

**Creating Livelihoods Enhancing Medicinal and Aromatic Plants based  
Biodiversity-Rich Production Systems:  
Preliminary Lessons from South Asia<sup>1</sup>**

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**ABSTRACT**

The literature defines livelihoods as 'the processes comprising the capabilities, assets and activities that provide a means for living' to the human beings. Livelihoods are best examined through Sustainable Livelihoods Framework (SLF), which is based on the premise that livelihood is not about resource productivity but it is about people and their lives. Livelihoods are sustainable when they are: a) resilient to shocks and stresses, b) independent of external support, c) maintain the productivity (and diversity) of natural stocks; and d) do not adversely affect the livelihoods of others. In other words, SLF: a) builds on the strengths of people, their resources and knowledge systems, b) strengthens local institutional capacity, c) attempts to remove conditions causing poverty rather than poverty itself, and d) gives priority to improving policies, processes and institutions in developing and implementing programs.

Medicinal and aromatic plants (MAP)-based livelihood systems are often mediated by the market forces and/or related directly to employment and income of the poor people. Based on the research work carried out by IDRC supported research in South Asia, we find that MAP and other biodiversity-based livelihoods can not only become poverty reducing they can also be made socially equitable and gender balanced. However, the interventions have to be carefully designed to enhance and diversified livelihood strategies with a focus on strengthening existing biodiversity-based livelihoods by considering the following points: a) both non-monetary and monetary benefits from biodiversity-based livelihoods; b) improving linkages and synergies with and amongst other components of biodiversity; c) landscape-scale management practices that protect or enhance biodiversity (organic farming, mixed farming, community forest management, water management to enhance aquatic resources, opposition to enclosure of the commons, etc.). MAP-based livelihoods can be easily mainstreamed with other components to enhance human welfare, especially among the poor and marginalized communities.

**Keywords:** medicinal & aromatic plants, market, monetary & non-monetary benefits, and livelihoods.

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<sup>1</sup> [www.idrc.ca/uploads/user-S/10754427911WOCMAP3.Full\\_Paper.doc](http://www.idrc.ca/uploads/user-S/10754427911WOCMAP3.Full_Paper.doc)

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## **INTRODUCTION AND BACKGROUND**

### **Introduction**

South Asian countries have a large number of valuable medicinal plants naturally growing mostly in fragile ecosystems that are predominantly inhabited by rural poor and indigenous communities. The sustainable management of these traditionally used plants not only help conserve nationally and globally important biodiversity but also provide critical resources to sustain livelihoods. Himalayan mountain region, for example, has in abundance, a diverse range of herbs, shrubs, trees and vines that have significant medicinal value whose healing properties are known to the local healers and traditional doctors for centuries but are currently threatened due to lack of concerted conservation efforts. A recent study (Tiwari, 2002) conducted in the state of Meghalaya shows that annual trade of Cinnamom leaf from one district alone is about 2800 tons valued at close to a million dollar (Annex Table 1). The value of medicinal raw materials annually exported from Nepal to India and other countries is estimated between 18 to 20 million dollar (Kanel 2000).

In all the countries of South Asia, medicinal and aromatic plants (MAPs) play a significant role in the subsistence economy of the people, especially those living in the rugged and impoverished hills, mountains and rural interiors. The collection, simple processing and trading of medicinal plants contribute significantly to the cash income of the poor and women in these regions. A recent study carried out by CECI-India (Regmi & Bista, 2002), indicated that from a single district of Pithoragarh in Uttranchal state of India, more than 1300 tons of MAPs are collected and traded annually, most of them illegally. Unsustainable and large scale harvesting of MAPs from the natural habitats without providing equitable benefit to the local people and government is of grave concern to all. In the Great Himalayan National Park of Himachal Pradesh, almost all the local people are dependent on medicinal plants collection for their livelihoods and earn around \$100/HH/year through collection and sales. Therefore, by sustainably using and growing economically remunerative MAPs, there is an ample scope to maintain both the rural livelihoods and environmental sustainability. MAP-based local micro-enterprises can also bridge the gap between rural poor and relatively well-off urban rich and promote social harmonization and sound environment conservation.

### **Multi-faceted Importance of MAPs**

#### *The Social Perspective*

Throughout South Asia, the use of medicinal plants in meeting family's primary health care and nutrition needs is traditional and imbedded in all cultures — a practice dating back to at least four thousand years in many countries (Fransworth & Soejarto, 1991). In this respect - it needs no introduction, nor are there major problems of acceptability regarding familiarity with the usage of plant products, methods of cultivation of many commonly grown plants and technologies required for processing into items of common household uses and value. Med-plants are socially acceptable employment avenues for women. Traditionally, women have been the mainstays of med-plants-based activities and micro-enterprises because the products and activities thereof easily fit within the average daily needs and work schedules of women. These typically include med-plants raw materials being collected, dried and transported to

the market as well as training of women employed by herbal drug industry. Med-plants have also been used to develop family-based health and livelihood oriented enterprises in rural areas. Many traditional healers have been running MAP-based health care system to earn their livelihoods. Arya Vaidya Sala (AVS), Kottakal in Kerala is an excellent example of business and traditional medicine service combined. Such industries not only strengthen the social fabric, but also help: a) preserve the traditional medical knowledge, and b) provide easily adaptable enterprising opportunities for unemployed youth and rural poor who can learn the trade from their parents and peers and earn not only their livelihood but also contribute to the society (Karki, 2000).

#### *Protection of Traditional Knowledge*

The urgency and need to protect the fast disappearing medicinal plants-based traditional knowledge, which is still abundant in the hills and valleys of South Asia cannot be overemphasized. In fact, the sacred mountains of Himalayas (popularly known as Dev Bhumi or abode of God) are widely believed to be the source of the age-old traditional system of medicine called Ayurveda. The indigenous people of Himalayas have a rich local health traditions and a large number of traditional healers have been practicing indigenous medicine for hundreds of years (Rynjah, 1995; Bordekar, 2000). If proper values can be added to the traditional medical knowledge-based health practices and subsistence-oriented MAP applications, a large number of jobs can be created in the rural areas. Even at current level of conversion of traditional medicinal knowledge into economic opportunities, enterprise-based application can account for thousands of jobs in rural areas. Thus, med-plants have high potential in creating jobs and pushing economic growth in resource-constrained areas suffering from limited educational opportunities, mountain-specific marginalities and lack of infrastructure, and underdeveloped med-plants-based trade and commercial activities. The conversion of socio-cultural traditions and indigenous knowledge into livelihood means and economic opportunities also has the advantage of preserving the rapidly eroding cultural knowledge and practices which are increasingly threatened due to globalization and homogenization of people and communities. As the Himalayas are recognized to be the treasure trove of biological and cultural diversity - the product of millions of years of evolution – there is a need to protect indigenous knowledge and cultural diversity on an urgent basis. In the uplands of Northeast Himalayas, especially in the areas predominated by shifting cultivation and marginal agriculture, the means of achieving this may be by providing economic value to traditional and indigenous knowledge (Ramakrishnan, 1992).

#### *Environmental Perspective*

The growing apathy toward products made from chemical (allopathic) products and unsustainably harvested forest products becoming ethically unacceptable consumer goods have created new markets for quality, certified and organic herbal products. Medicinal plants have the potential to fill these needs as they provide green health alternatives and a number of other eco-friendly products of domestic and industrial usage (Bordekar, 2002, Temptesa & King, 1994). Found as trees, shrubs, grasses and vines, these plant species abundantly growing in South Asia. Its entry into the world food and drug market as the environment friendly (including organic and certified) botanical products is looked upon as an emerging and new opportunity that can help

save tropical and subtropical forests by promoting community-based conservation, especially in the uplands. The development of medicinal plants-based economic incentives is being increasingly applied to enlist greater participation of people in conservation of forest ecosystem.

## **LIVELIHOOD IMPORTANCE OF MAPS**

### **Potential of Equitable Commercialization**

The MAP sub-sector in South Asia has immense potential as the sustainable commercialization of MAPs can benefit local collectors by providing higher price for traditionally traded products and by opening up national and global markets for new products from the region. Private sectors stand to benefit by ensuring sustainable supply of quality raw materials to benefit their industry and trade if they can be facilitated to build partnerships with cultivators and wild collectors especially in Himalayas, Western and Eastern Ghats and Central Indian and Sri Lankan plateau. Their environmental value lies in the fact that by growing as under story crops, associated species and inter- crops, they complement to the growth and sustenance of trees thus conserving the forests. The structures of root systems of many med-plants species contribute to soil stabilization and prevent erosion in the fragile hilly slopes. Medicinal plants can grow in very poor soils and under low rainfall and moisture conditions thus assisting natural regenerations. There are enormous areas of land including the shifting fallow land on which mixed plantations involving MAP can be raised. Many of the species are shade tolerant and others are climbers, trees, shrubs and herbs that can be grown in different configurations of crop geometry.

### **Through Trade and Enterprise Development**

The demand for medicinal plants in India – to meet both domestic and export market - comprising 162 species, is expected to increase at about 15 to 16% between 2002 and 2005 (CRPA, 2001). Medicinal plants cultivation and management therefore, can become highly remunerative both in financial and economic terms for the small-scale growers. The annual turnover of three of the major Indian systems of medicine, i.e., Ayurveda, Unani and Siddha is estimated to be more than half a billion dollars. The current gap between demand and supply is estimated to be 40,000 to 200,000 tons, which is expected to rise to 152,000 to 400,000 tons by 2005 (Planning Commission, 2000 & CRPA, 2001). Not only the plants are in increasing demand by major herbal drug industries as an essential raw materials of their drugs, but also its collection, production, processing, packaging and transportation requires high labor input, which can create employment in job-starved Himalayan states. Collection from wild and selective harvesting in addition to primary processing is mostly done manually, and even at the secondary and tertiary levels, med-plants have substantial labor requirements. Moreover, not only do MAP-based industries expand jobs, enhancing traditional uses through value added processing can increase cash earnings to the local people (Karki, 2002).

### **Through Domestication and Cultivation**

Some of the practical applications integrating medicinal plants into traditional farming systems have taken an obligate relationship in backstopping upland agriculture. South Asian states have a tradition of practicing mixed farming systems

that include herbal plants and therefore, cultivation of medicinal plants especially applying organic and certified farming concepts has a greater scope in the region. Other important opportunities and advantages of cultivating MAPs include ease of their incorporation in the existing cropping systems due to availability of a large number of species and choice of plant types i.e., trees, shrubs, forbs, vines and their suitability to grow in different eco-physical conditions. Cultivation of carefully selected species as a mixed, inter or companion crop in agro and farm forestry conditions following a soil-improving crop rotation is highly feasible livelihood enhancing activities in South Asia. However, this will require an improved input and service delivery system including marketing, and post harvest technologies. Cultivation needs to be done on a business platform by a chain of small and micro-enterprise-based groups and individuals. In order to achieve an economy of scale and desired impact, it may need to be concentrated in selected pockets in an intensive manner as cluster of activities and micro-enterprises.

## **MAPs AND SUSTAINABLE LIVELIHOODS APPROACH (SLA)**

### **Model Building**

Med-plants resources can be successfully utilized to develop sustainable livelihoods of the NTFP/MAP-dependent communities (Figure 1). The model can be analysed, refined, and applied to suit the specific conditions of highlands, especially in the Himalayas, of Bhutan, India, Nepal and Pakistan. SLF is a recent evolution in the international development paradigms and it has been said to '.... offer an opportunity to launch poverty reduction efforts by taking an all round view of the circumstances of the poor, as they themselves view them, rather than jumping to early conclusions and immediately proceeding to conduct isolated and in-depth analysis of particular attributes.' (Hobley Shields Associates, 2001). The MAP-based research projects can collect information required by the SLA and critically analyse as to which parameters and components need greater emphasis and what should be the depth and quality of the research information the framework may require in order to be an useful tool. The following process-based data collection tools and analytical methods need to be tested and analysed.

### **Stakeholder participation**

Local communities, especially weaker and marginalized groups or ethnic minorities need to be involved in planning, designing, development and implementation of the research activities and learning studies in the project. The NGOs and GOs should consult and work with community-based organizations and engage them into participatory process to involve collectors, producers and traders including ultimate users, women and disadvantaged groups in project implementation. In each of the selected villages or communities, stakeholder represented CBO, NGO or PRI should implement and/or supervise the execution of projects. Their involvement from the very beginning of the project development process is expected to enhance people's participation in the project and provide benefit to a wide range of users.

In order to understand the complex market and marketing related issues, market-related information, scooping of problems & opportunities, successful case studies with 'good practice' tag need to be surveyed and studied to develop a marketable product portfolio. The tool proposed is value-chain or Production-to-Consumption & Marketing (PC&M) model. The outcome of these studies can be useful to plan equitable commercialisation, identify potential small & micro enterprises, and assess available raw material resources and product mix.

### **Implementation of MAP-based Livelihoods Framework**

Alleviating rural poverty in South Asia will require efforts, which go well beyond the basic income yardstick. It has to include improved access to primary health and education services, the right to a sustainable means of livelihood, protection from external shocks, and the power to participate in decision-making that affects the lives of the poor and marginalized communities. Meeting all these challenges will require, in addition to enabling rural development oriented policies, sustained income growth of rural people. The MAP sub-sector is an integral part of natural resource management (NRM), contributing to economic growth, environmental protection and trade. The potential contribution of MAP can be substantial in capital-poor but resource-rich countries of South Asia if investment and efforts can be substantially increased in this sub-sector. The over-riding challenge for the region in the coming decades is to secure sustainable economic growth in the face of an increasing population and distribute the additional wealth created to reduce rural poverty and improve the quality of life, especially for poor, women and indigenous community who are most vulnerable to slip in and out of poverty trap

### **Strengths and Benefit of MAPs**

In this context, med-plants sub-sector has much to offer, not just in the way of raising season income through collection and cultivation activities, but being an integral component of forest resource management, especially in the processing and marketing of non-timber forest products (NTFP), and providing a means to create rural assets and wealth through the development of micro-enterprises. MAP biodiversity assessments, inventorying and management, and establishment of mixed and multi-story plantations are particularly labor-intensive activities that can create a large amount of employment. MAP-based community/agro/farm forests can provide opportunities for livelihoods in nursery development, plantation management and post harvest activities and in the development of nature-based complementary health care products and services managed by local people. Although much of the employment traditionally created by community forestry is relatively low skilled, and has in the past been mainly for men, there is no reason why in the new plantations, especially home-gardens and agro-forests, women cannot be targeted.

### **Linkages with Research and Traditional Knowledge**

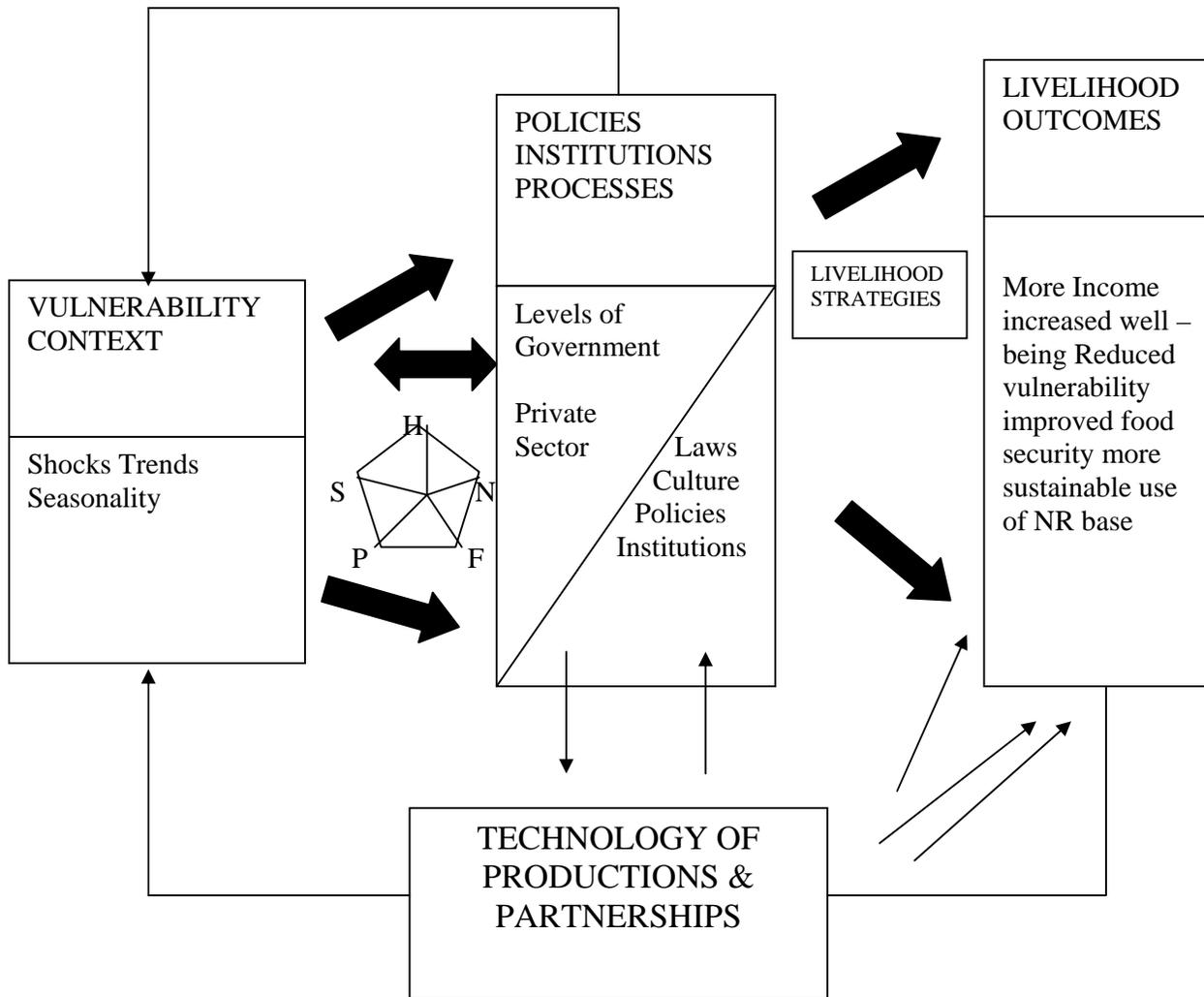
In the context, as a part of the SLA-based intervention, the med-plants resources and associated knowledge can be included as the inherent strengths of rural people in South Asia on which sustainable livelihoods can be built. These diverse and versatile resources can be made to provide local people with greater economic incentives by investing in NTFP/MAP-based livelihood projects and initiatives. There is a potential to increase current benefits to many fold provided the livelihood enhancing MAP-based activities could be built-on the strengths of the local people such as rich bio-resource, indigenous & traditional knowledge and robust social organizations. The decentralized governance of the resources could be made possible through enhanced people's participation and greater government's support. Research institutions and non-government organizations could help define key parameters of MAP-based SLA that can enhance rural livelihoods as compared to alternative or existing practices. Special attention could be given to assess and design cultivation and production projects, which grow high value-low volume products of MAPs. There is a need to design and develop sustainable livelihood models, which clearly demonstrate feasibility of integrating *in-situ* conservation and *ex-situ* cultivation with larger livelihood picture of the poor and marginalized stakeholders. The MAP sub-sector needs to be examined as a key component of the overall natural resource management program. Figure 1 illustrates a conceptual framework that can be used to guide the researchers and development workers in the development of such work.

### **Bio-partnership to link Rural Communities with Industry**

As considerable research activities supported and conducted by various donors, governmental organizations (GOs), NGOs, national research institutions and universities in South Asia have shown, clear scope of building sustainable livelihood schemes based on medicinal and other NTFP plant resources. IDRC's MAPP program has included this aspect in its targeted research program under the theme of biodiversity-enriching and livelihood-enhancing activities. The vast potential of harnessing traditional knowledge and associated plant resources can be mobilised through improved coordination of activities among the major stakeholders. Multiple links need to be established with collectors, growers, traders, processors and consumers at different levels in a value-chain or production-to-consumption system framework. Equitable bio-partnership – not bio-prospecting - arrangements between and among processing and marketing drug and health-care companies and community-based organizations (CBOs) can be developed to ensure dependable markets for the producers and quality supply for the industry. A number of industries have shown interest in direct collaboration with producer groups/associations and many are committed to practice a fair and ethical commercialisation of MAPs. Donor agencies, GOs, INGOs and NGOs need to pro-actively assist CBOs such as forest user groups (FUGs), joint forest management committees (JFMCs) and others to design and implement partnership and harvesting models striking a sustainable balance between the need of biodiversity conservation and imperatives of livelihoods. The livelihoods model can also address the needs of the local healers and practitioners involved in traditional medicine to provide safe and efficacious health service to the local, especially, poor communities.



Figure 1: PROPOSED SUSTAINABLE LIVELIHOOD MODEL<sup>b</sup>



Key to the Notation:

- H = Human Capital
- N = Natural Capital
- F = Financial Capital
- S = Social Capital
- P = Physical Capital

<sup>b</sup> The model is based on concepts and models developed by DFID, World Bank and IFAD

Some experience from South Asia: IDRC’s MAPPA program has funded more than 25 small and medium size projects in South Asia since 1994. Three case studies, which indicate high livelihood implications, are presented below:

**CASE STUDY # 1: ATIS (*Aconitum heterophyllum*) CULTIVATION IN UTTARKASHI**

**Case Introduction:**

This case describes a project supported by the IDRC/MAPPA and implemented by a local NGO (SHER) to demonstrate MAP cultivation and conservation to the local communities in Uttar Kashi district, Uttranchal state of India. The main focus has been placed on the large-scale cultivation of three species of valuable medicinal plants – *Aconitum atrox*, *Aconitum heterophyllum* and *Saussurea costus*. The project collects germ plasm from elite habitats and are domesticated through trials and maintained as ‘mother plants’ (Table 1).

**Table 1: Cultivation area for High Priority Species at the SHER Nursery in Shirolatok**

Plant species	Demonstration/cultivation area
<i>Aconitum atrox</i>	1.5 acre (6000 sqm.) = 0.6 ha.
<i>Aconitum heterophyllum</i>	1 acre (4000 sqm.) = 0.4 ha.
<i>Saussurea costus</i>	1.5 acre (6000 sqm.) = 0.6 ha.

**Expected Economic Returns:**

A preliminary cost benefit analysis of the production of high-value MAP species was calculated comparing the returns with that of traditional food crop. Results revealed that as compared to the traditional crop of potato which yields a net profit \$ 200/ha, the same anticipated from the cultivation of *Aconitum atrox* is around \$1600/ha and *Aconitum heterophyllum* \$ 6000/ha (Annex, Tables 1 & 2). Local farmers are willing to substitute large part of the potato acreage with a more lucrative crop of either *Aconitum heterophyllum* or *Aconitum atrox*. Farmers do minimize the risk of displacing subsistence food crops by bringing only part of the field under MAP crops. At the time of the current study, 12 farmers had initiated cultivation of MAPs from SHER on their private land, with approximately 150 farmers interested in participating in the future. In April 2001, SHER initiated a network among 50 medicinal plant cultivators. The number of members in the network is likely to increase in future as a large number of farmers have expressed an interest in medicinal plant cultivation. In Kumaon region of Uttranchal, there is already a Growers Association promoting cultivation of medicinal plants for enhancing livelihoods.

**Marketing Strategies Adopted**

Given the scarcity of the plants such as *Aconitum atrox*, *Aconitum heterophyllum* and *Saussurea costus*, sourced both in wild and on farms, drug companies have assured the full-purchase price of these herbs promising, in some cases, at an additional 10% above the market price. SHER has also negotiated a formal bio-partnership between certified farmers and an Ayurvedic pharmaceutical company. The arrangement ensures that farmers with a guaranteed market and a fixed fair price for their harvest, in exchange for exclusive rights to the produce as the sole buyer. In addition, the company guarantees to pay 25% of production costs up front to farmers, and 5% of profits are returned to the community as an investment to continue research and development in the sustainable production of MAPs.

**Policy and Legal Issues being faced:**

Given that the project is located within a protected area, there are several restrictions placed on the marketing of endangered species that restrict the incentive to cultivate MAPs for income generation. The park regulations prevent the cultivation and sale of any commercial crops outside the park’s boundaries. The

project has negotiated an arrangement on behalf of local farmers with the State government. Farmers receiving training and subsidized plant material through the project would be certified as growers operating under agreed-upon standards and procedures of production, and would be permitted to sell their produce. The project is however, relatively new and the gestation period for the majority of plants being minimum of three years, most of the medicinal plant products are just reaching marketable stock and more issues may crop up during marketing and benefit sharing.

## **CASE STUDY # 2: BAY LEAF (CINNAMOMUM TAMALA) IN JAINTIA HILLS**

### **Case Introduction:**

Bay leaf or is a medium size tree. The leaves are used as condiment. It grows naturally in the subtropical humid forests of in Meghalaya where it is well-husbanded wild tree. The trees growing in wild are protected and promoted to regenerate and grow in its natural habitat in association with a variety of other native trees. In areas where more intensive management is in place, its cultivation is considered to be ecologically sound because it is grown in poly-culture along with betel-nut, betel-leaf, jackfruit, timber tree and a host of shrubs and herbs. Over the years, *C. tamala* has emerged as a semi-domesticated tree that provides supplementary income to the forest dwellers. The local tribal communities of Khasi and Jaintia Hills in Meghalaya state of India collect, process and market a large variety of NTFPs and MAPs including bay leaf, wild pepper (*Piper longam*) from the forests. However, they have on their own evolved a unique MAP management practice without degrading their forests. The marketable MAPs, such as the bay leaf have helped in improving the livelihoods of the local tribals. In a cluster of villages near Dowki about 80 km south of Shillong, bay leaf tree (*Cinnamomum tamala*) has become an important aromatic plant that naturally grows in the local forests and has sizable national market.

### **Traditional Management System**

Villagers have developed an indigenous system of Bay leaf management system. Large trees are pruned to give space for the growth of preferred trees of NTFP and MAPs. Seedlings of preferred trees are retained during annual clearing and weeding of the forest. Vines of betel leaf (*Piper* spp.) are planted in the base of selected trees. Clearing of weeds and removal of tree shade promote medicinal plants like wild pepper and herbs. Cutting of old branches of bay leaf plant is usually done when the plant has attained a height of about 4 to 6 meters. Epiphytes like orchids, aroids and lichens that grow on the stem of the bay leaf tree are removed manually. Cutting the infected branches and burning also remove the parasitic plants that grow on their branches. Sometimes, preferred trees such as Bay Leaf and Jack Fruit etc. are allowed to regenerate in the forest gaps caused due to death of old trees. Thus the population of MAP species gets increased year after year. Weeding is repeated 2 to 3 times, when the regenerating trees are three to five years old, but for the older plants, weeding is done only once a year. Fire lines are cut annually and maintained properly. The forests near the village and on the roadsides are more intensely managed. In such plantations, betel nut, several farmers also do pineapple and orange cultivation.

### **Production and Harvesting of Bay Leaf**

The yield depends upon the age of the plant and also the size of the tree. The production from small trees ranges from 30-40 kg/tree/harvest and for the bigger trees it ranges from 55-65 kg/tree/harvest. Based on the data collected, it has been found out that the average yields ranges between 26 to 44 ton/ha for the forests of lower altitude. Leaves are harvested during November to February. Harvesting is done in a very sustainable way. This is considered to be a specialized job and only skilled person can do it. The older branches that have attained a particular diameter are cut down, while the growing younger branches are left. Harvesting can be done after a gap of 1 to 2 years depending on the age of the tree and fertility of soil.

### **Economic Returns:**

About 2800 MT of bay leaf reaches the regulated market every year from Meghalaya (Annex, Table 2). At an average purchase price of Rs 7/kg, bay leaf brings approximately Rs 20 million cash to the growers. Since, the growers themselves do most of the activities, a sizable part of this money adds to the income of growers themselves. Apart from this, during past five years, on an average, every year the Syiem and District Council got a royalty of Rs 46,645 and Rs 31,093 respectively. The average tax collected by the state government was Rs 4.95 million (Annex, Table 3). The bay leaf has thus helped in improving the economy of all sections of the people. The forests provide additional source of income to the landowners, whereas the landless locals obtain daily wages. The processing and marketing of this forest produce also create opportunities for setting up of small-scale industries at the local and regional level. However, lack of knowledge, concerning the marketing of these products outside the local region, has inhibited growth of its production. The above income from the forest comes from bay leaf only. The forest owners also maintain a number of other NTFP/MAPs, which also add to the overall income of the growers.

### **Policies and Legal Issues Faced**

The state government has established a regulated market for forest and agricultural produce and encourages the farmers/growers to sell their produce through the market. The market enables the farmers to obtain a minimum fixed price even when the market value for the produce falls below this minimum. The government also intends to set up godowns in War area to enable the growers to store their produce when the market value falls down. *C. tamala* is a notified tree species and government levies tax on sale and purchase of its produce. However, farmers do not have secured access to the land and face numerous bureaucratic hurdles to process and market the products freely. There are multiple taxes levied by Autonomous District Councils, townships and state governments.

## **ANALYSIS AND DISCUSSION OF SOUTH ASIAN EXPERIENCES**

### **Community Participation**

Production and marketing of MAPs involves a number of stakeholders viz., forest owners, skilled and semi-skilled labourers, village traders, women workers, wholesalers, transporters, small-scale industry owners, regional traders and exporters. The small forest owners perform all the management works including pruning, weeding, harvesting, threshing, etc by themselves. However, large forest owners engage labourers for various operations. The labourers are normally poor villagers who do not have their own plantations. The workers include both men and women. For harvesting experienced skilled workers are needed. The labourers are employed for a number of activities such as harvesting, drying, plucking, packing, carrying to roadsides, sorting, repacking, loading and unloading and transporting. Thus MAP-based activities can create employment for the poor and disadvantaged section of the society

### **Degree of dependence of the people**

MAPs provide supplementary income to the forest dwellers and poor rural people. The degree of dependence of local people on MAP-based livelihoods is significant as it provides jobs to the poor people and much needed cash to the subsistence farmers, especially to the small scale cultivators, collectors, processors and traders.

### **Equity and Gender**

Both men and women play an important and distinct role in production and marketing of MAPs. While men do harvesting, carrying, trade and transport, the harvesting of products, drying, women do sorting and packing. Most MAP-based communities are poor villagers and therefore, a significant portion of the income earned goes to the disadvantaged sections of the society. In Khasi society women have the right over the

resources but it is the men who manage the forests business. The large chunks of forestlands belong to the government or rich forest owners while the poorer inhabitants are usually employed as labourers by the landowners and forest departments.

### **Employment Potential**

Cultivation and gathering of MAPs has a great employment potential. From these vast group of plants, medicine, nutritive food, essential oil and natural dyes can also be extracted which can be exploited by setting up micro-enterprises for processing of the raw materials and value addition locally. This would provide more employment to the local people. For example, in a small community in Meghalaya, Bay leaf production is providing employment opportunities for the local people in the form of labourers and traders

### **Marketing Channel and Pricing Mechanism**

The growers usually sell their produce to the traders. The traders are of two types 1) who transport and sell the produce outside the state/country and, 2) who sell the produce within the state/country. Market demand and price depends upon the quality of leaf and availability of goods. Marketing mechanism has not developed properly and is largely controlled by external demands. Being a perishable and bulk good MAPs are subjected to the vagaries of weather. The price is mostly controlled by outside traders or whole sellers. Relatively rich growers, who can afford to store the produce, can some times bargain for a better deal. The producers however, generally do not have any say in deciding the price. The collector or producer sells to the local trader at the price fixed by them. The local traders buy the goods at the price fixed by the regional traders. It is the regional trader who has access to the market information and thus controls the market and price to a large extent. The local traders transport the goods to border towns like Haridwar, Shillong or Nepalganj. From these market centers, it is transported to Mumbai, New Delhi, Kanpur, Amritsar and Kolkata (Annex, Figure 2).

### **Factors affecting the Market Prices**

MAPs are basically non-timber forest product (NTFP) and therefore, it attracts royalty and higher taxes, if processed in any form, from the government . The traders have to pay these taxes to local government, District Council and the State Government. Besides these, if illegal collections are also included in the consignments of legal products there are additional informal and formal payments. These taxes and illegal collections lower the sale price of growers. The state government collects sales tax at two levels: on purchase price from the growers and sales price to outside agency as shown below:

**Table 4: Taxes paid by the bay leaf traders to different agencies in Meghalaya**

<u>Collecting agencies</u>	<u>Amount paid</u>
Syiem (Traditional Village Authority)	= Rs. 75.00/truck (4.5 MT)
District Council	= Rs. 50.00/truck
State Government	a)Purchase tax = 10% b) Sales tax = 8%

The prices also depend on the stage of the harvest, visual colour, moisture percentage, and smell of leaf, barks, seeds, fruits and roots. Light green leaf is the best quality in Bay leaf. The colour of the leaf or fruit depends on the time and duration of drying after cutting from the tree. At the time of drying the leaves should not be spread in damp places and dew also is not allowed to fall on it, or else the leaves will turn brown, which would then fetch a lesser price. Rainfall at the time of drying also causes browning of leaves.

For obtaining the maximum value of the produce, the leaves should be loosely packed to avoid damage of the leaves and air-dried. The infected and broken leaves need to be discarded from the bulk.

## **DEVELOPMENT STRATEGY FOR SOUTH ASIA**

### **Livelihood Enhancing Strategy**

The issue of diminishing supply and growing demand for MAPs needs to be addressed seriously and in an integrated manner. This will require a long-term program on augmentation of supply by putting in place a strategically balanced system of *ex-situ* cultivation and *in-situ* conservation and management. Species for cultivation should be prioritized based on their assured market and availability of simple agro-technologies e.g. *Aconitum spp.*, *Cinamum tamala* etc. There is documentation of a large number of potential MAP species with promising net returns to investment (Annex, Table 1 & 4), which need to be further tested on-farm.

As there is complete lack of sub-sector approach in the development of MAPs in the region, there is a need to begin work in a phased manner. There is a need to establish strong foundation of grass roots based organizations starting with well grounded Self Help Groups (SHGs) to plan and carry out social and financial mobilization. Cultivation and sustainable in-situ management needs to be linked with the market from the very start of the project. Implementation of development project should be done in two phases: 1) pilot phase, 2) expansion phase. There may be a need for putting in place an alternate livelihood support system to the poor and vulnerable groups for the duration of conversion from collection to quality MAP production including cultivation of organic herbs. The project should invariably start with learning phase during which it should develop a cultivation/processing/marketing/ enterprise models involving CBOs and SHGs besides identifying and firming up potential national and international market destinations. A typical development project should carry out step-wise activities as follow: a) assessing and prioritizing a number of target MAP species, b) developing in-situ production area to be called Medicinal Plants Conservation and Management Areas (MPCMA) of about 200 ha each in natural ecosystems and ex-situ conservation area to be called as the Medicinal Plants Production Areas (MPPA) of about 50 ha each in degraded areas, c) developing Resource and Extension nurseries for producing and distributing quality seeds and seedlings as well as imparting on-site training, d) enlisting industry's participation in entering into buyback guarantee of the cultivated products, e) continuously generate, disseminate and transfer useful and targeted research information and technologies to the farmers; f) promoting policy reforms through collaborative efforts with the government agencies, g) promoting integrated and holistic agro-ecological farming practices giving priority to production of organic and certified MAP products, h) implementing value-chain or production-to-consumption and marketing linkages to ensure remunerative returns to the farmers and collectors, and i) promote sustainable harvesting and value-adding processing of both collected and cultivated materials.

### **Livelihood Supporting Activities:**

The collectors and growers should be provided with credit and storage facilities to avoid distress sale. Fixing minimum floor prices also works as a strong incentive for collectors and growers as they can rest assured for a certain level of income through sales of their produce. In the current marketing scenario in South Asia, there is a lack of transparency, equal opportunity and incentives to all the players. Also, the powerful outside and local traders have distorted the markets in their favour. Information on price and markets is important to the collectors and small-scale producer to make appropriate decisions. Establishment of local institutions like growers' cooperatives can help increase the bargaining power of small-scale producers. Development of market information and communication strategies using appropriate information and communication technologies (ICTs) is also desirable for information exchange and knowledge sharing. As of now most produce is used as raw spice or condiments, raw materials for extracts and drugs by

industries located within and outside the country. Value addition at local level has high potential to increase employment and also assure market and remunerative price to the growers.

### **Market Development and Linkages**

Market centres at suitable locations need to be developed by government and/or donor supported projects by providing storing and primary processing facilities in the form of Godowns or Common Facility Centre (CFC) at a nominal service fee. In addition to this, the market enterprises need to be developed at the production areas to obtain produce from the farmers and collectors at a fixed minimum price with an option available to the sellers to seek higher price if they so choose. This will be critical when the market price falls below the minimum cost of production. However, the minimum floor price should not be promoted as a subsidy but an incentive to promote cultivation, especially of quality products such as organic and certified materials. It is also important that in the long run, the producers' association or micro-enterprises so as to minimize the transaction costs and commission fees manage the market services.

### **CONCLUSION**

There is a growing awareness of the serious and long-term implications of over-exploitation of medicinal plants, caused especially by expansion in national and international demand. The loss of these valuable plant species may have far-reaching implications especially for poor rural communities who are often highly dependant upon them for their health and economic benefits based on their traditional and commercial collection and use.

Various development and research actions have been attempted by both the government agencies and national and international conservation and development organizations to find solutions so that these resources can be harvested and used sustainably. However, these attempts have often been isolated and sometimes not based on systematic analyses of the conditions needed for success. Situations in which the resources are being managed are often very complex, related to a web of interrelated ecological, socio-economic, cultural and political factors.

The sustainable livelihoods approach (SLA) used by various development agencies in project planning is compatible with med-plants research on biodiversity-based livelihoods because it asks a broad range of questions about community's resource-base, knowledge-base and other strengths opening up our thinking about their poverty level and its causes. This approach helps us to reorient researchers' mindset towards interventions that are designed to enhance existing and diversified livelihood strategies that can better cope with uncertainties and risks. The SLA remains limited, however, as a framework for posing research and development questions on MAP-based livelihoods as it leaves actual interventions to come from the target beneficiaries. However, NGOs and micro-enterprises can fill this apparent gap. MAP biodiversity is simply one of many examples of natural capital and needs to be functionally linked with larger biodiversity system in order to provide for synergy and complementarities in the actions yielding cost effective products and services to the people concerned.

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## ANNEXES

**Table 1. Cost Benefit Analysis of Cultivation of *Aconitum heterophyllum* (per hectare)**

Total no of plants per hectare 1,10,000 (spacing – 30 cm X 30 cm)						
Items	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	Cost of cultivation	Gross income	Net profit
Land preparation	15,000	-	-	15,000	After 3 years	
Agricultural Equipments	2,000	-	-	2,000		
Manure	8,000	8,000	5,000	21,000		
Planting Material Atish 1,10,000 @ Re. 1/-	1,10,000	-	-	1,10,000	330 kg @ 2500/ kg Atish	
Crop Maintenance (fixed plantation, weeding, hoeing etc.)	25,000	15,000	15,000	55,000		
Insecticide/ Post harvesting	5,000	5,000	5,000	15,000		
Harvesting / Post harvesting	-	-	15,000	15,000		
Other Works (Irrigation facilities, fencing, Protection from Wild animals etc.)	50,000	5,000	3,000	58,000		
<b>Total</b>	<b>2,15,000</b>	<b>33,000</b>	<b>43,000</b>	<b>2,91,000</b>	<b>8,25,000</b>	<b>5,34,000</b>

**Table 2. Annual Production of Bay Leaf (Source: Mawiong Regulated Market)**

Year	Annual production (Metric tones)	Total value (in Rupees)	
		Purchase price	Sale price
97-98	2699	1,88,93,000	35087000
98-99	2772	1,94,04,000	36036000
99-00	2472	1,73,04,000	32136000
00-01	3138	2,19,66,000	40794000
01-02	2911	2,03,77,000	37843000
Average	2798.4	1,95,88,800	36379200

**Table 3. Annual Revenue accrued to the Syiem, District Council and Government of Meghalaya**

Year	No of truck loads	Taxes collected (in Rupees)				Total revenues (approx.)
		Syiem	District Council	State Government.		
				Purchase tax	Sales tax	
97-98	600	45,000	30,000	18,89,300	28,06,960	4771260
98-99	616	46,200	30,800	19,40,400	28,82,880	4900280
99-00	549	41,200	27,466	17,30,400	25,70,880	4369946
00-01	697	52,300	34,850	21,96,600	32,63,520	5547270
01-02	647	48,525	32,350	20,37,700	30,27,440	5146015
Average	622	46,645	31,093	19,58,880	29,10,337	49,46,954

**Table 4. Crop Duration, Gross and Net Return of Potantial MAPs in India**

Name/Species	Crop Duration	Av. Cost of Production or Yield/ha (Rs.' 000)	Net Return (Rs.)
Amla ( <i>Phyllanthus emblica</i> )	8 years	30	20,000/ha
Ashwagandha ( <i>Withania somnifera</i> )	6-9 months	50.6	24,000/ha
Atis ( <i>Aconitum heterophyllum</i> )	3-4 yrs.	440 kg.	1000-1000/kg.
Chirata ( <i>Swertia Chirata</i> )	6-8 months		Rs. 300-400/kg.
Jatamansi ( <i>Nardostychnus jatamnsi</i> )	3-4 yrs.	780Kg. /ha	Rs. 150-160/kg.
Kutki ( <i>Picrorhiza kurrooa</i> )	2-3 years	450-600 kg./ha.	Rs. 120-150/kg.
Kuth ( <i>Sausurea costus</i> )		14,000	31,000/ha.
Pashan bheda ( <i>Bergenia ligulata</i> )		600-1000 Kg. dry roots	50-75,000/ha
Pipli ( <i>Pipar longum</i> )	1 year		50-75,00/ha
Sarpagandha ( <i>Rauwolfia serpentina</i> )		19.0	41,000/ha
Bach ( <i>Aconitum ferox</i> )	1-2 yrs.	-	125/kg. (Roots)
Shatavar ( <i>Asparagus racemosus</i> )		10.0	29,970/ha
Tulsi ( <i>Ocimum sanctum</i> )	3 months	1.0	4-5,000/ha
Daruhaldi ( <i>Berberis aristata</i> )	2 yrs.	-	40-50/kg. of bark
Seabuckthorn ( <i>Hippophae salicifolia</i> )	2-3 yrs.	Perennial	-
Tejpat ( <i>Cinnamom tamla</i> )	2-3 yrs.	Perennial	Rs. 50-70/Kg.

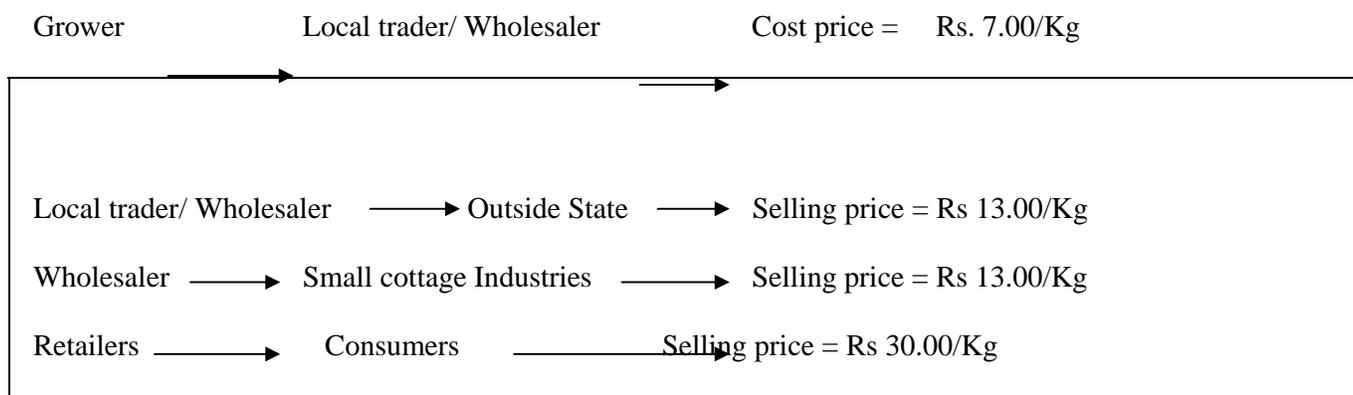
Source: Cultivation Practices of Some Commercially Important Medicinal Plants, National Medicinal Plant Board, Dept. of ISM&H, GOI, New Delhi, 2002.

**Table 5 Estimated production and price for various medicinal plants (Unit One Ha)**

(Source: Maikhuri et al., 2000)

Botanical name	Local name	Expenditure (Rs/ha)	Income (Rs/ha)	Profit (Rs/ha)	Income/Expenditure ratio
<i>Aconitum hetrophyllum</i>	Atis	3560	78750	75190	22.3
<i>Allium humile</i>	Ladum haran	2957	37620	34663	13.0
<i>Allium stacheyi</i>	Jimbu pharan	2618	29220	20702	9.0
<i>Angelica glauca</i>	Choru	2998	27750	24752	9.0
<i>Arnebia benthamii</i>	Balchari	4870	54000	41130	11.0
<i>Carum carvi</i>	Kala zeera	1630	40000	38370	25.0
<i>Dactylorrhiza hatagirea</i>	Hathajari	2680	33750	31070	12.5
<i>Megacarpaea polyandra</i>	Barmaoo	1999	12750	10571	6.0
<i>Nardostachys jatamansi</i>	Jatamansi	3047	58500	55453	19.2
<i>Plantago ovata</i>	Isabgola	2900	12000	9100	4.0
<i>Picrorhiza kurrooa</i>	Kutki	2817	27500	24683	8.7
<i>Pleurospermum anglicoides</i>	Chhippi	2998	27750	24752	9.0
<i>Poligonatum verticilatum</i>	Salam mishri	3870	66150	62260	17.0
<i>Potentilla fuuuulgens</i>	Vajardanti	4570	55250	50690	12.0
<i>Rheum australe</i>	Archa/ Dola	4150	57000	52850	12.7
<i>Saussurea costus</i>	Koot	3360	30625	27265	9.0

**Annex, Figure 1: Prevailing pricing mechanism and structure for Bay Leaf (C.Tamala)**



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Medicinal and Aromatic plants are grown from the time immemorial and possess high social, religious, cultural, and economical value in Nepalese community. Various parts of these annuals, biennials and perennial plants have been used as medicines, perfumes, and food. A total of 118 ecosystems are found in Nepal and 10,091 species of plants has been documented which include 5884 species of flowering plants. Medicinal and Aromatic Plants (MAPs) contribute to the local and national economy and become the source of the cash for the rural livelihood at the hard time. The financial contribution made by Non-Timber Forest Products (NTFPs), especially medicinal plants, is significantly higher as compared to the timber products. Key words: Aromatic plants, Medicinal plants, Phytoremediation, Lethal effects, Regulatory. Received July 29, 2019. Various aromatic and medicinal plants have the ability to accumulate toxic metals and are currently being exploited in phytoremediation technology. Hence, the cultivation of aromatic and medicinal plants offers a novel approach to remediate contaminated soils. Here we discuss the impact of heavy metals on aromatic and medicinal plants and how they play an essential role as a sustainable phytoremediation crops. Heavy metals and their lethal effects in plants. MT's are metal binding low molecular weight cysteine rich proteins that are generally synthesized during mRNA translation (Kagi, 1991). Egyptian Medicinal and Aromatic Plants (EMAP) Project support for producers and exporters .18 3. Markets for Asian Medicinal Plants and Extracts .19 3.1. Minister of State reports short supply of certain endangered medicinal plants .19 3.2. Rebuilding livelihoods of sandalwood farmers on Erromango after Vanuatu Cyclone PAM 2015 ....24 6. Sustainable use of Biodiversity News.25 6.1. The Market Insider for medicinal plants & natural ingredients provides market intelligence on the production and international trade of selected botanical raw materials and value-added forms such as extracts and oils.