The traditional values of various forest based products, especially of plants having medicinal and aromatic properties, have acquired tremendous importance in the present century. The Himalayan mountain system being a repository of high value medicinal and aromatic plants (MAPs) has been providing raw material for continuation of various traditional systems of medicine from the distant past. The state of Himachal Pradesh in India not only supports high biodiversity, but also helps to evolve cultural diversity. The different tribal communities of Himachal Pradesh, which include Gaddis, Kinnaura, Lahaula, Bhotia, Swangla and Gujjars are well acquainted with biodiversity-based traditional knowledge and practices. A part of the traditional knowledge on use of plants, with due course of time, has started to attract commercial sector, which finally give space to develop small scale herbal factories. With the development of the herbal sector in the state the demand of a group of MAPs fetching high amount of price has cropped up enormously. At the same time, a part of the traditional knowledge has started declining due to the ignorance of lesser known MAPs. With this background, the present study was carried out from 2013 to 2016 to comprehend the above mentioned issues about MAPs in Dhauladhar mountain range of district Kangra, Himachal Pradesh with the following objectives:

1) To study the population structure of medicinal and aromatic plants and their distribution pattern along the altitudinal gradient.
2) To document the ethno botanical knowledge of medicinal and aromatic plants used by local people.
3) To study the collection practices of medicinal and aromatic plants.
4) To study the conservation and management issues related to medicinal and aromatic plants and to set priorities for their long-term conservation.
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District Kangra lies between 31°21’ to 32°59’ N latitude and 75°47’ to 77°45’ E longitude with the total geographical area of about 5,739 km, which constitutes 10.31% of the total geographical area of the state. The altitude varies from 500 m to 6000 m above sea level. To study the distribution of MAPs in district Kangra, the study area was stratified based on altitude and forest types. Equidistant transects were laid at a distance specified in all the four directions considering village the center point. Sample plots (Quadrat) were laid at equal intervals along transect. Each sample plot on the transect was of 10×10 m for tree species, 5×5 m for shrubs/ saplings and 1×1 m for herbs/ seedlings. In each plot the number of individuals of each plant species was enumerated and the circumference at breast height (CBH) of tree species was measured. Soil samples were collected from each quadrats. Structured questionnaires along with focal group discussion were carried out in the randomly selected villages. The local harvesting practices were also enumerated from the study site.

For the MAPs distribution and population structure, the relative density, relative frequency and relative dominance following Curtis (1959) and Mishra (1968) was estimated, and the Importance Value Index (IVI) and Shannon–Wiener Diversity Index (Shannon, 1948) was calculated. For the local importance of MAPs Use Value Index, Informant Consensus Factor (ICF) and Fidelity level were calculated. Based on the density, Use Value Index and Harvesting Risk Index, the Conservation Priority Index (CPI) score was calculated. Statistical analysis was conducted using SPSS and CANOCO 4.5 vegetative analysis software.

Result highlights are discussed below:

**Ethnobotanical knowledge of MAPs**

A total of 29 villages were selected for the documentation of ethnobotanical knowledge on MAPs in the Dhauladhar mountain range. A total of 174 MAPs belonging to 76 families were recorded. Apart from medicinal uses, these plants were used for some other purposes, like, 35 species as fodder, 30 species as fuel wood, 23 species as food, 15 species used for construction, 14
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species in religious ceremony, 13 species for making agricultural tools, 12 species as timber and 24 species were used for making ropes, fishing net, dyeing, pesticide etc.

About 40 Vaidyas (traditional healers), 16 Amchis (Tibetan traditional healers) and 25 professional degree holders were identified in the study area. The decrease in number of traditional knowledge holders was found in the study. Among these practitioiners of traditional herbal medicine, most of the practitioners belonged to the higher age classes (>41 yrs old). Both male and female members of the society practiced herbal medicinal system, of which 46.91% were female healers and the rest were males. Along the altitudinal gradient maximum population of traditional healers were found in the high altitudinal zone, followed by middle altitudinal and low altitudinal zones. According to the herbal practitioners, the decrease in the number of practitioners was due to several reasons including loss of interest of the new generation, decrease in the MAPs population, availability of the medical facility and lesser number of younger generations coming forward to receive the knowledge from their elders. The traditional knowledge transmission among the practitioners was both horizontal (between the members of the same generation) and vertical (between different generations) in the study area. The generalized linear model reflected that distance from the district headquarters and elevation were important indicators for the occupancy of traditional knowledge by local people in the study area.

About 30 categories of human and one category of animal diseases prevalent in the study area and cured by using MAPs were identified during the present study. The common mode of preparation of herbal medicine was decoction, concoction, crushing and powdering. Most of the herbal medicines were consumed orally or applied on skin or through nasal. The most common disease category cited by the informants were mainly muscular-skeleton disorders, gastrointestinal problems, birth and menstrual disorders, skin infections, cuts wounds burns, fever and, cold and cough.
Population structure of MAPs

A total of 184 species were recorded during the forest survey in the study area, among these 42 were tree species, 29 shrubs, 91 herbs, 7 ferns and 15 comprised of climbers, epiphytes, mosses and grasses. The distribution of plants varied across various forest types, of which highest number of plants (n=116) were found in temperate region, followed by 68 species in subtropical region and 51 in sub alpine region. In the subtropical forest type, total tree density was 1379.03 individuals per ha and total basal area was 68.31 m² per ha. *Pinus roxburghii, Pyrus pashia, Prunus cerasoides, Berberis asiatica, Vitex negundo, Murraya koenigii, Arisaema tortuosum, Cissampelos pareira, Boerhaavia diffusa, Cirsium verutum, Cannabis sativa, Impatiens balsamina, Urtica dioica, Centella asiatica* and *Tinospora cordifolia* were among the dominant species based on the Importance Value Index (IVI).

The temperate forest had total tree density of 1581.72 individuals per ha and total basal area of 87.42 m² per ha, respectively. *Rhododendron arboreum, Cedrus deodara, Pyrus pashia, Abies pindrow, Pinus wallichiana, Lyonia ovalifolia, Berberis lycium, Prinsepia utilis, Cotoneaster acuminatus, Rosa macrophylla, Rubus niveus, Viburnum nervosum, Centella asiatica, Viola canescens, Urtica dioica, Hedychium acuminatum, Prunella vulgaris, Piptanthus nepalensis, Cannabis sativa Adiantum venustum, Diplazium esculentum* and *Asplenium dalhousia* were the most dominating species in the temperate region. The MAPs dominated in the sub alpine zone include, *Abies pindrow, Betula utilis, Juniperus communis, Rhododendron campanulatum, Berberis lycium, Trillidium govanianum, Jurinea macrocephala, Picrorhiza kurroa, Anemone rivularis, Selinum vaginatum, Anaphalis nubigena* and *Bergenia ciliata*.

In terms of density, the chir pine (*Pinus roxburghaii*) was the most dominant species in sub-tropical forest, *Rhododendron arboreum* in temperate forest and *Abies pindrow* in sub alpine forest. About 65 species were common to any two altitudinal zones whereas, four species, namely *Cirsium verutum,*
*Digitaria setigera, Morina longifolia and Cyperus rotundus* were found across the altitudinal zones, indicating their wide adaptability. Shannon-Weiner diversity index ranged from 1.85 to 3.01 in the present study. The highest tree species diversity was found in the mixed forest across the altitudinal range of 1600-2900 m. Trees had maximum dominance in the sub tropical forest, whereas shrubs had maximum dominance in temperate forest and herbs had highest dominance across the subalpine region. The use of CANOCO vegetative analysis software reveals that the occurrence of different MAPs depends on the microclimate and soil composition along the altitudinal gradient. Besides, the factors influencing the MAPs distribution along the altitudinal gradient were degree of slope, altitude, soil moisture and soil temperature showing significant differences.

**Local Harvesting Practices**

The present study revealed that in the Dhauladhar mountain range a total of 77 MAPs were harvested from the wild. At the same time, 15% MAPs traded in the market were sourced from the farms. Among the total number of collectors interviewed (n=356 individuals) 39.88% were females and the rest were males. About the total collectors, 48% (n=171 individuals) were regular and 52% (n=185 individuals) were irregular collectors. Regular collectors in most of the cases collect the MAPS as per requirement, maturity of plant and availability whereas irregular collectors collects MAPs on basis of demand by the trader, availability and weather condition with least concern of maturity of plant part. The most harvested plant part from the study area was root, followed by stem, whole plant and bark. Increase in the number of irregular collector, destructive harvesting and other anthropogenic activities were imposing pressure on the MAPs in the study area.

Apart from the traditional channels, new channels of trade were identified in the study area through which the MAPs are directly supplied to the manufacturing units and exporters by the collectors, cultivators and local agents. *Rhododenron arboreum* supply chain in the study depicted information gaps
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among MAPs stakeholders, especially in terms of accessibility of market, lack of reliable buyers, discriminatory and unfair pricing.

Conservation and management of MAPs

Based on the density, Use Value Index, Harvesting Risk Index and the current status as per global threatened lists issued by IUCN, Red Data Book, CAMP and literature, the MAPs were classified under different conservation priority categories. As per Conservation Priority Index (CPI) and threatened status, a total 45 MAPs were prioritized, of which 57.77% were herbs, 26.66 % trees, 13.33% shrubs and 2.22% were climber. Among these MAPs, 10 species were common in three threatened list criterion and 9 MAPs were common in two different threatened list criterions. Based on the CPI score, a total of 19 MAPs which were assigned as Least Concern (LC) category by the IUCN Red List, were found in category I, II and III of CPI score in the study.

Long term conservation of all prioritized MAPs is required and are discussed in the present study. There is a need to induce community based programmes which may help in protection of highly valuable MAPs utilized for both domestic as well as commercial purpose in the study area. Plantation programmes for prioritized MAPs based on availability of their habitats should be organized by involving local village institutions. The role of SHGs for the protection of MAPs highlighted in the study can help in their management and conservation. Awareness campaigns and training program should be provided to the locals about the importance and techniques of harvesting MAPs. Sustainable harvesting practices and suitable value addition techniques need to be developed and disseminated among various stakeholders of MAPs. Other than these, 12 collection sites as identified, should be selected as Medicinal Plants Conservation Areas. Besides, to meet the need of MAPs for domestic as well as commercial consumption Medicinal Plants Development Areas need to be developed in the study area where the MAPs resource can be augmented through their continuous plantation.