecha >Diiran sankhan >Taaming. Species like Enging, Giyang hamang, Haliyan, Hulu taro, Jiling ayi, Jojuru ayi, Kheyi, Kra ayi, Luli hamang, Miiji, Niming, Payinglamu hamang, Piirii, Rhiihing ayi, Samo, Santero, Senko, Takung, Tapyo and *Yorkhum* did not find place in the index since the price or quantity of these products were not available.

The above ranking indicated the degree of commercial importance of different species and therefore, their potential role in the economic uplift of society. But it is a matter of concern also since exposure to market pressures and opportunities is inescapably changing many subsistence-based use systems to market-oriented production systems with a clear loss of biodiversity [23-25]. The potential of NTFP commercialization to be effective as a tool for biodiversity conservation is limited. The main responses to increased market demand for NTFPs are inimical to biodiversity conservation in many situations [26]. As the demand of NTFPs increased, the pressure on the resources increased and sometimes reached the threshold of economic extinction. Therefore, to meet the extra demand, some NTFPs are required to be cultivated or domesticated, affecting a shift in natural resource dependence to the resource outside the forests [27].

On the other hand, commercialization of NTFPs enables rural dwellers and poor urban households to diversify their source of incomes, which contributes to their food security and reduces their level of poverty. It also increases the economic value of NTFPs thereby increasing the awareness and incentives for local communities to conserve many forest products [28]. Although, rapid commercialization potentially leads to overexploitation or depletion of such NTFP [29], it has the potential to ensure the long

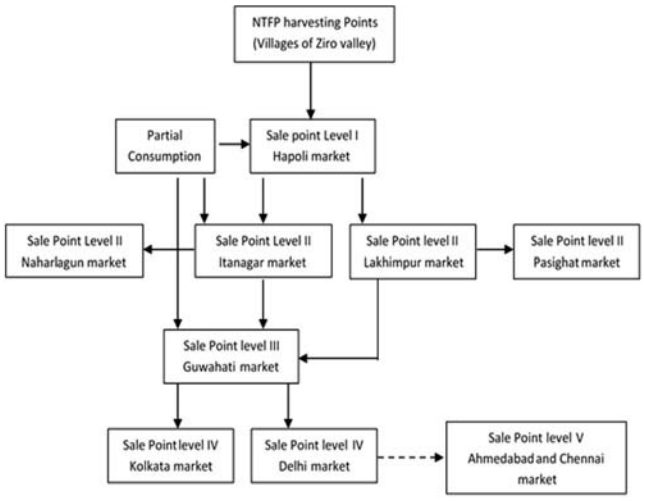

Figure 4: Different markets for the NTFPs produced in Ziro valley. Each level indicates involvement of additional intermediaries or agents.

term conservation of these plants (wild food and medicinal plants) due to the fact that people start seeing them as being of great value and therefore, they get more protection than non-valued species [30].

Marketing channels of *Apatani* NTFPs

The level, size and number of marketing channels determine the value chain of the NTFPs being sourced from the valley people. The length of the channel or the width of the network of markets for a particular product reflects on the value added and the benefits accruing to different channel members. The current information indicated that all the NTFPs collected in Ziro valley were traded from/at Hapoli, market channel level I. Some quantity of the NTFPs was consumed in and around Hapoli area and the remaining quantity was traded at Itanagar and Lakhimpur, market channel level II. There was lateral supply to Naharlagun and Passighat markets, respectively from these two collection centers. After local consumption, still some quantity was exported from Itanagar to Guwahati, Channel level III market. The Guwahati agents further exported them to Kolkata and Delhi, channel level IV markets (Figure 4). One product, Tiiming, was reported to be sent to Ahmedabad. Most of the products (Table 1; locally and externally marketed) were sold in level I and level II markets where very few traders were involved and the benefit was limited. Beyond this point selected products (Table 1; externally marketed) were sold in level III and IV markets, enhancing the benefit to the traders marginally.

The local trade and corresponding markets tend to be informal with relatively short, although not necessarily simple, value chains in many situations. Sometimes the same individuals perform all functions along the value chain from harvesting to final sales, while in other cases intermediate wholesalers, processors and traders may provide the link to consumers [31]. The marketing channels of the most Apatani NTFPs were very short and simple. Mostly unprocessed NTFPs were sold in the market by the harvester, possibly due to (i) fresh consumption as cultural practice (ii) lower demand in the external market (iii) quicker need of income etc. The norm of raw product consumption needed to be modified [27] as processing of NTFPs helps add value to the products, reduces the urgency to sell, improves bargaining power, reduces transportation cost etc. This might lead to the enhancement of financial benefit to local people [32,33]. However, a few products, which were processed and had their shelf-life enhanced, had longer marketing channels. These products reached a larger number of consumers but benefit was distributed among the intermediaries not the valley people. This is because there exist exploitative relations between producers and marketers and the bulk of profits from NTFPs accumulating far up the marketing chain from the collectors [29]. The potential cause could be the informal nature of markets where producers remain ignorant of vital information (pricing structure, availability of substitute, quality requirement and consumer preferences; [34]) along the value chain. Therefore, the promotion of marketing of quality products from the valley needed to be enhanced on a larger scale and the market network also needed to be strengthened.

Value addition of *Apatani* NTFPs

Most of the NTFPs were harvested and used fresh by the valley populace, especially food supplements and herbal medicines. Some of the fruits and vegetables were sent to the market for sale and were consumed by the urban population of Hapoli on a daily basis. The construction materials were stored for a very short period just before the commencement of house construction. Therefore, value addition to most of the NTFPs was not practiced in general. Other than green consumption, dried NTFPs (*Baching ayi, Byako*, *Hiyi*=dry Bamboo shoot, *Hiibyo lima, Kiira ayi, Kung ayi, Miiji, Nikhe, Pecha, Piitta ayi, Riiko, Salyo, Samper, Santero, Sati, Tarko, Yabing and Yorkhum*) were also consumed by the rural Apatani population. Drying was done primarily for storage purpose. A few NTFPs were powdered and stored in wooden/bamboo vessels. Grading was practiced only to the cleaning level in some of the NTFPs (*Salyo*, *Samper*) to remove unwanted dirt from the lot collected in bulk. Processing was adopted in very limited NTFPs like *Lyobyo*, *Pinging* etc. which were used to make a local salt called *Tapyo*. Dried *Riiko* was smoked, powdered and stored in a bamboo vessel. *Tiiming* stem or root was also dried properly before storage to protect it from fungal attack and degradation. Use of any commercial branding and packaging was not practiced for almost any of the *Apatani* products. Only fermented bamboo shoots were stored in used plastic bottles and dry bamboo shoots in polythene bags without the use of any brand name.

In most cases farmers were using simple technology for collection and preprocessing (storage) and were often not involved in processing or distribution which resulted in low returns [35]. However, raw product marketing had the advantage of low investment capital and direct access to the consumer (without any facilitator) both resulting in good returns. But processed or value added products have the benefit of potentially higher returns owing to their enhanced shelf-life, access to a larger network of markets and consumers of high purchase power. The value can also be increased by sorting produce by quality grades or by performing simple value addition operations such as separation of impurities, pulverizing, powdering and making tablets and so on [27]. Establishing food processing units could be very useful for making pickle, jam and jelly like products from *Apatani* raw materials procured in the form of wild fruits which are believed to be of high nutrient value (Kuru Ama Pers. Comm). Juice drinks, fruit roll-up or fruit leather etc. could also be produced through forest based small scale enterprises which may also be able to

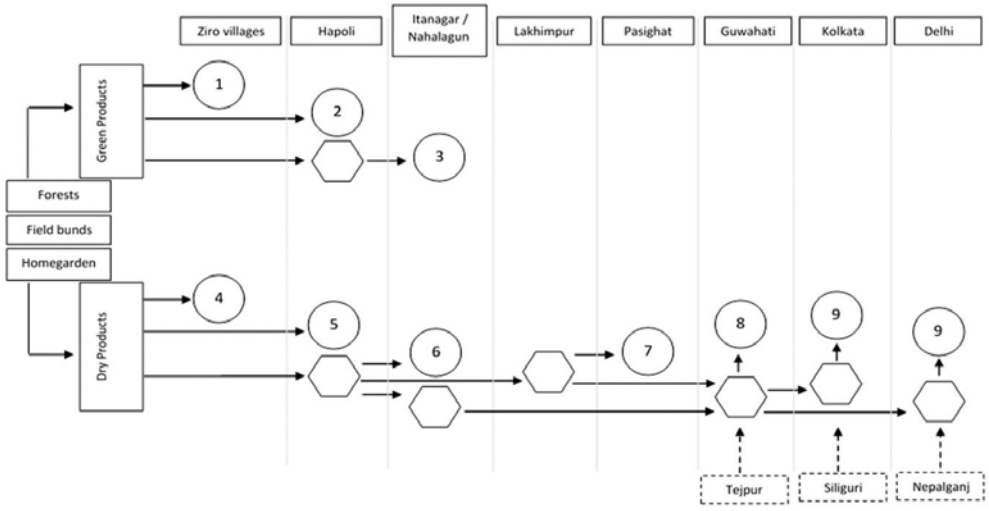

Figure 5: Shows the movement of NTFPs from origin to different markets. Circles are the consumption wells and hexagons are the storage and supply wells. Solid arrows show the movement route of *Apatani* products while dashed arrows show the movement of same products but fed from different sources.

neutralize the impact of big business, generally, taking away most of the benefit from the producers. Bamboo shoot and *Tapyo* which are already established commercial products could be given appropriate branding and packaging to add value and promote them among a wider range of customers.

The positioning of the product in the market could be one of the important strategies for *Apatani* products as it has some attributes, for example, natural, native, traditional, sustainable, herbal, heritage etc., which the modern customer values since it reconnects with something not available easily and everywhere. A brand could be created based on these valuable attributes with an aim to enhance the commercial value of the products. On the line of "Arkiset Aromit" of Finland [36] "Apatani Flavours" or "Heritage Flavours" could be created by promoting wild value and health benefit.

Value chains of *Apatani* NTFPs

Ziro-origin NTFPs were sold in the local village markets as well as the urban market of Hapoli, district headquarter of Lower Subansiri, which was a central point for inflow of products from different villages. Some of the common products, as told by the key informants and seen during the survey, were *Sanii tero, Hiika hamang, Yorkhum, Riiko, Padii hamang, Siya hamang, Hiipe hamang, Salyo, Samper, Hiyi,* fresh bamboo shoots, mushroom etc. (Table 2), though this composition varied in two different seasons. These products were sold by a group of vendors in an organized place or by isolated vendors in the streets. Major buyers from them were the *Apatani* in addition to immigrated population. Some of the informants revealed that select products were collected by the agents from harvesters and taken to the state capital Itanagar and the nearby town of Naharlagun, where many *Apatani* were settled. Such products were Bamboo shoots (*Bije, Bipu, Toh, Yabin*), Ginseng, *Hika hamang*, Paris, *Pato hamang, Raru hamang, Salyo ayi, Samper, Santero, Siya hamang, Tiire, Taamin, Tiiming, Yaso, Yorkhum,* etc. Lakhimpur was another market in the bordering State Assam where few Ziro valley products were collected for further transport to Guwahati. Some products were transported to Pasighat, another market place in Arunanchal Pradesh for local consumption. However, business at Lakhimpur market place was waning owing to two major reasons: one - new, shorter and convenient route from Itanagar/Naharlagun to Guwahati and two - deterioration in local business conditions especially for the outsiders or non-Assamese who were the main business agents for *Apatani* products. Agents in Guwahati dispatched the products to Kolkata or Delhi markets of NTFPs. Main products for these markets (Ginseng, *Nikhe, Paris, Taxus, Tiiming* and *Yaso*) were not processed before reaching the destination. However, same products of non-*Apatani* origin were supplied in these markets from Tejpur, Siliguri and Nepalganj also. *Tiiming*, which yields dye in addition to some medicine component, traveled far to the textile market of Ahmedabad. The schematic representation of movement of NTFPs from the villages of Ziro valley to urban centers or sale points is depicted in Figure 4.

The flow of *Apatani* products from origin (Ziro valley) to last consumption point (Delhi) through intermediaries is given in Figure 5. The movement of green products was restricted to intrastate markets. They were consumed in Ziro, Hapoli, Itanagar Naharlagun and Pasighat (well number 1, 2, 3). Similarly, some dry products were also consumed in these markets (well number 4, 5, 6) but their movement further extended beyond the state and covered interstate markets as well (well number 7, 8, 9). These green (unprocessed) and dry (semi-processed) products are recorded in Table 1 which could be read with the wells in Figure 5. During the present study only short value chain of the products involving intrastate markets was studied. The price spread of commonly available products at level I and Level II markets are given in Table 3. This showed that variation in the price outside the valley is 21% to 100% (average increase 55%) which included transport expenditure and profit over buying price. This margin increased when the products were purchased in bulk since the bulk-sale price was always lower than the retail price given in the table. Therefore, the actual price spread will also increase in the case of wholesaling of the product which was around 15% at Hapoli (Taku Taga, Pers. Comm.).

Proper marketing is a crucial element of NTFP commerce. Appropriate identification, documentation, systematic collection and improved storage facility were necessary for suitable marketing

Table 3: Price spread (INR) of some common short chain NTFPs in 2014-15.

SN	NTFPs	Retail price at origin (Hapoli)	Retail price for consumer Outside valley			Price spread (INR)	Increase over origin price (%)
			Naharlagun	Itanagar	Average		
1	*Baching*	40	60	60	60	20	50
2	*Byako*	60	100	100	100	40	67
3	*Byapu*	200	300	300	300	100	50
4	*Engin*	30	50	60	55	25	83
5	*Ginseng*	1500	na	2500	2500	1000	67
6	*Higu hamang*	100	150	150	150	50	50
7	*Hiika hamang*	20	40	30	35	15	75
8	*Kiira ayi*	50	70	80	75	25	50
9	*Ngliyang khiko*	100	150	150	150	50	50
10	*Paris*	2000	na	2500	2500	500	25
11	*Pato hamang*	70	90	100	95	25	36
12	*Raru hamang*	60	90	110	100	40	67
13	*Salyo ayi*	200	250	250	250	50	25
14	*Samper*	180	250	300	275	95	53
15	*Santero*	50	70	80	75	25	50
16	*Siya hamang*	40	60	60	60	20	50
17	*Tapyo*	250	350	350	350	100	40
18	*Tayi hamang*	50	100	100	100	50	100
19	*Tiiming*	150	300	300	300	150	100
20	*Yorkhung*	215	250	270	260	45	21

na = not available

channels [37,38]. However, all the markets involved in *Apatani* products, either short chain (local markets) or long chain (regional markets) were informal in nature where the sellers were trading through bilateral bargaining. There was no transparency in business and quality assurance of the product was also lacking [39]. Contrary to the formal market system, there was no control over the method and quantity of harvesting resulting into unsustainable harvesting [40]. Therefore, introduction of a formal marketing system may not only regulate the pricing system resulting in benefits to the producers but also ensure the ecological health of the resource [38], as has been pointed out by [39] so that people are motivated to use the resources sustainably when economic value get attached to that.

The study of longer value chain involving interstate markets was left out due to some constraints, primarily long distances (Figure 6), heavy resource and time involvement. Nevertheless, traders at Lakhimpur market, which was the major hub of *Apatani* products before opening of Itanagar and Naharlagun markets, informed that the trade route had gradually shifted from Ziro-Lakhimpur-Guwahati to Ziro-Itanagar-Guwahati. However, the business was waning but not completely wiped out as some products in low quantity were still coming in. The products like *Tiiming*, *Yaso*, broom grass (*Thysanolaena maxima*) and large cardamom (*Amomum subulatum*) were being collected from Ziro-agents and forwarded to Guwahati-agents at 20-30% margin of profit. The production of *Tiiming* and *Yaso* was declining and it was possible that trade in these two products may end very soon. This was in consonance with the information provided by key informants at Ziro valley that production of large cardamom, good quality cane and *Tiiming* was decreasing in the forests. Lakhimpur traders also informed that after temporary storage in the warehouses, products were further forwarded to Kolkata and Delhi regularly, and to Ahmadabad and Chennai occasionally. Same products from different regions were also fed in at Guwahati, Kolkata and Delhi via Tejpur, Siliguri and Nepalganj, respectively. It was also

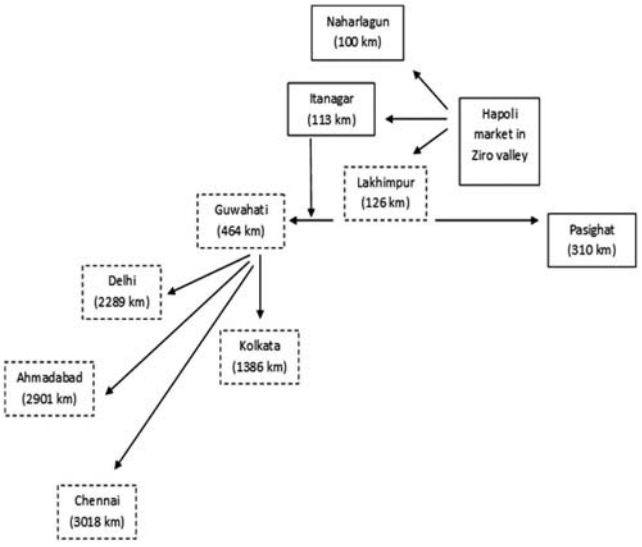

Figure 6: Showing the distances of markets of *Apatani* product starting from Ziro valley. Boxes with broken outline are the interstate markets.

Figure 7: Short chain products sold in intrastate markets. **Left to right Top row:** Informal markets at Hapoli and Naharlagun, **Middle row:** Unprocessed products *Harkhu ayi* and *Siya hamang*, **Bottom row:** Semi-processed products Dry and Fermented Bamboo shoot.

Figure 8: Long chain products sold in Interstate markets. **Left to right Top row:** Plant of Paris and Rhizome of Ginseng, **Middle row:** Palm grass wrapped Tapyo and Taxus plant, **Bottom row:** *Eppane nanii* and *Yaso*.

informed by the traders that the price of the products kept increasing at all these market points due to inclusion of transport costs and margin of profit at each point.

Belcher and Schreckenberg [32] described the NTFPs value chains of certain activities like NTFPs production /collection, transport, storage, processing, marketing and sale. Longer chains may have all these components while shorter ones might lack a few. Nevertheless, this enabled households to have ready access to the products that they would otherwise have to buy. This also offered income enhancement and employment opportunities [42]. The value chain of NTFPs practiced by *Apatani* tribe in Ziro valley could also be broken into similar steps such as, production, collection, storage, value addition, transport, marketing for local consumption and local and external sale for outside users (Figure 3). This was associated with commercialization of products intended to improve the livelihood of local people. However, commercialization lead to sustainability issues, as is the case currently with a few species. Nevertheless, the valley dwellers have already started practicing an alternate system of production -- homegardening [14].

Problems and Impacts on NTFP resources

Couple of market places, short and long chain products are presented in Figure 7 and 8. Most of the short chain products like vegetables and fruits (*Hiibyo hamang, Raru hamang, Tai hamang, Jojuru ayi, Salyo ayi, Samper ayi, Sanko ayi* etc.) had very little shelf value. Additional markets for such products were fairly distant from the source -- 100 to 125 km which made direct disposal by the producer almost impossible. This was further accentuated by poor transport facility. Spoilage and wastage of such products was inevitable for want of storage and processing units. Babalola [43] also agreed that NTFP marketing was challenged by lack of storage facility and poor transportation along with price fluctuation and middlemen exploitation.

The key informants revealed that harvesting techniques and tools in certain cases were not proper. In the case of *Samper* and *Salyo* fruits were collected earlier from the ground but this method of collection has changed in past few years. Either trees are felled or branches are hacked to get maximum and easy harvesting to meet increased demand. The market pressure gets reflected on *Paris* and *Rubia* also as these have been heavily extracted beyond recovery. Therefore, careful collection and extraction (only mature products) and use of better equipment and tools like, ladder and climber, can increase long run productivity and assure sustainability [35].

From a biodiversity perspective the impact of trade is ambiguous. Trade results in declining abundance of goods that are exploited for export to the outside market. Market value, exploitation technology and the life history characteristics of the exportable goods together determine whether a species is exploited to local extinction or not.

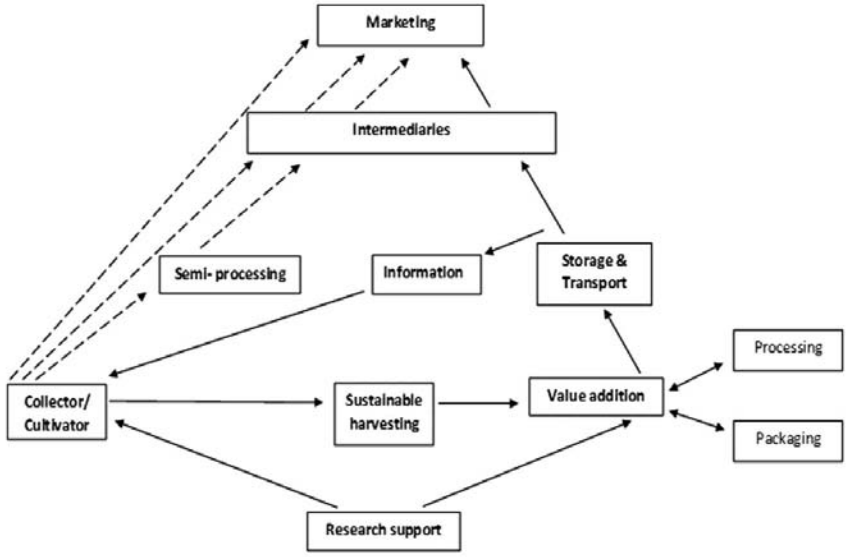

Figure 9: Flow chart showing Current (broken arrow) and Proposed (solid arrow) marketing channels of *Apatani* NTFPs.

Empirical evidence suggested that few wild resources can sustain commercial exploitation and the trade results in either local extinction or domestication of species of exploitable goods [44-46]. A few key resource persons pointed out that the bulk of business in the sale of NTFPs has increased to meet internal as well as external demands of Ziro valley products during last three decades. They also expressed the concern of continued supply of the product to the market and thereby economic sustainability. This was corroborated by the respondents of questionnaire survey that availability status of some species had become scarce. At the same time the availability trend of certain species had also decreased. Such species identified by them with scarce availability status were *Bukhe, Hiibin, Imyo, Jojuru ayi, Khung, More taku, Pabo kormo ayi, Payinglamu hamang, Payu, Pumi haman, Sanchi, Santotero, Santutaki, Taku ayi* and with decreasing availability trend were *Antiitari ayi, Ayopakhe haman, Biiling, Diiran sankhan, Henchi, Hiibin, Hiibyo hamang, Imyo, Jojuru ayi, Khung, Kukulyu, More taku, Ngilyang khiiko, Niming, Pachu koyu, Payu, Raru hamang, Salyo ayi, Samper ayi, Sanko ayi, Santi, Tai hamang, Tapang, Yaso*. After combining these two parameters, the availability trend and availability status, the products like *Hiibin, Imyo, Jojuru ayi, Khung, More taku, Payu*, fell in a new category like high vulnerability towards conservation. This raised the issue of identifying the reasons and need of immediate conservation of such products in the valley.

It is a well-established fact that low intensity extraction of NTFP from a natural forest can have a low impact on the local ecology and biodiversity at the landscape and the species level. But, on the contrary, as harvesting and management intensity increase the negative impact is higher which could be the result of higher product demand, better markets and improved infrastructure [26]. It is also a reality that most of the high valued NTFPs are collected without paying attention to the quality and quantity of harvested material. Being the least benefiting groups, collectors often tend to harvest more than the harvestable quantity to get more money. Similarly, competition among collectors compels them to collect NTFPs prematurely, resulting in their gradual disappearance [47].

Conclusion and Recommendation

The current marketing practices and proposed improvement in marketing strategy is depicted in Figure 9. This is based on the following principles and practices:

i. *Apatani* NTFPs have well documented economic importance and are linked to livelihood [5,9,10]. Therefore, the commercialization of such NTFPs, defined as increasing the value of a product in trade, is expected to increase income and employment opportunities, especially for poor and otherwise disadvantaged people [32] of Ziro valley.

ii. Although there is apprehension that NTFP commercialization has not been successful universally, it has not fulfilled the expectation of local income generation and has not led to improved conservation of resources [48,49], successful commercialization in the present case could be achieved through innovation in improved resource management and domestication [50]. The *Apatani* have developed homegardening of more than thirty species of different ecologically important categories of NTFPs such as Abundant-Increasing, Abundant-Stable, Abundant-Decreasing, Limited-Increasing, Limited-Stable and Limited-Scarce [14]. This measure of conservation needs to be scaled up further based on need assessment.

iii. Value addition potential to Ziro valley products was limited due to limited size of the market, purchasing power of the people, product processing and marketing skills available, along with lack of investment capital. Therefore, measures to counter these hurdles may be useful in promoting high potential NTFPs to a higher scale.

iv. Current price spread condition not helping too much to the producers could be improved by strengthening the information passage system and changing the informal nature of the market to formal one if possible.

v. Research and development activities related to sustainability of resources and value addition suited to the local products are

required to be converged first, then the gaps to be identified and finally scaled up in order to maximize the value. Simultaneously, infrastructural base would also be required to establish in the wake of research findings to complement the development of trade up the line.

vi. NTFPs are extremely critical for the rural poor as a livelihood strategy, and often provide the means to close the income gap with wealthier classes [29]. There are many potential risks and dangers in the commercial exploitation of NTFPs -the first is overexploitation and the second is harvester's cash desire trap leading to unsustainable exploitation [51]. Currently there are certain species facing vulnerability in Ziro valley [14]. Therefore, NTFP extraction should be well organized and coordinated with harvest guidelines for the sustainability of extraction. A key feature of successful approach to NTFP management will be a sound monitoring and evaluation programme [22].

Having the constraints removed commercialization of *Apatani* NTFPs and chances of livelihood improvement of *Apatani* populace seem to be very bright. However, I would like to propose a caveat. The line is very thin between maintaining the heritage value of the system practiced by the *Apatani* and uplifting the condition of this tribe through commercialization of their long preserved system. Owing to the spread and influence of cosmopolitan culture and adoption of modern life style at faster pace, the younger generation is staying away from traditional practices of forest based resources. Traditional indigenous knowledge in the valley is also on the path of decline [7,14]. Therefore, commercialization of NTFPs should be done with utmost care emphasizing on prevention and without compromising on the negative impacts.

Acknowledgement

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