

# PRIORITIZATION OF NON-TIMBER FOREST PRODUCTS FOR INCOME GENERATION : A PARTICIPATORY APPROACH

Debabrata Saha and R.C. Sundriyal\*

G. B. Pant Institute of Himalayan Environment and Development,  
North East Unit, Itanagar -791 111, Arunachal Pradesh.

**Abstract:** Prioritization of Non-Timber Forest Products (NTFPs) of commercial value as per people's perception has high implications for conservation as well increasing community incomes through domestication. Based on a study done in Western Arunachal Pradesh, where as many as 343 NTFPs are collected from wild habitats and used by five tribal communities, an exercise of community preference matrix for prioritization of best NTFPs for adoption in traditional farming systems was performed. It was accomplished through focused group discussion by assessing community choice and preferences of NTFPs along with a further prioritization of species by matching them with each other. The communities identified 23 potential NTFPs that can fetch high incomes to rural communities. Most preferred species were *Illicium griffithii*, *Swertia chirayita*, *Panax bipinnatifidum*, *Taxus wallichiana*, *Picrorhiza kurrooa*, *Cordyceps sinensis*, *Gymnadenia orchidis*, *Wallichia densiflora*, *Aconitum fletcherianum*, *Rubia cordifolia* and *Valeriana jatamansii*. Among all *Illicium griffithii* was most preferred species that has high prospective to be domesticated. Status assessment of six species was also done. To meet community livelihoods from NTFPs, it desires a thorough domestication and management plan for these species which will help to increase community income and also conserve them in their natural habitats.

## INTRODUCTION

The Non-Timber Forest Products (NTFPs) are often used as multipurpose products, such edible fruits, medicinal raw materials, fodder, fuel wood, gum, resin, etc. There is a growing consciousness that these species should play a prominent role in increasing the income of farm households in the mountains (Dhyani and Khali, 1993). Such species are needed to be adopted in the traditional agricultural systems. Prioritization of species however needs community backing for adoption in their traditional farming systems which could be done based on people's perception and knowledge. The tribal communities possess huge traditional ecological knowledge about wild plant resources, their use and management (Gangwar and Ramakrishnan, 1990; Maikhuri *et al.*, 1994). Therefore, it is highly desirable to implement community based approach for promotion of forestry and natural resource management in biodiversity rich areas (Sundriyal *et al.*, 2004). Prioritization of selected species that are producing high economic return to locals and gathering information on their natural status could play a prominent role in management of such species (Phillips, 1993).

A careful screening and prioritization of most potential species, and detailed information on their structure, regeneration, stand productivity, its harvest level and possibility of harvest adjustment would help to devise a long-term management plan for the species at large (Panayotou and Ashton, 1992). Devising agronomic trials on these species would help them to adopt in farming systems. Considering that the present study was undertaken on NTFPs of Western Arunachal Pradesh, a biodiversity rich and tribal dominated area, where communities have high dependence on these resources. This investigation comprised to prioritize NTFPs as per community perception for domestication and possible adoption in Agroforestry System.

## METHODS

### Study Area

The study was conducted at West Kameng district of Arunachal Pradesh in Northeast India, which has high diversity of NTFPs (Saha, 2009). The district lies between 26°54' to 28° 01' N latitude and 91°30' to 92°40' E longitude and covers an area of 7422 km<sup>2</sup>. The area is predominantly hilly with an altitude range from 200 m to 7090 m. The climate is humid with high rainfall (>2500 mm) and thus the area exhibits luxuriant

\*Presently at Herbal Research and Development Institute, Gopeshwar (Chamoli) - 246 401, Uttarakhand, India.

vegetation. The district has a population of 74,595 (Census, 2001) with decadal growth rate of 32.21%. The 94% population of the district is rural with an average population density of 13 persons per km<sup>2</sup>. The forests of the district are rich in species diversity and show a clear demarcation in structure and composition (Saha, 2009). The forests change with elevations and mainly composed of tropical/sub-tropical evergreen forests up to an elevation of 900 m, subtropical pine forests between 900-1800 m, temperate broad-leaved and conifer forests between 1800 to 3000 m, sub-alpine forests between 3000-4000 m and alpine vegetation >4000 m (Kaul and Haridasan, 1987). The most common tree species up to 1100 m elevation are *Terminalia myriocarpa* (Hollock), *Altingia excelsa* (Jutuli), *Ailanthus grandia* (Borpat), *Amoora wallichii* (Amari), *Canarium strictum* (Dhuna), *Duabanga grandiflora* (Khokan), *Mesua ferrea* (Nahar), *Morus laevigata* (Bola), *Albizia arunachalensis* (Siris), *Kydia glabrescence* (Pichola); between 1100-2200 m *Quercus lamellosa*, *Q. griffithiana*, *Q. serrata*, *Pinus roxburghii*, *P. wallichiana*, *Michelia* spp., *Magnolia* spp., *Rhododendron* spp., *Acer* sp., *Rhus* spp., *Alnus nepalensis*, *Betula alnoides*, etc.; between 2200-3000 m - *Pinus wallichiana*, *Cupressus torulosa*, *Taxus baccata*, *Tsuga dumosa*, *Larix griffithiana*, *Abies densa*, *Acer* sp., *Rhododendron arboreum*; between 3000-3500 m *Abies bensa*, *Juniperus wallichiana*, *Tsuga dumosa*, *Betula* sp., *Rhododendron* sp., *Sorbus* sp.; and between 3500-4000 m the main species are *Abies densa*, *Sorbus* sp., *Rhododendron* spp., *Acer* spp., *Juniperus wallichiana*, *Polygonum*, *Aconitum* spp., *Rheum* sp., *Geranium* sp., *Cyananthus* sp., etc. These forest comprise large variety of NTFPs that are used by the communities for different purposes.

The district is inhabited by five main ethnic communities, viz. Aka, Bugun, Miji, Monpa, Sherdukpen. All communities have small parcels of farm lands, as a result the agriculture sector is not able to produce sufficient surplus, and therefore dependency is very high on the natural resources, which is evident in the form of collection of fuel, timber, wild edibles, medicinal plants, wild animal poaching, etc. There is huge potential to develop NTFPs sector for socio-economic upliftment of the rural population as well as biodiversity conservation in the region (Saha *et al.*, 2006).

## Species Prioritization Criterion and Survey

The community surveys are frequently used to facilitate farmer preferences in NTFPs researches (Martin, 1995). In this study, a multipurpose screening trial method was used to priorities best NTFPs in West Kamang district of the state. The investigation covered five tribal communities covering ten villages, viz. Chondor and Ewang villages for Monpa tribe, Old Shergaon and New Shergaon for Sherdukpen, Singchung and New Kaspi for Bugun, New Jamiri and Old Jamiri for Aka, and Upper Dzong and Lower Dozng villages for Miji tribe. These villages cover 1000 to 3000 m elevational range, which also coincides to the major human habitation zone of West Kameng district (Table -1). A detail investigation was made on the NTFPs being collected by the tribal communities of these villages (Saha, 2009). For prioritization of NTFPs an exercise was undertaken as which species the farmers wanted to adopt the most and grow on their farms if they are given the opportunity of selection. It was accomplished in two steps; initially the community choices of all possible plant species was done using focused group interviews while later on asked to further prioritize 4-6 plant species that they would like to adopt in their farming system along with reasons for their choices. As a second step, a supplementary survey was done by prioritizing farmers' preferences by matching each species with one another. In this exercise, farmers from different villages were invited to develop a matrix ranking using a chart sheet. The local name of the species were written on the left side of the chart sheet along with a identification number. Same numbers were also place on the upper side of the chart. Now each species was matched with one another by the villagers themselves. Finally, all species were ranked as per the community choice. Overall, the method of selection of economically important plant species as per community desire and their further prioritisation proved to be a useful and cost-effective exercise for screening best preferred species.

## RESULTS

### Community Facts and Diversity of NTFPs Being Used

The socio-economic status of ten villages undertaken for this investigation varied remarkably (Table -1). Of the total population 60% was male and 40% female population. Only 12, 3 and 33% persons

worked as causal labours, agricultural labours and other workers. Among total workers, just 4% workers were agricultural labour, 25% as causal labour and 71% involved as other workers, which clearly showed that major source of livelihood is other sources. Literacy also varied among the studied villages though a mean literacy rate of 52% was recorded for all villages (Table -1).

A total of 343 NTFPs recorded used for diverse purposes by tribal communities (Table -2). When species choice grouped as per use category, utilization for medicinal (163 species), edible fruits (75 species) and vegetables (65 species) purposes was reasonably high. Community dependence on forest resources was 100% for firewood and house construction material. The distribution pattern of NTFPs showed that these species found at all elevations, though maximum species were recorded at upper hills, followed by mid-upper hills, and low-mid hills (Table -2). 76 plant species were sold in three major local markets while an additional 22 species traded at commercial scale mainly outside the state. NTFPs contributed 19-32% of total household income for different tribal communities, which was significant. *Illicium griffithii*, *Rubia cordifolia*, *Oroxylum indicum*, *Swertia chirayita*, *Litsea sebifera*, *Taxus wallichiana*, *Valeriana jatamansii*, *Thalictrum foliolosum*, *Picrorhiza kurrooa*, *Everniastrum cirrhatum*, *Cordyceps*

*sinensis*, *Aconitum fletcherianum*, *Nardostachys jatamansi*, *Gymnadenia orchidis*, *Calamus*, *Quercus* and *Pinus roxbughii* were important commercial species. NTFPs also generated substantial revenue to the State government, though it is falling year after year, which is alarming.

**Community Selection Criteria and Choice of Species**

For selecting suitable species for adopting in agricultural fields, members of each of the five communities were invited for a common exercise. A total of 69 male (53%) and 62 female (47%) member comprising all ten villages participated in the exercise (Table -3). They were asked to formulate a set of questions that they feel important for consideration and selection of NTFPs. After detail discussion a species selection criterion was devised by the communities, i.e. (i) the species should provide multipurpose benefits through wide range of products or services to the communities, (ii) it should hold socio-economic-cultural significance for local people, (iii) the species (or its products) are marketed, generate ready income to communities, and have the potential for semi-processing at local level, (iv) the species are collected from wild and people are interested to domesticate it, (v) there is a possible conservation threat on the species if unabated exploitation continues, (vi) the communities have some experience in harvesting, use and management

**Table -1:** Socio-economic structure of the study villages in West Kameng district of Arunachal Pradesh

Village	Number of householdss	Total population	Male	Female	Workers (Main + Marginal)			Literacy	Literacy (%)
					CL	AL	OW		
Upper Dzong	24	128	67	61	46	0	6	44	39.3
Ewang	278	1123	574	549	180	74	210	538	58.4
Old Shergaon	13	65	35	30	7	1	15	39	60.1
New Shergaon	250	1049	567	482	118	8	248	631	60.1
New Kaspi	41	177	92	85	37	0	29	93	68.9
Singchung	369	2028	1468	566	78	5	1074	1659	92.8
Old Jameri	17	141	72	69	27	0	18	37	36.6
Jamiri New	53	217	120	97	21	0	81	102	56.4
Chongdor	20	87	47	40	0	0	39	12	14.6
Lower Dzong	63	330	160	179	110	1	34	93	35.9

CL= Casual labour, AL= Agricultural labour, OW= other workers  
 Source: District Statistical Office, Census 2001

**Table -2:** Distribution range of locally used plant and animal species in the West Kameng District, Arunachal Pradesh

Category	Number of species						
	LH	LMH	MH	MUH	UH	LUH	Total
Wild vegetables	11	15	10	12	11	6	65
Edible fruits	12	15	10	12	24	2	75
Edible mushrooms	1	4	6	6	1	0	18
Dye and Colour fixer	3	3	4	4	4	2	20
Spices and condiments	1	3	1	4	2	2	13
Medicinal plants	25	21	23	36	38	20	163
House construction	3	7	1	1	4	0	16
Fuel wood	1	2	2	7	5	1	18
Fodder	4	4	6	3	3	2	22
Hunting and piscicide	2	1	0	2	3	3	11
Incense and aroma	2	0	1	4	3	0	10
Oil yielding	0	2	1	2	2	0	7
Local drinks & beverages	0	1	1	1	6	2	11
Others	24	18	14	14	14	4	88
Total	89	96	80	108	120	44	343

LH= Low hill, 200-900 m; LMH= Low-mid hill, 300-1500 m; MH= Mid hill, >900-2000 m; MUH= Mid-Upper hill, 1500-2500 m; UH= Upper hill, >2000 m; LUH= Low-upper hill, 300-2500 m.

**Table -3:** No of farmers involved in species prioritization survey for the West Kameng district

Village	Tribes inhabited	Total	Number of participants	
			Male	Female
Upper Dزون	Miji	15	8	7
Ewang	Monpa	16	7	9
Old Shergaon	Sherdukpen	12	5	7
New Shergaon	Sherdukpen	12	7	5
New Kaspi	Bugun	11	6	5
Singchung	Bugun	14	8	6
Old Jameri	Aka	11	6	5
New Jamiri	Aka	13	7	6
Chongdor	Monpa	13	8	5
Lower Dزون	Miji	14	7	7
	Total	131	69	62

of the species, and (vii) there is complete lack of information on species with relation to their structure in natural stands, its regeneration, and yield of plant parts used.

Based on the above criterion a detailed list of plant species of communities' choice was prepared. The villagers identified NTFPs which were selected as per their perception and day to day interactions with these species. A total of 23 NTFPs met the criterion selected by the villagers which comprised *Acorus calamus*, *Aconitum fletcherianum*, *Illicium griffithii*, *Taxus wallichiana*, *Valeriana jatamansii*, *Swertia chirayita*, *Rubia cordifolia*, *Cordyceps sinensis*, *Calamus flagellum*, *Myrica esculenta*, *Picrorhiza kurrooa*, *Litsea citrata*, *Cinnamomum caudatum*, *Litsea sebifera*, *Cornus capitata*, *Persea fructifera*, *Gymnadenia orchidis*, *Wallichia densiflora*, *Juglans regia*, *Zanthoxylum armatum*, *Panax bipinnatifidum*, *Oroxylum indicum* and *Gymnocladus assamicus*. The exercise revealed that farmers had a clear understanding about the species, its economic benefit and they were also concerned for reliable and continuous supply of the species and its products.

To further prioritize 23 preferred NTFPs in a rank of 1-23 (best to least preferred), the community members were asked to match each species with all

other species (Table -4). This exercise helped to rank all preferred species as per the community perception and choice. Based on such farmers preference matrix, *Illicium griffithii* was ranked first, followed by *Swertia chirayita*, *Panax bipinnatifedum*, *Taxus wallichiana*, *Picrorhiza kurrooa*, *Cordyceps sinensis*, *Gymnadenia orchidis*, *Wallichia densiflora*, *Aconitum fletcherianum*, *Rubia cordifolia*, and *Valeriana jatamansii* (Table -4). Other species followed subsequently.

A comparative account of community perception about six prioritized species in terms of its use, access rights and their preference for cultivation is presented in Table -5. The data revealed that these species are collected from wild though their availability vary from area to area, all of them can easily be marketed, there is lack of information on species structure, regeneration and yield, and community have high desire to domesticate them.

*Illicium griffithii* ranked highest among all NTFPs it is medium size evergreen tree locally known as 'Lissi'. It is found in subtropical and temperate broad-leaved forest of West Kameng, Tawang, Lohit and Lower Subansiri districts of Arunachal Pradesh. It is distributed in Bomdila, Dirang, Kalaktang areas of West Kameng district. The fruits are star shaped, having pungent, liquorice-like flavour and consisting of 7-13 follicles with brown seeds. *Illicium griffithii* possess potent antimicrobial properties. In view of high demand of the seeds of this species, communities have initiated to maintain forests of this species, which should be considered as an important effort to conserve this species. They showed strong desire to cultivate this species. Except for *Rubia cordifolia*, which was available in abundance in wild, the villagers showed interest to cultivate other 5 species as well, though they were not aware if agronomic practices are available for these species.

## DISCUSSION

Sustainable marketing and conservation of non-timber forest products and their habitats requires identification of potential species, and analyse their stand status (density, regeneration, phenology, productivity and harvest levels i.e. fruit yield and collection), and harvest adjustment if any (Peters *et al.* 1989). The participatory survey for prioritizing plant species that are important for communities,

particularly from economic point of view, is key consideration for selection of NTFPs. Two tier strategy was used to prioritise the species, first at villages/single community level and thereafter between communities. Each village community identified a set of 5-6 species, thus a total twenty three species were identified by 10 surveyed villages. A supplementary survey of farmers' preference for NTFPs by matching all prioritized species with one another clearly prioritized the best preferred species.

Communities have their own choices for most potential economic species. They had a clear understanding of natural availability of species. The exercise was useful to develop proper understanding of communities view on best preferred plants. Through small group discussion, they were able to prioritize and rank all identified species. Such participatory approaches in data gathering are central in ethnographic and anthropological researches (Martin, 1995; Sundriyal and Sundriyal, 2003). Such technique not only provides comprehensive accounts of difference /likeness of men and women but also between tribes about their practices, knowledge, access to resources and management of resource. Six most preferred species (*viz.*, *Illicium griffithii*, *Swertia chirayita*, *Panax bipinnatifidum*, *Taxus wallichiana*, *Picrorhiza kurrooa* and *Cordyceps sinensis*) need to be further assessed for their status and availability of R&D information on them.

This study found that *Illicium griffithii* was best preferred species because of its high market value. This species is distributed to subtropical and temperate areas in Northern Hemisphere from Assam to Japan and Korea and South to Borneo, and in America, Florida, Mexico and West Indies and commonly called as Star anise because of its star shaped fruits (Duchok *et al.*, 2005). In Arunachal Pradesh it is reported from West Kameng, Tawang, Lohit and Lower Subansiri districts (Duchok *et al.*, 2005). The average life of the tree is 80-100 years. The fruits possess potent antimicrobial properties and its oil is used as flavouring agent and carminative (Haridasan *et al.*, 2003). Star anise has been used as spices in oriental cooking for thousands of years. It has pungent flavour, and was introduced into Europe in the 17<sup>th</sup> century where it was used in baked goods and fruit jams. Star anise produces large variety of

Table -4: Farmers species priority matrix

Species	Local	code	AC	AF	IL	TX	VA	SW	RC	CO	CL	MY	PC	LC	CN	LI	CR	PR	GO	WD	JU	ZA	PB	OI	GA
<i>Acorus calamus</i>	Jingka che	AC		AF	IL	TX	VA	SW	RC	CO	CL	MY	PC	LC	CN	LI	CR	PR	GO	WD	JU	ZA	PB	OI	GA
<i>Aconitum fletcherianum</i>	Ngyeng/Chanduk	AF			IL	TX	AF	SW	AF	CO	AF	AF	PC	AF	AF	AF	AF	AF	GO	WD	AF	ZA	PB	OI	GA
<i>Illicium griffithii</i>	Lissi	IL			IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL	IL
<i>Taxus wallichiana</i>	Kitangma	TX				TX		SW	TX	TX	TX	TX	TX	TX	TX	TX	TX	TX	TX	TX	TX	TX	PB	TX	TX
<i>Valeriana jatamansii</i>	Pangoss	VA						SW	RC	CO	VA	VA	PC	LC	VA	VA	VA	VA	GO	WD	VA	ZA	PB	VA	GA
<i>Swerita chirayita</i>	Pangduk man	SW							SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
<i>Rubia cordifolia</i>	Lainee	RC								CO	RC	RC	PC	LC	RC	RC	RC	RC	GO	WD	RC	ZA	PB	RC	GA
<i>Cordyceps sinensis</i>	Yarchi gombu	CO									CO	CO	CO	CO	CO	CO	CO	CO	CO	CO	CO	CO	PB	CO	CO
<i>Calamus flagellum</i>	Raidang	CL										CL	PC	LC	CL	CL	CL	CL	GO	WD	CL	ZA	PB	OI	GA
<i>Myrica esculenta</i>	Zen sheng	MY											PC	LC	CN	MY	CR	PR	GO	WD	JU	ZA	PB	OI	GA
<i>Picrothiza kurroa</i>	Kongleng/Kutki	PC												PC	PC	PC	PC	PC	PC	PC	PC	PC	PB	PC	PC
<i>Litsea citrat</i>	Niyeng	LC													LC	LC	LC	LC	GO	WD	LC	ZA	PB	OI	GA
<i>Cinnamomum caudatum</i>	Chingcha	CN														CN	CR	CN	GO	WD	CN	ZA	PB	OI	GA
<i>Litsea sebifera</i>	Laham	LI															CR	PR	GO	WD	JU	ZA	PB	OI	GA
<i>Cornus capitata</i>	Shyamrunigma	CR																CR	GO	WD	CR	ZA	PB	OI	GA
<i>Persea fructifera</i>	Setulje; Magu	PR																	GO	WD	JU	ZA	PB	OI	GA
<i>Gynmadania orchidis</i>	Salap panja	GO																		GO	GO	GO	PB	GO	GA
<i>Wallichia densiflora</i>	Niyuk/Rongbong	WD																			WD	ZA	PB	WD	GA
<i>Juglans regia</i>	Khe sing	JU																				ZA	PB	OI	GA
<i>Zanthoxylum armatum</i>	Khagi/Timur	ZA																					PB	ZA	ZA
<i>Panax bipinnatifidum</i>	Gunamanchung	PB																						PB	PB
<i>Oroxylum indicum</i>	Namkaling	OI																							GA
<i>Gymnocladus assamensis</i>	Myangmanbase	GA																							
Score			1	11	22	19	9	21	10	18	6	2	17	10	5	0	7	3	15	13	4	15	20	10	15
Rank			XVIII	IX	I	IV	XI	II	X	VI	XIII	XVII	V	X	XIV	XX	XII	XVI	VII	VIII	XV	VII	III	X	VII

**Table -5:** Comparative status of selected important species of West Kameng district

Details	<i>Swertia chirayita</i>	<i>Picrorhiza kurrooa</i>	<i>Cordyceps sinensis</i>	<i>Rubia cordifolia</i>	<i>Illicium griffithii</i>	<i>Taxus wallichiana</i>
Local name	Pangduk man	Kongleng	Yarchigonbu	Lanii	Lissi/ Munsheng	Kitangma
Family	Gentianaceae	Scrophulariaceae	Scolecosporae	Rubiaceae	Illiciaceae	Taxaceae
Use of species	Asthma, liver disorder	Diarrhoea, stomach trouble, fever	Revitalizer	Dye, against cough	Spice, carminative, stomach ache, colic in babies, lung cancer cells, bird flu, dye, agricultural tools	Hysteria, epilepsy, Fodder and as fish poison
Whether collected by communities from wild	yes	yes	yes	yes	yes	yes
Access rights to resource	Transit permit	Transit permit	-	Transit permit	Transit permit	Transit permit
Community control to resource	No	No	No	No	Community	Govt.
Availability of resource	Common	Rare	Rare	Abundant	Common	Rare
Any community management in practice	No	No	No	No	Yes	No
Community desire for cultivation of species	Moderate	Moderate	High	No	High	Moderate
Whether the species is economically beneficial	Very beneficial	Yes	Very beneficial	Yes	Very beneficial	Yes
Information regarding structure, regeneration, and yield on species	No	No	No	No	No	No

essential oils and have been used in Chinese medicine for centuries (Tam *et al.*, 2005). Now it is also used in pharmaceuticals for the treatment of stomach ache, colic in babies, and even facial paralysis. In Bhutan, to increase role of *Illicium griffithii* in rural economies, suggestions are being given for enabling regulations and clear guidelines to facilitate the process of permit allocation as per sustainability of the resource (Mukhia *et al.*, 2006). In recent years, scientists also found cancer fighting properties

especially against lung cancer cells (Tam *et al.*, 2005). These reports are sufficient to highlight the need of this species in near future as well. Similar is the case of other species as well.

Sustainable extraction of Non-Timber Forest Products (NTFPs) is considered best feasible strategy for forest conservation in biodiversity rich areas. Northeast India being a global hot spot of biodiversity provides immense opportunities to identify local species of commercial value that can

change the economic profile of communities if the species are selected based on local perception and considering their demand in national and international markets (Sundriyal and Sundriyal, 2004). To enhance linkages between rural communities and conservation of valuable NTFPs, there is a need to promote and implementing community-based approaches to natural resource management. If cultivation of selected wild NTFPs is promoted with a dimension of poverty alleviation, it could bring high return to the communities. The present study therefore suggests that a community centred approach for species selection and their promotion in traditional farming system can expand community-based forest and natural resource management in biodiversity rich areas. The planners need to correctly plan sustainable management of NTFP resources and community development in near future.

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