

CHAPTER 16

DEVELOPING A SUSTAINABLE MEDICINAL-PLANT CHAIN IN INDIA

Linking people, markets and values

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Abstract. 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 Western pharmaceutical industry. At present, resource-poor people in India's poorest state Uttaranchal collect plants from the wild in order to complement their meagre incomes. Due to continued collection and increasing market demand, numerous plant species are threatened with extinction. For rational and regulated collection, strong local communities or strict governmental control measures are necessary. High risks, transaction costs and lack of trust among chain actors prevent smallholder producers from taking up cultivation of medicinal plants. Public-private collaboration is suggested as a way of reducing these constraints and to secure market access to small producers. Such collaboration can provide a promising mechanism for establishing the conditions for the establishment of supply chains in the initial stages of development.

Keywords: indigenous species; biodiversity protection; public-private cooperation

INTRODUCTION

The medicinal plant sector in Uttarakhand, 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). Uttarakhand'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

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higher value per unit volume. This makes them particularly attractive for remote, mountainous areas with transport limitations.

In this paper, we analyse the opportunities for, and constraints on, developing medicinal-plant chains in Uttarakhand. 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 Uttarakhand and examines constraints and opportunities for further development of the medicinal-plant chain involving resource-poor farmers in Uttarakhand.

The role of medicinal plants in Uttarakhand

Uttarakhand 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 Uttarakhand 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 Uttarakhand 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 Uttarakhand has formulated a special policy to protect medicinal plants and to support commercial cultivation and arrangements for processing and marketing (Government of Uttarakhand 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 Uttarakhand 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 Uttarakhand 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 labourers. 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.

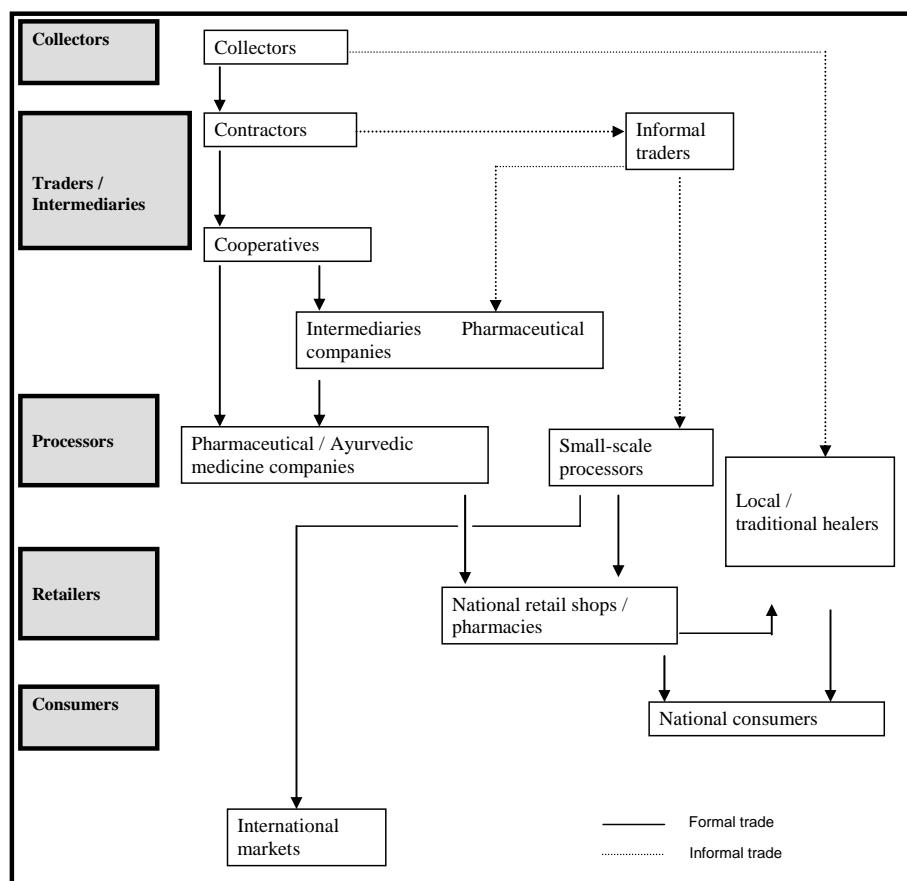


Figure 1. The chain: from collection in the wild to consumption in India (Source: Belt et al. 2003)

The number of local traders, even in the large collection areas, is small. For example, in Munsiyari, a major centre for collection in Uttarakhand, 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.

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).

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 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 government of Uttarakhand 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 Uttarakhand (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 Uttarakhand 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 Uttarakhand are high, even though some of these costs are offset by favourable 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 Uttarakhand, 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 (Dorward 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 Uttarakhand 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 Uttarakhand 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 Uttarakhand, 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 centre of research on medicinal plants in Uttarakhand. 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).

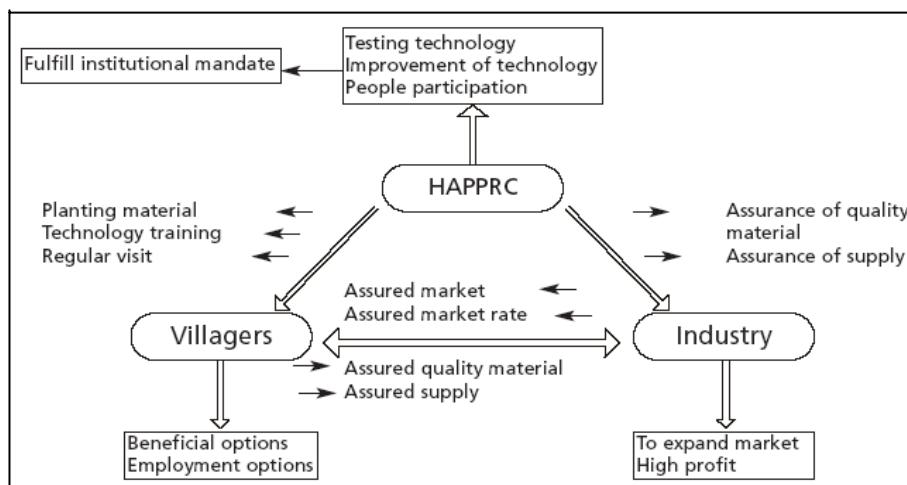


Figure 2. Collaboration features for public–private partnership in Gheshe village (Nautiyal and Nautiyal 2004)

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 Uttarakhand 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 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 Revitalisation 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 Uttarakhand. 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 favourable. 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.

DISCUSSION AND CONCLUSIONS

At present, resource-poor people in Uttarakhand collect plants from the wild in order to complement their meagre incomes. Due to continued collection and increasing market demand, numerous plant species are threatened with extinction. This has a particularly negative impact on the incomes of the poorest sections of rural societies. For rational and regulated collection, strong local communities or strict governmental control measures are necessary. The first is not in place in Uttarakhand, while collection-control regulations tend to affect the poorest households hardest and push them into illegal, risky ventures. This brings us to the possibility that cultivation of medicinal plants offers a greater opportunity for the poor people of Uttarakhand. It is important that the potential of cultivation of medicinal plants is investigated and the possibilities of public-private collaboration are explored through action research programmes. It is also important to focus this research on issues that affect the livelihood of the poor, including farmers with small landholdings, income opportunities for women, and food security of the poorer section of rural society.

We find that, in spite of considerable government efforts, large-scale cultivation of medicinal plants has not yet taken place in Uttarakhand. It also highlights some of the difficulties that farmers face in carrying out the cultivation of medicinal plants. These include: long gestation period and high risk, poor institutional infrastructure to provide technical and marketing support, high transaction costs and insufficient social capital.

Public-private collaboration is often suggested as a way of reducing these costs to acceptable levels, reduce risk, and secure market access to small producers. Will this make a difference in Uttarakhand and create pro-poor, sustainable chains based on the cultivation of medicinal plants? The example cited in the paper illustrates that such collaborations can overcome many of the constraints and provide a promising mechanism for establishing the conditions necessary for the growth of chains that are in the initial stages of development.

However, the number of public-private collaborations supporting the cultivation of medicinal plants is still very small. What can be done to promote collaboration on a larger scale? A number of conditions will have to be met before the private sector will be attracted to join programmes to support the cultivation of medicinal plants. These include:

1. Public-sector investment, to build the infrastructure necessary for the provision of technical and marketing support

2. Increased involvement of civil society in organising farmers' groups and building capacity to deal with public institutions and private companies, collect market information and build entrepreneurship
3. Build social capital so that the efficiency of the chain is improved. Networks of the actors involved in the medicinal-plant chain must be strengthened both vertically (e.g. producer–industry), as well as horizontally (e.g. strengthen the producer organizations) in order to increase people's trust and ability to cooperate, and expand access to markets. In this process, consulting the stakeholders is not enough. A more profound collective investigation into the motives and underlying values of the stakeholders is essential to enable sustained common action
4. Create greater demand for cultivated material. Presently, the private sector has little reason to participate in joint programmes as it is largely satisfied with the supply of medicinal-plant produce, whether legally or illegally obtained. Only large exporters may be interested in offering cultivation contracts to farmers for species that are difficult to obtain and whose supply fluctuates. Also, cultivated material would be of interest to exporters as it is impossible to trace the origin of collected material, due to a lack of transparency and documentation in the chain. Unfortunately, the role of exports as an impetus to cultivation can only be small for two reasons. Firstly, compared to domestic market, the importance of export is small. This limits their overall influence on the chain. Secondly, it is still possible to export without traceability.
5. The private sector will be more willing to support the cultivation of medicinal plants if the cost of collected material increases significantly. This can happen if the restrictions on collection from the wild are strictly enforced.

Uttaranchal's experience with public–private collaboration to promote the cultivation of medicinal plants by small farmers is at an early stage. It is hoped that these collaborations will provide important lessons that can be replicated in Uttaranchal and other mountainous areas. This would provide strong impetus to agricultural diversification, leading to increased incomes for farmers.

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NOTES

¹ Ayurveda is a 4500-year old health-care system, recognized by the World Health Organization

REFERENCES

- 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 Uttarakhand, 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]
- Belt, J., Lengkeek, A. and Van der Zant, J., 2003. *Cultivating a healthy enterprise: developing a sustainable medicinal plant chain in Uttarakhand-India*. KIT Publishers, Amsterdam. KIT Bulletin no. 350. [http://www.kit.nl/publishers/assets/images/isbn9068328395_compleet.pdf]
- DFID, 1999. *Sustainable livelihoods guidance sheets*. Available: [http://www.livelihoods.org/info/info_guidancesheets.html] (2004).
- 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]
- Dr.J.VanderStelt, 1999. *Ayurveda*. Available: [<http://www.drvanderstelt.nl/>] (2004).
- Government of Uttarakhand, 2002. *Marketing of medicinal plants: status and action plan*. Government of Uttarakhand, Horticulture and Rural Development Department, Dehradun.
- 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.
- Mountain Technology, 2004. *Mountain farming system*. Available: [<http://mountaintechnology.tripod.com/intro/mtnfarmsys.html>] (2004).
- 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, Uttarakhand. In: Alam, G. and Belt, J. eds. *Searching synergy: stakeholder views on developing a sustainable medicinal plant chain in Uttarakhand, India*. KIT Publishers, Amsterdam, 63-72. KIT Bulletin no. 359.
- 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]
- 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>]
- Virdi, 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 Uttarakhand, India*. KIT Publishers, Amsterdam, 41-54. KIT Bulletin no. 359.