



Sustainable Approach Towards use of Medicinal Plants: A case study from Niti Valley, Uttarakhand, India

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Abstract

In order to promote the sustainable use of medicinal plants, it is essential to disseminate the knowledge amongst the grassroot practitioners. This can be done by formulating suitable policies that could consider regulatory impact analysis and assessment along with the information sharing and engagement of marginalized people. The present research is focused on socioeconomic aspects, ethnobotanical use and agrotechnological approach for conservation strategies of selected high value Medicinal and Aromatic plants (MAPs) i.e., *Angelica glauca*, *Arnebia benthamii*, *Rheum emodi*, *Pleurospermum angelicoides*, *Allium stracheyi*, *Saussurea costus* and *Carum carvi* are from Nanda Devi Biosphere Reserve (NDBR) in Central Himalayas. These medicinal plant species are vulnerable and endemic category in the Himalayan region, and have huge dietetic, medicinal and culinary uses particularly in tribal milieu. The key objective of the study is to assess every influential aspect with scientific inputs to strengthen herbal market and document lesser-known dietetic value of these wild plants. Due to high market demand and having high medicinal and aromatic values, cultivation of these species also vary from each other. Out of total 19 villages in the study area, *A. stracheyi* were cultivated in 16 villages followed by *C. carvi* and *S. costus* (7) *P. angelicoides*, *A. glauca* (5) and *A. benthamii* were cultivated only in 4 villages. Majority of the families also cultivate *A. stracheyi* (60%) followed by *A. benthamii* (25%). However, all family consumes *A. stracheyi* followed by *P. angelicoides* (97%) as species in their food. Almost maximum people use *A. stracheyi* in their daily life in different forms, followed by *A. glauca* and *C. carvi*. Collections from wild also depend on the uses and availability of these species in their surrounding areas. *S. costus* is collected 1.9/kg/family/year followed by *A. stracheyi* (1.5/kg/family/year) in the study villages. The inhabitants find difficulties in the cultivation and domestication of plant species other than the above-mentioned MAPs and collected from wild when required.

Keywords: Ethnobotany, Medicinal and Aromatic Plants, Conservation, Traditional Healthcare System; NDBR.

Introduction

Himalayan region occupies only 15% of the country's geographical area, however; about 30% of the endemic plant species found in the Indian subcontinent (Maikhuri *et al.*, 2005). These plants grow naturally under diverse environmental conditions in the sub alpine to alpine meadows. High level of endemism and narrow ecological amplitude indicates that these species are most vulnerable and narrow range endemic (Satyal *et al.*, 2002). The most widely conservation views on commercial Himalayan medicinal plant species is that a large number of species are endangered (Rai *et al.*, 2000). Most of the Himalayan plants were known for medicinal value in their below ground parts followed by leaves and fruits. The collective effect of commercialization of these herbal species, anthropogenic pressure deforestation and excessive grazing in high altitude pastures of the Himalayan region make the fragile ecosystem vulnerable. However, collection of some these medicinal and aromatic plants (MAPs) from the Himalayan region is prohibited by state Government in any form. Originally, only local people collect these MAPs in small quantities as per their requirement with environment friendly approach but now commercial sector and other people have also involved in the collection process.

Consequential huge demand of planting materials i.e. seed or vegetative parts of many species in the region for research and development activities by pharmaceutical companies also affected the plant habitat. The livelihoods of majority of the rural population residing in upland area depend on natural resources. Traditional Ecological Knowledge (TEK) became a major focus of attention with in the past decade. Recent years attention of is mainly focused towards conservation of MAPs through sustainable harvesting (Karki, 2002; Kandari *et al.*, 2011). Ramakrishnan (1992), also arguments that ecological concepts and process should be linked with social process and perception. Knowledge and perception of local resource users is very valuable for developing management guidelines in MAPs sector.

The Bhotiya tribal communities of Nanda Devi Biosphere Reserve (NDBR) in the Central Himalayas have been using several medicinal plants to treat different ailment over many centuries (Phondani *et al.*, 2010). This tribal way of life, culture and often very existence is threatened by rapid acculturation and mainstream development. The young generations are migrating towards metropolitan cities for education and economic opportunities; however, besides this migration some tribal farmers are still living and cultivating MAPs under small scale in the region. Due to illegal exploitation and migration of young people from this region, the traditional knowledge is eroding day-by-day. Therefore, the present study is focused on traditional uses and agricultural practices of selected MAPs of the NDBR region in Central Himalaya.

Study area

The present study was conducted in 15 villages of Niti valley in Nanda Devi Biosphere Reserve (NDBR), which is located in Chamoli district of Uttarakhand (30° 16' to 30° 32' N and 79° 44' to 80° 02' E) state in India (Fig. 1).

Climatic conditions

The climatic year consists of three distinct seasons, namely, summer (April-May), monsoon (June-September) and winter (October-March). Monthly minimum and maximum temperature ranges from 15.3°C to 27.2°C and 2°C to 16°C, respectively. June-August was the hottest months of the year with an average temperature of 27°C and 16.4°C. Average rainfall was about 936.6 mm/year and about 43% of annual rainfall occurred over a short period of two months (July-August) with strong monsoon influence (Figure 2).

Socio-economic set up

Tolcha and Marcha sub-communities of Bhotiya tribes are the main inhabitant in the Niti valley. Traditionally, the cross-border trade with Tibet was the main source of income for the Bhotiya tribal communities before it was banned in 1962 and after the Indo-Chinese war (Silori 2001). The major occupations of these communities have been sheep and goat rearing. Bhotiya tribal communities comprises of three small sub-community viz. semi-agrarian, Tolcha, Marcha and semi-pastoral Jadha. They usually practice traditional transhumance to the lower altitudes (400-1400 m asl) outside the buffer zone during the severe winter months (November-February), while from March-October they spend in higher Himalaya (2000-36000 m asl)). With the changing times many household of Tolma, Suki, and Bhallaon, Lata, and Phagati villages have now permanently settled in the buffer zone (Table 1).

Table 1 Geographical, socioeconomic description and cropping pattern in the Buffer Zone villages of NDBR

Parameters	Lower Altitude	Higher Altitude
Altitude (m asl)	1900-2700	2700-3600
Transhumance	Not Practiced	Practiced
Cropping pattern	3 crops/ 2 years	1 crop/ year
Main occupation	Agriculture	Agriculture
Subsidiary occupation	Animal husbandry, Woolen carpet making	Animal husbandry, Woolen carpet making
Villages	Tolma, Lata, Reni, Surithota, Peng, Bhalgaon, Suki, Phagati, Parsari Markuda and Badagaon,	Mallari, Dronagiri, Jhelum, Kaga, Garpak, Ghamsali Bampa, Niti, Long

Materials and Methods

Survey method

Extensive field survey at randomly household level was conducted in all 19 villages of NDBR during the period 2003 to 2005. Observations and personal interviews with elder persons, local farmers, collectors and traders were carried out to know the

economic and traditional uses, traditional agrotechniques, use patterns, marketing, cultural and religious practices related to cultivation, conservation and management. The questionnaire survey method was employed to collect household information such as, family size and distance covered by the villagers in nearby forest to collect medicinal plants for different purposes in the study area.

Ethnobotanical study

Traditional herbal healers (Vaidyas), actively engaged in traditional health care practice were interviewed to document their unique knowledge on the medicinal uses of different plant species. Collection of species and recording of their local names, harvesting time, medicinal uses, habitat and conservation status has been a continuous process during all subsequent of the field visits. Specific questions focused on knowledge of composition and specific dose for curing common ailments. The entire households in all 19 villages surveyed were interviewed to collect information on various aspects of medicinal plants (collection/cultivation, plant part used, harvesting season, pharmacological action, their uses in traditional medicine system) by using semi-structured questionnaires. In addition to this, focused group discussion (FGD) and village level meetings were conducted with different groups of people i.e., Vaidyas (Traditional herbal healers), medicinal plants growers, local people, woman and researchers. The data and information were cross checked by interviewing at least five herbal healers (Vaidyas) for the use of specific plant species and herbal formulations. The collected plant specimens were identified with the help of literature (Phondani 2010; Kala 2005; Pant *et al.*, 2009), regional floras (Naithani 1985; Gaur 1999) and taxonomists. Voucher specimens are deposited in the herbarium of G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, Srinagar Garhwal, Uttarakhand, India.

Result and Discussion

Ethnobotanical Uses

The present study showed that high market demand and having rich medicinal and aromatic values, the cultivation of MAPs varies from each other (Table 2). We also found that except to *carum carvi* and *Allium stracheyi*, all the species were cultivated for under ground parts such as roots and tubers. A total of 19 studied villages, *Allium stracheyi* were cultivated in 16 villages followed by *carum carvi*, *saturea costus* (7), *Pleurospermum angelicoides*, *Angelica glauca* (5) and *Arnebia benthamii* only in 4 villages (Figure 3). Almost all people used *Allium* spp (100%) in their daily life in different forms, followed by *Angelica glauca* (97%) and *carum carvi* (92%). Collections from wild plant species also depend on the uses and availability of the species in the surrounding areas. *S. costus* is collected 1.9/kg/family/year followed by *Allium stracheyi* (1.5/kg/family/year) (Figure 4). MAPs traders at the road head and along the main trails are the critical link between medicinal plants and the markets (Maikhuri *et al.*, 2002).

Post harvesting practices:

Rhizomes of MAPs are dried in sun, by the villagers for effective, decaying and easy to carry from one place to other. After sun drying the rhizome is powdered and used as spice and condiments. Despite of such diverse resource base of MAPs in the community, traditional knowledge of MAPs is eroding very fast during the recent years due to changing socio-economic and cultural scenarios of the traditional communities, unavailability of desired MAPs herbs, and ban of Govt. For collection MAPs from wild and low interest and migration of local youths also have shifted their attention to these professions. In this community, the rules and regulation by which the tribal people have been traditionally governed have been broken down (Maikhuri *et al.*, 2002). The homogeneity of societies has given way to heterogeneous settlements. Younger generation find cultivation and domestication of MAPs, a difficult task in this hilly terrace and hence opted for other alternative professions (Maikhuri *et al.*, 1998; Silori 2004).

Table 2 MAPS used for curing different ailments through traditional healthcare system

S. No.	Plant name	Part used	Ailments	Vernacular name	Folk medicinal uses
1	<i>Angelica glauca</i> ,	Root	Fever, skin diseases, muscular pain.	Choru	Root powder mixed with water and orally drink in case of fever, vomiting, and body pain extract are applied.
2	<i>Arnebia benthamii</i> ,	Root	Baldness, hair loss	Baalchadi	Root mixed with mustard oil used as hair tonic, antiseptic and in throat problems.
3	<i>Rheum emodi</i> ,	Root and leaf	Rheumatism	Dolu	Roots paste with turmeric powder mixed with mustard oil is applied externally to relieve muscular pain.
4	<i>Pleurospermum angelicoides</i>	Root	Fever	Chippi	Fever, stomachache
5	<i>Allium stracheyi</i>	Leaf/Root	Goiter	Faran	The fried leaves of <i>A. stracheyi</i> are used in culinary purposes. The bulbs and leaves of <i>Allium stracheyi</i> have sweet and acid taste with warm potency, used in boils and winds disease.
6	<i>Saussurea costus</i>	Root	Leprosy	Kuth	The root paste is applied externally for the treatment of leprosy
7	<i>Carrum carvi</i> .	Seed	Stomachache	Kala jeera	Seed powders are also used to cure stomachache.

Due to high pressure of MAPs collected from wild for different purposes by the local people is also developed an appropriate strategy for conservation, sustainable development, documentation and policy planning of MAPs sector of the entire Himalayan region. In addition, the rapid change in socio-economic and cultural values among local people could be attributed to this change. Agricultural and forest

biodiversity also play an important role in sustaining livelihood in this region (Chandra *et al.*, 2010a), Sustainable resource use depends partly on local people's ownership, control and management of landuse and other resources (Chandra *et al.*, 2010b). If this is not halted, a significant portion of this valuable medicine practice will be vanished in near future.

In the Bhotiya communities, traditional healers who prepare remedies also serve as diagnosticians, identifying causes of illness before prescribing treatment. The dose given to the patient depends on age, physical status and health conditions of the patient. The method of use of plants varies according to nature of disease. In the majority of the cases, a decoction of various parts of plants used is administered for treating a disease or diseases. Most of the decoctions are made just by crushing the plant parts but some are made by boiling plant parts in water, decanting of the liquid and drinking after cooling. Paste of some plants is plastered to set dislocated or fractured bones or muscular pain (Phondani *et al.*, 2010).

Traditional knowledge of plants in many communities is changing because of rapid socioeconomic and cultural changes that are taking place. This is particularly true in these tribal communities. Documentation of this knowledge is valuable both for the communities and their future generations and for scientific consideration of wider uses of the knowledge. The indigenous knowledge and rights of the Bhotiya communities and local people regarding uses of plants needs to be secured. Considering the above facts, besides protecting these plants in their natural habitats, sustainable harvesting of these selected MAPs is required (Kandari *et al.*, 2007; 2008). Appropriate mechanisms for effective benefits sharing of potential value of this knowledge need to be developed.

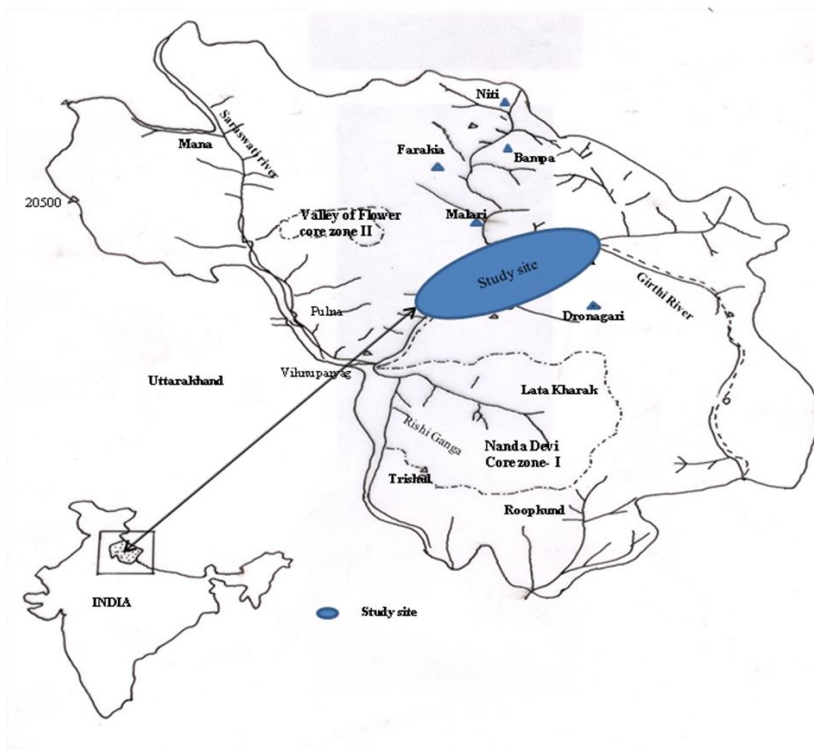


Figure 1. Location map of the study area in Nanda Devi Biosphere Reserve, India (A World Heritage Site).

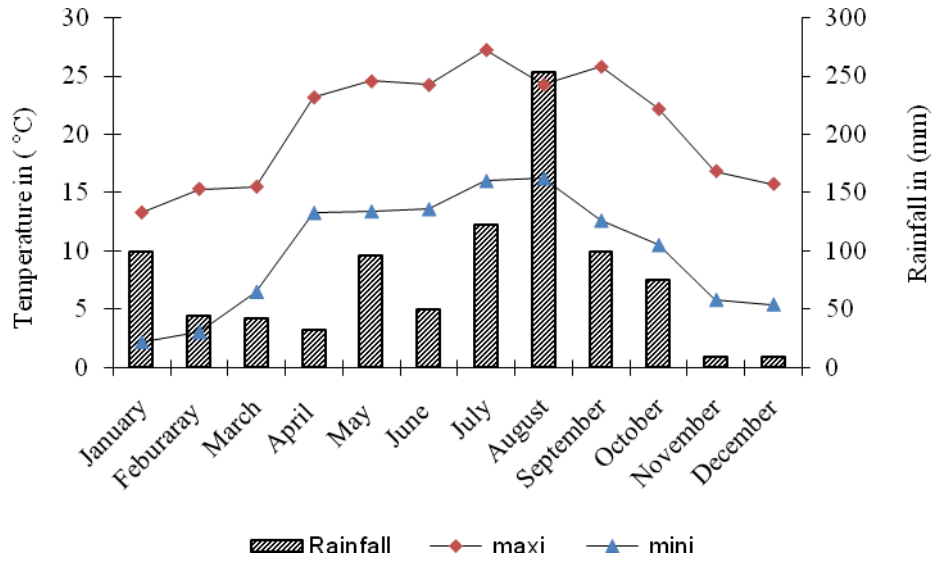


Figure. 2 Wether information collected through maximum and minimum temperature as well as rainfall of the study area.

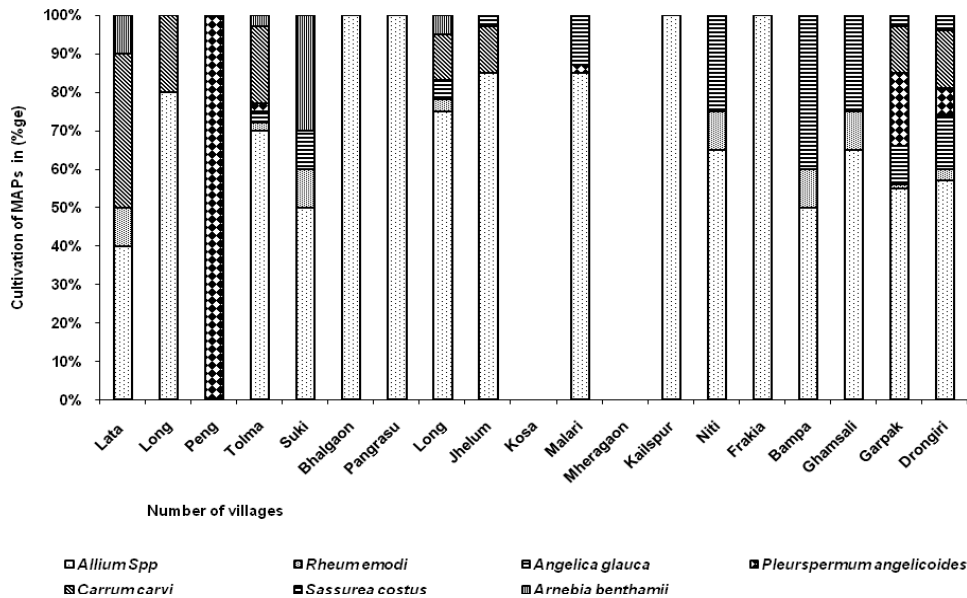


Figure. 3 Percentage of MAPs cultivation in different villages of the study area.

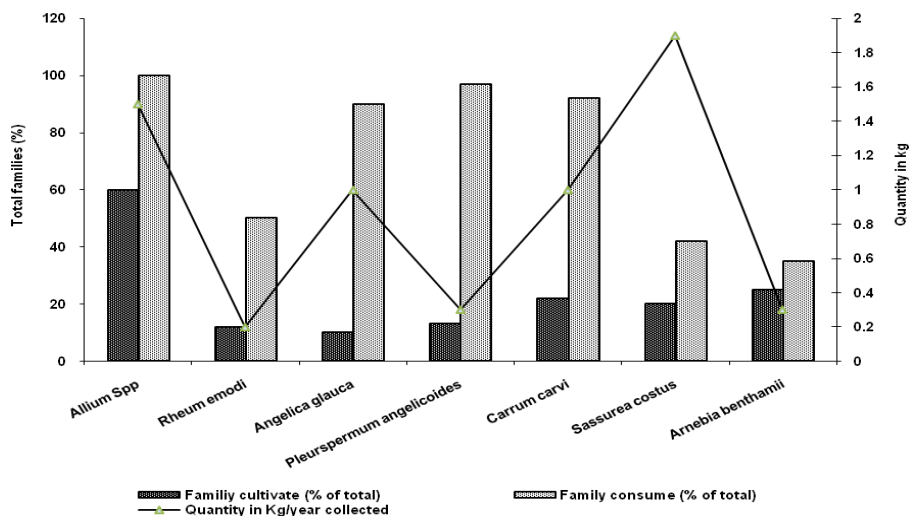


Figure 4 Consumption patterns of MAPs from the study area,

Conclusions

Conservation also required a multi-sectoral and integrated approach that linked social, economic and environmental factors. Besides government agencies, there are numbers of stakeholders ranging from MAPs collectors, local middleman, urban traders, wholesalers, manufacturers, exporters and traditional herbal healers in the medicinal plant sectors. Large portion of land in the higher mountainous region of the central Himalaya that are owned by the Government and local communities i.e., barren, degraded and unproductive. This land could be easily being rehabilitated with people participation by cultivating of high value MAPs. The MAPs growers should also give rewards and compensation for their crop damage and production. The MAPs cultivation is not only important for livelihood enhancement of the local people but also help to conserve the MAPs in their natural habitat.

Authors' contributions: *Dr. L.S. Kandari* (Assistant Professor), contributed in experiment design and manuscript writing; *Dr. K.S. Rao* (Professor), Investigator for the project, contributed in experiment design; *Dr. R.K. Maikhuri* (Scientist in-Charge) co-investigatior of the project, contributed in experiment design performed some of the experiment; *Dr. Kusum Payal* (Researcher), contributed in performed some of the experiment design; and *Ms. Tripti Negi* helped in data analysis and manuscript and correction.

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