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GLOBALISATION AND SUSTAINABLE EXPORTS OF INDIAN MEDICINAL AND AROMATIC PLANTS: A PROTECTION NECESSARY

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ABSTRACT

India has a rich heritage of traditional systems of medicine viz. Ayurveda, Unani, Siddha, Tibetan which are mostly based on botanical formulations. Although biologically, the region is extremely rich in medicinal plants, due to years of unwise use, the availability of raw materials in desired quality and quantity has become difficult to obtain raising serious doubt about the safety and efficacy of the medicines currently in use. There is unprecedented demand for natural medicines, green health products, pharmaceuticals, food supplements, cosmetics, and herbal pesticides to bring about this alarming loss of plant biodiversity. The sustainable production, conservation and use of medicinal plants are influenced by a number of factors, largely of socio-economic, technical, institutional and policy nature. Unsustainable harvesting of the raw materials from the wild by untrained and poor collectors mostly using primitive methods and lack of awareness about the real value of the resources are other two important factors leading to resource depletion. Rural people derive a substantial portion of their income and products for their basic health care needs from medicinal plants gathered from the nature. Medicinal plants-based drug industries and enterprises which run into thousands presently source more than 85% of their raw materials from the wild as they are cheap and believed to be of higher potency. There is a great need to reduce pressure on the in-situ sources by

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diversifying the production sites of these important plants. Domestication is one of the alternatives being attempted but given the large population of developing countries living below poverty line and growing need for economic and environmental security, it is unlikely that the current lands devoted to pure or mixed agriculture or forestry can be diverted to grow medicinal plants in a significant amount. Besides, domestication has to be carried out in similar habitats since some of the cultivated plants are known to give different chemical constituents than their natural counterparts due to environmental factors. As a large number of private sectors investment is possible in this sector, medicinal plants can be developed as a potential bridge between sustainable economic developments, safe & affordable health care and conservation of vital biodiversity. The paper suggests that a long-term and sustainable bio-partnerships between industry and rural communities should be formed which is in the interest of both the producers/collectors and drug industries as both stand to gain. The former will have regular, reliable and quality supply sources of raw materials and later will have assured market, increased income and fair price for their products. Necessary support and facilitation by the GOs, NGOs and academia in terms of technology transfer,

Policy and legal support and extension may build and strengthen the partnership evolution process. There is an immediate need to initiate pilot case studies and model buy back arrangements between collectors/growers and industry representatives to start this process. This paper analyses the social, economic and institutional implications of such relationships based on various examples of evolving partnership concepts focusing on their efficiency, equity, and feasibility.

INTRODUCTION:

India has a rich heritage of traditional systems of medicine, which are mostly based on formulations derived from herbs, shrubs, trees, vines and some animal products. Although biologically, the region is extremely rich in medicinal plants with an estimate of possessing more than 50% of the global biodiversity, due to years of unwise use and government's failure to institute a system of sustainable management, the availability of quality resources has become difficult raising serious doubt about the safety and efficacy of the medical formulations currently in circulation and use by almost 80% of the people in the region. Conservative estimates place the economic value of medicinal plants related trade in India to be of the order of USD 200 million a year.

The sustainable production and conservation of medicinal plants are influenced by a number of factors, largely of socioeconomic and institutional in nature. Unsustainable harvesting of the plant materials from the wild by collectors mostly for selling in the outside markets and lack of awareness of the people about the real value of the resources are two important factors for over harvesting. Rural people derive a substantial portion of their income and products for their basic health care needs from medicinal plants gathered from the nature.

Increasing threats to resources

Perceived threats of overexploitation have brought several species in the CITES (Convention on International Trade on Endangered Species) lists (16 worldwide). Conservation of threatened medicinal taxa is clearly one of the priorities toward which available technologies and strategies are being directed, more notably in ex-situ approaches such as seed banks, in vitro banks, and cry-preservation and DNA libraries. There is an urgent need to develop agro-techniques for cultivation of those species are in great demand.

In this paper, it is being argued that there should be a major reform in the policy and institutional set-ups of the country in the interest of major stakeholders including the generations yet to come. Necessary support and facilitation by the government agencies, NGOs, academia and private sector companies in terms of information sharing, technical inputs and enunciation of local perspectives would be necessary. But most important of all, private sector participation in the form of 'bio-partnerships' as opposed to 'bio-prospecting' should be encouraged. Formulation of Medicinal and Wild Food Plants-specific policy, reform of legal framework and easier mechanism of technology transfer may expedite and strengthen the partnership building process. It is also argued that there is an immediate need to initiate dialogue with the private sector to start pilot projects to demonstrate the possibility of harnessing higher benefits by working in partnership, which can be called as Bio-partnership. This paper analyzes the social, economic and institutional implications of such an endeavor based on various examples of existing partnerships focusing on their efficiency, equity, and feasibility.

Medicinal Plants and Livelihood Security

Environmental problems all over the world have been influenced partly by the increasing population, survival needs of the poor and the economic greed of the commercial interests and aggravated by prevalent economic models and policy structures which are deeply embedded in unsustainable patterns of production, consumption and exchange; ill-informed policies and programs and the inappropriate development strategies. Extraction of timber for local and export markets has disrupted many forest ecosystems in the third world and resulted in tremendous loss of biodiversity. Other than forestry, mountains have been extensively used for unsustainable agriculture, mining, and tourism. These interventions have had a disturbing impact on the mountains. The imperatives of specific mountain conditions, which alone can determine the relevance and effectiveness of interventions in mountains, are seldom incorporated into development policies and programs for these areas (Jodha, 1992). Besides, most existing policies and programs relating to these areas do not address the needs and

priorities of resource users at the grassroots level (Agarwal and Narain, 1990). Furthermore, there is an inadequate data about the availability, location and distribution of resources and the level, pattern and rate of resource consumption and environmental degradation. Lack of applied research and extension services have also resulted in unsuitable land use. Finally, loss of traditional methods in resource management and lack of an appropriate institutional arrangements have had adverse effects on the people's control over resources on which they depend for their sustenance (Jodha, 1992).

MANAGEMENT OF MEDPLANTS: THEORETICAL CONCEPTS

The process, by which resources are allocated, regenerated, managed and conserved over time and space to meet the needs and aspirations of humankind has been termed resource management. Resource management involves an interaction of three major elements; the physical resource base (land, water, forests, wildlife, etc.); the production system (the mix of technologies and productive activities); and the social regulation (laws, rules and principles) that govern access to resources, their distribution and use. The spatial and temporal distribution of MAPs resources that correspond to the needs and aspirations of society can be termed as MAPs resource allocation. Preservation, regeneration and maintenance of resource productivity and diversity are understood as MAPS conservation. Likewise, MAPs management entails utilization, manipulation or development of natural resources to meet the basic needs of the local community and to enhance critical service functions of the ecosystem they occupy. Moreover, this also includes exploitation and transformation of resources into commodities (through processing and valuation) for human consumption and use (in case of application medicines).

MAPS management comprises ecological, technical, social, economic, legal and political aspects. As an ecological concept it deals with complex ecosystems that need to be monitored and maintained. Its technical aspect entails choice between different methods and techniques

and development of appropriate harvesting and processing technologies. There is also social aspect of resource management as dealing with people, cultures, belief systems, attitudes and behavior, ethics, aspirations and social values. Its economic aspect aims at maximizing benefits and efficiency from a resource and minimizing input costs as well as waste. In case of MAPs, the social aspects also involve dealing with competing and insatiable demands the local people invariably place on the shrinking resources. And finally, resource management is political because it involves exercise of power and control over users of resources and this raises issues of administration and decision-making.

Approaches to Management

Within the framework discussed earlier, MAPs management is a process involving collection, gathering, harvesting, utilization and management of resources within a given ecological, economic, social, political, institutional and legal frameworks. In the past, the focus of forest resource management has been sectoral and on single-purpose users and uses, solely giving the responsibility of managing resources to technical experts such as foresters and biological scientists. This scientific approach has neglected traditional resource management systems based upon local people's knowledge, cultural values and needs. Moreover, the multi-disciplinary and integrated nature of resource management has often been ignored. With the increasing recognition of the limitations of such centralized approaches in recent years, a need has been felt for more holistic and integrated approaches for sustainable management of MAPS resources. Integrated management approach (IMA) can consider all the different approaches simultaneously by factoring both the internal and external factors into the management system/s proposed. Some of the examples can be as follow:

Ecosystem Approach:

The ecosystem approach considers the whole ecological system and the relationship among its various components. It recognizes the dynamics of the ecosystem as the basis for resource

management. This approach aims at the rational allocation and management of resources based on ecological characteristics, component behavior, change processes and functional relationships among different components within ecosystems. The overriding concern is to manage resources in a manner that minimizes ecological impairment. This approach involves practices such as; resource inventory, identification of natural processes that affect ecological stability; evaluation of functional significance of different components in an ecosystem and design of alternative management strategies to ensure ecological stability, productivity and sustainable development.

Technological Approach:

The technological approach comprises comprehensive land use/resource management plans and their implementation for rational allocation and utilization of natural resources. It aims to monitor and mitigate environmental change using physical tools and modern technologies such as mapping, Geographical Information Systems (GIS), remote sensing, etc., environmental impact techniques, soil management, biotechnology and other techniques.

Economic Approach:

An economic approach to resource management is based on the premise that there is a need to rationalize the allocation of natural resources and optimize their use through competitive market economies to achieve maximum economic efficiency. This approach has dominated the resource use policies in many developing countries using cost benefit analysis (CBA) as the yardstick against which resource allocation and use decisions are evaluated. This approach is restrained as it assumes that; a) cost and benefits from the use of natural resources are known and quantifiable and; b) costs and benefits from one resource can be isolated from those of another. It is observed that sometimes, it is difficult to price or determine the economic value of intangible benefits from natural resources such as aesthetic beauty, ecological uniqueness, biodiversity, unpolluted air, or antiquities such as historical monuments.

Moreover, minimizing production costs and maximizing monetary benefits in order to strive for economic efficiency tends to increase pressure on some resources and neglect other resources for being of little or no significance in terms of economic development. The economic approach has also sometimes tended to prompt disregard for environmental degradation and ecological restoration among policy makers, especially in cases where costs of restoration are relatively higher than the foreseeable benefits accruing from such restoration.

Sociological Approach:

The sociological approach emphasizes the significance of culture, ecological and social ethics, indigenous knowledge, the role of local people and social institutional arrangements in resource management. The sociological aspect of resource management (including social goals and legitimate concerns of the local resource users) has been the most neglected area in the resource management strategies of many countries until recently. Chambers (1991) observes that the failure of a number of resource management programs can be linked to disrespect for local culture and wisdom. This approach involves research methods such as Participatory Rural Appraisal (PRA) and institutional arrangements including consideration of administrative structures and procedures, policies and laws and financial management.

HOLISTIC RESOURCE MANAGEMENT (HRM) APPROACHES:

Holistic approach means linking people, institutions, sectors, disciplines, agencies, activities, systems and programs together in a dynamic system of resource management. It implies relating one initiative and action to others that directly or indirectly affects its chances of success. A holistic resource management (HRM) refers to a management strategy that endeavors to recognize the interrelationships among a wide range of resource management activities and bring together a variety of needs and values into the decision making process. This approach recognizes that management and use of anyone resource inevitably affects the management of other resources and emphasizes on participation, consultation before action,

cooperation, communication, coordination, comprehensives and shared decision making. Similar to this approach are the concepts of holistic approaches such as "systems approach" and the "ecosystem approach" defined as "an approach which considers the whole environmental system, not just its components; focuses on the interrelationship among various elements of the environment to include the natural, physical, economic, social and cultural systems; incorporates the concept of carrying capacity, resilience and sustainability; and finally, it is based on natural geographic units like watersheds rather than political boundaries". Its relevance to MAPs is high, as the vegetation boundaries tend to coincide with watershed boundaries.

Since environmental systems function in an interdependent holistic manner and deal with multifaceted issues hence, the resource management approaches, policies and institutional arrangements dealing with them should be holistic as well rather than sectoral, compartmentalized and disjointed. Acting on only one part of an interdependent system inevitably affects or produces problems elsewhere in the system. Similarly, it was noted in the new version of the world conservation Strategy, "Caring for the Earth" (IUCN, 1991), broad environmental problems cannot be effectively addressed in a sectoral manner. Instead, an integrated approach to agriculture, forestry, wildlife, rural development, and other activities is needed. Moreover, an integrated management approach is one possible approach that might help to reconcile conflicts between agencies and seek to promote coordination among them.

LIMITATIONS OF THE HOLISTIC RESOURCE MANAGEMENT (HRM) CONCEPT:

Among the various factors affecting integrated resource managements are; (1) lack of an effective institutional framework for an inter sectoral approach to environmental decision-making, (2) lack of comprehensive policies, (3) vested interests in exploitation of resources, (4) lack of compatible institutional mix. (5) Lack of policy mechanisms for Environmental Impact Assessment (EIA) on development projects and programs; (6) limited public awareness, (7) lack of people's participation, and (8) neglect of gender considerations in planning, and (9) poor

implementation of projects and programs and inadequate resources (funds and technical expertise) to support environmental programs.

HRM requires reorganization of institutions responsible for natural resource management. The public needs to be better informed and involved actively in resource management planning and implementation and finally, there is a need to foster cooperation, coordination, communication and sharing of information between and among various resource management agencies (both government and NGO's) and to pursue integrated extension approaches.

COMMUNITY PARTICIPATION APPROACHES

Community participation refers to the active process whereby the beneficiaries of a given undertaking influence the goals, direction and execution of such activity rather than merely receiving a share of its benefits. Experience has shown that achievement of rational, equitable and sustainable development is difficult without the participation and full support of the local communities in the planning and implementation of development activities, including; policies, projects and programs. Many multilateral and bilateral development agencies including U.N. agencies, the World Bank, USAID, CIDA, IDRC SIDA, NGOs; and national governments, now consider people's participation as a means for achieving efficient program implementation.

Theory and Principles of Community Participation

The theory of community participation has been influenced by the western theory of democracy, which argues that ordinary citizens have a right to share in decision-making through the election of representatives. Populist theory seeks to mobilize people and make them aware of their situation. The theory of community participation also emerged in response to inadequacies of the community development movement of the 1950's and sixties, which resulted in exploitation of masses while trying to pursue rural development through local self-help. It was concluded that the programs by and large were top down in decision making,

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compartmentalized along the disciplinary lines and unsustainable. Few cases of radical community organization in third world countries also influenced the theory of community participation, and the Chipko Movement and the Community Action Movements in India are few such examples. Inspiration for community organization also came from the United Nation's popular participation program in the 1970s and the influence of NGOs, academia, and international organization.

As a result some governments have taken steps to pursue community participation through policies such as decentralization, privatization and popular democracy. However, the extent to which meaningful participation in development process has been achieved is debatable. Three basic principles of community participation recognized by the United Nations are: a) Local people must be allowed and facilitated to contribute to the development process, b) they should share equitably in the benefits of development and c) they should be involved in decision making. Robert Chambers (1983) discusses the strategies for promoting people's participation under the terms "reversals in learning" and "reversals in management". He states that; reversals in learning include; sitting, asking and listening, learning directly from the poorest, understanding and eliciting indigenous technical knowledge, joint research and development with rural people, learning by doing and simulation games; and "reversal in management" include; changes from authoritarian to participatory communication, fewer staff transfers, and enabling and empowering weak clients to make effective demands for services and for their rights; to achieve these reversals, it is best to start by acting and learning by doing (Chambers 1993).

Moreover, to be effective, participation must be direct, not through representation, and must give absolute power to local communities to make their own decisions and ultimate control over their implementation. It must allow people to define their felt needs, identify possible solutions, set goals and mobilize local resources to achieve their goals. Vandana Shiva (1991) also observes that people's involvement is imperative on two counts. First, the marginalized majority has a right to determine their path of development. Second, the

marginalized communities retain the ecological perceptions of nature at a time when the more privileged groups have lost them largely as a result of their constant interactions with the environment they live in.

In soliciting true participation, it is important to identify who participates, how participation takes place, when participation occurs in the development process and at what level. According to Cernea (1989), if true participation is to occur, rhetorical pledges to "people's participation" must give way to precise identification of whom "the people" are, and how they are organized. Therefore, it is imperative to take into account the above-mentioned dimensions, different social actors, and structural/functional constituents of the local communities in designing strategies for promoting participatory resource management ventures.

The term "community," as a unit of organization, is often fallaciously assumed to be homogeneous within it and the different actors within each community are rarely differentiated. In these communities, decision-making and executive action often tends to fall into the hands of small, self-perpetuating cliques of local elite who tend to act in their own interest and not those of the wider community. In order to assure inclusive participation, it is important to know the different sections of a community and ensure that as many members of the community as possible are involved (especially the poor, women, children and the disabled) and not only the leaders, the rich or local elite's. Also, while planning an equitable systems of benefit sharing, it is important to try and ensure enhancement of both inter and intra household equity and a system of benefit sharing among the individuals and families in commensurate with the investment an individual or a family has incurred.

Limitations of HRM-based MAPs management

Nonetheless its promise to benefit more positively from resource management, community-based participatory MAPS management has its own limitations. Communities vary in their ability to care for the environmental resources. Lack of consensus, organization,

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knowledge, skills, suitable technologies and practices, funds and other resources all undermine the capacity of some communities. Many MAPSs-based community problems are caused by external factors and cannot be solved by community actions alone (IUCN, 1991). The biggest challenge relates to the question of the "Tragedy of Commons" (Hardin, 1968), which neither is completely true nor can totally be disputed.

Given the individualistic and competitive nature of many societies today, people are likely to obtain extra benefits from the common resources such as MAPs over other members if there are no strict control measures to ensure equitable sharing of the resource. Local elites may also manipulate the system by fulfilling their own interests. However, there have been instances where specific societies have successfully managed their resources under specified user rights and using social sanctions to control any violations (Jodha, 1992).

Nevertheless, it is important to acknowledge that lack of effective local resource management authority to govern resource use and failure to reach an internal consensus, because of heterogeneous nature of some communities can lead to resource over exploitation. Furthermore, since the management of forest commons in many countries present many problems, there is a need for the clarification of rights of resource use and establishment of powerful local management systems.

It has also been argued that participatory approaches in MAPS management may be costly and may sometimes lead to unnecessary delays due to elaborate consultations and negotiations with local people and that these processes sometimes raise too much anxiety and expectation along with additional managerial and administrative tasks.

Need for Partnership Ventures

It is apparent from the preceding discussion that the community-based participatory approach on its own may not be effective in all situations. Karki (1994) suggests that, to be

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sustainable, the transfer of responsibility of resource management from central government to the respective line departments to local communities will require technologies and procedures tailored to the villagers' knowledge, skills and experiences; compatible with their needs and priorities; economically viable and socially acceptable and also requires local people to have secure long term tenure over the resources. Joint or co-management can be broadly viewed as policy and program initiatives/institutional arrangements that allow governments, donors, private-sector interests, and NGOs to collaborate with communities in managing resources. This approach is based on the premise that the goals and aspirations of local people and the government would be complemented and weaknesses of the centralized systems would be offset by the community-based approaches.

Collaborative, joint management and partnership-based initiatives are gaining popularity as a means of soliciting the participation of forest-dependent communities in the sustainable management of public domain forests especially in South Asia. However, the major challenge in such ventures is the reluctance of government bureaucrats to relinquish authority to local communities, particularly where they think this would threaten their control over the resources. Gilmour and Fisher (1991) observe that in Nepal District Forest Officers showed great reluctance to release effective control of forests to user-groups; they handed over management responsibility but retained the powers and authority over exploitation and sale of forest products. Similarly, Saxena (1995) describing the constraints to joint forest management (JFM) in India highlights several limitations. For instance, government policies hamper JFM initiatives and legal and organizational frameworks for JFM remain weak and controversial. Also, there is no built-in mechanism to develop capacity of the local JFM committees to enable them to gradually assume the role of the de facto custodians and managers of their forest resources.

Regardless of possible setbacks, community based-resource management systems and joint management ventures have provided encouraging results. India provides one such successful example, where the JFM has proven a success in some states. Other examples include Nepal

(Gilmour and Fisher, 1991) Pakistan, Bangladesh, and Sri Lanka (ADB, 1995). Since the late 1970s, a number of countries in Asia, Africa and Latin America have initiated and implemented community-based forestry programs and joint forest management ventures, which promote people's participation. In Nepal, the government in the late 1970s embarked on a new policy to formally return woodlands and degraded forests to local communities. In India the first National Policy breakthrough occurred in 1988 with the recognition of the rights and needs of the local people living in forest's areas. This was followed by National Joint Forest Management Resolution (1990), supporting the rights and responsibilities of Forest communities in the management of public forests. Nevertheless, so far the success of JFM has been limited to very few states such as Andhra Pradesh, Madhya Pradesh, West Bengal and Orissa. Some of the bottlenecks to success such as the lack of local people's access rights to MAPs and equitable benefit sharing from these resources in the protection forests have been removed through new circular issued by the Ministry of Environment of Forests (MOEF) recently. However, there is still a need for supportive policies and programs for such ventures to spread. More important is the need for successful integration of a diverse range of local problem and support of both the formal and informal local institutions to develop problem-solving initiatives to be incorporated in the national policies and programs.

POTENTIAL PROBLEMS DUE TO UNSUSTAINABLE COMMERCIALIZATION of MAPs:

Medicinal plants/herbs and related products-based industry have become a big business in the South and East Asia region. The region is one of the largest biodiversity regions in the world. It also contains some of the richest countries in regard to their forest resources such as Indonesia, India, Malaysia and Pakistan. India and China are sources of some of most developed traditional systems of medicine such as Ayurveda, Unani and Traditional Chinese Medicine (TCM).

In the global context, India's rich, especially that of Himalayas, Western and Eastern Ghats, biodiversity resources are being viewed as a major source of traditional and modern

pharmaceutical products. In India, with its rich legacy of ancient culture and traditional systems of medicine, forest resources are increasingly becoming the source of big business too. The annual world market value of medicines derived from plants discovered through indigenous peoples is reported to be US \$43 billion. And the total value of traditional medicinal products worldwide is estimated to be as large as that of modern medicines (about US \$80-90 billions).

According to one estimate the trade in Maps in Madhya Pradesh alone in the 1980s was around US \$700 million (Poffenberger, 1990). Currently the Ayurvedic pharmaceuticals (comprising other systems of Indian systems of medicines) in India are exporting their products to 123 countries in the world.

Although the total value of exports of medicinal plants based from India is shown to be around US \$ 53 million in 1994-95 (Lambert, 1996), the actual value is supposed to be far greater. Detailed statistics are not available. According to conservative estimates more than half a million tons of raw material is harvested from India forests annually. More than 70% of threatened medicinal plants are being traded. The total turnover of the herbal drug industry is estimated to be around USD 500 millions and is estimated to reach USD one billion by year 2000. A recently commissioned Task Force on medicinal plants in India has put an export target USD 2.5 billion by the year 2005 for India. The domestic market for botanical products is estimated to be growing at an annual rate of approximately 15 to 20% in South Asia. India's total export was worth USD 100 millions in 1999 with an estimated volume of the total trade in medicinal plants estimated to be 36,200 tones (FRLHT, 1998,). In case of Nepal, it is estimated that every year between 10,000 and 15,000 tons of Maps are harvested and 90% of them exported to India generating an estimated trade value of 18 millions USD (Kanel, 2000). Pakistan's export earnings are estimated to be around USD 7 millions per annum. All these figures seem to be vastly under reported and it becomes difficult to get a realistic picture. In view of all these highly varying estimates of MAPS values, it would be fair to assume that the total value of the forest resources in the area of medicinal plants and other NNTP's is of enormous value to the people and the countries in South and Southeast Asia. This is highly

relevant to meet the urgent needs of livelihoods of local people, especially those living below poverty line.

In the context of the above, one thing becomes crystal clear. The richness of region's MAPS biodiversity and its great heritage of ancient systems of medicine along with a large population of tribal with their own traditional and indigenous knowledge systems related to usefulness of medicinal plants and herbs, make it one of the most deserving cases for study and research. The dynamics of rapidly changing development scenario including the globalization of local economies and growing concerns for protection of biodiversity in these two regions make the task related to research and development all the more challenging and complex. In order to meet these multiple challenges, there is a need to create a network of success stories, which can be up scaled to provide large-scale impact. One such success story is described below:

BIOPARTNERSHIPS: CONCEPTS & POSSIBILITIES

Basic Principles:

The basic concept of 'bio-partnerships' as mentioned above, is that equitable and sustainable relationships are formed which satisfy the short and long term needs and interests of both parties to the extent possible. The term has similar connotation as 'social contract' which was first coined by the philosopher John Locke, in his work - On Liberty -, in the sixteenth century. The 'contract' referred to was the implied agreement between citizens and their government, where citizens voluntarily turned over some of their freedoms and accepted certain rules in order to also experience certain benefits, such as protection of property, social security, and the like. This willingness to become party to such a 'social contract' was referred to a century later by the philosopher de Tocqueville as 'enlightened self-interest,' or the recognition that one gained overall by arrangements, which sometimes seemed to constrain one at the moment. However, the concept and purpose of 'bio-partnership' is quite different than that of 'bio-prospecting', which has a connotation of a more exploitative system of

commercial utilization of medicinal plants. It is argued that the Costa Rican example of Merc and INBIO partnership has fallen in disrepute due to such evolutionary thinking.

To make sense of this agreement in the context of the plant based drug industry, it will likewise be necessary for the industries involved to begin to follow certain practices regarding collection and harvesting of medicinal plants, which, if followed by large enough number, will actually increase the productivity of the entire sector and hence the growth opportunities of each firm in the long run.

Conservation of valuable biodiversity and realization of social benefits in the form of food security, poverty alleviation and employment are the other opportunity. In fact, the development of `social contracts` with local communities can address not only the basic problem of supply of medicinal plants raw materials but also assist the industry in lifting the ceilings to growth identified earlier. A closer involvement with local communities and a clear indication that these target groups will also benefit from a more productive sector can attract increased public investment in research and development, as well as technology transfer and marketing opportunities. Intensive management of plant resources will create new employment opportunities to the rural people and ultimately lead to development of primary processing units in rural areas.

Conceptual Framework:

`Social contracts` or `Bio-partnerships` are thus symbiotic relationships between industry and local communities/ resource poor people in an interdependent fashion. In India, the idea has been propounded by M.S. Swaminathan Research Foundation (MSSRF), Chennai in order to empower the poor farming communities especially the women, tribal peoples, and small farmers - so as to give them an equitable share of the benefits from the common pool resources (e.g. forests, grazing land etc.) on which they depend. The main aim is to first empower the communities with better knowledge, skills, and information so as to gradually

train the poor people involved in collection and cultivation of medicinal plants into sustainable harvesting, primary processing, marketing, and packaging. This will create eco-jobs thereby enhancing the livelihood security of the poor people. The multiplicity of benefits that are possible can be realized on a sustainable basis if a long term contractual arrangement can be worked out between the families of a particular resource community and interested industry or industries. This concept in short is called 'social contracts' and a schematic framework is provided in Figure 1.

The process of building 'bio-partnership' involves a number of sequential steps starting with general discussion between the parties concerned. The initiation can generally be based on past and ongoing relationships or through facilitation by an 'honest broker' such as NGO, community-based groups, Village Committees, and User Groups, research and training agencies. The motive for industries to enter into contractual agreement will be the improved prospect of ensuring regular and reliable supplies of quality raw materials. Similarly, the attraction to the rural communities to enter into the contract will be likelihood of ensured markets at fair prices with possible gains in technology transfer to help achieve sustainable management of their herbal resources and development of their community. Successful establishment of industry-rural community partnership first of all, will require a liberal amount of goodwill and commitment of physical and social resources on the part of industry. They need to reach out to the poor farmers, tribal and women collectors and win their trust first before rural communities repose their trust and join the partnership.

The Case Study of Uttaranchal

The medicinal plant sector in Uttaranchal, a Himalayan state in northern India, can provide an important source of income to the rural population, especially because returns from traditional crops are declining (Alam 2003). Uttaranchal's unique climate, its locally available expertise, motivated farmers and NGOs and a supportive government policy provide a strong base from which to take advantage of the growing national and international demand for medicinal plants (Belt et al. 2003; Alam and Belt 2004). The main advantage of medicinal plants

for small producers lies in the fact that compared to bulky and perishable commodities; they have a higher value per unit volume. This makes them particularly attractive for remote, mountainous areas with transport limitations.

In this survey, we analyse the opportunities for, and constraints on, developing medicinal-plant chains in Uttaranchal. The paper specifically aims to identify the role of medicinal-plant chains in poverty reduction; the basic conditions for successful integration of small producers in the medicinal-plant chain; and the institutional infrastructure required to support a pro-poor medicinal-plant chain. The paper is based on action research conducted by KIT Royal Tropical Institute, the Institute for Applied Manpower Research (IAMR) and the Centre for Sustainable Development (CSD). The study involved fieldwork and multi-stakeholder consultations to discuss research findings and identify pathways to the development of a pro-poor medicinal-plant chain (Belt et al. 2003; Alam and Belt 2004).

THE MEDICINAL-PLANT CHAIN IN UTTARANCHAL: FROM COLLECTION TO CULTIVATION

This section describes the current structure of the medicinal-plant chain in Uttaranchal and examines constraints and opportunities for further development of the medicinal-plant chain involving resource-poor farmers in Uttaranchal.

THE ROLE OF MEDICINAL PLANTS IN UTTARANCHAL

Uttaranchal is one of India's poorest states: in 2001, per capita income was 33% lower than the Indian average (US\$ 240). Road and communication infrastructures are not well developed because of the mountainous geography of the area. This limits farmers' access to markets. About 80% of the state's working population depends on agriculture as its main source of (Mountain Technology 2004). As in

Other parts of the Himalayas, the proportion of land under cultivation is very small. In the plains, about 70% of the total area is cultivated, but only 12% of the total land area of Uttaranchal is under cultivation due to inaccessibility and poor soil quality. Average landholdings are small: more than 50% of the households own less than two acres and only 5%

of the households own more than five acres. Furthermore, the average productivity of the region is low and most farmers practice subsistence farming to meet their household needs (Maikhuri et al. 2001). Due to declining returns from traditional crops, farmers in Uttaranchal are only able to survive for 8-9 months a year on farm production. For the rest of the year they depend on non-farm income such as the collection and sale of medicinal plants (Alam 2003). The poor, in particular mainly landless people and marginal farmers, benefit from current collection activities.

Because of its diverse agro-climatic conditions and relative isolation, India's Himalayan region is richly endowed with a large variety of plant species, many of which have medicinal properties. The medicinal plants found in the Himalayan areas include species of particularly high medicinal value (Planning Commission 2000). People in India have long known of the benefits of medicinal and aromatic plants, which provide raw materials for both the pharmaceutical industry and traditional forms of medicine. Besides basic health care, the plants generate income and employment but also have implications for the preservation of biodiversity and of traditional knowledge.

In recent years the demand for medicinal and aromatic plants has grown rapidly because of accelerated local, national and international interest, the latter notably from the pharmaceutical industry in the West. Worldwide, the number of species used for medicinal purposes is estimated at more than 50,000, which is about 13% of all flowering plants (Schippmann et al. 2002). In India, over 8,000 plant species are used in traditional and modern medicine (Planning Commission 2000).

Motivated by the need to increase farmers' incomes through agricultural diversification while conserving biodiversity, the government of Uttaranchal has formulated a special policy to protect medicinal plants and to support commercial cultivation and arrangements for processing and marketing (Government of Uttaranchal 2002). This policy has two main components: regulation of collection of medicinal plants from the wild to protect biodiversity, and promotion of cultivation to meet demand and provide new income opportunities to farmers.

THE CURRENT MEDICINAL-PLANT CHAIN: COLLECTION FROM THE WILD

Most of the medicinal plants from Uttaranchal are collected from forests and rangelands. The State Forest Department is responsible for regulating the collection of species from the wild that are not considered endangered. It determines the areas from which plants can be collected, fixes the volumes to be collected and monitors collection activities in order to prevent illegal and excessive collection. To promote the participation of local communities in conservation activities, the government of Uttaranchal has set up a number of medicinal-plant cooperatives (Bhaishaj Sangh).

The State Forest Department issues permits to these cooperatives, which in turn employ contractors to organize collection. The contractors employ collectors, usually farmers with small landholdings and landless laborers. The contractors can sell the collected material either to the cooperatives or directly to independent traders after paying royalties to the cooperative. The cooperatives sell to either the local agents of wholesalers, or traders in larger cities or drug manufacturers. The traders supply the domestic market and international markets, mainly in the United States and the European Union (Figure 1).

In the medicinal-plant chain, the collectors and local contractors are in a very vulnerable position. As they cannot sell directly to large traders in big cities, the collectors depend on local traders for market information, credit and the actual marketing of the raw material. This puts them in a weak bargaining position and results in farmers receiving prices that are considerably lower than those prevailing in the wholesale markets. The illegality of the business also puts a downward pressure on prices at the lowest levels in the chain.

The number of local traders, even in the large collection areas, is small. For example, in Munsiyari, a major center for collection in Uttaranchal, five traders are reported to dominate the trade. Although the number of contractors in Munsiyari has increased to about 20, the trade continues to be dominated by few traders (Virdi 2004). An important reason why contractors and traders exercise such strong control

is that the collectors depend on them for loans. As many collectors are poor, they often need to borrow money, which is provided by the contractors and traders. This practice, which is widespread, keeps the collectors tied to local contractors. Also, as they have only small amounts to sell, they do not have the option of selling directly to wholesalers.

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In spite of various policy measures, excessive and illegal collection of medicinal plants continues to take place on a large scale. This includes the collection of species considered endangered and whose collection is prohibited by law. The contractors who organize legal collection are often involved in illegal collection as well. As they have connections with both official agencies and large traders, it is easy for them to undertake illegal activities alongside legal trade.

Large-scale collection has led to the depletion of important species in the area. This is reflected in a significant decrease in the amount of material a person can collect in a day. For example, in the Johar valley in the Pithoragarh district, collectors reported that, until five years ago, they were able to collect about 200 grams of dry Atish (*Aconitum heterophyllum*) in one day. Now they do not get more than 70 -100 grams a day (Belt et al. 2003; Alam and Belt 2004).

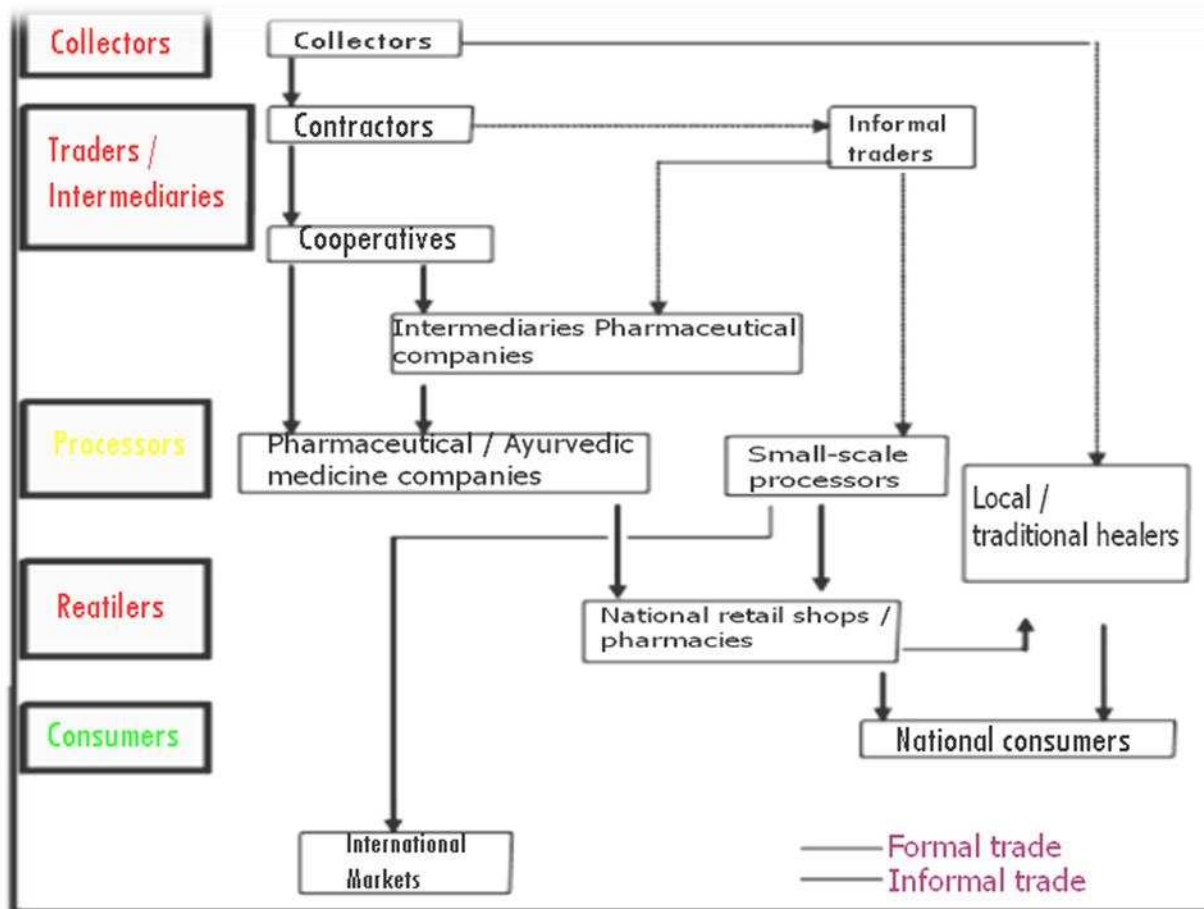


Figure 1. The chain: from collection in the wild to consumption in India

There are a number of reasons for the excessive collection. Firstly, both collectors and contractors are primarily interested in higher incomes in the short run and have little concern for sustainability. As the contracts are given for only one year, the contractors are primarily interested in maximizing the volume of collection, irrespective of long-term effects. Similarly, the collectors are poor and need to maximize their income to pay back loans taken from contractors/traders. Secondly, the collectors are paid according to volume. Their main interest is to harvest as much as they can in the limited time available to them, irrespective of the consequences. Thirdly, many collectors do not have the traditional knowledge for sustainable collection and have no ownership over the resources they exploit. They use collection methods

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that are often detrimental to the long-term availability of resources (Belt et al. 2003; Alam and Belt 2004).

Development of the chain: factors limiting medicinal-plant cultivation Motivated by the need to conserve biodiversity and increase farmers' incomes through agricultural diversification, the overnment of Uttaranchal has initiated policies to promote the cultivation of medicinal plants. These are being implemented through various government departments such as the Horticulture Department, the Forest Department and the Department of Rural Development, as well as a number of research institutes. Specific measures to promote cultivation include activities to familiarize farmers with the potential of medicinal plants as cash crops; developing and disseminating cultivation technologies; setting up nurseries to propagate and supply planting material to farmers; training farmers; and providing loans and subsidies linked to the cultivation of medicinal plants. Research shows that these

policies are yet to have an impact: both the numbers of farmers cultivating medicinal plants and the scale of cultivation remain small in Uttaranchal (Belt et al. 2003; Alam and Belt 2004).

This section describes the main factors that prevent smallholder producers from taking up cultivation of medicinal plants. The factors discussed include the high risks and transaction costs, the lack of trust among chain actors and the need for an enabling institutional infrastructure.

LONG GESTATION PERIOD AND HIGH RISK

Many medicinal plants can be harvested only after three years or more. This is particularly true of the plants grown in high-altitude areas. As most farmers are poor, have small landholdings and lack credit, they cannot wait so long for returns. Understandably, they are reluctant to convert a significant part of their land to medicinal-plant production.

The cultivation of medicinal plants is also highly risky. This is for a number of reasons. It is a comparatively new activity and reliable cultivation technologies and other inputs are yet to be fully developed. Also, many of the communities currently involved in the cultivation of medicinal plants were traditionally traders. Farming is a comparatively new occupation for them and the risk of failure is particularly high. In addition to the risks of crop failure, the

farmers face serious market-related risks and difficulties. Moreover, in most cases they do not have a guaranteed market and price premiums for cultivated material. They also lack reliable market information about demand and pricing, which puts them in a vulnerable position. Local traders often transfer the price risks to them.

TRANSACTION COSTS

Due to the mountainous geography, the physical infrastructure in Uttaranchal is poor: road networks are not well developed, poor communication networks limit access to information, and agro-processing facilities are limited. For these reasons the transaction costs for rural producers and local entrepreneurs in Uttaranchal are high, even though some of these costs are offset by favorable agro-climatic conditions for the cultivation of high-value medicinal plants and the high value to weight ratio.

SOCIAL CAPITAL AND VALUES

As the medicinal-plant trade based on cultivated material is new in Uttaranchal, various linkages essential for trade are not yet well developed. In the current system the risks of economic coordination opportunism (i.e. risk related to the level of trustworthiness of the actors involved and the chance that arrangements are not respected) are high (Forward et al. 2004). For example, in the current system traders exert their power to transfer price risks to producers, people often fail to implement agreed actions, and individuals may act opportunistically, withdrawing from collective agreements. Efforts are needed to strengthen the networks of the actors involved in the medicinal-plant chain. Strong social networks (or social capital) can create trust and facilitate cooperation, reducing risks and transaction costs (DFID 1999).

INSTITUTIONAL INFRASTRUCTURE

Being a new state, the institutional infrastructure in Uttaranchal is weak. This is particularly true for institutions that provide technical support and remove marketing bottlenecks.

Medicinal plants require specific soil, climate and moisture conditions, as well as interactions with other species, in order to grow. This makes them difficult to cultivate and presents farmers with serious difficulties that they have no experience in solving. There is a clear need to develop technologies related to cultivation, harvesting, storage, transportation and quality control. The state has very limited infrastructure to generate these technologies. Similarly, the state lacks institutions to provide marketing support to farmers growing medicinal plants. There is also a lack of coordination between various institutions, which diminishes their effectiveness. For example, there is very little collaboration among the research institutes working on medicinal plants, resulting in duplication of efforts and inefficient use of scarce resources. Similarly, there is little collaboration between these institutes, agricultural extension institutions and farmers. This limits both the appropriateness of technology, and its diffusion.

OVERCOMING CONSTRAINTS BY PUBLIC-PRIVATE PARTNERSHIPS

Public-private collaborations can play an important role in removing many of the bottlenecks described in Section 2.3. In fact, some promising public-private collaborations have already started in Uttaranchal that aim to overcome some of the existing impediments to the development of a medicinal-plant chain based on cultivated material. This section describes two of these examples, using a contract farming model: one focusing on the national market and the other on the international market.

PPP: Collaboration between Gheshe farmers, industry and research organization In Gheshe, a remote village in Uttaranchal, a farmers' organization is involved in a public-private partnership with a national firm and a research institute. The partnership was initiated by the High-Altitude Plant Physiology Research Centre (HAPPRC), which is an important center of research on medicinal plants in Uttaranchal. Having developed cultivation technology for a number of medicinal plant species, HAPPRC was searching for modalities to make their technologies available to farmers. It focused on the farmers of Gheshe, with whom it had worked earlier on the cultivation of vegetables. As they had trust in the researchers from

HAPPRC, the farmers agreed to start the cultivation of a number of medicinal plants, including *Picrorhiza kurrooa* (Kutki) and *Saussurea lappa* (Kuth). HAPPRC provided seeds and

seedlings free of cost as well as technology and training. Following the marketing concerns of farmers, HAPPRC also located a company that could provide a guaranteed market for the production. This resulted in a tripartite arrangement between the farmers' group, HAPPRC and Dhawan International, a Delhi-based firm (Figure 2).

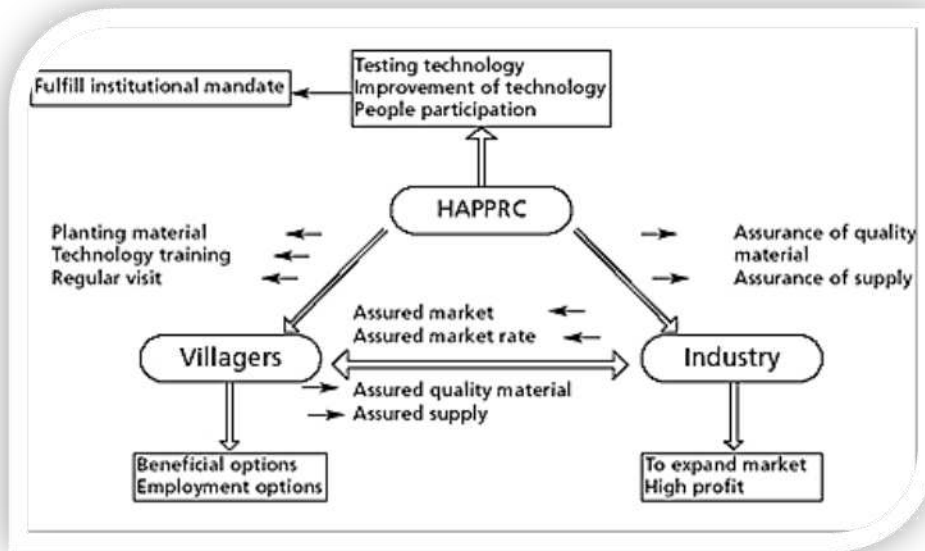


Figure 2. Collaboration features for public-private partnership in Gheshe village (Nautiyal)

The basic conditions of the agreement are as follows:

The farmers cultivate medicinal plants organically and guarantee certain specified quality standards. The farmers are required to sell their produce only to the company. Farmers can ask the company for an advanced loan.

The company guarantees a minimum purchase per growing season at a fixed minimum price. The actual selling price will be based on both the minimum and prevailing price one month before time of delivery. The difference between the minimum price and the selling price is shared equally between the industry and the farmer organization. The price information will be collected by HAPPRC.

The research institute provides technological assistance to farmers to remove any cultivation-related problems and ensure high product quality. The company has the exclusive

rights to cultivation based on HAPPRC technology until cultivation covers a minimum area (50ha). HAPPRC is free to transfer the technology to other companies when cultivation extends to more than 50 hectares. HAPPRC charges both the farmer organization and the industry 3 % of the selling price for its services.

As part of this collaborative effort, thirty-two farmers are growing kutki. The first harvest of kutki cultivation was taken in October 2004. It produced about 0.2 tons of kutki. A second harvest is planned for May 2005. The tripartite agreement has succeeded in removing some of the bottlenecks in the cultivation of medicinal plants discussed earlier. For example, it provides the farmers with an assured market at a pre-agreed price. This greatly reduces the risk faced by the farmers. The contract also ensures that the farmers will receive planting material, technical support and training from a competent research institute. The industry will receive supplies of cultivated material of a uniform quality, which is not possible in the case of material collected from the forest. The agreement also facilitates the commercialization of cultivation technology developed by public-sector research.

However, it must be pointed out that this collaboration removes only some of the constraints. A number of other issues, such as the need to strengthen the farmers' capacity to collect information on markets and negotiate with industry, are not covered by the agreement. Similarly public-private collaborations do not remove the difficulties created by the lack of appropriate policies and institutions. Civil society and government agencies have important roles to play in building farmers' capacity and improving the efficiency of policies and institutions.

PPPs: matchmaking with international business partners in an effort to link farmers' organizations from Uttaranchal to buyers in international markets, KIT approached importers of traditional medicines and aromatic plants in Europe to assess the potential for establishing international business linkages. This led to an interest from the Dutch company IHC/VanderStelt. This company imports Ayurveda herbs from India and distributes them in The Netherlands and Germany as health products (capsules and tablets) to pharmacies, chemists, health shops and therapists. Currently, the total product range contains 55 products, all of them based on the Ayurveda principle¹. Presently IHC/VanderStelt sources its materials from

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the Covenant Centre for Development (CCD). The latter is an Indian NGO, whose main objective is to promote community enterprise with a focus on the cultivation of medicinal plants. CCD is part of the Foundation for Revitalization of Local Health Traditions (FRLHT) and produces quality-standard Ayurvedic products. It has approximately 50 hectares of land, where more than 400 species are cultivated. In addition, CCD works with farmers in 300 villages surrounding their unit. It supplies planting material for cultivation and purchases organically produced herbs, from which ingredients are extracted. Since they collect the raw material directly from the growers and make the ingredients, they can guarantee the product quality. IHC/VanderStelt buys directly from the CCD, without the involvement of big industries, ensuring maximum benefit for the 300 communities. It pays a pre-agreed premium on the prices prevailing in India at the time of supply. The major aim of IHC/VanderStelt is to set up a distribution network in cooperation with the CCD or a similar organization, in order to have a direct distribution channel to therapists all over Europe, with The Netherlands as the gateway to Europe. When production volumes based on sustainable cultivation increase, large parties can be approached, such as pharmaceutical industries and companies that work with natural aromatic substances.

IHC/VanderStelt is interested in procuring organically cultivated medicinal plants from the high altitude areas of India. To make this possible, KIT, CSD and IHC/VanderStelt have agreed to support jointly the organic cultivation of medicinal plants in Uttaranchal. Initially, cultivation will be carried out by about 50 farmers who will receive a guaranteed price for their production, to be exported to IHC/VanderStelt in The Netherlands. The collaboration will enable IHC/VanderStelt to source raw materials from the North of India, where growing conditions for many medicinal plant species are favorable. It is expected that all parties will benefit from the partnership: farmers will have guaranteed access to markets, reduced risk, lower transaction costs, and capacity strengthening of their organizations. KIT and CSD will be able to link IHC/VanderStelt to reliable farmers' organizations and facilitate the cultivation of medicinal plants and their export. IHC/VanderStelt will have access to larger production volumes of organically produced raw materials. It is anticipated that both the number of farmers and the range of medicinal plants to be cultivated will increase as the collaboration progresses.

Conclusion:

Both herbal drug industry and rural communities are in great need of sustainable partnership for their mutual survival and prosperity. The concept and mechanism suggested in this paper indicate the potential gains if a relationship based on industry-rural community bio-partnership could be implemented in South Asia. Industry obviously has a greater role to play due to their stronger economic and technical capacity. They need to reinvent the whole supply process by proactively supporting communities suffering from poverty, backwardness, lack of awareness, and poor management of their rich bio-resources and lack of organizational capacity. Professionals, NGOs and researchers need to identify few 'champions' among the industry and community leaders engineer bio-partnership.

By hosting local, national and international dialogues, we can begin a process of partnership building between industry and local communities that is based squarely on the felt needs of both. Researchers have a great role to play by motivating drug industry to develop more innovative arrangements than the one initiated by Merc in Costa Rica, Shammon in Brazil and others where communities and industry can work together in a level playing field or achieving a sustainable use of medicinal plants and other food and aromatic plants. Since development comprises integrated development of people's health, protection of environment, and provision of livelihood security to the poor, Industry and private sector should shoulder this social responsibility to solve their both short and long-term problems in the process. It is hoped that national and international conferences such as the current one can be a platform from which such recommendations and ideas can be generated that can influence policies and sensitize the private sector.

References

1. Kala *Studies on the Indigenous Knowledge, Practices and Traditional Uses of Forest Products by Human Societies in Uttaranchal State of India*. Almora: GB Pant Institute of Himalayan Environment and Development; 2004.

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The RePEc Plagiarism Committee is convinced that one of the authors has plagiarized another contribution.

Please check this one carefully for plagiarism before citing it.

The original source may be found at: http://www.research-matters.net/uploads/user-S/10754426571MKPAPIUFRO_2000.DOC

2. Stein R **Alternative remedies gaining popularity.** *The Washington Post* Friday, May 28, 2004
3. Kala CP **Revitalizing traditional herbal therapy by exploring medicinal plants: A case study of Uttaranchal State in India.** In *Indigenous Knowledge's: Transforming the Academy, Proceedings of an International Conference*. Pennsylvania: Pennsylvania State University; 2004:15-21.
4. KIT **Cultivating a Healthy Enterprise.** In *Bulletin 350*. Royal Tropical Institute, Amsterdam, The Netherlands; 2003.
5. Raven PH **Medicinal plants and global sustainability: The canary in the coal mine.** In *Medicinal Plants: A Global Heritage, Proceedings of the International conference on medicinal plants for survival*. New Delhi: International Development Research Center; 1998:14-18.
6. Myers N **The world's forests and human population: the environmental interconnections.** *Population and Development Review* 1991, **16**:1-15.
7. Lacuna-Richman C **The socio-economic significance of subsistence non-wood forest products in Leyte, Philippines.** *Environmental Conservation* 2002, **29**:253-262.
8. Kala CP *Medicinal Plants of Indian Trans-Himalaya*. Dehradun: Bishen Singh Mahendra Pal Singh; 2002.
9. Farooquee NA, Majila BS, Kala CP **Indigenous knowledge systems and sustainable management of natural resources in a high altitude society in Kumaun Himalaya, India.** *Journal of Human Ecology* 2004 , **16**:33-42.
10. Kala CP **Current status of medicinal plants used by traditional Vaidyas in Uttaranchal state of India.** *Ethno botany Research and Applications* 2005, **3**:267-278.

11. Kala CP *Ethnobotanical Survey and Propagation of Rare Medicinal Herbs in the Buffer Zone of the Valley of Flowers National Park, Garhwal Himalaya*. Kathmandu: International Centre for Integrated Mountain Development; 1998.
12. Nautiyal S, Rao KS, Maikhuri RK, Negi KS, Kala CP **Status of medicinal plants on way to Vashuki Tal in Mandakini Valley, Garhwal, Uttaranchal**. *Journal of Non-Timber Forest Products* 2002, **9**:124-131.
13. Jablonski D **Extinction: past and present**. *Nature* 2004 , **427**:589.
14. Kala CP **Status and conservation of rare and endangered medicinal plant in the Indian trans-Himalaya**. *Biological Conservation* 2000, **93**:371-379.
15. Shiva MP *Inventory of Forestry Resources for Sustainable Management and Biodiversity Conservation*. New Delhi: Indus Publishing Company; 1996.
16. Prajapati ND, Purohit SS, Sharma AK, Kumar TA *Handbook of Medicinal Plants*. Jodhpur: Agrobios; 2003.
17. Rao MR, Palada MC, Becker BN **Medicinal and aromatic plants in agro-forestry systems**. *Agroforestry Systems* 2004, **61**:107-122.
18. Samant SS, Dhar U, Palni LM *Medicinal Plants of Indian Himalaya: Diversity Distribution Potential Values*. Almora: G.B. Pant Institute of Himalayan Environment and Development; 1998.
19. Kala CP, Mathur VB **Patterns of plant species distribution in the trans-Himalayan region of Ladakh, India**. *Journal of Vegetation Science* 2002, **13**:751-754.
20. Chatterjee D **Studies on the endemic flora of India and Burma**. *Journal of Royal Asiatic Society Bengal* 1939, **5**:19-67.
21. Dhyani PP, Dhar U *Myrica esculenta Box myrtle Kaphal: A promising underexploited tree crop of the Himalaya*. Almora: G.B. Pant Institute of Himalayan Environment and Development; 1994.

22. Samant SS, Dhar U, Rawal RS **Diversity and distribution of wild edible plants of the Indian Himalaya**. In *Plant Diversity of the Himalaya*. Edited by: Pande PC, Samant SS. Nainital: Gyanodaya Prakashan; 2001:421-482.
23. Arora RK, Nayar ER **Wild relatives of crop plant in India**. *NBPGR Science Monograph* 1984 , **7**:97.
24. Samal PK, Shah A, Tiwari SC, Agrawal DK **Indigenous health care practices and their linkages with bio-resource conservation and socio-economic development in central Himalayan region of India**. *Indian Journal of Traditional Knowledge* 2004 , **3**:12-26.
25. Kala CP *The Valley of Flowers: Myth and Reality*. Dehradun: International Book Distributors; 2004.
26. Cunningham AB **Medicinal plants and sustainable trade**. In *Medicinal Plants: A Global Heritage. Proceedings of the International conference on medicinal plants for survival*. New Delhi: International Development Research Center; 1998:109-121.
27. Silori CS, Badola R **Medicinal plants cultivation and sustainable development: A case study in buffer zone of the Nanda Devi Biosphere Reserve, Western Himalaya, India**. *Mountain Research and Development* 2000 , **20**:272-279. [Publisher Full Text](#)
28. Dhyani PP **Common plant species have potential for economic upliftment of rural populace- Bantulsi a case in point**. *Hima-Paryavaran* 2000 , **12**:11-13.
29. Nadkarni KM, Nadkarni AK *Indian Materia Medica*. Bombay: Popular Prakashan; 1908.
30. Kaul MK **Medicinal Plants of Kashmir and Ladakh**. New Delhi: Indus Publishing Company;; 1997.
31. Alam, G., 2003. IPRs, **access to seed and related issues: a study of the Central and North-Eastern Himalayan region**. Centre for Sustainable Development, Dehradun. Alam, G. and Belt, J., 2004. Searching synergy: stakeholder views on developing a sustainable medicinal plant chain in Uttaranchal, India. KIT Publishers, Amsterdam. KIT Bulletin no.

- 359.[http://www.kit.nl/net/KIT_Publicaties_output/showfile.aspx?a=tblFiles&b=FileID&c=FileName&d=TheFile&e=605]
32. Belt, J., Lengkeek, A. and Van der Zant, J., 2003. **Cultivating a healthy enterprise: developing a sustainable medicinal plant chain in Uttaranchal-India**. KIT Publishers, Amsterdam. KIT Bulletin no. 350. [http://www.kit.nl/publishers/assets/images/isbn9068328395_compleet.pdf]
33. DFID, 1999. **Sustainable livelihoods guidance sheets**. Available: [http://www.livelihoods.org/info/info_guidancesheets.html] (2004).
34. Dorward, A., Kydd, J., Morrison, J., et al., 2004. **Institutions, markets and policies for pro-poor agricultural growth**. Centre for Development and Poverty Reduction, Imperial College Wye, Wye. [http://www.imperial.ac.uk/agriculturalsciences/research/sections/aebm/projects/poor_ag_downloads/ghentpap2.pdf]
35. Dr.J.VanderStelt, 1999. Ayurveda. Available: [<http://www.drjvanderstelt.nl/>] (2004). Government of Uttaranchal, 2002. Marketing of medicinal plants: status and action plan. Government of Uttaranchal, Horticulture and Rural Development Department, Dehradun.
36. Maikhuri, R.K., Rao, K.S. and Semwal, R.L., 2001. **Changing scenario of Himalayan agro-ecosystems: loss of agrobiodiversity, an indicator of environmental change in Central Himalaya, India**. The Environmentalist, 21 (1), 23-39.
37. Mountain Technology, 2004. **Mountain farming system**. Available: [<http://mountaintechnology.tripod.com/intro/mtnfarmsys.html>] (2004).
38. Nautiyal, M.C. and Nautiyal, B.P., 2004. **Collaboration between farmers, research institutions and industry: experiences of Picrorhiza kurrooa cultivation at Gheshe village in Chamoli district, Uttaranchal**. In: Alam, G. and Belt, J. eds. Searching synergy: stakeholder views on developing a sustainable medicinal plant chain in Uttaranchal, India. KIT Publishers, Amsterdam, 63-72. KIT Bulletin no. 359.
39. Planning Commission, 2000. **Report of the Task Force on Conservation and Sustainable Use of Medicinal Plants**. Planning Commission, New Delhi. [http://planningcommission.nic.in/aboutus/taskforce/tsk_medi.pdf]

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The RePEc Plagiarism Committee is convinced that one of the authors has plagiarized another contribution.

Please check this one carefully for plagiary before citing it.

The original source may be found at: http://www.research-matters.net/uploads/user-S/10754426571MKPAPIUFRO_2000.DOC

40. Schippmann, U., Leaman, D.J. and Cunningham, A.B., 2002. **Impact of cultivation and gathering of medicinal plants on biodiversity: global trends and issues.** In: **Inter-Departmental Working Group on Biological Diversity for Food and Agriculture** ed. Biodiversity and the ecosystem approach in agriculture, forestry and fisheries: satellite event on the occasion of the ninth regular session of the Commission on Genetic Resources for Food and Agriculture, Rome, 12-13 October 2002. FAO, Rome, 1-21. [<ftp://ftp.fao.org/docrep/fao/005/aa010e/AA010E00.pdf>]
41. Viridi, M., 2004. **Wild plants as resource: new opportunities or last resort? Some dimensions of the collection, cultivation and trade of medicinal plants in the Gori basin.** In: Alam, G. and Belt, J. eds. Searching synergy: stakeholder views on developing a sustainable medicinal plant chain in Uttaranchal, India. KIT Publishers, Amsterdam, 41-54. KIT Bulletin no. 359.