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Essential Oil Production in Mustang & Mugu Districts

A Site Study on Feasibility of Establishment of Distillation Plant in Collaboration with Local Authorities for the Production of Essential Oil in Mugu and Mustang

2075

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Mr. Sarad Bickram Rana
Executive Director

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EXECUTIVE SUMMARY

This research work was conducted to analyze the feasibility establishing distillation plant for the production Medicinal and Aromatic Plants (MAPs) essential oils in Mustang and Mugu. Nepal is well known for the availability of diverse species of plants with medicinal and aromatic properties. In fact, majority of these MAPs in Nepal are found in Himalayan region like Mustang and Mugu. In fact, MAPs have been used in these region since centuries for medicinal purpose through homeopathic, amchi, ayurvedic, and other medicinal practices. Currently, most of the MAPs produced in Mustang and Mugu are collected from the wild and there is very limited farming activity for MAPs. The wild collected and cultivated MAPs are mainly sold in raw forms without further processing. The supply chain of MAPs involves at least four intermediaries/ middlemen before it reaches from the farm to the national or international buyers. Thus, there is huge price fluctuation and the MAPs farmers and MAPs collectors get very low price for MAPs. Although value addition of MAPs is not explored locally in Mustang and Mugu, there is huge potential for value addition through production of essential oil in the region itself in collaboration with the local authorities and communities. Due to high elevation and extreme climatic conditions, the MAPs produced in Mustang and Mugu region are known to have higher level of chemical components with medicinal and aromatic properties expressed in them. This quality provides unique value proposition and competitive advantage to the MAPs product produced in the region. However, due to lack of awareness, low appetite for product diversification, lack of technical capabilities, no access to niche market, and lack of business acumen, the local beneficiaries (MAPs farmers, collectors, traders, businessmen) have not been able to effectively capitalize on the competitive and unique properties of these MAPs in the market. Based on the field study, market analysis, and business analysis of MAPs value chain conducted in Mustang and Mugu during this preliminary research project, we have concluded that Mustang and Mugu have huge potential for establishment of MAPs distillation plant and to make it a highly profitable business in collaboration with the local communities and authorities. During initial phase, small/medium scale set-up, for few selected high value MAPs, should be established to conduct pilot study before scale up of distillation plant in Mustang and Mugu. Specific challenges, opportunities, and recommendations for interventions from both public and private sectors have been highlighted in this report.

1 INTRODUCTION
Medicinal & Aromatic Plants (MAPs)

1.1 Overview

Medicinal and Aromatic Plants (MAPs) are herbs that are primarily used for curative, aromatic or culinary purposes. MAPs are also botanical raw material for various value-added processed products such as liquid/ dry herbs-extracts, essential oils and oleoresins. There is increasing interest towards use of medicinal herbs and their value added products globally in search for organic and non-toxic alternatives to harmful chemical present in most consumer products. The extracts of herbs are utilized as a component of various contemporary herbal medicine, supplementary health foods, natural health products, cosmetics, and beauty products. The categorization of MAPs is not very clear because mostly herbs tend to have properties of both medicinal and aromatic plants, but in general categorization, medicinal plants are precursors utilized as a source of medication by altering pathological and physiological process while aromatic plants have elevated level of essential, volatile oil or aromatic oil employed in both therapeutic and cosmetic products. But both has maintained their importance in search of new and valuable precursor of drugs and lead compounds.

In most of the developing countries, around 80% of the population still relies on traditional herbal medicine for primary health care. In Asia, herbal market demand have almost doubled during late 1990’s and the overall international trade in medicinal plants and their products was US$ 60 billion in 2010 and is expected to reach US$ 5 trillion by 2050 according to WHO research.[1] This increasing demand and trade of herbal health care, herbal-based cosmetic products and herbal health supplements, highlights the need for sustainable utilization and conservation of herbal plants. Moreover, indigenous knowledge of traditional healers, health care practitioners and increasing consumption at the household level have added up to the necessity of focus on herbal products and their sustainable utilization, processing and production.

1.2 MEDICINAL AND AROMATIC PLANTS

1.2.1 Medicinal Plants and their uses in different forms Medicinal and aromatic plants can be processed in different forms for uses lie medicinal, culinary, cosmetics, aromatic, etc. These are some of the most widely used forms of medicinal and aromatic plants:

- Raw
- Dried
- Powdered
- Aqueous and Organic solvent extracts
- Oil extracts

Among these different forms, raw, dried and powdered forms require less technological infrastructure than aqueous and organic solvent extracts and oil extracts need more technologically. However, the latter two forms also have significantly higher return and profit margin since they are high value added products (HVAPs). While each forms have their own value and uses, we will be focusing on HVAPs and more specifically on distillation of MAPs to obtain extracts.

1.3 Distillation

Distillation is a method of separating components from a mixture by heating at certain temperature and condensing the vapors. Some of the traditional distillation techniques use direct heating of the raw material mixture to evaporate the contents that work well for most inorganic solutions and a few organic ones, but there are many organic compounds that decompose at high temperatures, including many natural essential oils and aromatic compounds. In such cases, the essential oils industries use three distinct types of distillation methods: water distillation, water and steam distillation, and direct steam distillation. In these three methods, the difference lies only in the handling of the raw plant material but they have same theoretical considerations which deal with distillation of two-phase systems.

In Nepal, there has been reported use of other water distillation methods but steam distillation units are more efficient in terms of distillation time, yield of essential oils, handling of the unit and producing quality essential oils. Steam distillation has been used since the 8th century. The oils can be distilled from the leaves, stems, flowers, bark, roots, seeds, fruits or other parts of a plant.[2]

1.3.1 Steam Distillation

Steam distillation is a method where steam flows through the material, as shown in **Figure 1.1**.

Figure 1.1. Picture representation of Steam distillation method

In the process of distilling plant material, the steam generated outside the still in a steam generator (referred to as boiler) vaporizes the plant material's volatile compounds, which eventually go through a condensation and collection process. The injected steam passes through the plants from the base of the still to the top and functions as agents to break up the pores of the raw material and release the essential oils from it. The system yields a mixture of a vapor and desired essential oil. The vapor is then condensed further and the essential oil is isolated. The basic principle of this method is that the combined vapor pressure equals the ambient pressure at about 100 °C so that the volatile components with the boiling points ranging from 150 to 300 °C can be evaporated at a temperature close to that of water. Also, this technique can be carried out under pressure based on essential oils extraction difficulty.[2]

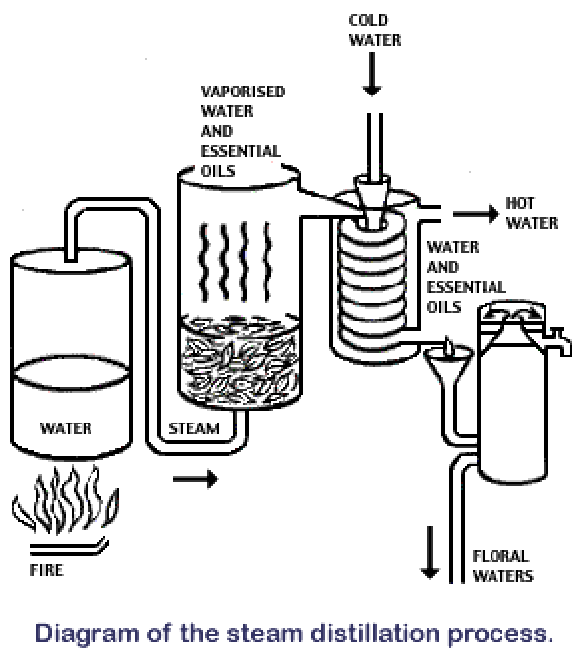


Figure 1.2. Diagramatic representation of Steam distillation method

Source: anandaapothecary.com

Steam distillation has a competitive advantage and widely accepted over other methods of distillation as steam can be readily controlled and has no thermal decomposition of oil constituents.

1.4 Benefits of extracting oil from MAPs and their Industrial uses:

Low mass and volume

The overall mass and volume of medicinal plants decrease by more than 95% after processing them into oil or extract forms. This eases the transport of these materials as well as significantly lowers the transport cost. Especially in the hilly and mountain regions like Mugu and Mustang, transportation is a critical limiting factor in commercialisation and trade of medicinal plants.

Increased efficacy

The extracted oil contains more than 90% (with an efficient extraction process) of active organic ingredients present in the plant. This also results in increased concentration and efficacy of the active ingredients responsible for medicinal and aromatic properties in MAPs.

Ease of purification

The extracted oil are already purified at one level since a lot of water and ash content can be removed in the distillation process itself. The oil can be further purified by fractional distillation or further solvent or aqueous extraction methods using much smaller sized distillation unit in a factory setting as well.

Ease of quality tests and certification

The extracted and purified oils are much easier to test to assure their quality. The certification process for the oils and extracts are simpler as well because there are several scientific methods than can be used to test their content per need.

Easier access to market

For reasons already mentioned like transportability, increased efficacy, purity, and quality assurance, it is much easier to find national and international market for oil extracts of MAPs.The revenue and profit margin increases exponentially going from raw to HVAPs like essential oils from MAPs.

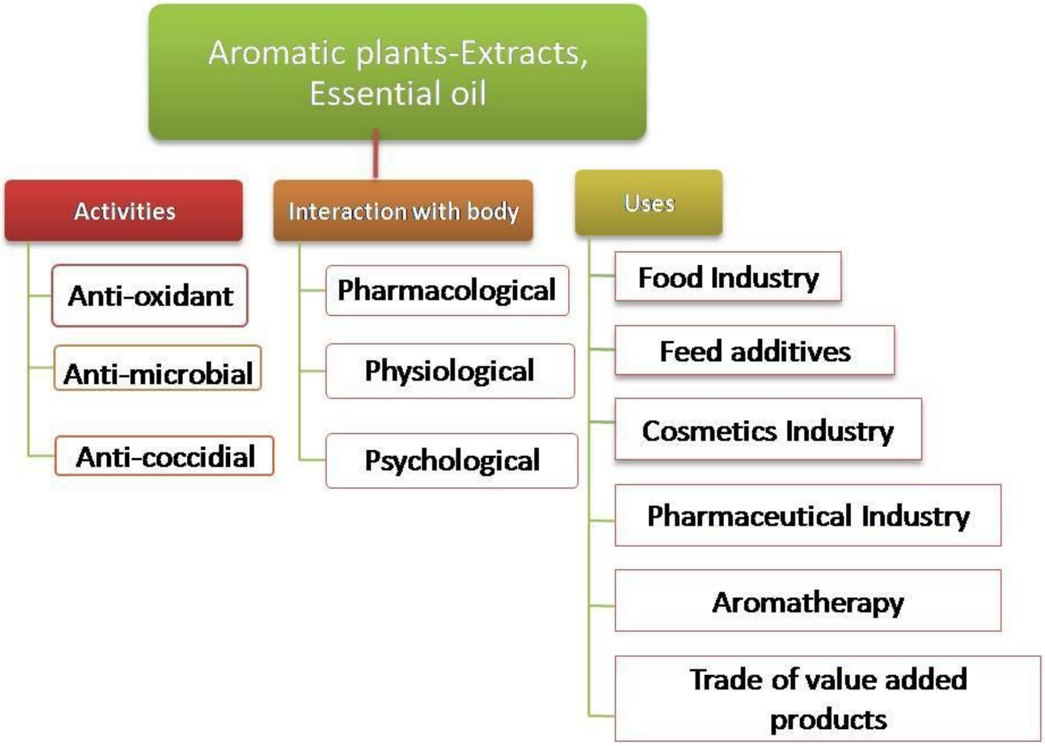
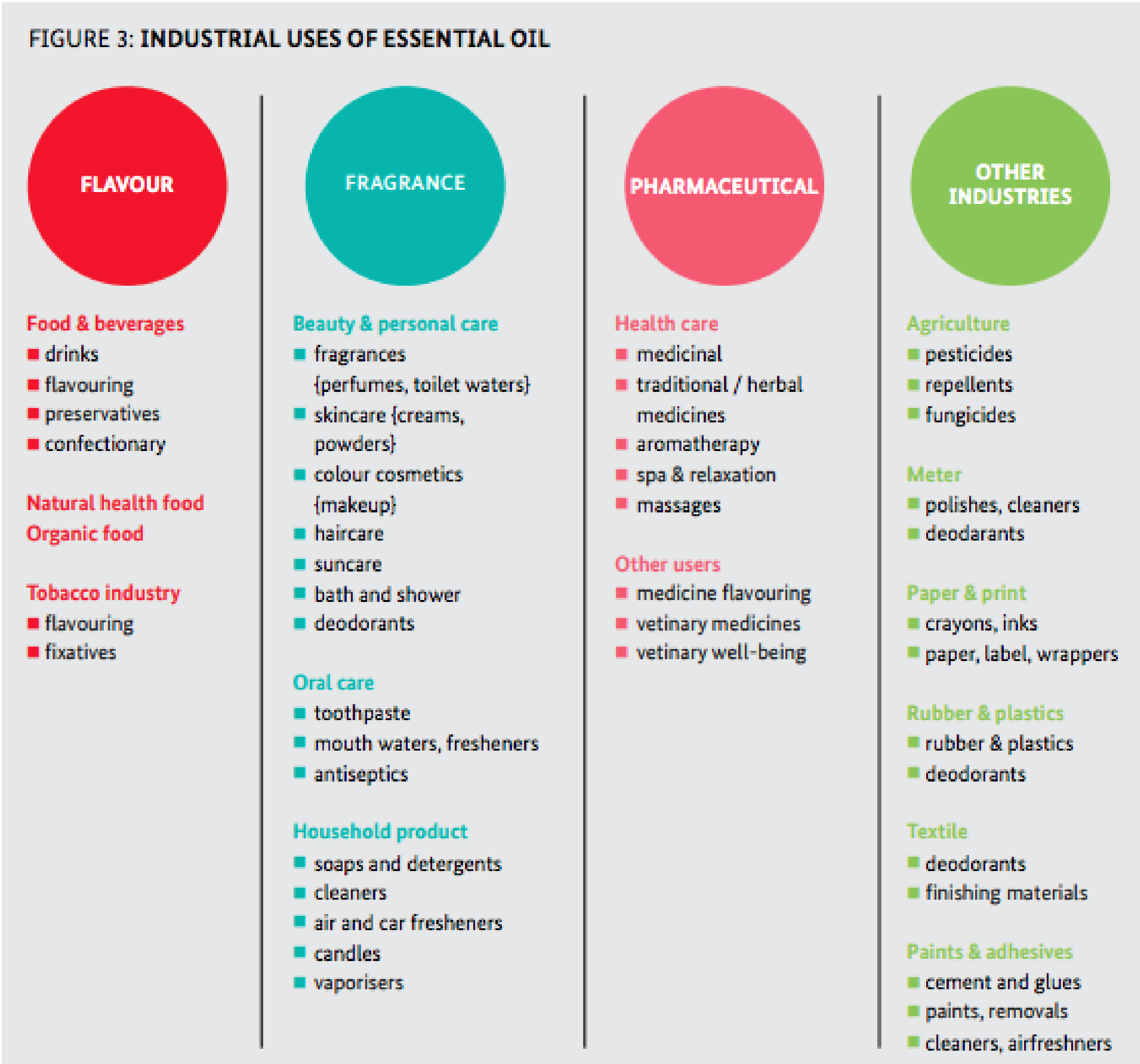


Figure 1.3. Value added products uses and activities

The chart in **Figure. 1.3** lays out different medicinal activities, pharmacological interactions, and uses of MAPs oils extracts.[3]

The industrial uses of aromatic oils can be subdivided into various industrial segments and components which is shown in the **Figure 1.4**.[4]



Source: FAO, Searce estimates (2016)

Figure 1.4. Essential oil uses in different industrial segments and components

2 RESEARCH METHODOLOGY

Scope of the research study

The main focus of this research study is to study the availability of various medicinal and aromatic plants (MAPs) present in Mustang and Mugu to analyse their potential to prepare essential oil. Based on the study, we also plan further analyse the feasibility of establishing distillation plant in the region in collaboration with local authorities. There are varieties of MAPs in Mustang and Mugu region that are identified as high value plants and can be distilled to produce essential oil However, for the enterprise to produce essential oils from MAPs to be profitable, various factors other than availability have to be properly analyzed.

This study aims to do exactly that by examining the currents trends, volume of MAPs production, investments, operating investments, infrastructure needs, technical needs, and other indices to reflect whether establishment of distillation plants in Mustang and Mugu region can be profitable or not. In addition, strategic recommendations will be provided on step-wise implementation strategies to achieve the project goal and to promote MAPs essential oil production in Mustang and Mugu.

Approach

For the probability analysis of establishing distillation plant in Mustang and Mugu in collaboration with the local authorities, we applied a set of research methodology and procedure to come up with impact oriented strategies. Different activities were carried out, mainly with government officials, community people and some with private enterprises. This interdisciplinary relationship helped us gather adequate information, strengthen capacities, and get clear idea about the strengths, weaknesses, opportunities and threats in Mustang and Mugu for the establishment of distillation plant to prepare essential oil from selected high priority and high value MAPs in the region.

The project has prioritized MAPs as a sector having the potential to generate income and create employment opportunities in the region. Different stakeholders and cooperatives in the community who are involved in MAPs farming and collection activities, traders, wild MAPs collectors, trade and commerce related governmental and private organizations, Annapurna conservation Area project officers, and stakeholders in the value chain were the major target groups of the research. Several field group discussions (FGDs), personal interviews, and multi-stakeholder discussions were conducted in Mustang and Mugu. The final report was prepared based on the learnings from these consultations, field observation visits, and literature study. From the beginning of the preparation of the report, the project expert team has undertaken the following activities as shown in **Figure 2.1**.

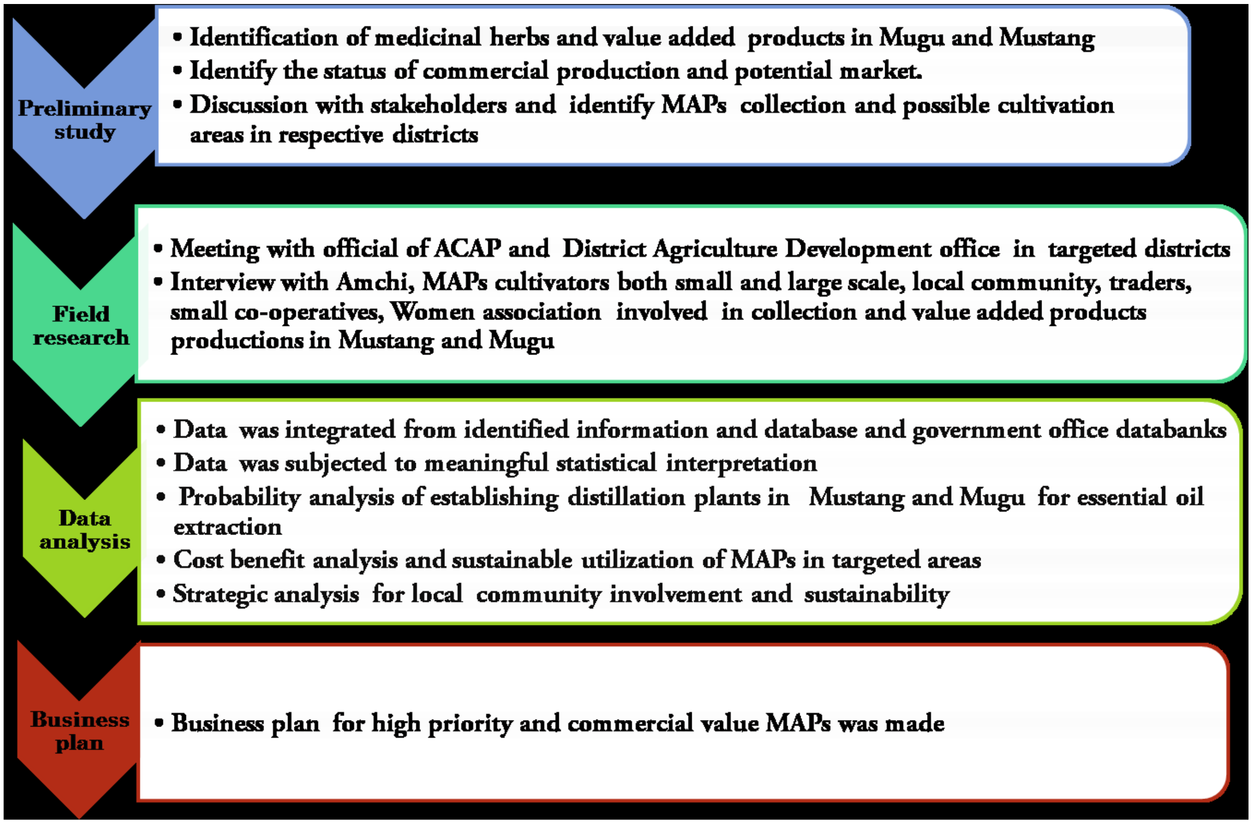


Figure 2.1. Flow of Research activities

3 MAPS DISTRIBUTION IN THE CONTEXT OF NEPAL

Nepal is rich in geographical, biological, climatic and cultural diversity. It contributes to only 0.1% of the world's land area but accounts for a high percentage of diversity in terms of flora and fauna. The Himalayan range places Nepal in a transitional zone between eastern and western Himalaya which are hubs of herbal plants. The range of variations in ecological regions, topographic features, and climatic conditions has resulted in a varied distribution pattern of medicinally important plants and the resulting indigenous knowledge of different groups of MAPs. The medicinal plants in Nepal are distributed between the elevations of 100 to 6,000 meters above sea level.[5]

Figure 3.1. Distribution of medicinal plants in different regions of Nepal

Despite having immense potential to introduce a variety of herbal products, the country still lags far behind in proper utilization of the available resources

3.1 MAPs in Mustang and Mugu

3.1.1 Mustang The Mustang district is in the Mid-Western Development region of north-central Nepal (Dhaulagiri Zone), which covers an area of 3,573 km2 , and shares boundaries to the south with Myagdi, to the east with Manang, to the west with Dolpa, and to the north with the Tibetan Autonomous region of the people's Republic of China. The district lies within the Annapurna Conservation Area Project (ACAP) and is mountainous and has a fragile ecosystem.[Link1]

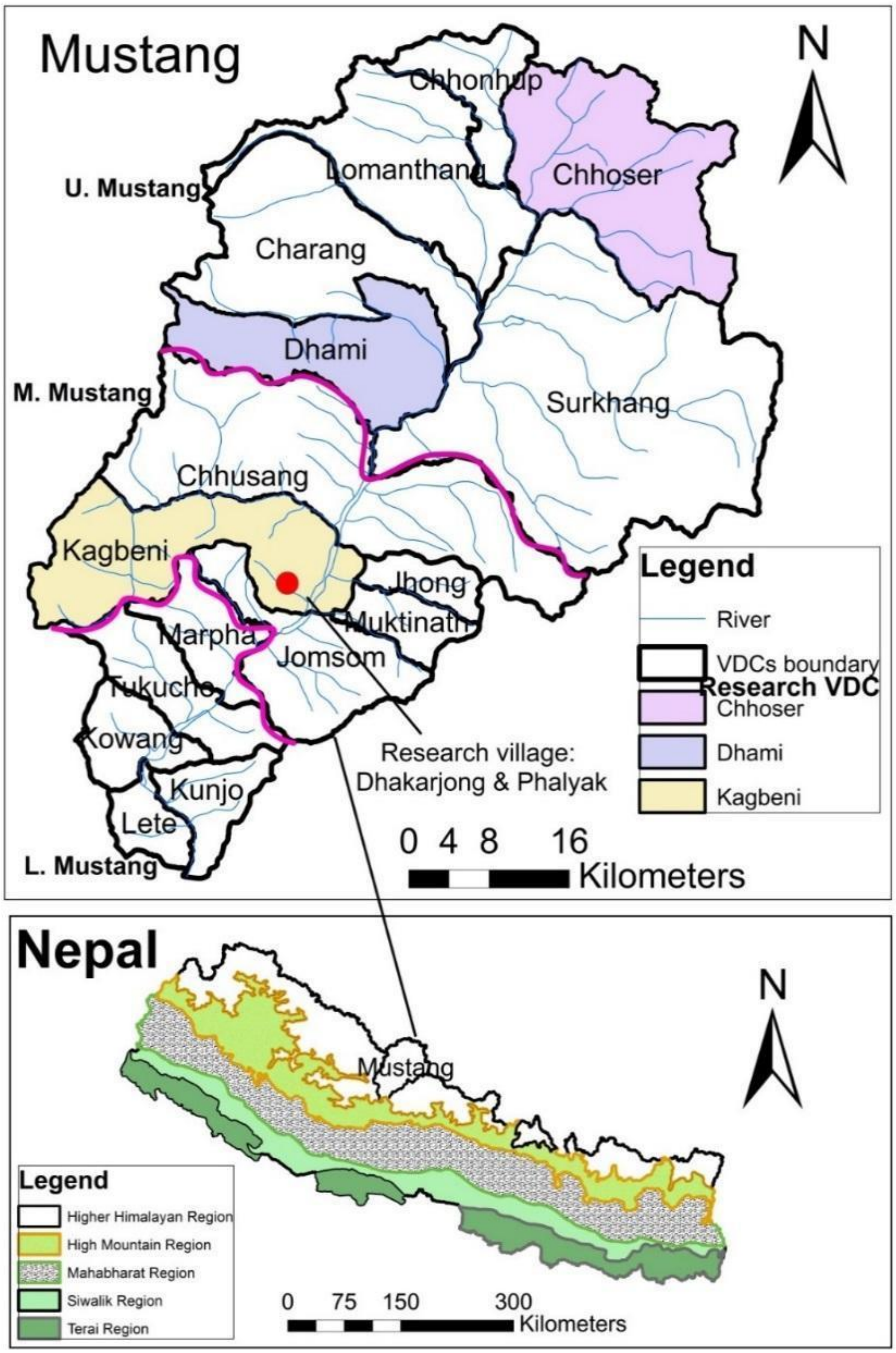


Figure 3.2. Map of Mustang District

3.1.2 Mugu

Mugu district is in the karnali province and covers an area of 3,535 km2. Mugu is known as huge resource of MAPs.[Link1] Local communities have indigenous knowledge about medicinal herbs and their uses but are less aware about scientific and economic benefits of value added products, propagation techniques and proper commercialization of available MAPs which is one of the most important means of income generation. Value added products have competitive advantage in the market to eliminate the poverty.

Figure 3.3. Map of Mugu District

Mustang and Mugu are strategically chose locations in Himalayan region in two different conservation areas. These locations are rich in diversity of MAPs, some of these plants are in traditional practice while some are still unexplored. The learnings from these regions can be later transferred to other Himalayan region in Nepal as well. Communities having indigenous knowledge in traditional healing and medicinal practising such as “Amchi” are responsible for preserving the traditional practice of disease treatment in these areas. Also, there is a culture where knowledgeable people transfer their traditional knowledge from generation to generation. Mustang and Mugu environmental conditions suitable for growth of some of the native medicinal plants and aromatic plants at an altitude range of about 6000-6300 masl. It also has a characteristic vegetation with a freezing season of about 119 days and is dominated by dwarf and shrubby plants. Research has revealed that around 246-310 species of flowering plants are endemic to Nepal and most of these species are found in Mugu and Mustang and surrounding region. Furthermore, the local biodiversity of Mugu and Mustang play an important role in meeting the basic daily needs of the indigenous peoples inhabiting this region.[6]

Concurrent with the increasing demand of herbal products and aromatic oil in the national and international market, cultivation of MAPs is in increasing trend in different districts of Nepal based on availability, climatic conditions, land area and workforce. Mugu and Mustang being the hub of various medicinal and aromatic plants (MAPs) owing to its favorable high-altitude climate, the commercial cultivation of aromatic plants in Mugu and Mustang can be encouraged understanding the increasing demand of aromatic oils or essential oils in Nepal and in the international market. Mugu and Mustang are also very popular tourist destinations, so it will be strategic to start from well known and popular Himalayan destination to gain international market.

High values aromatic plants that are found in Nepal in the high mountains including Mugu and Mustang are listed in **Table 3.1**.[7]

Table 3.1. High value Aromatic plants of Mustang and Mugu

S.N.	Name	Scientific Name	Available in Altitude
1	Bojho (Calamus)	*Acorus calamus* 	2000-2300m
2	Sugandhakokila	*Cinnamomum glaucescens* 	2000-2500m
3	Dhasingre, patpate (Wintergreen)	*Gaultheria fragrantissima*	1200-2700m

			
4	Jatamasi (Spikenard)	*Nardostachys grandiflora* 	3600-5000m
5	Jungali sayapatri	*Tagetes minuta* 	1200-2500m
6	Sugandhawal (Valerian)	*Valeriana jatamansii* 	1500-3600m

7	Timur	*Zanthoxylum armatum*	1100-2500m
			
8	Cinnnamon	*Cinnamomum tamala* 	450- 2,100 m Tropical and subtropical himalayas)
9	Safflower (Kusum phool)	*Carthamus tinctorius.* 	>2000m
10	Agarkara	*Anacyclus Pyrethrum* 	>900m

Source: [link 2][link 3]

Table 3.2. Selected medicinal and aromatic plants from himalayan region (Mustang and Mugu) with high marl essential oil

Herbs	Parts used	Traditional use of herbs	Scientific use of herbs	Active Ingredients
Dhasingre, Wintergreen (*Gaultheria fragrantissima*)	Leaves	Flavoring agent in confectionery industry and in soft drinks, Pharmaceutical and perfume industries	Antiseptic,anti-rheumatic, diuretic, antispasmodic	Methyl salicylate, gaultherline
Dalchini, Tejpat, Cinnamon (*Cinnamomum tamala*)	Barks and leaves	Fragrances, disinfectant	Treatment of circulation, muscles and joints complication, digestive system and relieves arthritis,	cinnamic aldehyde 3% eugenol 80-96% benzyl benzoate 3% eugenol acetate 1%
Timur, peppercorn (*Zanthoxylum armatum DC)*	Fruits.	Fragrance and flavoring.	Anti-infectious, sedative, arthritis.	Lemonene, linalool and methyl cinnamate as major components and 1-pinen, 1-thujene, β-pinene, sabinene, myrcene, γ-terpinene, p-cymene, terpenin-4-ol, piperitone, carvone, cuminaldehyde, methyl cinnamate as other constituents.
Jatamansi, Spikenard (*Nardostachys grandiflora*)	Rootstocks	Perfumery and in flavors	Sedative, Antihypertensive.	Valeranone (jatamansone), spirojatamol, patchouli alcohol, norseychelanone, ά - and β - patchoulene, jatamol A and B, jatamansic acid, terpenic coumarins-

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Source: [link 4]

3.2 Current uses and practices of MAPs in researched districts

Traditional medicinal practice, which preceded modern allopathic medicine, was performed to restore good health conditions using herbal plant resources and such health practices are still prefered in various regions in and outside Nepal. Such treatment approaches differ based on the traditions, availability of herbs and information transferred from practitioners.

There are multiple traditional medicinal practices used to treat, diagnose or prevent illness such as Amchi, Ayurvedic medicine, indigenous knowledge and beliefs of incorporating herbs, spiritual therapies, manual techniques and exercises. On the one hand, traditional medicinal practice remains widespread and is still becoming more and more popular in developing countries, while on the other hand, in many parts of the world , health professionals, public and policy makers are struggling with the questions on safety, quality, effectiveness, preservation and future prospects of such herbal health care. In the Traditional Medicine Strategy Paper 2002-2005, WHO states that these traditional medicinal practices have attracted a spectrum of reactions, uncritical enthusiasm and uniformed skepticism. Despite such criticism, research and development in the field of value added products from herbs is underway at a rapid rate in various parts of the world.[8]

Although Mustang and Mugu are botanical reservoirs for many medicinal and aromatic plants, only few of these plants are used in current day-to-day practice. Amchi and Ayurvedic treatments are the most practiced traditional approaches of treating diseased conditions.

3.2.1 Amchi

Tibetan medicine practitioners are well known as Amchi. Amchi System of Medicine is known as Sowa-Rigpa, which is similar to Ayurvedic medicine. It is a traditional medicinal practice which exists mostly in the Himalayan region of Nepal. Both Upper Mustang and Lower Mustang have been practising this approach of treatment. Though previously this practice was not considered as an official system of medicine, people have been practising this either by following the community traditions or getting trainings from traditional healers. Now, Nepal also has one institution in Baudha, Kathmandu, Nepal that educates students about the Amchi system of medicine to graduate as Amchis (Tibetan medicine doctors). Our research site was Lower Mustang, where, Dr. Tsampa Ngawang Gurung, an internationally renowned Amchi from Jomsom, has been performing research and practicing Sowa-Rigpa on medicinal herbs for years. He has tremendous indigenous knowledge of local medicinal and aromatic plants and their applications. He has his own clinic (Tibetan Medical Center) and also runs the Amchi Sorig Herbal Collection Center. Mostly local communities rely on his treatment practices as they have ethno-traditional, and spiritual faith towards this practice.

3.2.2 Essential oils

Very few aromatic plants are currently used in regular medicinal practice in Mustang although it is known to harbor of variety of aromatic plants. The community does know about the aromatic plants, but the awareness towards their application and value added products was found to be very low. Few aromatic plants have been used for extracting oil, but only for domestic use.

Both traditional and modern medicine systems use medicinal and aromatic plants as their source of raw material. Herbal plants have been employed as over-the-counter drugs by various pharmaceutical and cosmetic industries as home remedies and therapies for years in developing countries, mainly in Asia. They also represent a sustainable portion of the global drug market. Though some medicinal herbs are not fit for administration in their natural state and are not prepared according to pharmacopoeia directions, people in developing countries rely on those raw herbs (traditionally practiced) without much researched information.

Different herbs have different therapeutic potential depending on the part of the plant and form used. Herbal remedies make use of both plant parts as well as isolated extracts containing several key constituents, which work together synergistically. However, two major interventions- value addition and quality assurance, are needed for improving the quality, safety and efficacy of such products from medicinal plants. In the case of Nepal, quality assurance has always been a major hurdle for the effective promotion and marketing of MAPs and its products.

3.3 Need for establishment and promotion of distillation plants in Mustang and Mugu

MAPs have been widely unexplored and under-utilized as a profitable and sustainable business in Nepal. Instead, several high value natural herbs are being overexploited by haphazard and illegal wild harvesting and trading, which has made many of such species endangered in Nepal. In various districts of Nepal like Mustang and Mugu, collection of herbs and their traditional processing is an old practice for the majority of population there, to augment income and enhance livelihood. Though people are also involved in other occupations, they find exporting MAPs as an important income-generating activity. Despite being aware about the worth of processed, value-added, herbs over raw herbs, there has always been a trend of exporting raw herbs to other countries both legally and illegally because of myopic vision of the traders for immediate gain.

Establishing distillation plants can be an effective and feasible way to avoid exploitation of herbs, generate value added products and ensure long-term use and sustainable management of MAPs. Many distillation plants with advanced technologies have been established successfully in the Terai region in Nepal. However, there are a few challenges to ensure MAPs conservation and sustainable utilization in the Himalayan or hilly regions. Some of those challenges are information collection, coordination with MAPs stakeholders and making them aware about the importance of MAPs and their current status.

Also, it is very important to convince stakeholders that distillation plants and sustainable cultivation management techniques can prevent the ongoing exploitation of herbs and in fact generate higher revenue to boost the local economy.

Figure 3.4. MAPs Nursery in the MAPs farm of Mr. Chandra B. Gauchan from Kunjo, Mustang

During our research in Mustang and Mugu, we found wild collection to be dominant over cultivation. Cultivation of MAPs is carried out either in greenhouses or by performing organised farming of medicinally important MAPs, and it involves a number of technical, geographical and socio-economic challenges. Consequently, the local communities prefer collection in the wild over cultivation despite getting low price because of lack of MAPs farming knowledge, lack of access to land and finance, and lack of successful examples of such practices.

Mostly people having indigenous knowledge and experience prefer MAPs farming for conservation or for medicinal purpose within the area. Large scale cultivation has not been adopted by the local communities, but only by some of the Amchis, considering their interest and traditional knowledge of cultivating, preserving and using MAPs. Some of the Mother's groups in Mustang are also involved in value-added product generation like Apple juice and Tora juice for income generation. These groups could be one of the key entry points to convince the local communities and authorities that MAPs value addition through activities like essential oil production can be very beneficial for the economic growth of the region.

Case Study#1: Local community's involvement in preserving and utilizing MAPs

Figure 3.5. Mr. Chandra B.Gauchan in his MAPs Farm, Gunjo,

Mr. Chandra Bahadur Gauchan, a resident of Kunjo, Lower Mustang has been cultivating herbs for several years in his personal land. He is partially funded and technically supported by a faculty member at Kathmandu University. According to him, he is doing this in order to preserve local herbs and contribute in conservation of natural diversity of the country. He has a greenhouse nursery with almost 21 different herbs having medicinal and therapeutic properties. He also cultivates herbs based on seasonal availability and conditions. Some of the cultivated herbs are taken for component identification and research to NARC Khumaltar, Kathmandu. He also added that Mustang is a hub for important plants, mainly MAPs and apples, and high-value oils and medicinal components can be extracted from MAPs of Mustang.

“Plants of Himalayan range have high medicinal value and we have been using herbs for years for our medicinal purposes”

3.4 Potential MAPs essential oils of Mustang and Mugu

The value and pricing of MAPs are commonly dictated by their origin, whether they grew in the wild or they were cultivated, the geographical and climatic environment of their origin, and their chemical constituents. Nepal, also known as the rooftop of the world, houses various MAPs endemic to Nepal. Nepal places itself in having higher medicinal value and exclusive wild potential natural medicinal and aromatic herbs. In addition, the mountain regions like Mustang and Mugu are well know to have MAPs with higher medicinal potency due to over-expression of various secondary chemical metabolites. These unique qualities of MAPs from Mustang and Mugu can be strategically highlighted when developing MAPs essential oils from the region. It is also one of the best way to stay exclusive and to differentiate from other parts of the world.

Table 3.3. Potential essential oils from Nepal with high market potential

Key sectors	Potential oil
Flavour	Timur, Cinnamon, Wintergreen Curcuma and Ginger
Fragrance	Rhodondendron Ginger Jatamansi, Palmarosa
Medicine	Timur, Wintergreen, Calamus, Rhodondendron, Cardamom, Yarshagumba

Source: Adapted from [Link 5].

3.5 Advantages of Establishing MAPs Distillation Plant to Produce Essential Oil in Mustang and Mugu

3.5.1 Increase in local economy

MAPs are being traded in Mustang and Mugu in raw form at very low price to the local businessmen and road head traders. This type of unorganized trading activity of MAPs results in price fluctuations and does not guarantee market. Therefore, the locals are not benefitting as much from MAPs as they could. The profit and overall gain from MAPs can significantly increase by adding value in selected MAPs by processing them into essential oil, and by introducing proper marketing and branding strategies. Such organized and planned MAPs essential oil business activity will increase access to sophisticated market and higher pricing. If the distillation of essential oil is performed locally in Mustang and Mugu, then the locals will benefit directly by reducing the middlemen (at least four) thus significantly increasing the local economy.

3.5.2 Generation of Employment

Currently most of the employment of locals in MAPs-related activities are either small scale farming, collection, or trading at low price in Mustang and Mugu region. With the establishment of distillation unit for essential oil production, there will be more job opportunities for the locals ranging from MAPs collection, farming and processing, distillation units' technical care and operation, to business related functions like finance, marketing, branding, and logistics. Thus, employment opportunities will increase at various levels of the MAPs value chain with introduction of distillation of MAPs essential oil in Mustang and Mugu.

3.5.3 Promotion of MAPs and Geographical indication

Mustang and Mugu have several MAPs that are unique to the region and have been used for various homeopathic, ayurvedic, amchi - medicinal practices since centuries. These MAPs are also part of their cultural and traditional practices, but are currently underutilized. If these MAPs are utilised to produce high value essential oil and are marketed by highlighting their story and significance in Mustang and Mugu region, then they can be sold in more sophisticated international market. This will not only increase access to international market and give higher monetary returns, but will also promote the MAPs and geographical significance of Mustang and Mugu. In addition, if geographical indication signs are used in the products then the value of MAPs products originating from the region will also increase due to their unique value proposition in terms of quality and composition of MAPs products.

3.5.4 Increase in profit

The value added MAPs essential oil can be much more expensive and profitable than in their raw forms, after proper selection of plant and marketing. There is more than 95% reduction in the total weight and volume after the MAPs are processed into essential oil, which also reduces the cost and logistics of transporting MAPs.

3.5.5 Competitive advantage of MAPs from Mustang and Mugu

The essential oils listed in **Table 3.3** above are of great potential based on demand, price, added value and cultivation. It is generally believed that the plants in higher altitudes have a competitive advantage over plants in lower land as extreme climatic conditions can alter the chemical composition of herbs which could ultimately affect the survival of herbs in high altitude region. Mainly, the temperature stress can affect the secondary metabolites secreted by plants which are the sources of medicinal and therapeutic properties. Most of the secondary metabolites and other phytochemicals that are present in plants are outcomes of stress response- adverse weather, diseases etc. Generally, when plants are stressed, they release increased active components as secondary metabolites, as growth is inhibited and photosynthesis is highly activated. The fixed carbon which is not utilized for growth is allocated to secondary metabolites. Therefore, exposure to environmental stresses like cold weather, lower water uptake contributes to higher accumulation of active components of the plants which generally occurs due to physiological changes in plants.[9]

Mustang and Mugu have a broad range of environmental factors which change with elevation. These factors include temperature extreme, mean temperature precipitation, soil fertility, wind speed, duration of snow-cover, atmospheric pressure, length of the vegetation period, and radiation intensities. All these factors are responsible for elevating the secondary metabolism of plants growing in high altitudes.[10] In the context of a developing country like Nepal, selection of MAPs for distillation of essential oils must be carefully done, in order to get effective and sustainable advantage in the long run with less problems for infrastructure, market access and technical difficulties that come with new production.

4 INTERNATIONAL TRADE OF MAPS AND ESSENTIAL OIL, AND ANALYSIS OF NEPAL'S STRATEGIC POSITIONING IN MAPS AND ESSENTIAL OIL TRADING

4.1 Top exporters of Essential Oil from Nepal

Most of the exporting firms are located in Nepalgunj, Krishnanagar, Kathmandu. They export crude herbs and processed herbal products mostly to India and China and few to third countries. Now-a-days few exporters of high mountains and terai export MAPs and essential oils to the borders of China and India. Final processing and value addition is very limited in Nepal and most trade is in crude or semi processed form.The following are few of many exporters of Nepal.[11]

1. Aarya Aroma Kamaladi, Kathmandu
2. Alternative Herbal Products Pvt. Ltd Balkhu, Kathmandu
3. Annapurna Aroma Naya baneshwor, Kathmandu
4. Bahubali Herbal Essence and Extracts Pvt. Ltd. Surkhet
5. Nepalgunj Chaudhary Biosys (Nepal) Pvt. Ltd, Khumaltar, Lalitpur
6. Fauz Mohamad and Company. Ghosi Tole, Nepalgunj
7. Gajurmukhi Herbal Pvt. Ltd Mechi, Jhapa
8. Jadibuti Association of Nepal(JABAN), Nepalgunj
9. Natural Products Industries Jawabhari 3, Kapilbastu

4.2 International and Nepalese Trade Scenario of MAPs

In the year 2017, the worldwide export of MAPs (1121) totalled US$ 3.1 Billion where two of our neighbouring countries China and India ranked as top two exporters of MAPs in the world, respectively (**Table 4.1**). Nepal ranks 42 in the list exporting MAPs worth US$7.4 Million.

Table 4.1. Top 10 medicinal plants (1211 plants and parts of plants- Trademap data) exporters in the world in 2016 and 2017.

Rank	Exporters	Exported value in 2016 (US$ thousand)	Exported value in 2017 (US$ thousand)
1	China	1,008,243	964,461
2	India	259,375	222,110
3	Canada	192,872	185,606
4	Germany	151,620	173,834
5	USA	155,178	172,827
6	Hong Kong	130,166	141,364
7	Egypt	119,187	114,513
8	Spain	81,729	86,801
9	Mexico	61,290	72,879
10	Korea, Republic of	54,430	71,269
42	**Nepal**	**6526 (2015), NA (2016)**	**7448**

Source: TradeMap

Looking closer into the top 10 importers of MAPs from Nepal (**Table 4.2**), Nepal exports 76% of MAPs produced in the country to India and ~2.5-3.5% MAPs to Viet Nam, France and China. Among the top 10 importers, Asian market imports 87% and European market covers 8% of the total MAPs exported from Nepal. Most of the MAPs from Nepal are exported in raw form or with minimal processing, which then are further processed in the destination countries for value add. After value add, these MAPs products are either consumed internally by these countries or exported to other countries with much higher profit margin. This scenario presents as case where lack of value addition serves both as an issue and an opportunity for MAPs products in Nepal. One of the high value added MAPs products is essential oil.

Table 4.2. Top 10 medicinal plants (1211 Plants and parts plants - Trademap data) importing markets for a product exported by Nepal

Rank	Importers	Imported value in 2016 (US$ thousand)	Imported value in 2016 (US$ thousand)
1	India	4,019	5,691 (76%)
2	Viet Nam	955	267
3	France	202	266
4	China	176	189
5	Germany	65	174
6	Hong Kong	334	153
7	Italy	3	94
8	Singapore	117	91
9	United Kingdom	1	76
10	Pakistan	104	67

Source: TradeMap

Based on the data for MAPs imported to Nepal (**Table 4.3**), India and China again rank top two markets to export to Nepal. Inspite of huge potential for MAPs production and export, Nepal is still a net importer of MAPs in terms of net revenue and is becoming increasingly so. One of the ways to invert this curve from net import to net export in terms of monetary gain is to export value added products like essential oil to the foreign market of MAPs which is growing each year (4% MAPs market growth in 2017).

Table 4.3. Top 3 medicinal plants (1211 Plants and parts plants - Trademap data) imports to Nepal

Rank	Importers	Imported value in 2016 (US$ thousand)	Imported value in 2016 (US$ thousand)
1	India	3,666	3,372
2	China	3,430	3,166
3	Pakistan	178	155

Source: TradeMap

4.3 International and Nepalese Trade Scenario of Essential Oil

In the year 2017, the worldwide export of essential oils (3301) totalled US$ 5.4 Billion in which

USA and India ranked as top two exporters of essential oils in the world, respectively (**Table 4.4**). Nepal ranked 62 in the list exporting essential oil worth US$3.3 Million.

Table 4.4. Top 10 essential oil (3301 plants and parts of plants- Trademap data) exporters in the world in 2016 and 2017

Rank	Exporters	Exported value in 2016 (US$ thousand)	Exported value in 2017 (US$ thousand)
1	USA	634,821	728,974
2	India	607,726	608,459
3	France	396,796	471,376
4	Brazil	339,048	431,217
5	China	423,524	354,559
6	United Kingdom	218,628	271,915
7	Germany	191,524	217,496
8	Netherlands	163,595	212,181
9	Argentina	196,376	203,718
10	Spain	124,928	161,836
62	**Nepal**	**3,554**	**3,330**

Source: TradeMap

From the table for top 10 importers of essential oil from Nepal, Nepal exports 34% of essential oil produced in the country to USA and 23% to India (**Table 4.5**). Ironically, USA and India are both top exporters in the world as well as top importers of essential oil from Nepal. In contrast to Nepali MAPs market (**Table 4.2**- 87% Asian market- India covered 76%, 8% European market, <1% US market), Nepali essential oil is exported to USA the most (34%) followed by Europe (37%) and then to Asia (24%- India covered 23%) (**Table 4.5**). This data also indicates that we can access more sophisticated markets like USA and Europe with value added products like essential oil, and also due to ease of transportation and other comparative benefits of essential oil (mentioned above) over other MAPs products in raw or least processed forms.

Table 4.5. Top 10 essential oil (3301 Plants and parts plants - Trademap data) importing markets for a product exported by Nepal

Rank	Importers	Imported value in 2016 (US$ thousand)	Imported value in 2016 (US$ thousand)
1	United States of America	1,239	1,131 (34%)
2	India	537	773 (23%)
3	France	411	494 (14%)
4	Canada	96	256
5	Belgium	348	251
6	Germany	87	90
7	China	44	58
8	Czech Republic	46	56
9	United Kingdom	64	49
10	Switzerland	131	45

Source: TradeMap

From the total essential oil imported to Nepal, more than 90% is imported from India (47%) and Indonesia (45%). In contrast to MAPs trade (net importer), Nepal is a net exporter of essential oils in terms of net revenue (**Table 4.6**). Most of the essential oil are exported to Nepal in either bulk after certain quality assurance or as labeled/branded products. Based on these analyses and Nepal's positioning in the international trade market for MAPs, it makes more strategic sense for Nepal to start exploring the domain of MAPs value addition rather than selling raw and unprocessed MAPs at very low price.

Table 4.6. Top 5 essential oil (3301 Plants and parts plants - Trademap data) imports to Nepal

Rank	Exporters	Exported value in 2016 (US$ thousand)	Exported value in 2016 (US$ thousand)
1	India	448	486
2	Indonesia	987	465
3	Singapore	19	46
4	Malaysia	0	11
5	China	3	4

Source: TradeMap

4.4 Selection of MAPs essential oil production based on international market demand, national export profiles, and regional MAPs availability

Based on national and international commercial value, market demand, geographical range of distribution, indigenous traditional practices and inherent medicinal properties, widely available herbs and potential. Essential oils found and exported overseas from Nepal has been listed in **Table 4.7**. The respective herbs contribute highest share towards income generation, value addition, research and cultivation. .[11]

4.4.1 List of Essential oil items exported overseas

Table 4.7. Most exported MAPs essential oils and crude herbs overseas from Nepal

Essential oils	Crude herbs
Abies oil (Abies spectabilis),	Yarshagumba (Cordyceps sinensis)
Anthopogon (laliguras) oil (Rhododendron anthopogon)	Timur (Zanthoxylum armatum)
Chamomile oil (Matricaria recutita)	Chirayito (Swertia chirayita)
Citronella oil (Cymbopogon winterianus)	Jatamansi (Nardostachys grandiflora)
French basil oil (Ocimum basilicum)	Kaulo (Persea odoratissima)
Jatamansi oil (Nardostachys grandiflora)	Kutki (Neopicrorhiza scrophulariiflora)

Juniper oil (Juniperus indica)	Majitho (Rubia manjith)
Lemongrass oil (Cymbopogon flexuosus)	Padamchal (Rheum australe)
Mint oil (Mentha arvensis)	Pakhanved (Bergenia ciliata)
Wintergreen (Dhasingre) oil (Gaultheria fragrantissima)	Rittha (Sapindus mukorossi)
Palmarosa oil (Cymbopogon martinii),	Rudrakshya (Elaeocarpus sphaericus)
Zanthoxylum (Timur) oil (Zanthoxylum armatum)	Satavari/Kurilo (Asparagus racemosus)
	Satuwa (Paris polyphylla)
	Tejpat (Cinnamomum tamala)

Comparing the MAPs essential oils that are exported the most (**Table 4.7**) and the MAPs that are most available in Nepal (**Table 4.8**) and in Mustang and Mugu region (**Table 3.3**), we identified several MAPs (wild harvested and cultivated) with high business potential. Furthermore for preliminary analysis and for pilot project, we chose to perform business analysis of wild MAPs (**Section 7**) that have high medicinal and aromatic properties and have potential for scale up. More specifically financial feasibility analysis for establishment of distillation of wild Zanthoxylum (Timur) oil and Anthopogon (Laliguras) oil was performed.

Additionally, comparative business analysis between wild timur seeds and wild timur essential oil was also performed to determine the profitability after value addition. Wild timur from Mustang and Mugu region are highly preferred than from terai belts. Also, Rhododendrons are specific to hilly and himalayan region and are underutilized because of lack of technology for value addition to produce their essential oils. Thus, in addition to making it to the list of most exported essential oils from Nepal, these MAPs are competitively advantageous as well.

Table 4.8. List of wild harvesting and cultivable MAPs in Mustang and Mugu region

Wild harvesting	Cultivation
Atis (Aconitum heterophyllum)	Mentha (Mentha arvensis)
Jatamansi (Nardostachys grandiflora)	Lemongrass (Cymbopogon flexuosus),
Kutki (Neopricrorhiza scrophulariiflora),	Citronella (Cymbopogon winterianus)
Padamchaal (Rheum australe)	Palmarosa (Cymbopogon martinii)
Satuwa (Paris polyphylla)	Chamomile (Matricaria recutita)
Chirayito (Swertia chirayita)	French basil (Ocimum basilicum)
Wintergreen (Dhasingre) oil (Gaultheria fragrantissima)	Tejpat (Cinnamomum tamala)
Zanthoxylum (Timur) oil (Zanthoxylum armatum)	Chirayito (Swertia chirayita)
Anthopogon (laliguras) oil (Rhododendron anthopogon)	Timur (Zanthoxylum armatum)
Yarshagumba (Cordyceps sinensis),	Rittha (Sapindus mukorrosi)
Tejpat (Cinnamomum tamala)	Kurilo (Asparagus racemosus)

6 POSSIBILITY ANALYSIS OF ESTABLISHMENT AND PROMOTION OF DISTILLATION PLANT FOR PRODUCTION OF MEDICINAL AND AROMATIC OIL IN MUGU AND MUSTANG

6.1 MAPs essential oil market and value chain in Nepal

6.1.1 Current MAPs production, collection, and market management

Village trade level

In rural areas of hilly and mountain region the local traders have very good knowledge about the availability and location of various types of MAPs. They also have good understanding with the local MAPs collectors, MAPs farmers, and road head level traders. The local traders leverage their MAPs knowledge and network to collect MAPs in larger quantities at the village level. The collectors and farmers are paid very low price for the MAPs and the local traders get very high profit margin from these raw materials. The MAPs collected at the village level are then sold to either the road head level traders, regional traders or national level traders at higher cost.

Road head trade level

There is a high level of competition among local level traders/ businessmen after for the collection and trading of MAPs in the village. This kind of trading is mainly practiced in hilly and mountain region that are far from regional and national trading centers with access to indian market and international market. These local businessmen gather in various MAPs season to meet and negotiate with national level traders or regional (mainly from terai)

Terai trade level

The group of traders in the terai region bordering Indian states have large network and connections with MAPs industry in India. These traders collect the MAPs raw materials and value added products like essential oil, processed MAPs and extracts from different regions in Nepal and take them to Indian businessmen or Indian market for trading. In the MAPs supply value chain, these national traders are most powerful and gain the highest profit margin. The price obtained by these traders are also not on par and are much lower than the price in International markets (mainly in developed countries).

Indian trade level

India is the largest importer of Nepali MAPs. Major cities in India like Delhi, Mumbai, Hyderabad, Calcutta where there are big industries and manufacturing plants for MAPs are the highest consumers of MAPs. The industrialists and businessmen in India have direct connections with terai level traders in either side of the border and thus large quantities of MAPs are sold to them from Nepal. The MAPs raw materials are further processed and refined in India to meet international quality standards. Further value addition of these materials are done proper packaging, labeling, branding, marketing, certifications to be sold in international markets like USA, Canada, European Union at very high price.

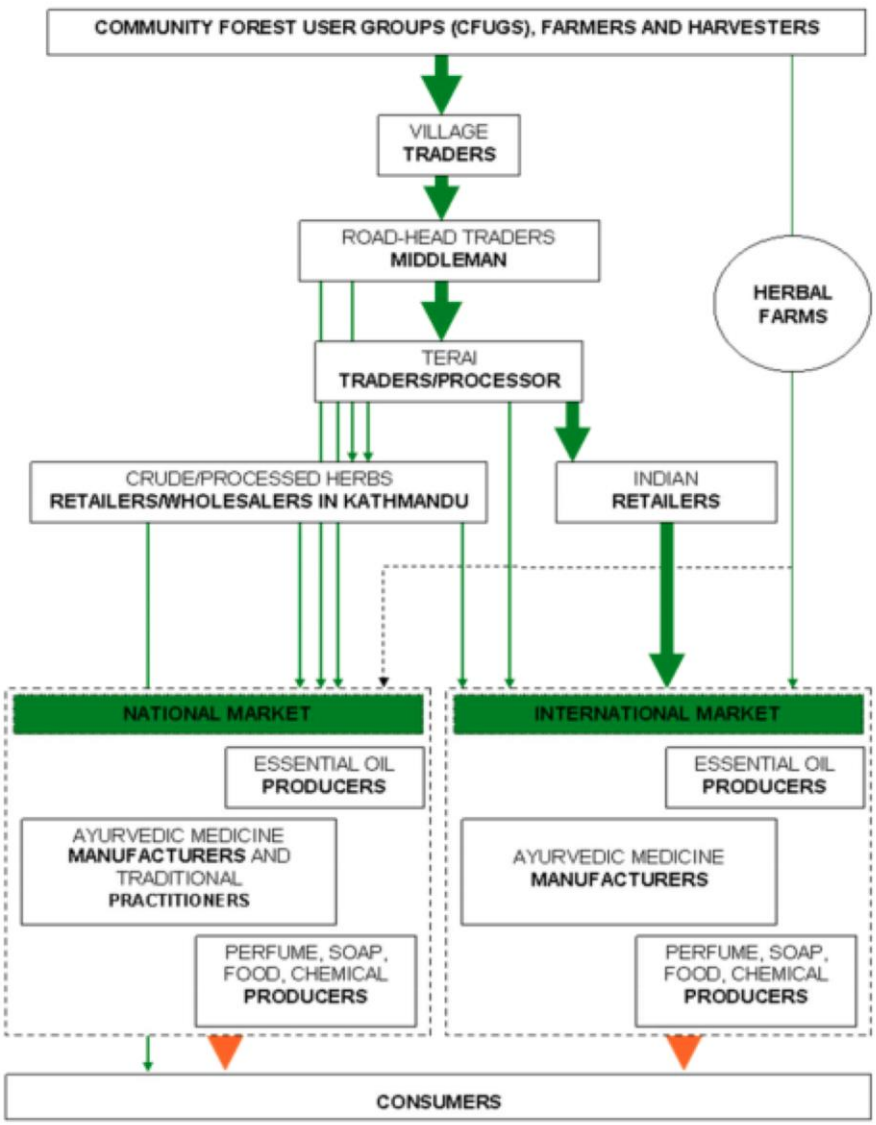

Figure 6.1. Value Chain of MAPs and Essential Oils in Nepal[11]
Source: MAPs QI Report. Gurung (2013).

6.1.2 Challenges in cultivation and harvesting

Sustainability of resources

Forest is the only source of MAPs in Mustang and Mugu. To preserve and for local medication, medicinal herbs are being cultivated in green houses by few people but there is no record of commercial cultivation or large scale cultivation. Improper wild harvesting techniques have led to the extinction of several indigenous medicinal herbs which in turn has led to the unavailability of quality cultivation precursors. Also, MAPs have longer gestation periods that causes farmers to wait for long to generate income from its cultivation. Therefore, without any incentives or alternate source of income, farmers show reluctance to switch to cultivation of MAPs from cultivation of traditional crops. Unlike other traditional crops where farmers can grow or sell without any consent from government officials, the case of MAPs is different. To harvest and sell MAPs, farmers have to get release letters and fulfil various other formalities. This also discourages the local communities from engaging in cultivation of MAPs. Together, all these factors affect the sustainability of MAPs cultivation as well as wild collection.

Information availability

There are no prepared guidelines for the collection and cultivation of MAPs. Local communities have been practising based on traditional Indigenous knowledge or also based on Amchi practices. No proper trainings or awareness programs are conducted regarding sustainable management of herbs to avoid extinction. Poverty has also been a huge contributing factor to unsustainable collection of MAPs since the local level collectors' priority would be to fulfill their immediate needs rather than think of the future.

Land and resource access

Unlike the Terai region, the Himalayan region has irregular topography which results in less cultivable land availability. Availability of less flat land has been the biggest challenge for initiating the switch from traditional crop cultivation to large scale cultivation of medicinal herbs. Due to extreme climatic conditions, favourable soil conditions are difficult to maintain for specific MAPs. There are no organised seed or plantlet banks due to which some of the herbs are introduced to Nepal from other countries. One of such example is of Chamomile which was first introduced from other countries for cultivation in Nepal. On the overall, though Nepal possesses several herbs having high medicinal value, lack of proper resource management has led to many challenges.

Processing infrastructure

For cultivation, drying and for primary processing, local technologies are used. For value-added processing, a range of technologies and advanced infrastructure are required for activities such as drying, grading, packaging, distillation of essential oils etc. Geographical location of himalayan and hilly region makes the transportation of bigger equipment and immediate adoption of modern technologies challenging.

Expertise

Farmers do have traditional knowledge of growing crops, but they do have no clear idea about the consumer interest, market demand and purpose of use. Even if farmers are main actors in the value chain, a better sense of value addition comes only by collaboration between the expertise and farmers. Lack of local expertise has lead to more adulteration of natural herbs. People are primarily interested in the high demand of an herb/plant and the price they can get for it, regardless the quality. In order to realise the importance of high value crops and their uses, an expertise capable of stimulating person on the spot with a technical knowledge is required. Also, lack of awareness, technical expertise and malpractices of buyers/traders has affected farmers to involve in or enlarge MAPs business or to add value by offering good quality herbs/plants and appropriate handling or storage.

Export Market

Farmers usually don’t have clear idea about the consumer demands of particular essential oil, specific seasons or the purpose of use. Especially in remote areas, people do not get proper exposure to the market which leads them to sell MAPs at random and low price. It is important to estimate the potential and price of a crop by knowing whether an essential oil is used for its chemical constituent or for its aromatic property. Farmers, often in remote places, sell small quantities to collectors in raw form, which are further transferred to community level traders in villages or traders at the borders.

Price Fluctuation

The variation in the price of purchasing raw herbs or essential oil from producers and cooperatives in the supply chain is extremely high. This leads to instability in actual price for certain herbs. Difficulty among producers and collectors to connect to traders has also resulted in price fluctuation. Most of the producers or wild collectors are not familiar with the actual importance and commercial value of the herbs and their chemical constituents. They mostly rely on the traders or exporters for the pricing. Usually, farmers and collectors get the lowest and unfair value for MAPs.

Case Study #2: Perspectives and Challenges of a MAPs Farmer

Phurba Kulal, Ward 6, Chayanath-Rara, Mugu

Overview: Kulal has just started farming two Medicinal herbs: Chiraito, and Aatis. It's been six months, he hasn't had any harvest yet.

1. **Plant selection, seeds, and cultivation**

- I have planted two: Aatis and Chiraito
- Bought seeds of chiraito worth about Rs.12,000 from Nepalgunj. As for aatis – I myself went to the forest and got about 800 plants to plant on my land
- I have planted 5 bats of chiraito and 800 plants of Aatis
- Out of 800 aatis plants, 500 have grown. I have heard that chiraito is ready to harvest in 3 years' time. So, it will be a long wait before I can think of selling them in the market.

2. **Experience so far**

- I have started this farming with the hope that I will get a good return in due time. However, I also hear stories of people who started farming some of these MAPs, but could not sustain their farming for long.
- I also think that a lot will depend on how my harvest comes about, if I don't get enough returns to redo the farming – I will probably close my farms as well.
- I have been able to comfortably experiment this farming with very little knowledge– because I have enough land. We lack capital to start farming in a big scale. And what I have heard from other farmers is that, unless you can produce in large amount you cannot get enough returns to sustain the farm.

3. **Research into the farming**

- I started farming based on what I saw grew on the periphery of my village area. There is no research involved here.
- I have consulted few people regarding the soil and water, and temperature. But these are all based on experience rather than expertise. I don't even know what amount of water is needed or the type of manure for that matter. But because these grow in the wild without any human assistance – I hope I will get lucky as well.
- However, in the wild these have been growing for years – and that's probably why they are of good quality and are worth that much. Grown at home these might not be as valuable in the market. Plus, we lack a domestic market, I will need to find a buyer who will then sell to the bigger buyer in Nepalgunj or Kathmandu. So, I will be forced to sell at lower price.

4. **Investment so far**

- This is done by me and my family in our family farm.
- I have not taken any sort of grant. Don't know if they are available. Fortunately, I didn't have to take any loan for this.
- The cost so far is 12,000 for seed of aatis, a lot of hard work as I had to go to the forest to get the chiraito plants.
- I need to regularly tend to the plants, so that they are not eaten by the weed.

5. **Market knowledge**

- I have not started looking into that area.
- I have started the farm based on the price people are getting for the herbs that they collect from the forest. I myself used to collect and sell, so I have some ideas of what the market looks like for wild herbs, but not necessarily for the farmed ones.

6. **Challenges and expectations**

- Don't really know if the soil is good for the MAPs, and if there is enough water

SWOT Analysis for Essential Oil Production in Mustang and Mugu region 6.2

Most of the herbs exported from Nepal are endemic to Mustang and Mugu. The following SWOT Analysis summarizes the current scenario of MAPs and essential oil trade in Mustang and Mugu. The analysis was done on the basis of field study for feasibility analysis, focus group discussions with multi-stakeholders in the value chain, literature research, and archived local data from Mugu and Mustang.

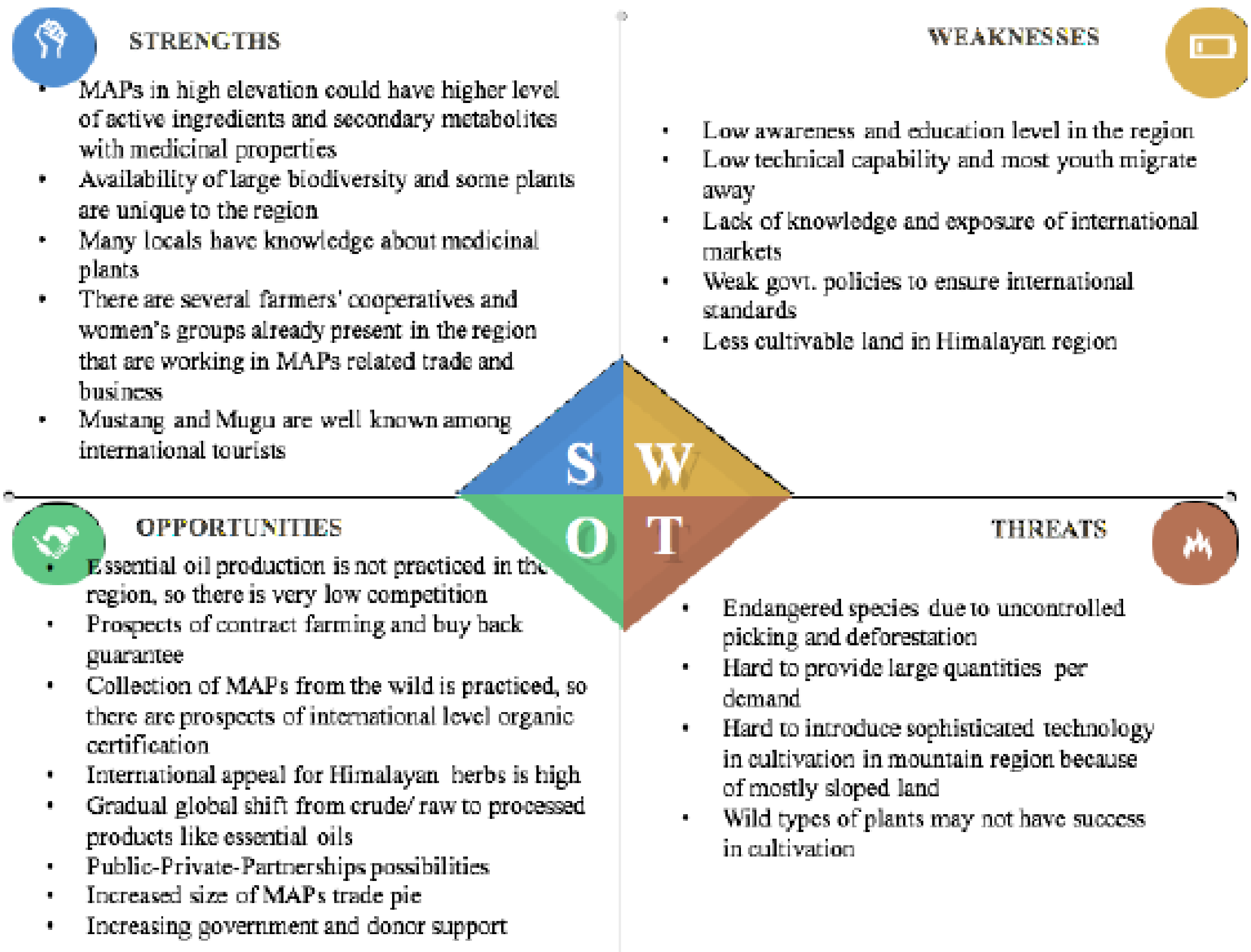

Figure 6.2. SWOT Analysis of MAPs and Essential Oils in Nepal

7 BUSINESS PLAN TEMPLATE FOR PRODUCTION OF MAPS ESSENTIAL OIL

This template can be utilized or modified based on the types of products, scale of production, and many other factors in a specific business.

Business Profile and Summary

Site Study For Probability Analysis of Establishment and Promotion of Distillation Plant in Collaboration with Local Concerned Authorities for Production of Aromatic Oil in Mugu And Mustang

Goals

● Add value to MAPs in Mustang and Mugu production of MAPs essential oil to maximize the return from MAPs cultivation and collection ● Establish MAPs essential oil distillation plant in Mustang and Mugu in collaboration with local authorities

● Expand national and international distribution network of MAPs essential oi

● Increase awareness about MAPs from himalayan region

Objectives

● Promote MAPs essential oil production via distillation in Mustang and Mugu in an organized and economically sustainable manner

● Access international market for MAPs essential oil

● Determine the costs and returns associated with production of MAPs essential oil using steam distillation unit

● Obtain competitive price of products in the international market

● Expand distribution network to include organic certified products' stores and international market

7.1 Business Plan for Essential oil Production from Wild MAPs Harvest

7.1.1 Income and Expense Report for Wild Timur Seeds (fruit), Wild Timur Essential Oil, and Wild Rhododendron essential oil

Business plan preparation date: dd/mm/yyyy

A Basic Information:

1. Entrepreneur’s name:

2. Age

3. Sex:

4. Name of business:

5. Address:

B Market and Production Plan:

B1. Brief description about products/services:

Installation of distillation unit for the production of essential oil from wild timur and wild rhododendron from Mustang and Mugu region

Production scale: scale- at least 5-10 tonnes per year (small and medium enterprises)

B2. Major market centre (current and target):

haat bazaar, district headquarters, Kathmandu, india, terai region, international market (target)

B3. Types of customers: (important for developing market strategy for individual entrepreneur)

All general households at market, small shops/retailers, middlemen.

B4. Products or service in comparison with competitors:

Name of service or products	Name of Major Competitors	Price Comparison	Quality Comparison	Packaging Comparison	Selling strategies Compared with Competitors
Timur seed	Other Wild timur collectors, high volume timur producers in terai regions	variable, mean = NRs. 70-150/kg – in line with other producers in local area	Good – in line with other producers in local area	Very simple to none (plastic bag or plastic container packaging – in line with other producers in local area	Local businessmen, national/ regional traders, road head traders, indian traders
Timur essential oil	Low local competition, high volume timur traders in terai region and kathmandu	variable, mean = NRs. 3500 - 6500/kg – in line with other producers in local area	Good – in line with other producers in local area	Very simple to none (HDPE containers packaging – in line with other producers in local area	Local businessmen, national/ regional traders, road head traders, indian traders
Rohododendron essential oil	Low local competition, high volume rhododendron traders from hilly and himalayan region	variable, mean = NRs. 10000 - 20000/kg – in line with other producers in local area	Good – in line with other producers in local area	Very simple to none (HDPE containers packaging – in line with other producers in local area	Local businessmen, national/ regional traders, road head traders, indian traders

B5. Market target in unit or price (monthly or annually) (note: very important here to set a target!) Sales price varies over the year; data below based on mean annual selling price, see B4 above

Target for lower Mustang region and Mugu

Timur seeds: 6000 kg of timur seeds/ years @NRs. 100 per kg **= NRs 600000**

Timur essential oil: 240kg essential oil (4% yield from 6000kg seeds) /year @NRs. 5500 per kg = **NRs 1320000**

Rhododendron essential oil: 120kg essential oil (2% yield from 6000kg flowers) /year @NRs. 10000 per kg = **NRs 1320000**

B6. Required fixed capital (machines/ tools/furniture fixture)

#	Fixed capital	Quantity	Rate per unit	Total Amount (NRs.)
1	SS wet steam distillation unit	1 unit - 1000L capacity	1000000	1000000
2	Facility to keep distillation unit (community owned)	1	100000	100000
3	Storage Center (community owned)	1	50000	50000
4	water tank (1000L)	1	15000	15000
5	weighing balance	1	4000	4000
6	Bucket and jug	2 each	500 per set	1000
7	HDPE containers	4	1000	4000
8	Furnitures			10000
Total capital investment		**For MAPs collection without additional processing**		65000
		Essential oil production only		1184000

NB. Depreciation is a fixed capital cost

B7. Depreciation over 3 years

#	Name of fixed capital	Total Amount (NRs.)	Depreciation rate (%)	Depreciation amount (NRs.)	Remarks
1	SS wet steam distillation unit	1000000	10%	100000	For essential oil project only
2	Facility to keep distillation unit (community owned)	100000	10%	10000	For essential oil project only
3	Storage Center (community owned)	50000	10%	5000	
4	water tank (1000L)	15000	10%	1500	For essential oil project only
5	weighing balance	4000	10%	400	
6	Bucket and jug	1000	10%	100	
7	HDPE containers	4000	10%	400	For essential oil project only
8	Furnitures	10000	10%	1000	
Depreciation in first year		**For MAPs collection without additional processing**		**5,000**	
		Essential oil production only		**116,900**	

NB. Depreciation is a fixed capital cost

C. Expenses Plan

C1. Calculation of raw materials (monthly/annually)

#	Description of raw materials	Quantity	Rate per unit	Total (NRs.)	Remarks
					Some of the raw materials are already mentioned in other sections
Total Annual cost of inputs					

C2. Human Resource cost for wage and salary – one-off and recurring

#	Description	Number of person days	Daily wage (NRs.)	Annual wage or salary (NRs.)
1	Wild collection and drying labor	300	300	90000
2	Labor required for distillation	50	350	17500
Total annual wage bill (first year only)				107,500

C3. Other costs (including overheads)

#	Description	Quantity	price/unit	Annual Expenses (NRs.)
1	Cost of land – rent equivalent	12 months	1500 per month	18000
2	fuel			40000

3	Transportation of timur fruit to main market	**6000kg**	2000 per 100kg	120000
4	Transportation of essential oil to main market	**240kg**	2000 per 100kg	4800
TOTAL		**For MAPs collection without additional processing**		**138,000**
		Essential oil production only		**62,800**

D. Financial Plan

D1. Calculation of per unit cost and selling price

		Annual Cost (NRs.)			
#	**Description**	**Wild timur**	**Wild Timur essential oil (4% yield)**	**Wild Rhododendron essential oil (2% yield)**	**Remarks**
1	Cost of raw materials (C1)	0	0		
2	Cost of Human Resource (C2)	90000	107,500	107,500	
3	Other costs (inc. overheads) (C3)	138,000	31400	31400	
4	Depreciation (B7)	5,000	58450	58450	assuming at least two types of MAPs will be distilled, the depreciation can be divided by the types of products (2 types in this case)
5	Interest	0	0	0	

A.	Total annual cost	233000	197350	197350	
B.	Per kg cost	39	822	1645	(total annual cost/annual market target)
C.	Profit Margin (rough estimate)	68%	85%	84%	
D.	Target mean selling price of essential oil (NRs) per kg	NRs 90/kg	NRs 5500/kg	NRs 10000/kg	

#	Description	Required days for calculation	Amount (NRs.)
1	Raw materials stock		0
2	Stock of semi-process goods		0
3	Stock		0
4	Credit facility		0
5	Cash for overhead cost management		0
	Total (NRs)		0

D3. Calculation of total capital

#	Description	Wild timur	Wild Timur essential oil (4% yield)	Wild Rhododendron essential oil (2% yield)	Remarks
1	Total fixed capital (B6)	65,000	11840000		Same unit can be used for multiple

D4. Source of capital

#	Description	Wild timur	Wild Timur essential oil (4% yield)	Rhododendron essential oil (2% yield)
1	Equity – self investment (D3)	65,000	11840000	
2	Loan	0	Bank, saving credit group, relatives	
Total (NRs.)		65,000	11840000	

D5. Calculation of profit and loss

		Amount (NRs.)		
#	Description	Wild timur	Wild Timur essential oil (4% yield)	Wild Rhododendron essential oil (2% yield)
1	Income from total sales (market target*selling price)	600000	1320000	1200000
2	Deduction of total expenses			
a	Cost of raw materials (D1 line 1)	0	0	0

D6 Return on investment (RoI): $\frac{\text{Net profit *100}}{\text{Total Investment}}$

Return of Investment (ROI)	Net profit	Total investment	ROI
Wild timur	367,000	233000	157
Wild Timur essential oil (4% yield)	1,122,650	197350	569
Rhododendron essential oil (2% yield)	1,002,650	197350	508

Note: Packaging and labeling is not included in the budget since it may vary significantlybased on the target market and other marketing and branding strategy.

D7 Conclusion:

In this section, income and investment plan was prepared to analyse the feasibility of establishing essential oil plant in Mustang and Mugu region. The high value MAPs wild timur and wild rhododendron were selected for the analysis. This study was performed for 3000 kg of wild MAPs collected from the region. According to this feasibility analysis, establishment of distillation plant for the production of essential oil from MAPs is feasible and highly profitable with more than 80% profit margin in essential oil production when only two types of MAPs, wild timur and wild rhododendron are produced. The return of investment was also found to be more than 500% in essential oil production of these MAPs. We also analyzed the financial implication of value addition to wild timur seeds by making wild timur essential oil. The profit margin increased from 68% (wild timur seeds) to 85% (wild timur oil) and similarly, return of investment increased from 157%(wild timur seeds) to 569% (wild timur oil) after value addition. This business plan template is based on the data obtained from the village development committee, MAPs collector, traders and farmers, MAPs conservation authorities, and market study. The investment and infrastructure required for MAPs distillation is not too high (~30-50 lakhs for 3000 - 5000 kg capacity distillation unit set up) compared to huge return and possibility for growth and diversification of MAPs being processed. If different types of MAPs essential oils are commercially produced then there is even more possibility for higher return and higher profit margin. Additionally, the target pricing in the template is determined based on domestic market. The value of these products can be much higher in international market if the niche market is targeted that focuses on MAPs only available in himalayan region with unique secondary metabolites with high medicinal properties.

8 QUALITY ASSURANCE AND CERTIFICATIONS OF MAPS ESSENTIAL OIL

8.1 The need for quality assurance

There is a huge demand for medicinal and aromatic plants (MAPs) and products worldwide for use in medicines, cosmetics, foods, and fragrances. To compensate for this demand, MAPs are imported exported from one country to the other worldwide. With increasing awareness and safety concerns of consumers, the quality protocols for MAPs products are becoming increasingly stringent and specific. The quality standards for MAPs are most demanding in the US, Europe, and Canada who are also the top importers of MAPs-related products. Therefore, it is absolutely necessary to ensure good quality of MAPs being produced and sold, especially in these international markets. Different plants of different physical and chemical properties that can be tested in a well managed laboratory with high accuracy. These components dictate and indicate the nutritional value, medical efficacy, and aromatic properties of MAPs. Thus, analysing the chemical and physical properties of MAPs is important to identify the authenticity, adulteration possibilities, improper storage damage, presence of harmful chemicals compounds, and quantity of useful chemical constituents.

Currently, Nepal is in the preliminary stages in terms of quality assurance of MAPs compared to international standards. For Nepal to be competitive in the international MAPs market, the quality regulations and laboratory facilities for testing has to be upgraded to be in par with international code and standards.

8.2 International market quality standards and requirements

International buyers increasingly require compliance with international standard under the WTO's Sanitary and Phytosanitary Measures (SPS) Agreement. SPS agreement is consistent with the standards and guidelines of the FAO and WHO with respect to food additives, pesticide residues, contaminants, hygienic practices and methods of analysis and sampling for harmonizing international rules in this field of trade. The main reason for the popularity of SPS compliance among buyers is because World Trade organization (WTO) encourages member countries to use internationally harmonized standards as a basis for their SPS measures in order to reduce distortions in market access. All major MAPs importers like the USA, EU, require all herbal products including essential oils to be made under the Good Manufacturing Practice (GMP) code developed by WHO. The GMP code is an internationally harmonized system for assuring quality and sanitary standards in trade related to medicinal products.[12]

8.2.1 Domestic standards

To ensure domestic standards of MAPs essential oil in Nepal, some of the government regulatory bodies like Ministry of Forest and Soil Conservation, Government of Nepal, and Department of Plant Resources (DPR) have set some key technical regulations. While it is an important step to ensure quality of MAPs essential oil, the standards set by these regulatory bodies are not in par with the international SPS or GMP standards and lack adequate infrastructure to certify per international code. Therefore, it becomes very difficult or impossible for MAPs producers and traders to be competitive in national and international market by assuring high quality MAPs products.[12]

Table 8.1. Key physical and chemical properties of essential oils tested for quality assurance

Organoleptic properties	
Appearance	
Color	
Aroma	
Physical properties	
Specific gravity	
Viscosity	
Optical rotation	
Refractive Index	
Chemical properties	
Acid number	
Ester number	
Ester number for acetylation	
Solubility	
Chemical constituents/ active ingredients	
Harmful chemicals	
Pesticides	
Heavy metals (lead, arsenic, etc)	
Persistent organic pollutants (POPs)	

8.2.2 Certifications

Certifications of MAPs products ensures that producers have met a set standards and criteria that are allocated by the certifying body. These standards are generally set by the authorizing body with health and wellbeing of consumers and sustainability of the environment as a priority.

8.2.3 Benefits of certifications

- Ensure greater access to existing and fast-growing markets
- Help protect the environment from harmful products and processes

- Helps MAPs producers to receive premium prices for their products
- Support local economies
- Access additional funding and technical assistance programs

8.2.4 Challenges for certifications process in Nepal

The key challenges for international certification process in Nepal are:

Awareness
There is very low level of awareness and information about certifications and their benefits. Even though there may be awareness about certification, there is not sufficient information about the process of getting certified.

Process
The certification processes could be very strict and meticulous. It could involve many steps like training, inspection, and follow-ups, which have to be done within specific deadline and guidelines to be approved for certification.

Time and Cost
The international certification of products and services can be expensive and time consuming, since it involves a long process with several steps.

Figure 8.1. Examples of Various Certifications of MAPs products

9 KEY FINDINGS, INTERVENTIONS, AND RECOMMENDATIONS TO PROMOTE MAPS ESSENTIAL OIL PRODUCTION IN MUSTANG AND MUGU REGION

9.1.1 Maximizing the strengths and opportunities & minimizing the weakness and threats

The following interventions (**Table 9.1**) are recommended to establish distillation plant in Mustang and Mugu region for the production of essential oil using MAPs in the region. These recommendations are based on our field study in Mustang and Mugu, the SWOT analysis (**Figure 6.2**), and the value chain map of key stakeholders, activities, and value propositions (**Figure 6.1**).

Table 9.1. Recommendations based on the field study in Mustang and Mugu's MAPs essential oil SWOT analysis

STRENGTHS	HOW TO MAXIMIZE?
• MAPs in high elevation could have higher level of active ingredients and secondary metabolites with medicinal properties • Availability of large biodiversity and some plants are unique to the region • Many locals have knowledge about medicinal plants • There are several farmers' cooperatives and women's groups already present in the region that are working in MAPs related trade and business • Mustang and Mugu are well known among international tourists	• Quality certifications can confirm the level of chemical components, which will increase the price of the product • Diversity of MAPs can be utilized by producing their essential oil to be unique in the market and also to serve larger range of customers • Already existing community groups can be mobilized easily • Popularity of Mustang and Mugu can be leveraged while marketing to international customers and entering new markets
OPPORTUNITIES	**HOW TO EXPLOIT?**
• Essential oil production is not practiced in the region, so there is very low competition • Prospects of contract farming and buy back guarantee • Collection of MAPs from the wild is practiced, so there are prospects of international level organic certification • International appeal for Himalayan herbs is high • Gradual global shift from crude/ raw to processed products like essential oils • Public-Private-Partnerships possibilities • Increased size of MAPs trade pie • Increasing government and donor support	• Set up distillation unit in the region and form a cooperative of MAPs collectors and farmers to collect the necessary MAPs • Get organic and natural certification of essential oil produced from wild grown MAPs • Register geographical indication to promote essential oil from Mustang and Mugu • Involve local authorities and other local stakeholders involved in the MAPs value chain to strengthen the value chain and make it a sustainable enterprise • Collaborate with government and NGOs for funding to support the enterprise

THREATS	HOW TO COUNTER?
• Endangered species due to uncontrolled picking and deforestation • Hard to provide large quantities per demand • Hard to introduce sophisticated technology in cultivation in mountain region because of mostly sloped land • Wild types of plants may not have success in cultivation	• Formulate and implement sustainable strategy for wild collection based on growth and harvest cycle of each plant species • Exercise hybrid strategy for MAPs collection by promoting both sustainable cultivation and wild collection of MAPs • Establish seed banks, and research and development nurseries, to preserve the seeds and plantlets and to study the potential of growing various plant species in the selected cultivation areas
WEAKNESSES	**HOW TO MINIMIZE?**
• Low awareness and education level in the region • Low technical capability and most youth migrate away • Lack of knowledge and exposure of international markets • Weak govt. policies to ensure international standards • Less cultivable land in Himalayan region	• Provide trainings and workshops to provide information about benefits of value addition to MAPs by producing essential oils • Train the locals to maintain and operate steam distillation plants • Advocate to create government policies to create quality regulations and quality assurance per international standards

9.2 Recommendations for Interventions

9.2.1 Technical Support for Cultivation, and Harvest/ Collection, and District-level Infrastructure Support for Proper Storage Hubs

Proper technical trainings and consultations should be conducted to avoid loss due to lack of timely technical information. Some of the criteria for cultivation are - good quality seeds, soil testing, plant care details, etc. Seeds play a vital role to determine the quality of the final product/plant. Therefore, it is necessary to support a local seed back through farming cooperatives or public-private partnerships (see below). Before harvesting MAPs, it is necessary to understand the harvest cycle of the plants and equipments necessary to harvest or collect the plants as well. MAPs in the Himalayan region are mostly collected in the wild, so sustainable procedure for collection is vital to ensure timely re-growth and availability. Storage of the harvested/ collected products is important to prevent microbiological contamination, avoid spoilage, and to increase the shelf life of the product. The storage conditions may differ based on the forms of the MAPs raw or processed. Establishment of a district level storage area/hubs where the MAPs products' can be properly stored will reduce the cost and hassle for the individual and cooperative farmers/collectors alike.

9.2.2 Engaging local authorities as key collaborators in MAPs collection, cultivation, and distillation process

A large number of local community people in Mustang and Mugu are engaged in the collection of MAPs for their livelihood. Therefore, formulation of proper legal procedures for MAPs and essential oils can contribute immensely to the upliftment of the socio-economic status of the local community as well as towards prevention of over exploitation of natural herbs.

In this context, local authorities can be key collaborators in MAPs' wild harvesting, storage, processing and for also organised cultivation for MAPs. In Mustang and Mugu, it is seen that there is a strong influence of authoritative individuals such as the Mukhiya in the community and their suggestions have been passed down from generation to generation usually through oral communication. Also, strong cultural ties and co-operation between members of the Thakali community in Mustang provides another advantage of involving a significant proportion of the local workforce in MAPs. Similarly, organizations like Aama Samuha and Women's Cooperatives that have a strong influence on the day-to-day social affairs can also be taken into consideration while involving the local community.

Furthermore, the Annapurna Conservation Area Project (ACAP) office is another equally important potential collaborator. The officials are treated with respect and their suggestions are received positively in the society. Therefore, the ACAP can play a significant role in helping people understand the scope of medicinal plant processing in Mustang and Mugu and thus encouraging participation in that sector.

A very good example is set by Dabur Nepal's "Agarkara Seed Bank" in Mustang

Figure 9.1. Agarkara Farming in Marpha, Mustang

Case Study#3: Engaging Local Community and Authorities for MAPs farming
Dabur Nepal
Farm: Marpha, Mustang

Purpose: Seed banks and plantlets growth of Agarkara
Manager: Mr. Lal Mani Pokharel

Dabur Nepal has firmly placed itself on the ground in Mustang for the last 17 years. It has been cultivating Agarkara plants for seed generation and collects almost 2.5 tonnes of seed per season in ~16-20 ropani land from Mustang. Initially seeds were collected from India for Agarkara farming in terai region. Dabur attempted to cultivate Agarkara in various parts of Nepal for seeds, and finally was successful in getting high quality seeds in Mustang. Due to cold climatic conditions of himalayan range, Agarkara farming fits well in Mustang and also has a very common farming procedures like other crops. Collected seeds are transported to Birgunj, Nepal for cultivation of Agarkara plants and further processing.

"Anacyclus pyrethrum Pennel, Agarkara, is a perennial plant and its root is widely used as medicinal purpose. The extracts of Agarkara root has medicinal properties and is used as one of the constituents of Chyawanprash, cough syrup, paste etc." Dabur Nepal has involved the local authority, Mukhiya of Marpha, Mustang Mr. James Hirachan as a local coordination and consultation point. Hirachan also owns his own Marpha "Apple Whiskey" distillery as well and is actively involved in other community activities. Agarkara cultivation and seed bank provides employment opportunities to local community throughout the year for activities like land preparation, cultivation, seed processing and storage. This has improved and diversified incomes for vulnerable and marginalised people in the community and also sustainable farming.

Figure 9.3. Dried Agarkara seeds collected from the farm to be transported to Dabur farm in Birgung innovative approaches in region like Mustang and Mugu where most of the people have very low appetite to taking risks and starting new activities due to various socio-cultural and economic reasons.

9.2.3 Technical and Infrastructure Support for Processing of Medicinal Plants

Processing of MAPs is key to advancing and being competitive in the MAPs trade. There is very limited technical knowledge and support in MAPs processing in Mustang and Mugu region. While there have been several efforts, very minimal progress is observed. Currently, essential oils distillation is not being practiced in Mustang and Mugu region, but there is prospect to establish MAPs distillation plants in the region. The distillation plants should be located selected areas with easy road access for transport of raw and processed materials.

The area should also have fuel/energy source. The cost of distillation plants can range from 10 lakhs to more than 60 lakhs based on the type, model, capacity, etc. In the initial stage, medium-scale distillation until should be installed in a central location as a pilot project to further understand the possible limitations and opportunities for improvement. After several iterations, the model should be replicated with local context in project design. Import and Installation of new technologies should be complemented by proper training to generate skilled and knowledgeable human resource in the region and country.

9.2.4 Quality Assurance and Certifications to Ensure International Trade Standards for Export

Good quality and consistency are absolutely necessary to be competitive in the international MAPs trade arena. The consumers of MAPs and essential oil are specially very aware and conscious about the quality of the product. The quality of the product can be discussed under two main categories from an international trade perspective- related to food safety, human, animal or plant health, and related to methods involved in processing and production of the product. In case of essential oils and MAPs, the quality criteria are even more stringent since these are use in preparing products like medicine, edibles, cosmetics, where consumers are directly in contact to the product. Quality assurance (QA) and certification also adds value to the product in international market. The importers like USA and several countries of Europe, are willing to invest significantly higher value for the product that have international level QA or certifications. In fact, some of them do not entertain products that do not meet specific quality criteria. Department of Plant Resources (DPR), Ministry of Forest and Soil Conservation, Government of Nepal, is the central agency authorized to issue quality certification, except for organic certification, of MAPs and essential oils of Nepal. However, DPR is not fully equipped and capable of certifying quality of products other than CITES certification (chemical composition and packaging). Government should invest on such institutions to fully equip them with necessary instruments for thorough international level analyses of MAPs.

9.2.5 Marketing, Branding, and Pricing Awareness and Training to Increase

Competitiveness and Add Value

Highlighting the elements of rich indigenous knowledge in promoting the products from Mustang, Mugu and other Himalayan region of Nepal could one of the key branding strategies to attract international market and gain competitive advantage over other similar products. The farmers, collectors, local traders, and other individuals in the MAPs supply value chain should be aware of business strategies like marketing, branding, and pricing so that they can gain higher value by implementing these strategies per their need and interest.

Business awareness also prevents random price fluctuations in the market, where farmers/collectors, who are at the bottom of the value chain, are misled and poorly paid for their products. Proper packaging and labeling also supports value addition and assure quality consistency over longer period of time. The farmers are collectors are not getting fair price for their products where lack of market awareness and marketing trainings are two major factors for their halted growth. Thus, marketing related trainings should be provided to them. They also need to be connected to the market, but only connecting to market without awareness only leads to ultimate failure to enter, capture, and flourish in the market.

9.2.6 Research and Development for Conservation, Sustainability and Advancement

Prioritization of research and development in different areas favouring advanced instruments, methodologies and modern technology in medicinal plants research laboratories, technology development for the production of herbal products, standardization and quality assurance of medicinal plants and plant products is recommended. Since Mustang and Mugu has so much potential in terms of medicinal herbs and their value added products, very few are in practice while others herb resources are still unexplored which calls for the alarming need for R&D and adequate budget allocations depending on priority sectors. Easy accessibility of website or databank sharing research outcomes/information among public private institutions at least within Nepal is recommended. The attractive scientific and financial incentives for people working in MAPs is a necessity of current scenario in order to generate good revenue form high value processed products.

9.2.7 Biobank establishment (herbs nursery for conservation and cultivation) to Guarantee Better/ Advanced Quality Seeds and Plantlets

Biobanks can be a huge reservoir for conservation of species that are in the verge of extinction and as a repository of high value medicinal plants, The biobank can be of plantlets, seeds or roots.

Policy level interventions are necessary in Mustang and Mugu which are botanical resources of high value plants. In order to conserve, sustainable cultivation and utilization of herbs biobank can be a useful database for researchers, organizations involved in MAPs, students, traders, farmers, concerned individuals, and investors in Nepal and beyond.

9.2.8 Industrialization and Intellectual Property Rights (IPR)

There is a need to transform and enhance value creation of herbal sector through technology and processing methodologies by capitalizing on the strength of MAPs in order to commercialize discoveries in natural products so as to promote the position of Nepal in bio-generic as well as industrial market. It is recommended to build the processing plants in potential areas of Mustang and Mugu as well as develop technical resource capabilities in line with market need through special policies, schemes, programs and trainings.

Development of infrastructure by applying competitive “field to market” incentives and fundings to promote committed participations of locals, experts, researchers, private sector, stakeholders and government-linked companies is recommended.

Strong policies to create an enabling environment through continuous revenues of country’s framework and procedure in line with global standards and best practices is recommended. The clear understanding of the access and benefit sharing of natural herbs, conservation, sustainable utilization, indigenous knowledge protection and information sharing should be at policy level. There is also a need for development of protocol and a strong intellectual property regime to support research and development and commercialization efforts.

9.2.9 Formulation and Implementation of Government Trade Policies

Trade policies specific to the region have to be formulated to create an environment conducive to socio-economic growth in the region. In the case of Mustang and Mugu, both the regions are protected as conservation areas to prevent uncontrolled and illegal trade of MAPs. However, if the conservation policies are not in alignment with the trade policies then it can pose economic threat to the region by disabling the optimal use and trade of resources in the region. Policies should be formulated such that sustainable harvest and collection of MAPs is promoted, instead of being completely stopped. Since it is a highly sensitive and debated topic, the policies should include the recommendations of not just the experts, but also the locals who have to follow the policy rules and regulations, if implemented. Another challenge is that of having proper policies in place, but lacking implementation. Different stakeholders like local community leaders, conservation organizations like ACAP, and government should also be involved to bring policy to implementation.

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Useful Link resources

1. https://en.wikipedia.org/wiki

2. http://hppcl.com.np/herbal-products/essential-oils

3. http://www.mbiotech.com.np/essential-oil/

4. http://www.biosysnepal.com.np

5. http://www.floracopeia.com/Essential-Oils/essential-oils-sub/wild harvested-rhododendron-oil.html

6. https://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|524||||0409|||4|1|1|2| 2|1|1|4|1

7. http://www.worldstopexports.com

8. https://echa.europa.eu/support/substance-identification/sector-specific-support-for-substance-identification/essential-oils

11 SUPPLEMENTARY DATA

Field Group Discussion (FGD) Questionnaires

MUSTANG/MUGU

FGD/ interview with farmers/ traders/ cooperative (MAPs: Medicinal and Aromatic plants-ayurvedic tatha sugandhit jadibuti)

Objectives:

• Plants being cultivated

• Cultivation methods

• Scale of production

• Processing methods and scale

• Trading Mechanism

• Raw or value added form?

• Livelihood

• Challenges

Questions:

1) Plants being cultivated

a) Different aromatic plants types

b) Are there any major preferential plants for cultivation and why?

c) According to you which aromatic plants has high commercial value.

d) Are there certain plants that are harder or more risky to cultivate than others?

e) Where do you bring the seeds or plantlets from? Is the source uniform every year?

f) Types of land suitable for MAPs cultivation?

2) Cultivation methods

a) Existing methods of cultivating,harvesting, collection and storage

b) Seasonal cultivation or not

c) Major constraints faced while cultivation

d) How long have you been practicing the same techniques

e) Is there any cultivation training programs for local farmers?

f) Any advanced technology introduced to mitigate management interventions?

g) Water source? Irrigation methods?

h) Collection model vs individual sellers model?

3) Scale of production

a) Individual farming scale vs cooperative farming scale

b) Annual production rates (in kg) of different aromatic plants

c) Is plant production consistent, increased or decreased in last 5 years?

4) Processing methods and scale

a) What is the final form before trading?

b) Based on the form what are the processing methods?

c) In case of aromatic oils, are there further steps after distillation?

d) What happens to the by-products after the oil distillation process?

e) What types of distillation plants do you use?

f) What is the capacity (in kg)?

g) How much did it cost? Where did you bring it from? Which year did you get it? (Make, Year, Company, number of vessels, coolers, heating process, general cost for fuel per round of distillation, water supply)

h) Do you share the distillation unit with other farmers?

i) How much is the vessel used? Hours per cycle of distillation?

j) Human resource involved in the process?

k) Are the HR/ technicians/farmers trained?

l) Maintenance process and cost?

5) Trading Mechanism

a) Do you trade directly or do you supply these to other traders?

b) Where do you take these products?

c) Who are the biggest buyers?

d) How many middlemen are there in the trading process?

e) How much do you get per kg?

f) Does the price fluctuate? What are some of the factors for fluctuation of price as pointed by the buyers?

6) Raw or value added form? Branding/ Marketing?

a) Are the oils further refined?

b) Are the oils sold in bulk or are branded before selling?

c) Have you received trainings for marketing/ branding/ value add?

d) Do you have some ideas for value add?

7) Livelihood?

a) Has MAPs cultivation and distillation increased your income?

b) When did you get the return of investment and started getting profit?

c) Do you plan on continuing or scaling up MAPs cultivation?

d) Do you plan to diversify the crop types?

e) How Socio-economic aspect of cultivating MAPs affects your life?

8) Multi stakeholder engagement?

a) What kinds of support have you gotten from external stakeholders?

i) Government

ii) Private sector

iii) NGOs/ INGOs

9) Challenges

a) What are some of your challenges?

b) Any challenges in these specific areas?

i) Access to Market

ii) Risks related to farming and harvesting?

iii) Yield fluctuation

iv) Price fluctuation

v) Social challenges

vi) Access to Finance?

vii) Climatic/Seasonal/year-to-year changes?

viii) Lack of skilled Human resource?

ix) Technical challenges- crop selection, technology used, distillation

x) Business acumen

xi) Storage

xii) Lack of experts for utilizing available technology?

FGD Quesionnaires translated to Nepali

ङ) तपाई वनस्पति (बिरुवा) कँहाबाट ल्याउनु हुन्छ ?प्रत्येक वर्ष Is the source uniform every year?

च. के जडीबुटी र सुगन्धित वनस्पतिका खेतीको लागि उपर्युक्त जमिन छ ?

२. खेतीका विधिहरु

क. खेती, संकलन र भण्डारणको लागि भइरहेका तरिका ।

ख) मौसमी खेती हो वा होइन ?

ग) खेती गर्ने क्रममा मूख्य के के मूख्य समस्याहरुको सामाना गर्नुपरेको थियो ?

घ.तपाई कहिले देखी एउटै तरिकाले खेती गर्दै आइरहनु भएको छ ?

ङ . के त्यँहा स्थानीय कृषकहरुको लागि खेती सम्बन्धि प्रशिक्षण(तालीम) कार्यक्रम भएका छन् ?

च. कुनै पनि आधुनिक प्रविधिहरु introduced to mitigate management interventions?

छ. पानीको स्रोत कस्तो छ ? सिँचाईका विधिहरु के के छन् ?

ज. संकलन तरिका- Collection model vs individual sellers model?

३. उत्पादनको मात्रा

क) व्यक्तिगत रुपमा गरिने खेती vs सहकारी मार्फत गरिने खेती

ख) विभिन्न सुगन्धित वनस्पति (बिरुवा) को वार्षिक उत्पादन दर (किलो ग्राम)

ग) पछिल्लो ५ वर्षमा वनस्पति (बिरुवा) उत्पादन दर घटेको वा बढेको छ ?

४. प्रशोधनको विधि र मापन

क) व्यपार गर्नु अघि What is the final form

ख) फारमका आधारमा प्रसोधनका विधिहरु के हो ?

ग) सुगन्धित तेलको अवस्थामा distillation पछिका कदमहरु के के छन् ?

घ) सुगन्धित तेलको आसवन (distillation) प्रक्रिया पछिमा अवस्थामा उत्पादन के हुन्छ ?

ङ तपाई कस्तो प्रकारको आसवन संयन्त्र प्रयोग गर्नुहुन्छ?

च. उत्पादनको क्षमता (केजीमा) कति छ ?

छ. यसमा कति लागत लागेको थियो? तपाईले कहाँबाट ल्याउनुभयो ? तपाईले कुन वर्ष पाउनुभयो? (वर्ष, कम्पनी, भाँडाहरुको संख्या, कूलर, हीटिंग प्रक्रिया, आसवन (distillation) का लागि प्रति ईन्धनको सामान्य लागत, जल आपूर्ति)

ज. तपाई आसवन आसवन (distillation) इकाई अन्य किसानसँग साझेदारी गर्नुहुन्छ?

झ. पोतको प्रयोग कति गर्नुहुन्छ ? आसवन (distillation) को घन्टा प्रति चक्र कति पर्दछ ?

ञ. आसवन (distillation) प्रक्रियामा मानव संसाधन पनि संलग्न छ ?

ट. के मानव संसाधन/प्रविधिहरू/किसानहरू प्रशिक्षित (तालीम पाएका) छन्?

ड. मर्मत प्रक्रिया र लागत ?

५. व्यापारिक संयन्त्र

क. के तपाई सिधै व्यापार गर्नुहुन्छ वा तपाई अन्य व्यापारीहरूलाई आपूर्ति गर्नुहुन्छ ?

ख. तपाई यी उत्पादनहरू कहाँ लैजानुहुन्छ?

ग. तपाईको सबै भन्दा ठूलो खरीदारहरु (खरिद गर्ने) को हुन् ?

घ. व्यापार प्रक्रियामा कति बिचौलियाहरू (middlemen) छन्?

ङ . तपाईले प्रति किलोग्राम कति कमाउनुहुन्छ?

घ. के मूल्यमा उतार चढाव हुन्छ ? मूल्यको उतार चढाव हुनुको कारण खरिदहरू (खरिद गर्ने) के कुरालाई मान्छन् ?

६ कच्चा पदार्थ र value added product- (ब्रान्डींग/बजारिकरण)

क. के तेलहरू अझ परिष्कृत भएका छन् ?

ख. के तेलहरू थोकमा बिक्री गरिएका छन् वा बिक्री गर्नु अघि ब्रान्डेड हुन्छ ?

ग. के तपाईले मार्केटिंग /ब्रान्डिङ/सामानको मूल्य थपिने तरिका सम्बन्धी कुनै तालीम प्राप्त गर्नुभएको छ?

घ. तपाईसँग सामानको मूल्य थपिनका लागि कुनै उपाय छ?

७ जीवनशैली

क. जडीबुटी र सुगन्धित वनस्पतिका खेती र आसवनले (distillation)तपाईको आयमा वृद्धि गरेको छ ?

ख. तपाई लगानी कहिले उठाउनु भयो र कहिलेबाट लाभ प्राप्त गर्न शुरु गर्नुभयो?

ग. तपाई जडीबुटी र सुगन्धित वनस्पतिको खेती जारी राख्ने वा स्केलिंग गर्ने योजना बनाउनु भएको छ ?

घ. के तपाइले उत्पादनको (फसल) प्रकारमा विविधता गर्ने योजना बनाउनुहुन्छ?

ङ. जडीबुटी र सुगन्धित वनस्पतिको खेतीले सामाजिक –आर्थिक पक्षमा तपाईको जीवनलाई प्रभाव पार्दछ ?

८. सरोकारवालाहरूको सहभागिता

१. तपाईले बाहिरी सरोकारवालाहरूबाट के कस्तो प्रकारको सहयोग प्राप्त गर्नुभयो?

क. सरकार

ख. निजी क्षेत्र

ग. गैर सरकारी संस्थाहरु- आई.एन.जी ओ.

९. चुनौतीहरू

क. तपाईका चुनौतीहरू क के हुन ?

ख. विशेष क्षेत्रहरुमा कुनै पनि चुनौतीहरू?

क. बजारमा पहुँच

ख. कृषि र कटाई संग सम्बन्धित जोखिम?

ग. उतार चढाव

घ. मूल्य उतार चढाव

ङ. सामाजिक चुनौतीहरू

च. वित्तमा पहुँच

छ. मौसम- मौसमी-प्रत्येक सालमा परिवर्तनहरू ?

ज. दक्ष् जनशक्ति-सीपयुक्त मानव स्रोतको कमी?

झ. प्राविधिक चुनौतीहरू (फसल चयन, प्रविधिको प्रयोग, आसवन)

ञ. व्यापारिक क्षमता

ट. भण्डारण

ठ. उपलब्ध प्रविधिको प्रयोगका लागि विशेषज्ञहरुको कमी छ ?

Survey Form

नाम:	थर:
उमेर:	विवाहित अविवाहित एकल
ठेगाना:	टोलको नाम:
सम्पर्क नं.:	न.पा./गाविस र वार्ड नं.
शैक्षिक योग्यता: कति कक्षा सम्म पढ्नुभएको छ ? ______	
पारिवारिक बिवरण: सदस्य संख्या _______	
महिला संख्या _________	पुरुष संख्या _________
कमाउने _________	नकमाउने _________
विदेशमा _________	स्वदेशमा _________
वैदेशिक रोजगारीको लागि जानु भएको छ की छैन ?	

तपाई कुनै संघ सस्था वा समूह संग आबद्ध हुनुहुन्छ? यदि छ भने ति के-के हुन्, कृपया नाम

सहित उल्लेख गर्नु होला?

सहकारी ____________________

आमा समूह ____________________

महिला समूह ____________________

कृषि समूह ____________________

अन्य ____________________

तपाईको उद्यमको मुख्य बजार कुन कुन हुन् ?

सामुदाय

सादरमुकाम

काठमाण्डौ

नेपालको अन्य ठूलो बजार

अन्तरारिट्रय बजार

अन्य ___________

MAPs Production in Mustang and Mugu

Research Area: Lower Mustang

Table 11.1. Micro forest production situation and total quantity ready to export data (2011-2012)

VDC- Jomsom

Species	Approx density per sq.m	Land occupied area	Production	Present stock	Total collection Quantity
Yarshagumba	0.05	541		33.8kg/hec	33.5kg
Dalechuk (Hippophaesalicifolia.)	1.57	23	115 gram fruits	450 kg/hec	350kg/hec
Sunpati (Rhododendron anthopogon)	3.25	237			75% of land area and productivity
Total		801			

Total land area 18420 hec, Possible availability for herbs in 801 hec

Source: ACAP

Table 11.2. Micro forest production situation and total quantity ready to export data(2011-2012) **VDC- Kobang**

Species	**Approx density per sq.m**	**Land occupied area**	**Production**	**Present stock**	**Total collection Quantity**
Yarshagumba	0.05	1170		0.0625 kg, 250 piece/hec	0.0625 kg, 250 piece/hec
Dalechuk (Hippophaesa licifolia.)	0.165(35% immature, 35% healthy)	40	115 gram fruits	100 kg/hec	75kg/hec
Sunpati (Rhododendron anthopogon)	3.25	239			75% of land area and productivity
Lauth salla (Taxus Wallichiana)	0.02	327		700kg/hec	264kg/hec
Atis (Aconitum heterophyllm)	0.66	239	15gm dry tubar	100kg/hec	50kg/hec
Total		2015			

Total land area 8015 hec, Possible availability for herbs in 2015 hec

Source: ACAP

Table 11.3. Micro forest production situation and total quantity ready to export data (2011-2012) **VDC- Lete**

Species	Approx density per sq.m	Land occupied area	Production	Present stock	Total collection Quantity
Yarshagumba	0.05	325		0.0625 kg, 250 piece/hec	0.0625 kg, 250 piece/hec
Dalechuk (Hippophaesalicifolia.)	1.57	160	115 gram fruits	450 kg/hec	337.5kg/hec
Sunpati (Rhododendron anthopogon)	3.25	171			75% of land area and productivity
Lauth salla (Taxus Wallichiana)	0.05	67		1000kg/hec	330kg/hec
Atis (Aconitum heterophyllm)	1.75	322	15gm dry tubar	250 kg/hec	220kg/hec
Total		1044			

Total land area 5080 hec, Possible availability for herbs in 1044 hec

Source ACAP

Table 11.4. Micro forest production situation and total quantity ready to export data(2011-2012) **VDC- Tukuche**

Species	Approx density per sq.m	Land occupied area	Production	Present stock	Total collection Quantity
Yarshagumba	0.05	806		0.0625kg or 50 piece/hec	0.0625kg or 250 piece/hec
Dalechuk (Hippophaes alicifolia.)	1.57	56	115 gram fruits	450 kg/hec	338.5kg/hec
Sunpati (Rhododendron anthopogon)	3.25	203			75% of land area and productivity
Total		1065			

Total land area 1225.4 hec, Possible availability for herbs in 1065 hec

Source: ACAP

Table 11.5. Micro forest production situation and total quantity ready to export data(2011-2012) **VDC- Kunjo**

Species	Approx density per sq.m	Land occupied area	Production/ Plant (green Weight)	Present stock	Total collection Quantity
Yarshagumba	0.05	240		0.0625 kg, 250 piece/hec	0.0625 kg, 250 piece/hec
Dalechuk (Hippophaes alicifolia.)	1.45	18	115 gram fruits	400 kg/hec	300kg/hec
Sunpati (Rhododendron anthopogon)	3.25	54			75% of land area and productivity
Lauth salla (Taxus Wallichiana)	0.32	64		1500kg/hec	495kg/hec
Atis (Aconitum heterophyllm)	1.58	211	15gm dry tubar	230 kg/hec	200kg/hec
Total		587			

Total land area 7599 hec, Possible availability for herbs in 587 hec

Source ACAP

Selected Field Research Pictures from Mustang and Mugu

Figure 11.1. In front of ACAP office, Jomsom, Mustang after informational interiews and data collection

Figure 11.2. Dr. Tsampa Ngawang Gurung, an internationally renowned Amchi from Jomsom, Mustang

Figure 11.3. Dr. Tsampa Ngawang Gurung's MAPs farm in Mustang

Figure 11.4. Interviewing Mr. Chandra Gauchan in Mustang

Figure 11.5. Mr. Chandra Gauchan's greenhouse nursery in Gunjo, Mustang

Figure 11.6. Meeting with the Mayor to discuss the project plan and ideas in Mugu

Figure 11.7. Visiting research site for FGDs and stakeholder interviews in Mugu

Figure 11.8. Gamghadi District Headquarter in Mugu

FGD Quesionnaires translated to Nepali

मुगु/Mugu

जडीबुटी तथा सुगन्धित बिरुवाअधारित भएर किसान/व्यापारीहरू/सहकारीसँगको एफजीडी/अन्तरवार्ता)

उद्देश्यहरुः

- बिरुवाहरुको खेती गरिदैं
- खेतीका बिधिहरु
- उत्पादनको मात्रा
- प्रशोधनको बिधि र मापन
- व्यपारिक संयन्त्र
- कच्चा पदार्थ र value added product
- जीवनशैली
- चुनौतीहरु

प्रश्नहरु

१. बिरुवाहरुको खेती गरिदैं

क) बिभिन्न सुगन्धित वनस्पतिका (बिरुवा) प्रकारहरु

ख) खेतीका लागि त्यँहा मूख्य प्राथमिकताको वनस्तति (बिरुवा) के हो र किन छ ?

ग) तपाईंको अनुसार सुगन्धित वनस्पति (बिरुवा) को उचित व्यपारिक मल्य कायम छ ?

घ) त्यँहा कुनै यस्तो वनस्पति (बिरुवा) छ ? जुन अरु वनस्पति (बिरुवा) को तुलनामा खेती गर्न अलि गाह्रो अथवा जोखिमयुक्त रहेको छ ?

Government of Nepal
Ministry of Industry, Commerce and Supplies
Trade and Export Promotion Centre