Ecological Indicators 93 (2018) 434–446

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

Original Articles

Criteria and indicators for promoting cultivation and conservation of Medicinal and Aromatic Plants in Western Himalaya, India

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ARTICLE INFO

Keywords:
Criteria and indicators
Medicinal and Aromatic Plants
Cultivation
Conservation
Traditional knowledge
Western Himalaya

ABSTRACT

The Indian Himalayan Region (IHR) is considered as a rich repository of the Medicinal and Aromatic Plants (MAPs), and has diverse traditional and modern base of therapeutic knowledge. Inhabitants of the region are traditionally well familiar with the healing properties of the available plants and therefore, dependency on medicinal plants for primary healthcare forms integral part of their life. Besides, modern pharmaceutical industries are also relying upon medicinal plants for developing new drugs or searching novel biomolecules. However, over-harvesting and habitat loss of MAPs has reduced its population in the wild, and threatened the sustainability of a number of species in IHR. This calls for an urgent attention and requires selection of suitable criteria and indicators towards encouraging long-term economic and environmental sustainability of the MAP sector. In this context, this study focuses on identifying four major sustainability parameters; i.e. economic, environmental/ecological, socio-cultural and governance, with 11 criteria and 48 indicators. The criteria and indicators approach is expected to be useful in assessing the impacts and monitoring the developmental initiatives in the MAP sector. Further, the study also prioritized potential MAP species for linking cultivation and conservation with livelihood opportunity in Western Himalaya. A total of 152 potential MAP species were identified based on medicinal value, market demand, availability and uses in traditional herbal system. Of these, 43 potential MAPs have been prioritized for cultivation and conservation in Western Himalaya. In addition, distribution and diversity of threatened MAPs of IHR has been documented and presented in a manner to develop strategies for sustainability of the sector at state and national levels.

1. Introduction

The Medicinal and Aromatic Plants (MAPs) sector all across the globe has received high impetus in view of its potential for supplying raw material for modern therapeutics and also as a source of precursor molecules for synthesis and preparation of new drugs (Shahidullah and Emdad, 2010). At present, there are about 121 clinically useful prescription drugs in the market developed from 90 plant species, and 74% of these compounds were used following folklore claims. The global market for plant-derived drugs was valued $1.2 billion in 1990 s (Lange, 1997), and has increased to $25.6 billion in 2015 (Roosta et al., 2017). This is expected to reach $35.4 billion in 2020 with a compound annual growth rate of 6.6% from 2015 to 2020 (BCC, 2015). Yet another estimate suggests that with the present annual growth of 15–25% for herbal products by 2050, the trade in MAPs will reach US$ 5 trillion (Booker et al., 2012). The World Health Organization estimates that 70–95% population in developing countries depends on MAPs for their primary healthcare (WHO, 2011).

MAPs have been used for decades and serve both as a source of income and affordable healthcare in many developing countries (Dangwal and Sharma, 2011; Baydoun et al., 2015). Evidences indicate that most of the medicinal plant material in the world market originates from developing countries (Smith and Larsen, 2003; Roosta et al., 2017). Therefore, MAPs based industry emerges as a promising sector and source of enormous economic growth for the developing countries, if undertaken properly (Larsen and Olsen, 2007; Roosta et al., 2017). Considering the conservation imperatives of harvest from wild and in view of the ever increasing demand for herbal medicine, there is a need for promoting large scale cultivation of MAPs towards ensuring sustainability of the sector (Larsen and Olsen, 2007; Chauhan et al., 2013; Phondani et al., 2016; Roosta et al., 2017). Depletion and loss of MAP diversity and associated traditional knowledge base may have significant impacts on human health and livelihood. Hence, protection of the genetic pool of this valuable wealth in nature is urgently required

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https://doi.org/10.1016/j.ecolind.2018.03.032
Received 5 September 2017; Received in revised form 13 March 2018; Accepted 14 March 2018

for long-run sustainability, and making it available for future generations. India has emerged as a strong destination in herbal sector with 8.13% of global share and 22% growth, which is highest in the world (Maitra and Satya, 2009). Therefore, conservation and cultivation of MAPs offers great potential for the health, food security, prosperity and progress of the country. In India, among others, IHR is a biodiversity hotspot with over 8000 species of vascular plants (Singh and Hajra, 1996), and has added advantage of diverse ecological conditions for growing and conserving MAPs. There are over 1740 species of MAP in IHR that fall under various traditional and modern therapeutic uses (Samant et al., 1998). Among different biogeographic provinces, nearly 643 species of MAPs are known from Himachal Pradesh and 701 from Uttarakhand in Western Himalaya. Nearly 26% of known MAPs are native to the Himalayan region while another 6% species share their nativity with Himalayan and adjoining areas (Samant et al., 1998).

The role of MAPs in traditional herbal medicine is well known and plays an important role in healthcare and livelihood enhancement in the rural areas of the Himalaya. The sale of MAPs accounts 15–30% of the total income of some households in few high altitude villages in Western Himalaya (Hamilton, 2004; Kuniyal et al., 2014; Roosta et al., 2017). These plants are also used by pharmaceutical companies for developing herbal medicine and used for synthesis of new molecules (Joshi et al., 2016). This has consequently increased their demand and at the same time promoted illegal collection. As a result, population of a number of MAPs has declined considerably (FAO, 2003; Kala, 2005, 2007; Maikhuri et al., 2005; Uniyal and Shiva, 2005; Vashistha et al., 2006; Kala and Ratajc, 2012). In the Western Himalaya, around 30% trade of MAPs operated from alpine areas, and 90–95% material is collected from wild habitats through destructive practices (Olsen and Helles, 1997; Ved et al., 1998; Olsen and Larsen, 2003; Vashistha et al., 2006; Larsen and Olsen, 2007; Pauls and Franz, 2013). Although, the Government of India has imposed ban on collection of 29 MAPs from natural habitats, inland trade and export either in crude form or plant products still persists (Ved et al., 2003); the ban has however been reported to be increase illegal trade (Kala, 2005, 2007; Chauhan et al., 2013). The Governments at the centre and states is making serious effort to promote conservation and cultivation of MAPs through different promotional schemes, including development of herbal gardens, establishment of MAPs nurseries for supply of quality planting material, cultivation of threatened high value species, conservation and development of areas naturally rich in MAPs and research in the Himalaya (Kala et al., 2004; Kala, 2006; Kuniyal et al., 2005; Maikhuri et al., 2005; Samant et al., 2007a; Badola and Aitken, 2010; Kuniyal et al., 2013, 2015; Phondani et al., 2016; Maikhuri et al., 2017). Nevertheless, most of the high value MAPs in the IHR remain under threatened category. The potential of different agro-climatic zones to support cultivation of diverse MAPs remains untapped. Hence, there is an urgent need to assess and analyze the MAP sector in order to suggest measures for further development. In this context, development of criteria for assessment of progress, and identification of indicators for monitoring will be helpful in management of MAP based progress in the country, particularly in the IHR. As such, in spite of various studies and efforts, the MAP sector generally lacks such criteria and indicators.

2. Study area and methodology

2.1. Study area

The Indian Himalayan Region with a geographical coverage of over 537,000 km^2 constitutes a significantly large proportion of the Himalayan biodiversity hotspot. IHR consists of 12 Indian states (10 fully and 2 partially), and within this area Uttarakhand and Himachal Pradesh states in Western Himalaya were considered for intensive studies (Fig. 1). Uttarakhand and Himachal Pradesh are most popular among the states of IHR for promotion of MAPs largely due to the suitable agro-climatic conditions and various Government programmes for their cultivation and conservation. Moreover, these states contribute about 50% of the total plant species used by the herbal industries (Chauhan, 2011). As such, Western Himalaya caters to 80%, 46% and 33%, demands for medicine in Ayurvedic, Unani and Allopathic (modern) systems, respectively, and contributes significantly to the economic earnings of rural and tribal farmers in the region (Chauhan, 2011).

2.2. Methodology

A systematic analysis and extensive review of the available information on MAPs (Chauhan, 1989; Maikhuri et al., 1998; Singh and Rawat, 2000; Dhar et al., 2000, 2002; Nautiyal et al., 2000, 2001; Olsen and Larsen, 2003; Maikhuri et al., 2005; Kuniyal et al., 2005; Kala, 2000, 2005, 2006, 2007, 2009; Kala et al., 2004; Larsen and Olsen, 2007; Samant et al., 2007a,b; Rawat et al., 2008; Chauhan et al., 2013; Pauls and Franz, 2013; Kuniyal et al., 2014, 2015; Phondani et al., 2016; Maikhuri et al., 2016, 2017; Negi et al., 2017) was carried out followed by fieldwork in various parts of the Western Himalaya. Various aspects such as species diversity, parts used in traditional herbal care system, species trade and volume, species promoted for cultivation and conservation, value chain and marketing, demand-supply trend, illegal trade, ecosystem services of MAPs along with socio-cultural values and acceptability of species in traditional farming system were used for identifying sustainability criteria and indicator approach. The developed criteria define and characterize the essential elements, as well as a set of conditions or processes against which sustainability could be measured in terms of indicators (Rawat et al., 2008). The broad criteria identified were based on resource status of MAPs, promoting organized cultivation and marketing, industrial potential, Research and Development (R&D), systematize wild collection, conservation, traditional knowledge system, enabling environment and policy formulation. Besides this, information was also gathered on institutional infrastructure available for execution of various R&D activities in the region. Data were also collected on the initiatives being undertaken by two states (i.e. Uttarakhand and Himachal Pradesh) for promoting MAP sector along with major policy formulation. Empirical studies that explicitly report status of MAP resources and impacts of interventions were also included to identify the criteria and indicators.

The criteria and indicators approach identified was validated through conducting semi-structured interviews with MAP stakeholders, market experts/traders and concerned scientists (n = 550) in different parts of Western Himalaya through G.B. Pant National Institute of Himalayan Environment and Sustainable development (GBPNIHESD) and its regional units. A total of 152 potential medicinal plant species under 72 families and 133 genera were identified as important for cultivation and conservation based on market demand, medicinal value, economic potential, availability and uses in traditional herbal system of medicine. Semi-structured interviews were also conducted with interested people asking varying numbers of well defined questions following Maikhuri et al. (1998), Nautiyal et al. (2000), Dhar et al. (2000), Kala (2005) and Samant et al. (2007a) i.e., from the tropical to the alpine zone. Baseline surveys were also conducted with local people/herbal healers of different age group (40–50, 51–60, > 60 year) selected randomly for documentation of traditional knowledge system associated with the selected MAP species using semi-structured interviews as well as questionnaire on local name of plant, use in different treatment/disease, part of MAP used and mode of application. Medical practitioners were consulted in classifying various ailments into 9 broad classes of diseases. The data were quantified by counting the number of species used in curing various ailments belonging to each broad class of disease following Kala et al. (2004). Further, progressive, interested and already engaged farmers in MAP cultivation were targeted for semi-structured interviews in different parts of the region.

All the above groups of respondant were also asked about their perception on ‘enabling conditions and challenges for medicinal plant