

**PROJECT FOR
SOCIO-ECONOMIC UPLIFTMENT OF JFMCS THROUGH
CONSERVATION, VALUE ADDITION
AND MARKETING OF MEDICINAL PLANTS
IN BANKURA (NORTH) DIVISION, WEST BENGAL
PROJECT NO: CSS/JFMC/WB-01/2015**



**OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FOREST
RESEARCH MONITORING AND DEVELOPMENT
DEPARTMENT OF FOREST
GOVERNMENT OF WEST BENGAL**

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PROJECT NO: CSS/JFMC/WB-01/2015

**SPONSORED BY
NATIONAL MEDICINAL PLANTS BOARD, NEW DELHI**

**STUDY CONDUCTED BY
RESEARCH CIRCLE, DIRECTORATE OF FORESTS
ITSCEED FOUNDATION, KOLKATA, INDIA**

**OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FOREST
RESEARCH MONITORING AND DEVELOPMENT
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PREFACE

India is known for its rich traditional medicinal knowledge (TMK) through various Systems of Medicine such as Ayurveda, Unani, Siddha, Homeopathy and others. About 8000 medicinal plants are used in folk and codified systems of medicine. Most Indian households have medicinal plants in their kitchen garden for treating general ailments such as fever, cough and cold, diarrhoea etc. The sacred plant *Ocimum sanctum* (tulsi) adorns the courtyard of Indian household not only for religious sentiments but also as a potent medicine for vitality. Plants such as *Andrographis paniculata* (kalmegh), *Terminalia arjuna* (arjun), *Tinospora cordifolia* (guduci), *Azadirachta indica* (neem), *Aegle marmelos* (bel), *Asparagus racemosus* (satamuli) and others found in Indian forests, wastelands and gardens play an important role in improving the health, economy and environment of Indian communities.

Many such medicinal plants are now threatened due to indiscriminate collection from the wild due to indiscriminate and unsustainable collection triggered by high trade and demand from the pharmaceutical industries. The Government of India had initiated several green projects for conservation of medicinal plant wealth of India considering the significant impact of this knowledge system on the quality of human life.

Traditional Medicinal Knowledge provides the scope for socio-economic upliftment of forest dwellers especially the Joint Forest Management Committee (JFMC) members who are closely related to the forest ecosystems of West Bengal. Survey across the JFMCs of Bankura (North) shows that JFMC members are interested in promoting trade of medicinal plants but had no road map for the same. Also, trade of medicinal plants is prevalent in the area but lacked trained collectors and organized trading. In this regard Research, Monitoring & Development Wing, West Bengal Forest Department with the help of International Tagore Society of Cultural, Educational and Environmental Development (ITSCEED), Kolkata have been taken up the program to train selected JFMC members of Bankura (North) district regarding the uses of medicinal plants and their sustainable collection practices. Further, the JFMCs were connected to the nearest warehouses established under this project at different locations, as well as traders and markets for medicinal plants. Value addition innovations were discussed along with JFMCs encouraged for creating products based on traditional knowledge systems. However, the value

addition to medicinal plants requires continuous research and development. The role of the Forest Department remains crucial in creating a win-win situation for biodiversity conservation and socio-economic upliftment of the JFMCs. The role of other organisation like ITSCEED will also essential to train the JFMCs for sustainable collection practices and assessment of resource base of medicinal plants in future.

The conservation of the resource base of MAPs is essential for developing a sustainable business model for the trade of MAPs. Sustainable collection practices, augmentation, value addition and trade of medicinal plants requires organized collaboration between the West Bengal Forest Department officials, JFMC members, traders, and social organizations for the socio-economic development of the forest dwellers. In the face of climate change the conservation of MAPs and natural ecosystems can act as a buffer against global warming by facilitating carbon sequestration, habitat protection, gene pool conservation and other ecosystem services. Awareness regarding the many fold benefits of practicing the Indian systems of medicine, conserving the medicinal plants, adopting as alternate source of income for forest dwellers is of paramount importance in meeting many of the Sustainable Development Goals for the nation.

ACKNOWLEDGEMENT

Traditional Medicinal Knowledge provides the scope for socio-economic upliftment of forest dwellers especially the Joint Forest Management Committee (JFMC) members who are closely related to the forest ecosystems of West Bengal. The Project for Socio-Economic Upliftment of JFMC through Conservation of Medicinal Plants, Value Addition and Marketing of Medicinal Plant Products was designed to achieve these objectives and implemented by Research, Monitoring and Development Wing of Forest Department, Government of West Bengal with the financial assistance from National Medicinal Plant Board.

The contribution of all Forest Officers for implementation of the project is acknowledged. Thanks to the Divisional Forest Officer of Bankura North Division and the staff of this Division contributed a lot for implementation of the project. The Principal Chief Conservator of Forests, Research, Monitoring & Development, Additional PCCF, Research & Monitoring and Chief Conservator of Forests, Research & Development constantly guided with their valuable suggestion for successful implementation of the project work and thanks to them for their contribution.

The International Tagore Society for Cultural, Education and Environmental Development (ITSCEED) took a key role for organizing members of the adjoining JFMCs, train them for sustainable collection of medicinal plants, processing of the collected parts and developing marketing linkage from those remote areas. The contribution of Dr. Debabrata Saha, Assistant Professor, TDU, Bargaon, Dr. Biswarupa Ghosh, Assistant Professor, BKC College, for joining the training program as resource person and imparting knowledge on various techniques related to sustainable collection, value addition marketing of medicinal plants and guidance to mobilise the community for the formation of Task Team in the selected JFMCs. Thanks to Mr. Anjan Singha, Ms. Shreyashe Kar, Research Assistant for their help to conduct the training programs, data collection and taking interviews with the major traders in the medicinal plants sectors, developing digital networks with the nodal persons in various JFMCs in the demarcated project areas. Thanks to Ms. Aditi Saha, Mr. Baivab Saha, Ms. Dipika Jani, Ms. Ms. Tista Debnath, Niharika Das, Aryamaan G. Saha, Ms. Ananya Ghosh, Ms. Oindrila Ganguly, for their help in various ways during implementation of the project and report preparation.

Thanks to the Divisional Forest Officer, Silviculture South Division for his contribution as Co- Principal Investigator along with Assistant DFO, Range Officers and other staffs of Silviculture South Division and Research Circle.

Principal Investigator

PROJECT PROFILE

1.	Title of the Project	Project for Socio-Economic Upliftment of JFMC through Conservation of Medicinal Plants, Value Addition and Marketing of Medicinal Plant Products.
2.	Project No.	CSS/JFMC/WB-01/2015
3.	Implementing Team	<p><i>Head of Organization –</i> Principal Chief Conservator of Forests, Research, Monitoring & Development, Directorate of Forests, Government of West Bengal.</p> <p><i>Principal Investigator –</i> Conservator of Forests, Research Circle, Directorate of Forests.</p> <p><i>Co-Principal Investigators</i> <i>Divisional Forest Officer –</i> Silviculture South Division and Bankura North Division.</p>
		<p>Research Works and Technical Assistance – ITSEED, Kolkata</p> <p>Represented by Dr Debabrata Saha, Dr Biswarupa Ghosh and their Research Scholars.</p>
4.	Project Location	Forest and its adjoining villages under Bankura North Division.
5.	Project Commencement Date	<p>2015-16</p> <p>2nd Phase from 2018-19</p>
6.	Project Completion Date	June, 2023-24
7.	Funding Agency	National Medicinal Plants Board.

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1.1. Introduction:

Medicinal plants have been utilized for ages and are now universally acknowledged. From ancient times to the present, humans have collected plants or their parts (roots, barks, rhizomes, seeds, and leaves) from the wild and used them in various forms to meet their requirements, such as food, fodder, shelter, and timber. Besides this, medicinal and aromatic plants are also used in pharmaceuticals, dietary supplement products, natural health products, beauty aids, cosmetics, and personal care products, as well as some products marketed in the culinary and food sectors.

However, over-harvesting or unsustainable collection, increasing global markets, and destructive collection practices from a single area are the major factors influencing the depletion of plant resources in the wild and have threatened a considerable portion of the world's medicinal plants species and populations. Some of the causes of unsustainable collection include a lack of awareness of good collection practices, rising industrial demand for wild resources, weak guidelines and monitoring mechanisms for wild resource collection, competition among local collectors, a lack of a better price for primary collectors, and the lack or loss of traditional knowledge. Apart from the growing demand for these herbal medicines in both domestic and international markets, the wild collection of medicinal plants secures valuable income for many rural households, especially in developing countries, and is an important factor in the source countries' local economies, which is also one of the causes of unsustainable collection.

Due to these reasons, medicinal plants should be collected in a sustainable manner. "Sustainability" has been defined simply as a system that serves the needs of the present without jeopardizing future generations' ability to meet their own needs. And sustainable collection is described as the collection of resources in such a manner that it does not contribute to a permanent decline of resources, thereby maintaining its ability to meet the needs of current as well as future generations.

Considering the ever-increasing demand for medicinal plants collected in the wild, it is imperative to develop a sustainable collecting practice. Thus, sustainable collection practices are some of the most essential conservation strategies for future generations in order to ensure the long-term availability of medicinal plants. Medicinal plants collected at the right time of maturity following sustainable collection practices possess better quality in terms of active ingredient concentration.

Sustainable collection practices ensure better-quality raw material while maintaining the population of wild medicinal plants. Additionally, it ensures that medicinal plant materials should only be collected during the appropriate season or period of time in order to maintain the highest quality possible for both raw materials and finished goods. Thus, regardless of increasing demand from the outside world, sustainable collection practices emphasize species population maintenance, regeneration, and serving ecosystem services in the wild.

To address the above mentioned issues, regular training and capacity building programs at various stakeholders levels need to be conducted. Training of medicinal plants collectors, farmers basically contributes not exclusively to human resource advancement but also to educate them in recent trends, varieties, technologies, methodologies developed in the field of medicinal plants augmentation in the wild as well as agricultural field. The basic needs are species wise information viz., soil testing, availability of improved seeds and quality planting material, inter-cultural operations, nutrient management, irrigation, plant protection measures, and allied

information etc. (Babu and Singh, 1986).

Global Approach Towards sustainable Collection of Medicinal Plants:

A number of initiatives have been developed in recent years to establish a better framework for the sustainable use of medicinal and aromatic plants (MAP). International Standard for the Sustainable Wild Collection of Medicinal and Aromatic plants (ISSC-MAP) is a joint initiative of the German Bundesamt für Naturschutz (BfN), WWF Germany, TRAFFIC, IUCN Canada, and the IUCN/SSC Medicinal Plant Specialist Group (MPSG).

The purpose of the ISSC-MAP is to ensure the continued use and long-term survival of MAP species and populations in their habitats while respecting the traditions, cultures, and livelihoods of all stakeholders.

The ISSC-MAP has six principles and 18 criteria, addressing ecological, social, and economic requirements for sustainable wild collection of MAP.

Principle 1 - Maintaining Wild MAP Resources

Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term.

1.1 Conservation status of target MAP species

The conservation status of target MAP species and populations is assessed and regularly reviewed.

1.2 Knowledge-based collection practices

MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.

1.3 Collection intensity and species regeneration

The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term.

Principle 2 - Preventing Negative Environmental Impacts

Negative impacts caused by MAP collection activities on other wild species, the collection area, and neighbouring areas shall be prevented.

2.1 Sensitive taxa and habitats

Rare, threatened, and endangered species and habitats that are likely to be affected by MAP collection and management are identified and protected.

2.2 Habitat (landscape level) management

Management activities supporting wild MAP collection do not adversely affect ecosystem diversity, processes, and functions.

Principle 3 - Complying with Laws, Regulations, and Agreements

MAP collection and management activities shall be carried out under legitimate tenure arrangements, and comply with relevant laws, regulations, and agreements.

3.1 Tenure, management authority, and use rights

Collectors and managers have a clear and recognized right and authority to use and manage the target MAP resources.

3.2 Laws, regulations, and administrative requirements

Collection and management of MAP resources complies with all international agreements and with national, and local laws, regulations, and administrative requirements, including those related to protected species and areas.

Principle 4 - Respecting Customary Rights

Local communities' and indigenous peoples' customary rights to use and manage collection areas and wild collected MAP resources shall be recognized and respected.

4.1 Traditional use, access rights, and cultural heritage

Local communities and indigenous people with legal or customary tenure or use rights maintain control, to the extent necessary to protect their rights or resources, over MAP collection operations.

4.2 Benefit sharing

Agreements with local communities and indigenous people are based on appropriate and adequate knowledge of MAP resource tenure, management requirements, and resource value.

Principle 5 - Applying Responsible Management Practices

Wild collection of MAP species shall be based on adaptive, practical, participatory, and transparent management practices.

5.1 Species / area management plan

A species / area management plan defines adaptive, practical management processes and good collection practices.

5.2 Inventory, assessment, and monitoring

Management of MAP wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts.

5.3 Transparency and participation

MAP collection activities are carried out in a transparent manner with respect to management planning and implementation, recording and sharing information, and involving stakeholders.

5.4 Documentation

Procedures for collecting, managing, and sharing information required for effective collection management are established and carried out.

Principle 6 - Applying Responsible Business Practices

Wild collection of wild MAP resources shall be undertaken to support quality, financial, and labour requirements of the market without sacrificing sustainability of the resource.

6.1 Market / buyer specifications

The sustainable collection and handling of MAP resources is managed and planned according to market requirements in order to prevent or minimise the collection of products unlikely to be sold.

6.2 Traceability

Storage and handling of MAP resources is managed to support traceability to collection area.

6.3 Financial viability

Mechanisms are encouraged to ensure the financial viability of systems of sustainable wild collection of MAP resources.

6.4 Training and capacity building

Resource managers and collectors have adequate skills (training, supervision, experience) to implement the provisions of the management plan, and to comply with the requirements of this standard.

6.5 Worker safety and compensation

MAP collection management provides adequate work-related health, safety, and financial compensation to collectors and other workers.

1.2. Trade Status of medicinal plants:

Medicinal plants as a group comprise approximately 8000 species and account for around 50% of all the higher flowering plant species of India. An estimate of the EXIM Bank puts the international market of medicinal plants related trade at US\$ 60 billion per year growing at the rate of 7% only. In India there are 880 medicinal plants species involved in all India trade. Of this, 48 species are exported and about 42 spices are imported. In India the value of botanicals related trade is about \$10 billion per annum with annual export of US \$1.1 billion (Yadav, 2019; Singh et al.). The export of medicinal plants has grown 33.2 per cent during the year 2020-21, with the growing awareness among people towards natural herbs and traditional medicines, according to the Central government.

The export of medicinal plants, under HS Code 1211 from the Country during the financial year 2020-21 was \$377.63 million as compared to \$283.52 million exports registered during 2019-20.

“The market of medicinal plants has increased in India as well as all over the world in the last few years due to awareness among people towards natural herbs and traditional medicines. The demand and supply has been depicted in the form of a comprehensive inventory of 1,622 herbal raw drugs correlated to 1,178 medicinal plant species in commercial demand (NMPB, 2017). The total consumption of herbal raw drugs in the country for the year 2014-15 was estimated at 5,12,000 MT with corresponding trade value of Rs. 7,000 crore.

1.3. Prospects of medicinal plants trade and livelihoods:

Herbal raw drugs obtained from 242 medicinal plant species collected, cultivated or imported largely for use in healthcare are used in high quantities, with each species being used more than

100 MT per year. Of this, the supply source of 15 species (6%) is through import, 54 species (22%) are obtained from cultivation, 59 species (25%) are wild collection from landscapes outside forests and 114 species (47%) are collected from forests.

However, while the Union Budget for the year 2020-21 has allocated Rs. 25 crore to the proposed Pradhan Mantri Vriksh Ayush Yojana for promotion of medicinal plant cultivation, and marketing, the proposal is pending for the approval from the Cabinet for the past several months. The Ministry of Ayush, in February 5, 2021 has said that the approval is pending with the Cabinet and has recently updated on December 17, that the proposal has been submitted for the approval of the Cabinet.

The Yojana, is for the promotion of medicinal plant cultivation, post-harvest management and marketing support by involving farmers and the Ayush industry. Under the proposed scheme, there is a provision for financial assistance to cultivate medicinal plants and establish post-harvest management infrastructure.

The Ministry further reveals that it has approved or released a total of Rs. 136.58 crore including state share for cultivation of medicinal plants under medicinal plants component of National Ayush Mission (NAM) scheme throughout the country from the financial year 2015-16 to 2020-21.

However, in the year 2020-21, when the Covid-19 pandemic hit the normal lives of the public, the fund approved for cultivation under NAM Mission Scheme went down a little to Rs. 20.26 crore, as against Rs. 21.56 crore during the year 2019-20. The highest fund release under the scheme in the last six years was Rs. 28.09 crore in the year 2016-17, which declined to Rs. 26.6 crore during 2017-18. In the following year of 2019-20, this has further declined to Rs. 21.24 crore, according to the data released by the Ministry of Ayush.

The highest allocation among the States were Madhya Pradesh (Rs. 24.86 crore), Uttar Pradesh (Rs. 21.94 crore), Rajasthan (Rs. 12.38 crore), Tamil Nadu (Rs. 10.54 crore) and Karnataka (Rs. 10.13 crore).

The Ministry had provided subsidies for 140 prioritised medicinal plants at 30%, 50% and 75% of the cost of cultivation per hectare through State Implementing agencies across the country.

The NMPB has supported six proposals for setting up of medical plant conservation and development areas (MPCDAs) through survey, documentation of existing natural populations of medicinal and aromatic plants and geo-referencing. The projects supported from the financial year 2015-16 to 2020-21 include two in Mizoram and one each in Gujarat, Nagaland, Odisha and Uttarakhand.

Medicinal plants market in the country is today unorganized due to several problems. Medicinal plants are a living resource, exhaustible if overused and sustainable if used with care and wisdom. At present 95% collection of medicinal plants is from the wild. Current practices of harvesting are unsustainable and many studies have highlighted depletion of resource base. Many studies have confirmed that pharmaceutical companies are also responsible for

inefficient, imperfect, informal and opportunistic marketing of medicinal plants. There is a vast, secretive and largely unregulated trade in medicinal plants, mainly from the wild, which continues to grow dramatically in the absence of serious policy attention with environmental planning. Confusion also exists in the identification of plant materials where the origin of a particular drug is assigned to more than one plant, due to which, adulteration is common in such cases. All these affect the market both directly and indirectly. Marketing is a daunting problem, which besets the development of the plant based industry in developing countries. Marketability of products will be a crucial factor in determining the failure or success of this sector. The market outlets can be for local use and for export. As for local use some products could reach the consumer directly while others have to be either further processed or used as secondary components in other industrial products. A clear understanding of both the supply side issues and the factors driving the demand and size of the medicinal plants market is a vital step towards planning for both the conservation and sustainable use of the habitats of these plants as well as for ensuring continued availability of the basic ingredients used to address the health needs of the majority of the world's population.

According to the report of the World Health Organisation (WHO), a large population of the world relies on the traditional systems of medicines, largely plant based to meet their primary health care needs. India at present (2000) exports herbal materials and medicines to the tune of Rs. 446 crores only while it has been estimated that this can be raised to Rs. 3000 crores by 2005. The Chinese export based on plants including raw drugs, therapeutics and other estimated to be around Rs. 18,000- Rs. 22,000 crores. In view of the innate Indian strengths which include diverse ecosystems, technical and farming capacity and a strong manufacturing sector, the medicinal plants area can become a huge export opportunity after fulfilling domestic needs.

Apart from requirement of medicinal plants for internal consumptions, India exports crude drugs mainly to developed countries. viz. USA, Germany, France, Switzerland, UK and Japan, who share between them 75 to 80 percent of the total export of crude drugs from India. The principal herbal drugs that have been finding a good market in foreign countries are Aconite, Aloe, Belladonna, Cinchona, Cassia, Dioscorea, Ephedra, Plantago (Isabgol), Cassia (Senna) etc. (Source: Planning Commission-Task Force Report, 2000)

1.4. Conservation of Medicinal plants vis-a-vis national and international trade- role of CITES & TRAFFIC :

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC) is the Wildlife Trade Monitoring Network, is a global organization monitoring the trade in wild animals and plants that focuses on biodiversity and sustainable development.

Appendices I, II and III to the Convention are lists of species afforded different levels or types of protection from over-exploitation. Appendix I lists species that are the most endangered among CITES-listed animals and plants (see Article II, paragraph 1 of the Convention). They are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial (see Article III), for instance

for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate). Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called “look-alike species”, i.e. species whose specimens in trade look like those of species listed for conservation reasons. Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation. International trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates (CITES).

1.5. Medicinal plants Trade in West Bengal:

West Bengal is rich in diversity of medicinal plants due to diverse biogeographical and phytogeographical regions ranging from costal area in the Bay of Bengal to Darjeeling Himalaya, Gangetic plains and part of South Bengal falls under the phytogeography of North Eastern part of Chotanagpur plateau. Medicinal plants are collected from the diverse habitats and sold in the market through an unorganized and long trade chain. Major source of the wild medicinal plants are Darjeeling Himalaya, foot hills and South Bengal. There are many medicinal plants traders in the state starting from the local traders at village and nearest town level to the big traders in Kolkata specifically in Barrabazar, Cotton street, Armenian street, 78- Netaji Subhash Lane area. Few traders were also recorded from Howrah, Burdwan, Bishnupur, Pingboni, Keshargarh, Manbazar area in Purulia District. Although, in India a total of around 8000 medicinal plants are traditionally used, a total of 1389 botanical entities corresponding to 960 plants species were enlisted under trade in India (NMPB; Goraya and Ved, 2017). A total of 242 species are enlisted as high commercial demand (>100 MT/year). A 62% increase in annual demand of herbal raw drugs was observed for the year 2014-15. The volume of herbal drugs exported in 2014-15 is 1,34,500 MT. However, the total number of medicinal plants found in the state is around 850 species and around 1600 plant species are used by various tribal communities in the state (Chakraverty et al., 1999). Many of these medicinal plants are threatened for their unsustainable collection practices e.g. *Gloriosa*, *Aconitum*, *Taxus*, *Swertia*, *Rauvolfia*, *Pterocarpus*, *Panax*, *Picrorrhiza*, *Ampelocissus*, *Berberis*, *Celastrus*, *Gymnema*, *Luminitzera*, *Podophyllum* etc.

1.6. Medicinal plants promoted for commercial cultivation in West Bengal

There are around 32 species of medicinal plants which are identified and promoted for commercial cultivation by State Medicinal Plants Board (SMPB), West Bengal.

1	<i>Ernblica officinalis</i>	Amla
2	<i>Saraca asoca</i> (Roxb.) de Wilde	Ashok
3	<i>Withania somnifera</i> (Linn.) Dunal	Ashwagandha
4	<i>Aconitum heterophyllum</i> Wall. ex Royle	Atees
5	<i>Aegle marmelos</i> (Linn.) Corl	Bael
6	<i>Phyllanthus amarus</i> Schurn & Thonn	Bhumi amlaki
7	<i>Bacopa monnieri</i> (L.) Pennell	Brahmi
8	<i>Santalum album</i> Linn.	Chandan
9	<i>Swertia chirata</i> Buch-Ham.	Chirata

10	<i>Tinospora cordifolia</i> Miers	Giloe
11	<i>Gymnema sylvestre</i> R. Bl:	Gudmar
12	<i>Commiphora wightii</i> (Arn.) Bhandari	Guggal
13	<i>Plantago ovata</i> Forsk.	Isabgol
14	<i>Nardostachys jatamansi</i> DC	Jatamansi
15	<i>Gloriosa superba</i> Linn	Kalihari
16	<i>Andropogon paniculata</i> Wall. ex Nees	Kalmegh
17	<i>Garcinia indica</i> Chois	Kokum
18	<i>Saussurea costus</i> C B. Clarke (S.lappa)	Kuth
19	<i>Picrorhiza kurroa</i> Benth ex Royle	Kutki
20	<i>Solanum nigrum</i> Linn.	Makoy
21	<i>Glycyrrhiza glabra</i> Linn.	Mulethi
22	<i>Chlorophytum borivilianum</i> Sant	Musali safaid
23	<i>Coleus barbatus</i> Benth./ <i>C. vetiveroides</i>	Patharchur
24	<i>Piper longum</i> Linn.	Pippal
25	<i>Berberis aristata</i> DC	Rasaut (Daruhaldi)
26	<i>Crocus sativus</i> Linn.	Saffron (Kesar)
27	<i>Rauwolfia serpentina</i> Benth. ex KulZ	Sarpgandha
28	<i>Cassia angustifolia</i> Vah	Senna
29	<i>Asparagus racemosus</i> Willd	Shatavari
30	<i>Ocimum sanctum</i> Linn.	Tulsi
31	<i>Embelia ribes</i> Burm	Vai Vidang
32	<i>Aconitum ferox</i> Wal	Vatsnabh

2.1. Medicinal plants and traditional knowledge base

West Bengal is rich in medicinal plants and the local communities follow a strong tradition of various use of medicinal plants as a part of promotive, preventive and curative health care approach. Many medicinal plants are used as food and involved in the local traditional diet such as need leaves fry with ghee, *Hygrophila auriculata* (Kulekhara) leaves, *Centella asiatica* (Thankuni) are used as daily leafy vegetable with fish, *Aegle marmelos* (Bael) is taken as daily fruit juice etc. There is a collection of a series of books on tradition medicinal plants named “Chiranjib Banoushadi”, used by the local communities in Bengal written by the eminent Ayurvedachariya/ Vadyaratnam Shri Shivkali Bhattacharya that tells itself about the rich tradition and culture of usage of Medicinal plant in Bengal.

2.2. Utilization pattern of medicinal plants in the state

Medicinal plants are mostly collected from the wild and, used in various kinds of preparations and doses. Many of the medicinal plants are collected from the wild and conserved in the home herbal gardens for their easy collection and use on a daily basis or during their urgent requirement. Many medicinal plants are used in combination with others as “Kashayam” mixed with various ingredients such as honey. Many medicinal plant parts such as roots, fruits, seeds, barks, resins or leaves are dried properly and preserved for use as those parts are available in a particular season e.g. fruits, seeds or resin.

2.3. Collection pattern of medicinal plants

Medicinal plants are collected mostly from their wild habitat as well as from the cultivable land. In general, people use to collect in little quantity for their own use and following the traditional way of sustainable collection specially if collected by the traditional healers. However, the approach is not same in case of those collectors where demand is for commercial purpose. Due to the commercial external demand from the pharmaceutical industries, the local collectors do not think about the sustainability of the species and collect indiscriminately from their wild habitat just to meet the bulk quantum. This approach makes many of the medicinal plants threatened and push them towards the verge of extinction. As the demand of herbal raw drugs is increasing year after year, the most important issues coming up with this approach is sustainability, uprooting the whole plant, lopping the branches and completely denuding the trees and ultimately declining population in their wild habitat. Medicinal plants are collected in immature conditions like whole plants are collected before the seeds get matured or dispersed e.g. *Swertia*, *Andrographis*. Further, exhaustive collection of fruits along with immature ones. Raw drugs are collected unsustainably e.g. roots of *Asperagus*, *Rauvolfia*, *Withania*, *Gmelina*, *Oroxylum*, fruits of *Emblica*, *Terminalia*, *Aegle*, Barks of *Holarrhena*, *Saraca*, *T. arjuna*, *A. scholaris*, leaves of *Cinnamon*, *Azadirachta*, *Taxus* etc.

2.4. Awareness, Training and capacity building on status of medicinal plants, sustainable collection, value addition and marketing

In the current age of national and international demand of herbal raw drugs, it is very important to make the mass aware about the conservation and sustainability issues of medicinal plants. This is one of the major criteria in one of the 17 IUCN Sustainable Development Goals (SDG) set for 2030. Many medicinal plants are brought under the CITES norms due to their threatened status which prohibit their collection from the wild habitat. Many more are brought under the law (Foreign Trade Development & Regulation Act 1982) e.g. *Rauvolfia serpentina*, *Pterocarpus santalinus*, *Cycas beddomei*, *Dioscorea deltoidea*, *Coscinium fenestratum*, *Podophyllum hexendrum*, *Aconitum* spp., *Picrorhiza kurrooa* etc. Awareness, Training and capacity building programs are required to make the local people alert about these facts and the approach towards the sustainability. This will surely help the community to slowly down and check the trend of population decline in the wild habitat, and conserve those medicinal plants in long run through adopting sustainable collection practice. Wherever required they may switch on cultivation of selected medicinal plants to reduce the pressure in their natural habitat.

2.5.1. Training and workshops conducted for awareness, training, capacity building

It was evident from the field survey that the unsustainable collection practices due to external demand has threatened many medicinal plants with sharp decline of their population status in their natural habitat as well as decline in income of the local collectors threatening their livelihoods. An effort has been taken to aware and train the local people in this regard. The International Tagore Society for Cultural Educational and Environmental Development (ITSCEED), Kolkata in collaboration with the State Forest Department, West Bengal conducted many training and capacity building programs on conservation, sustainable collection, value addition and marketing of medicinal plants in Purulia District of West Bengal. Resource persons from ITSCEED explained about the good collection practices adopted by ISSC –MAP and provided hand-on training in the collection sites in the forest itself. A total of around 200 representatives from various Joint Forest Management Committees (JFMCs) participated in different phases and got training on various aspects of medicinal plants viz., conservation, sustainable collection, grading, value addition and marketing of medicinal plants.

2.5.2. Role of ITSCEED in achieving ISSC-MAP goals-

The International Tagore Society for Cultural, Educational, and Environmental Development (ITSCEED) has played an important role in training the JFMC members on sustainable collection practices and educating them about sustainable use of medicinal plants in collaboration with the Forest department of West Bengal. The training of JFMC members and frontline forest officials were carried out in Rupnarayan Division and Kansabati Division of Purulia during the month of October and November of the year 2022.

Members were informed about the International Standard for Sustainable Wild Collection (ISSC) guidelines and principles and how ISSC is involved in the collection, management, trade,

manufacture, and sale of wild-collected medicinal and aromatic plants (MAP).

The participants were familiarised with the medicinal uses of plants such as Amla, Harataki, Bael, Arjun, Satmuli, Kalmegh and Bahera, with their scientific names, parts used, and their medicinal importance. Additionally, the market-based products of the above mentioned medicinal plants were also discussed.

The presentation also highlighted topics such as sustainable medical plant collection, value addition, medicinal plant marketing and long and complex market supply chains.

The participants were then shown a video presentation of sustainable collections of medicinal and aromatic plants.

Following that, participants/members were taken to the field and given hands-on training on when, what, and how to collect wild MAP species. As an example to achieve a sustainable collection of root material, the root should be dug at least 30 cm away from the main stem or tap root, and only the lateral roots should be collected.

Then, in the case of bark collection, the diameter of the bole should be measured first. A diameter of 30 cm or greater is suitable for collecting bark. Aside from that, the bark should be peeled in small pieces, and after collection, the place should be sealed to prevent the development of insect infestation or the development of infections on the wound.

Similarly, to ensure sustainable leaf collection, picking individual leaves instead of chopping the whole branch should be done. Leaves should be collected from mature trees, and a certain percentage of leaves should be left to ensure normal physiological processes in the plant.

Furthermore, to ensure the sustainability of fruit collection, fruits from individual plants should not be collected all at once, but rather a few healthy ones should be left on the ground so that more high-quality plants can germinate next season.

Finally, in the case of gum collection, gum is collected by stripping the bark with the help of an axe, and longitudinal and vertical incisions are made just like the structure of a fish bone to collect the exudates. After collection, the exposed parts should be treated appropriately to avoid any fungal or bacterial infestation. This program was followed by network development among the various task teams formed in various JFMCs and putting a system of organised collection of medicinal plants in the following months till March 2023. The communication has been established among the nodal persons and the traders through the nodal agency.

A research team from ITSCEED, Kolkata interacted with various wholesale traders in different parts of West Bengal especially in Cotton street, Barrabazar etc. and in other states like Chattisgarh and Karnataka. Specialist from ITSCEED participated in the Buyer-seller meeting organised by NMPB in the World Ayurvedic Congress (WAC), Goa in 2022 and tried to develop links with the pharmaceutical industries such as Himalaya, Dabur, Zandu, Badyanath, Chattisgarh State Minor Forest Produce Federation Ltd and Gram Mooli Ltd. Madhya Pradesh.

2.5.3 Feedback and expectations of the participants registered during the training programs:

The training program was conducted at two different levels such as divisional level and JFMC levels. In the first level training, members from various JFMCs were invited at divisional level and training was conducted in the meeting halls of Forest Department as well as hands-on training in the nearby forest area.

It has been reported by the participants in the feedback that

- a) There is a difficulty in identifying the medicinal plants traded from their area and their uses. Hence, requested for a pictorial field guide on medicinal plants of the area in local language. They asked for information on identification key, medicinal uses, parts traded, sustainable collection methods with pictorial interpretations, scope and method of value addition and current market chain.
- b) The current training program was the first such extensive on field hands-on training program on medicinal plants sustainable collection and they need more such training program time to time.
- c) Their frequently asked questions (FAQs) were (i) whereabouts of traders/companies fetching good prices of selling the medicinal plants collected in a particular JFMC. (ii) Installation of machines in the nearby warehouse/community halls and related support for value addition in the villages specially for the women members of the JFMCs/SHGs. (iii) How to get the product certified for trading. (iii) How to add value to medicinal plants for trading.
- d) There is a need of training on techniques of medicinal plants cultivation, integrated pest and disease management.
- e) Around 97% of the respondents coming from various JFMCs were unaware of the possibility of selling and good trade of medicinal plants.
- f) The most important gap felt by the respondents was “Need for organized markets” of medicinal plants.

3.1. Systematic approach for trade of medicinal plants

Trade of medicinal plants are largely unorganized and flow is in the gray market. Efforts are needed to make it more systematic and streamlined. It has been observed that the actual collectors of medicinal plants not getting much benefit as well as profit share in the whole chain of trade. The community people were informed about the trade chain, the quality assurance and other related issues such as quantum of medicinal plants collected, transportation, buyer-seller agreements and MoUs etc.

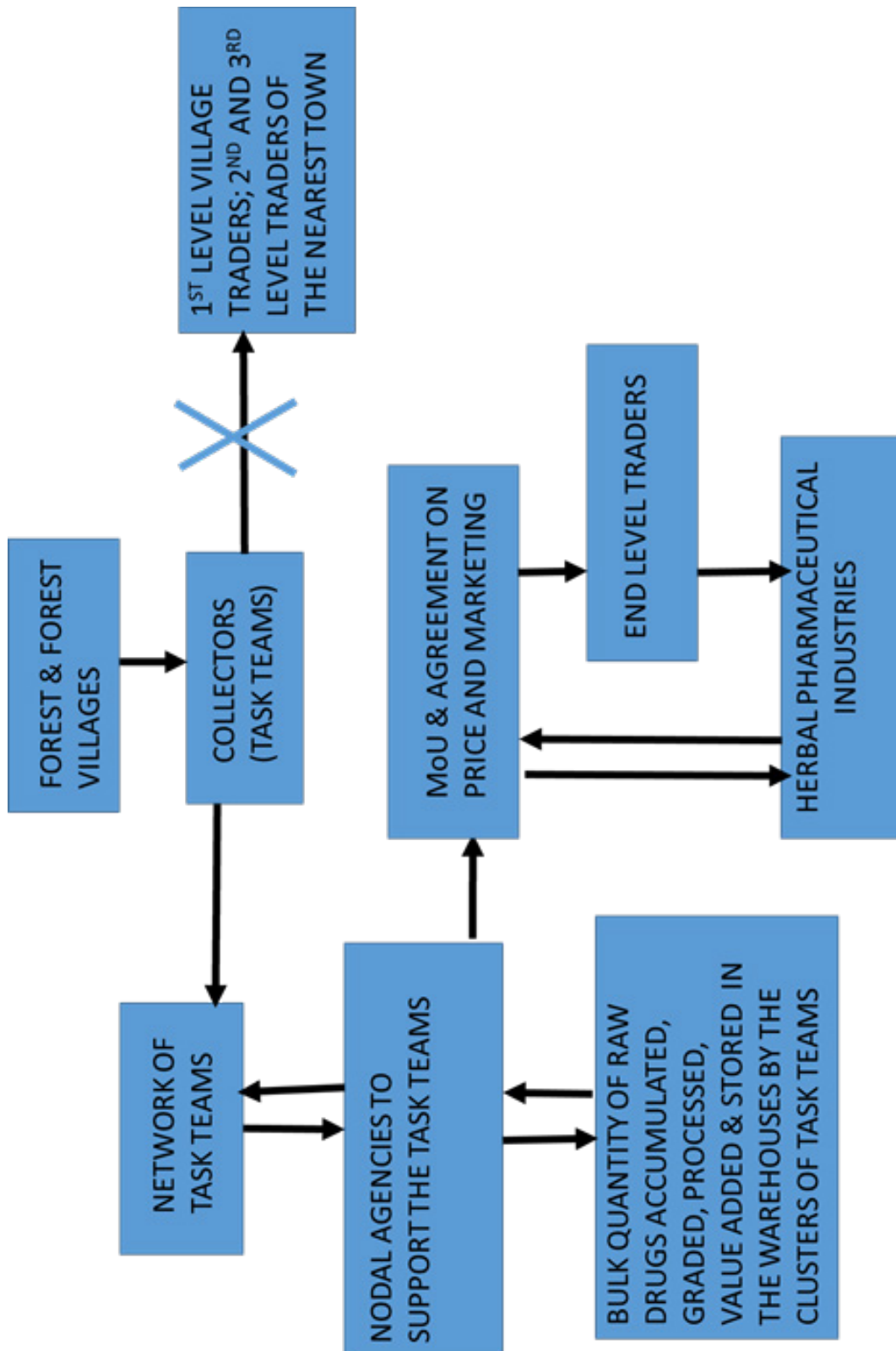
3.2. Network development for sustainable trade

It has been realized that the maximum profit share in this trade chain goes to the middleman. Collectors get only the nominal price which is not suitable for the labour invested per day, their livelihoods and broadly the sustainability of this sector. Low income push the collectors to collect more raw materials and thus compromising the quality and sustainability issues such as collection of immature fruits, unsustainable collection of barks or leaves etc. to achieve their minimum economic target for livelihoods. Therefore, to make it streamlined and reduce the gap of profit share and to meet the demand of the market, a task teams have been formed in each selected JFMC areas. These task teams are having minimum 17 members of active NTFP collectors including the concerned Beat Officer and the JFMC President. The nodal person from each Task Team can contact to the nearby forest officers for any Government assistance and may connect to various potential traders through Mobile network for better trade and communication.

3.3. Cluster forming among the JFMCs/FPCs for better trade

An effort has been taken to make a cluster of various Task teams to achieve the goal of collection of bulk quantum of the required raw drugs maintaining the quality with proper grading and processing. The nodal persons from each Task teams were informed about the benefits of cluster formation and need of bulk quantum of raw drugs for any kind of sustainable trade directly with the pharmaceutical companies or big end point traders.

FLOW CHART DEPICTING THE SYSTEMATIC COLLECTION, GRADING, PROCESSING AND MARKETING OF MEDICINAL PLANTS



4.1. Resource base of medicinal plants

A better understanding on the population status of any medicinal plants in its natural habitat or total resource base including plants outside the forest and cultivated lands is very much important to sustain a trade of Medicinal plants. For any strong and systematic trade of medicinal plants, it is necessary to have an assurance of rich resource base and their replenishment and regeneration with time.

4.2. Resource assessment

Traditionally the resource assessment has been done through direct field survey using systematic vegetation survey. However, recently helps are taken of the modern technology such as digital mapping using GIS and remote sensing that supports a lot to understand the spread and quantum of the resource base.

4.3. Ensuring the resource base for long-term sustainable trade

Many approaches are being adopted to ensure the continues flow of raw drugs in the market to sustain the trade of medicinal plants and ultimately maintain a steady livelihood of the local community and various other stakeholders. Forest Department has its own mandates regarding augmentation of various plant species inside the forest to strengthen the ecosystem services. They accomplish it through the Silviculture Division involving the JFMCs inside the forest. National Medicinal Plants Board (NMPB) also has many schemes on *in-situ* and *ex-situ* conservation, cultivation and augmentation programs involving State Forest Departments, NGOs, research organizations and Clusters of farmers. West Bengal State Medicinal Plants Board (SMPB) has involved many NGOs and clusters of farmers for cultivation of threatened but highly traded medicinal plants such as *Withania somnifera*, *Gymnema sylvestre*, *Gloriosa superba*, *Saraca asoca*, *Rauvolfia serpentine*, *Pterocarpus santalinus*, *Santalum album*, *Coscinium fenestratum*, *Dioscorea deltoidea*, *Podophyllum hexendrum*, *Aconitum heterophyllum*, *Picrorhiza kurroo*, *Commiphora wightii*, *Chlorophytum borivillianum*, *Tinospora cordifolia*, *Ernblica officinalis*, *Asparagus racemosus* etc.

4.4. Potential for cultivation of medicinal plants in the state

For cultivation of any medicinal plants, it is very important to ensure the demand in the market and buy-back agreement with the traders or any other agencies who will purchase the product to ensure the farmers livelihood and sustenance. Further, the standardized cultivation and propagation technique should be in place for the farmers else need to be developed through scientific research. There is a need of training program on cultivation technique, integrated pest and disease management.

4.5 Medicinal plants resource and quality assurance for national and international trade

It has been observed during the survey that the collectors does not get appropriate price of their collection due to low grade of the raw drugs. Therefore, it is important to maintain the quality though sustainable collection, proper grading and processing of the raw drugs collected from the wild habitat or cultivated land. Proper grading, drying, processing, storage and packaging is important to get appropriate price in the market. Every species has some characteristics identified and fixed by the traders to determine the quality at least morphological characters and appearance of the raw drugs. Certification of the raw drugs by the Govt. affiliated agencies helps to fetch better price in the market.

5.1. Developing a system for smooth trading of medicinal plants

It is difficult for any local collector to sell their collected small quantity of raw drugs to the big traders in the town because of low quantum, transportation cost and required investment of good time. Therefore, there is a need of an organized marketing with the formation of clusters among various “Task Teams” which can justify all above mentioned issues.

5.2. Buyer-seller meeting and tie-up

Establishing confidence among the collectors and the traders about the marketing of raw drugs is crucial in the trade network. It can strengthen the smooth trade through proper networking, conducting buyer-seller meeting and developing a trust through signing MoU between the two parties for long run. The buyers will be interested if they can collect the required raw drugs in sustainable manner and in substantial quantum. Therefor the JFMC members of forest fringe areas can utilize the plantations of West Bengal Forest Department, cultivate the medicinal plants as intercrop.

5.3. Role of nodal agency towards handholding the local collectors for quality assurance and better marketing of medicinal plants

During the household survey, trade study and consultation during trading and capacity building programs, it has been realized that the local collectors are unable on its own to streamline and do systematic marketing without a handholding by a well informed and capable nodal agency at least towards the beginning of the approach. ITSEED, Kolkata has taken an effort to play the role of nodal agency for systematic marketing of the raw drugs collected by the local communities.

5.4. Demand and supply of medicinal plants

It has been witnessed during the trade study that the requirement of any raw drugs i.e demand varies time to time and so as the price of the raw drugs. The collectors get better price when there is a balance between the demand and supply. Hence, there is a need of systematic grading, drying and processing of the raw drugs for storage for a specific period in the warehouse so that the materials can be sold during the high demand in the market. This can fetch good price to the collectors or the farmers.

5.5 Crucial observations from the training programs and the field study:

1. Most of the JFMC members either not aware of the potential trade of medicinal plants and the current extent of trade of the herbal market in the country and worldwide or process of marketing of medicinal plants.
2. Both the forest dwellers/ JFMC members and the Forest Officials expressed the need of printed guide books on medicinal plants to facilitate the identification, to know use pattern, parts traded, trade potential with other related trade informations.
3. Also felt the need of a printed manual on the methods of sustainable collection, value addition and marketing of the prioritised medicinal plants available in the region.

4. Many of the participants blatantly said that even though their forest area possess good population of many species discussed in the training program, they were unaware about those species were collected, traded and can fetch good profit e.g. *Asparagus racimosus*.
5. In comparison to male participants women participants showed more interest and hopeful for value addition and marketing of medicinal plants if they get proper facility at JFMC level and hand holdings from the proper agencies/ organisations.
6. There is a need of paradigm change in perception on the advantage of protection of wild medicinal plants, their augmentation in the wild habitat and cultivation in the agricultural land. This observation is in special context of usual augmentation of timber species such as *Acacia auriculiformis* locally known as “Sonajhori” vs. medicinal plants such as *Aegle mermelos* (Bael), *Terminalia chebula* (Haritaki). Training programs are needed to aware the local communities about the advantages of multiple services provided by medicinal plants that too every year without any interruption unlike timber yielding species.

Discussion and conclusion

The national and global demand of herbal raw drugs from the nutritional and pharmaceutical industries has increased many fold in last decade. It is a great challenge to meet such skyrocketing demand of herbal raw drugs in a sustainable manner and to ensure the long term economic gain from it by the local community and various other stakeholders engaged in this sector. Understanding and maintaining the resource base is also very challenging and herculean task in such a national and global scenario. However, systematic approach towards awareness, training and capacity building of the local community across the state for resource assessment, monitoring sustainable collection, grading, processing, value addition and marketing of medicinal plants can sustain meeting the major objectives related to this sector. Similar results have been registered in various parts of Karnataka (Athequlla et al., 2021). A confidence building measure between collectors and traders is buyer-sellers meeting and signing MoU. This approach is easier in case of farmers who grows the medicinal plants in their agricultural land and have a better assurance of the quantum and quality. However, in case of those collectors who collect the raw drugs from the wild habitat, there are so many factors which are uncertain such as quantity, quality and time of collection etc. Nevertheless, an approach with a cluster basis with the formation of task team can address these issues reasonably to the satisfactory level. Individual collectors with little quantity of materials at individual level are marginalised and does not have the advantage of bargaining on price rate with the traders.

Handholding by a nodal organization with proper experience on social organization of the local communities and their way of engagement in natural resource collection and management can help to address the above mentioned issues. Although, the State Forest Department is engaging the JFMCs in various forestry activities and extending their support but need to be upscaled and more intensive. NGOs need to be engaged for systematic handholding to achieve the goal.

Gaps and way forward

The demand of medicinal plants by the pharmaceutical industries varies from time to time and the sector is very much unorganised. There is a gap in demand and supply due to various factors such as high dependence on wild collection and lack of quality materials. Further, there is a lacuna in access to technology for grading, drying and processing of the raw drugs at the collection point. Current survey has revealed that the current generation is not much familiar with the diversity of various medicinal plants and their uses. Consequently, they are not bothered about those lesser known but highly important medicinal plants which has direct negative effect on the conservation and management of their wild population e.g. *Asperagus racimosus* commonly known as Satawari was not familiar among the young group of individuals in many JFMC members in Rupnarayan Division.

More intensive, and frequent training and capacity building programs on identification, sustainable collection, processing and value addition need to be conducted among the clusters of “Task Teams” covering the JFMCs across the selected forest divisions. Collection, grading, processing and marketing should be done on cluster basis to ensure bulk quantity of any traded medicinal plants for better marketing and to fetch better price to the local collectors. There is a huge gap in “marketing intelligence” among the JFMC members which should be addressed efficiently through various training programs. The most important constraints expressed by the participants were “Inadequate incentives for cultivation of MAPs. There is a critical need to plan and design regular capacity building programs. Field studies revealed that there is a need to fulfil the knowledge gap in specific thematic areas among the medicinal plants collectors and growers in the state to enable them for a sustainable profit share.

Recommendations

1. Establishment and expansion of the cluster formation of task teams formed under various JFMCs to ensure collection of bulk quantity of any raw drugs.
2. Digital networking and information exchange through mobile apps among the task teams, the nodal agency as well as the traders to ensure the required quantity, quality, processing techniques and marketing approaches and links.
3. Ensuring frequent buyer-seller meet as well as MoU between the parties for smooth marketing of the products. The recognized nodal agency may facilitate the process on behalf of the local community.
4. Frequent training and capacity building programs on plant and raw drugs identification, sustainable collection, grading, processing, value addition and packaging need to be conducted among the clusters of “Task Teams” covering various JFMCs across the selected forest divisions.
5. Establishment of MAP nursery units at block and gram panchayat levels.
6. Promote product making and marketing at least at local level in the beginning involving the task teams as well the Women Self Help Groups (SHGs). The recognized nodal agency may facilitate in the initial phase.
7. Promotion of augmentation in the wild habitat and cultivation in the private land.
8. Minimum assured price or minimum procurement price for the produce is needed.
9. Buy-back assurance or contract farming of MAP should be strengthened. This will reduce the pressure on the wild resource base.
10. A digital platform providing end to end information on wild collection, cultivation, processing and marketing aspects.

Annexure I

Location of warehouse constructed for drying, grading, processing and storage of medicinal plants collected by the Task team members under different JFMCs.

Sl. No	Division	Range & (Beat)	Latitude & Longitude
1	Rupnarayan	Amlagora (Patrisole)	22° 20' 08.2" N 87° 02' 47.1" E
2	Kangshabati (North)	Manbazar (Kenda)	23° 11' 37.62" N 86° 31' 31.21" E
3	Kangshabati (South)	Hura (Keshargarh)	23° 15' 54.85" N 86° 33' 13.00" E
4	Panchet	Bishnupur (Bishnupur II)	23° 03' 01.4" N 87° 16' 37.5" E
5	Bankura (South)	Simlapal (Simlapal)	22° 55' 53.9" N 87° 04' 17.2" E
6	Bankura (North)	Radhanagar (Bhara)	23° 09' 49.3" N 87° 22' 57.7" E
7	Midnapur	Godapiasal (Godapiasal)	22° 32' 18.1" N 87° 19' 41.5" E

Annexure II

Traded medicinal plants recorded during survey and interviews with the herbal raw drug dealers as well as survey in the local markets.

Sl. No.	Scientific Name	Family	Local name	Parts used	Area of documentation
1	<i>Terminalia chebula</i>	Combretaceae	Haritaki	Fruits	Bishnupur, Pinkboni, Manbazar
2	<i>Strychnos nux-vomica</i>	Loganiaceae	Kuchila	Seeds	Bishnupur, Manbazar
3	<i>Madhuca latifolia</i>	Sapotaceae	Mahua	Flower	Bishnupur, Pinkboni,
4	<i>Alstonia scholaris</i>	Apocynaceae	Chatim	Bark	Bishnupur, Pinkboni, Manbazar
5	<i>Stereospermum chelonoides</i>	Bignoniaceae	Parul	Root bark	Bishnupur,
6	<i>Cassia fistula</i>	Fabaceae	Badar lathi	Roots, Leaves	Bishnupur, Pinkboni, Manbazar
7	<i>Terminalia bellirica</i>	Combretaceae	Bahera	Fruits	Bishnupur, Pinkboni, Manbazar
8	<i>Sida cordifolia</i>	Malvaceae	Berala	Seeds and roots	Pinkboni, Manbazar
9	<i>Holarrhena antidysenterica</i>	Apocynaceae	Indrajab, Kurchi	Bark, Seeds	Bishnupur, Pinkboni, Manbazar
10	<i>Terminalia arjuna</i>	Combretaceae	Arjuna	Bark	Bishnupur, Pinkboni, Manbazar
11	<i>Oroxylum indicum</i>	Bignoniaceae	Sonachal	Root bark, Stem bark, fruits, seeds and leaves	Bishnupur, Pinkboni, Manbazar
12	<i>Bombax ceiba</i>	Malvaceae	Simul	Bark	Bishnupur, Manbazar
13	<i>Azadirachta indica</i>	Meliaceae	Neem	leaves, bark, roots, Fruits, seeds	Bishnupur, Pinkboni, Manbazar

14	<i>Desmodium gangeticum</i>	Fabaceae	Sholapani/ Shalparni	Whole plant	Manbazar
15	<i>Rauvolfia serpentine</i>	Apocynaceae	Sarpagangha	Roots	Bishnupur, Pinkboni, Manbazar
16	<i>Cryptolepis buchananii</i>	Asclepiadaceae	Shama lata/ Shyاملata	Roots	Bishnupur,
17	<i>Aegle marmelos</i>	Rutaceae	Bael	Fruits, leaves, roots	Bishnupur, Pinkboni, Manbazar
18	<i>Teramnus labialis</i>	Fabaceae	Maspani	Whole plant	Manbazar
19	<i>Withania somnifera</i>	Solanaceae	Aswagandha	Roots	Bishnupur, Pinkboni, Manbazar
20	<i>Ocimum tenuiflorum</i>	Lamiaceae	Tulshi	Whole plant	Bishnupur, Pinkboni, Manbazar
21	<i>Pederia foetida</i> (Rubiaceae)		Gandhari	Whole plant	Bishnupur, Manbazar
22	<i>Andrographis paniculata</i>	Acanthaceae	Kalmegh	Whole plant	Bishnupur, Pinkboni, Manbazar
23	<i>Amaranthus viridis</i>	Amaranthaceae	Chauli	Whole plant	Manbazar
24	<i>Litsea glutinosa</i>	Lauraceae	Leda	Bark, Leaves	Bishnupur, Pinkboni, Manbazar
25	<i>Sida rhombifolia</i>	Malvaceae	Set berala	Roots and seeds	Bishnupur, Pinkboni,
26	<i>Tinospora cordifolia</i>	Menispermaceae	Gulanča	Stem	Bishnupur, Pinkboni, Manbazar
27	<i>Shorea robusta</i>	Dipterocarpaceae	Sal	Bark, seeds	Bishnupur, Pinkboni, Manbazar
28	<i>Vitex negundo</i>	Lamiaceae	Nishad	Leaves	Pinkboni, Manbazar
29	<i>Asparagus racemosus</i>	Asperagaceae	Satamuli	Tubers	Bishnupur, Pinkboni, Manbazar
30	<i>Buchanania lanzan</i>	Anacardiaceae	Piyal	Seeds	Bishnupur, Pinkboni, Manbazar

31	<i>Semecarpus anacardium</i>	Anacardiaceae	Vella	Fruits	Bishnupur, Pinkboni, Manbazar
32	<i>Santalum album</i>	Santalaceae	Chandan	Heart wood	Bishnupur, Pinkboni,
33	<i>Kukumis melo</i>	Cucurbitaceae	Kachra	Seeds	Manbazar
34	<i>Tephrosia purpurea</i>	Fabaceae	Janggi		Bishnupur,
35	<i>Bacopa monnieri</i>	Plantaginaceae	Brahmmi	Leaves and branches	Bishnupur, Pinkboni, Manbazar
36	<i>Tamarindus indica</i>	Fabaceae	tetul	Fruits	Bishnupur, Pinkboni, Manbazar
37	<i>Hemidesmus indicus</i>	Apocynaceae	Anantamul	Leaves and stems	Bishnupur, Pinkboni, Manbazar
38	<i>Emblica officinalis</i>	Phyllanthaceae	Amlaki	Fruits	Bishnupur, Pinkboni, Manbazar
39	<i>Pongamia pinnata</i>	Fabaceae	Karanj	Seeds	Bishnupur, Pinkboni,
40	<i>Acacia auriculiformis</i>	Fabaceae	Sonajhuri	Roots	Bishnupur
41	<i>Carissa carandas</i>	Apocynaceae	Karamcha	Fruits and stem bark	Bishnupur, Pinkboni,

Annexure III

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Listed medicinal plants of India with their appendices (having various rules of international restrictions for trade)

Sl. No.	Species	Common Name	CITES (Appendix)	IUCN Red list status
1	<i>Cycas beddomei</i>	Beddome's Cycad	I	EN
2	<i>Vanda coerulea</i>	Blue Vanda	I	
3	<i>Saussurea costus</i>	Kuth	I	CR
4	<i>Paphiopedilium species</i>	Lady's slipper orchids	I	
5	<i>Nepenthes khasiana</i>	Pitcher Plant	I	EN
6	<i>Renanthera mschootiana</i>	Red Vanda	I	
7	<i>Rauwolfia serpentina</i>	Sarpagandha	II	
8	<i>Ceropegia spp.</i>			
9	<i>Frerea indica</i>	Shindal Mankundi		
10	<i>Podophyllum hexandrum</i>	Indian Podophyllum	II	
11	<i>Cyatheaceae species</i>	Tree Ferns		
12	<i>Cycadaceae species</i>			
13	<i>Dioscorea deltoidea</i>	Elephant's Foot	II	
14	<i>Euphorbia spp.</i>	Euphorbias	II	
15	<i>Orchidaceae species</i>	Orchids		
16	<i>Pterocarpus santalinus</i>	Red Sanders	II	NT
17	<i>Taxus wallichiana</i>	Common Yew or Birmi leaves	II	EN
18	<i>Aquilaria malaccensis</i>	Agarwood	II	CR
19	<i>Aconitum species</i>			
20	<i>Coptis teeta</i>			EN
21	<i>Coscinium fenestratum</i>	Calumba wood		DD
22	<i>Dactylorhiza hatagirea</i>	Wanpolagpa, Hathajodi, Salam panja	II	LC
23	<i>Gentiana kurroo</i>	Kuru, Kutki		CR
24	<i>Gnetum species</i>			
25	<i>Kamphergia galenga</i>	Galangal, Chandramula		
26	<i>Nardostachys grandiflora</i>	Jatamansi	II	CR
27	<i>Panax pseudoginseng</i>	Ginseng	II	
28	<i>Picrorhiza kurroa</i>	Kutki	II	
29	<i>Swertia chirata</i>	Charayata		

Annexure IV

Estimated annual consumption of highly traded MAPs extracted from the wild (TRAFFIC- India)

Common Name	Scientific Name	Parts used	Estimated current annual consumption (Dry weight in mt)	IUCN Red list	FRLHT CAMP Red list
Jatamansi	<i>Nardostachys grandiflora</i>	Root (Rhizome)	500-1,000	Critically Endangered	Critically Endangered
Agarwood	<i>Aquilaria malaccensis</i>	Bark (Stem), Heart			
Wood	50-100	Critically Endangered	Critically Endangered		
Queen Sago	<i>Cycas circinalis</i>	Flower, Pith	<10	Endangered	Critically Endangered
Himalayan Yew	<i>Taxus wallichiana</i>	Leaf	100-200	Endangered	Critically Endangered
Red Sanders	<i>Pterocarpus santalinus</i>	Wood	200-500	-	Critically Endangered
Ginseng	<i>Panax pseudoginseng</i>	Root	<10	--	Critically Endangered
Salampanja	<i>Dactylorhiza hataqirea</i>	Root (Tuber)	10-50	--	Critically Endangered
Kutki	<i>Picrorhiza kurrooa</i>	Root (Tuber)	1,000-2,000	--	Critically Endangered
Himalayan May apple	<i>Podophyllum hexandrum</i>	Fruit, Root	10-50	--	Critically Endangered
Elephant's Foot	<i>Dioscorea deltoidea</i>	Root	10-50	--	Endangered

Annexure V

Threatened medicinal plants of West Bengal as per the Conservation Assessment and management Prioritization (CAMP) exercise conducted using criteria and categories of IUCN in West Bengal in the year 2007

Sl. No.	Botanical Name	Family	Synonym	Trade Name	Local Name	Habit	Parts traded	Threat Status
1.	<i>Abelmoschus moschatus</i> Medik	Malvaceae	<i>Hibiscus abelmoschus</i>	Muskdana, Lata kasturi	Lata Kasturi, Kal Kasturi, Mushkdana	Undershrub	Seeds	Near threatened
2.	<i>Aconitum bisma</i> (Buch.-Ham.) Rapaics	Ranunculaceae	<i>Aconitum palmatum</i> <i>Caltha bisma</i>	--	Bikhma	Perennial - herb	Root	Endangered
3.	<i>Aconitum ferox</i> Wall. ex Seringe	Ranunculaceae	--	Atish meethi	Bish	Perennial- herb	Root	Endangered
4.	<i>Aconitum spicatum</i> (Bruhl) Stapf	Ranunculaceae	<i>Aconitum ferox</i> var. <i>spicatum</i>	--	--	Perennial herb	Root	Endangered
5.	<i>Alpinia calcarata</i> Roscoe	Zingiberaceae	--	--	Toroni	Herb	Rhizome	Endangered
6.	<i>Ampelocissus barbata</i> (Wall.) Planch.	Vitaceae	<i>Vitis barbata</i>	--	Jarila-lahaira	Liana (Climber)	Stem	Critically Endangered
7.	<i>Aphanamixis polystachya</i> (Wall.) Parker	Meliaceae	<i>Aglaia polystachya</i> , <i>Amoora rohituka</i> , <i>Andersonia rohituka</i>	Rohitak	Tiktaraj, Pittaraj, Harin-hara	Tree	Stem bark and seeds	Least concern
8.	<i>Aristolochia indica</i> Linn.	Aristolochiaceae	--	Ishwar mul	Ishwarmul, Sapsan, Bhedjanetet	Climber	Leaves and roots.	Vulnerable
9.	<i>Asparagus racemosus</i> Willd.	Liliaceae	--	Satawari	Satamuli, Shatawari	Shrub	Leaves and roots. Branchlets, fruits, bark, and root	Endangered
10.	<i>Berberis aristata</i> DC.	Berberidaceae	<i>Berberis sikkimensis</i>	--	Chotra	Shrub		Vulnerable

11.	<i>Celastrus paniculatus</i> Willd.	Celastraceae	<i>Celastrus multiflorus</i> , <i>C. rothiana</i> <i>Swertia paniculata</i>	Malkangni	Mulkangni, Jyostimati, Kujari	Climber	Seeds and bark.	Endangered
12.	<i>Cinnamomum bejolghota</i> (Buch.-Ham.) Sweet	Lauraceae	<i>Laurus bejolghota</i> , <i>Cinnamomum obtusifolium</i>	Bejolghota	BhaleSinkohli, Tezpata	Tree	Leaves and bark	Vulnerable
13.	<i>Cinnamomum cecidodaphne</i> Meissn.	Lauraceae	--	--	Malagiri	Tree	Wood and seeds	Endangered
14.	<i>Desmodium motorium</i> (Houtt.) Merr.	Fabaceae	<i>Desmodium gyrans</i>	Ban Chandal	Ban Chandal	Undershrub	Roots	Vulnerable
15.	<i>Dioscorea prazeri</i> Prain & Burkill	Dioscoreaceae	<i>Dioscorea clarkei</i> , <i>D. deltoideauar. sikkimensis</i>	Kukur, Tarul	Kukur, Tarul	Climber	Underground root tuber and bulbils	Endangered
16.	<i>Drosera burmannii</i> Vahl.	Droseraceae	--	'Sun-dew'	Suriya-sisir	Herb	Whole Plant	Endangered
17.	<i>Gloriosa superba</i> Linn.	Liliaceae	--	Kali Hari	UlatChandal, Agnisikha	Tendrill climber	Tubers	Vulnerable
18.	<i>Gynema sylvestre</i> R.Br.	Asclepiadaceae	<i>Periploca sylvestris</i>	Gurmar	Gurmar, Mesh shringi, Medasingi	Climber	Entire plant	Vulnerable
19.	<i>Gynocardia odorata</i> R. Br.	Flacourtiaceae	--	Chaulmoogra	Chaulmgra	Tree	Seeds	Endangered
20.	<i>Helminthostachys zeylanica</i> (Linn.) Hook. F.	Ophioglossaceae	<i>Helminthostachys dulcis</i>	Ekbir	Ekbir	Rhizomatous herb	Whole Plant and rhizome.	Endangered
21.	<i>Ipomoea mauritiana</i> Jacq.	Convolvulaceae	<i>Ipomoea digitata</i> , <i>I. paniculata</i> , <i>Convolvulus paniculata</i>	Bhumikumra, Bhumikus-hmanda	Bhumikumra, Bhumikusmanda	Climber	Roots and tubers	Near threatened
22.	<i>Litsaea glutinosa</i> (Lour.) Robinson	Lauraceae	<i>Sebifera glutinosa</i> , <i>Litsaea chinensis</i> , <i>L. Sebifera</i>	Maida Lakri, Maida Lakadi	Piplus, Kukur Chita, Maida Lakadi	Tree	Leaves, flower buds, fruits, roots.	Least concern

23.	<i>Lumnitzera racemosa</i> Willd.	Combretaceae	--	--	Kripa	Small tree	Leaves, barks, fruits	Critically Endangered
24.	<i>Lycopodiella cernua</i> (Linn.) Pichli-Sermolli	Lycopodiaceae	<i>Lycopodium cernuum</i> , <i>Palhinhaea cernua</i>	Lycopodium	Nag beli	Herb (Perennial)	Whole plant	Endangered
25.	<i>Mesua ferrea</i> Linn.	Clusiaceae	--	Nagkesar	Nagkesar	Tree	Bark. Timber and flowers buds	Endangered
26.	<i>Morinda citrifolia</i> Linn.	Rubiaceae	--	Noni	Ach, Chaili, Bartundi, Surangi, Aal	Small tree	Leaves, stems, fruits and roots.	Vulnerable
27.	<i>Mucuna pruriens</i> (Linn.) DC.	Fabaceae	<i>Dolichos pruriens</i> , <i>Carpogon pruriens</i> , <i>Mucuna prurita</i>	Kanso, Kuach	Kanso, Kuachi	Climber	Pod and seed	Endangered
28.	<i>Nipa fruticans</i> Wurm	Arecaceae	--	Golpata	Golpata	Tree	Leaves and fruits.	Vulnerable
29.	<i>Olax nana</i> Wall. ex Benth.	Olacaceae	--	Bhadu, Olax	Bhadu Shak, Merom Met	Undershrub	Leaves and ripened fruit.	Vulnerable
30.	<i>Ophioglossum reticulatum</i> Linn.	Ophioglossaceae	<i>Ophioglossum cordifolium</i>	Adder's tongue/ Ektir	Ektir	Terrestrial Fern	Tuber	Endangered
31.	<i>Panax pseudo ginseng</i> Wall.	Araliaceae	<i>Panax sikkimensis</i>	Ginseng	Jara-okhati, Mangan	Herb	Rhizome	Critically Endangered
32.	<i>Pericampylus glaucus</i> (Lamk.) Merr.	Menispermaceae	<i>Pericampylus incanus</i>	Pipal- pati	Pipal-pati, Lahara	Climber	Root tuber	Vulnerable
33.	<i>Persea glaucescens</i> (Nees.) Long	Lauraceae	<i>Machilus villosa</i>	Kawla	Kawla, Atilo	Tree	Bark and wood.	Critically Endangered
34.	<i>Picrorhiza kurroa</i> Royle ex Benth.	Scrophulariaceae	<i>Picrorhiza kurroa</i>	Kutki	Kutki, Kutaki	Perennial herb	Whole plant	Critically Endangered
35.	<i>Podophyllum hexandrum</i> Royle	Podophyllaceae	<i>P. emodi</i> , <i>P. emodi</i> var. <i>jaeschkei</i>	Ban kakri	Ban Kakri, Panchpatey	Perennial herb	Whole plant, fruit and root.	Critically Endangered

36.	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	--	Bijasal	Bijasal, Piyasal	Tree	Bark, wood and gum.	Vulnerable
37.	<i>Rauwolfia serpentina</i> (Linn.) Benth. ex Kruz	Apocynaceae	<i>Ophioxylon serpentinum</i>	Rauwolfia, Sarpagandha	Sarpagandha Chandra, Chhotachand	Shrub	Leaves, seeds, roots	Endangered
38.	<i>Sonneratia caseolaris</i> (Linn.) Engl.	Sonneratiaceae	<i>Rhizophora caseolaris</i> , <i>Sonneratia acida</i>	Archa, Ora	Ochra, Archa, Archaka	Tree	Fruits and wood.	Endangered
39.	<i>Stereospermum calais</i> (Dillwyn) Mabb.	Bignoniaceae	<i>S. tetragonum</i> , <i>S. personatum</i>	Parao, Padri	Parania, Padri	Tree	Bark	Vulnerable
40.	<i>Swertia chirayita</i> Roxb. ex (Fleming) Karst	Gentianaceae	<i>Gentiana chirayita</i> , <i>Ophelia chiraita</i>	Chirayata	Chireta, Chirayata	Herb	Whole plant	Critically Endangered
41.	<i>Taxus wallichiana</i> Zucc.	Taxaceae	<i>Taxus baccata</i> sub. sp. <i>Wallichiana</i>	Taxus	Dhengresalla	Tree	Leaf twigs and barks.	Critically Endangered
42.	<i>Thalictrum foliosum</i> DC.	Ranunculaceae		Dampate	Dampate	Herb	Whole plant and root.	Vulnerable
43.	<i>Toona ciliata</i> Roem.	Meliaceae	<i>Cedrella toona</i>	Toon	Toon	Tree	Seed, bark and wood.	Vulnerable
44.	<i>Tylophora indica</i> (Burm. f.) Merr.	Asclepiadaceae	<i>Tylophora asthmatica</i> , <i>Cynanchum indicum</i>	Anantamul	Anantamul, Ananthamul	Perennial climber	Leaves and roots.	Near threatened
45.	<i>Viscum articulatum</i> Burm. f.	Viscaceae	<i>Viscum nepalense</i>	Viscum	Bunda, Mandada	Shrub	Whole plant	Least concern
46.	<i>Xylocarpus granatum</i> Koer.	Meliaceae	<i>X.obovatus</i> , <i>Carallia obovata</i> , <i>Carallia moluccensis</i>	Pussur	Pussur, Dhandul	Tree	Wood	Vulnerable

Annexure VI

Medicinal plants which are promoted for commercial cultivation in West Bengal

1	<i>Ernblica officinalis</i>	Amla
2	<i>Saraca asoca</i> (Roxb.) de Wilde	Ashok
3	<i>Withania somnifera</i> (Linn.) Dunal	Ashwagandha
4	<i>Aconitum heterophyllum</i> Wall. ex Royle	Atees
5	<i>Aegle marmelos</i> (Linn.) Corl	Bael
6	<i>Phyllanthus amarus</i> Schurn & Thonn	Bhumi amlaki
7	<i>Bacopa monnieri</i> (L.) Pennell	Brahmi
8	<i>Santalum album</i> Linn.	Chandan
9	<i>Swertia chirata</i> Buch-Ham.	Chirata
10	<i>Tinospora cordifolia</i> Miers	Giloe
11	<i>Gymnema sylvestre</i> R. Bl:	Gudmar
12	<i>Commiphora wightii</i> (Arn.) Bhandari	Guggal
13	<i>Plantago ovata</i> Forsk.	Isabgol
14	<i>Nardostachys jatamansi</i> DC	Jatamansi
15	<i>Gloriosa superba</i> Linn	Kalihari
16	<i>Andropogon paniculata</i> Wall. ex Nees	Kalmegh
17	<i>Garcinia indica</i> Choisy	Kokum
18	<i>Saussurea costus</i> C B. Clarke (S.lappa)	Kuth
19	<i>Picrorhiza kurroa</i> Benth ex Royle	Kutki
20	<i>Solanum nigrum</i> Linn.	Makoy
21	<i>Glycyrrhiza glabra</i> Linn.	Mulethi
22	<i>Chlorophytum borivillianum</i> Sant	Musali safaid
23	<i>Coleus barbatus</i> Benth./C vettiveroides	Patharchur
24	<i>Piper longum</i> Linn.	Pippal
25	<i>Berberis aristata</i> DC	Rasaut (Daruhaldi)
26	<i>Crocus sativus</i> Linn.	Saffron (Kesar)
27	<i>Rauwolfia serpentina</i> Benth. ex Kulz	Sarpgandha
28	<i>Cassia angustifolia</i> Vah	Senna
29	<i>Asparagus racemosus</i> Willd	Shatavari
31	<i>Embelia ribes</i> Burm	Vai Vidang
32	<i>Aconitum ferox</i> Wal	Vatsnabh

Annexure VII

List of Herbal Raw Drug Traders

Sl. No.	Name	Address	Contact No.
1	Mr. Vijay Kedia	Basant Traders, 169, Cotton Street, Kolkata-07	9830081025
2	Mr. Surendra Nath Das	132, Rabindra Sarani, Kolkata-07	033-22694785
3	Mr. Sarbeswar Mullick	132, Rabindra Sarani, Kolkata-07	9830808906
4	Mr. Tapan Das	Debi Pada Das & Sons. 130, Rabindra Sarani, Kolkata-07	9038377803
5	Mr. B. Ananda Babu	Chattishgarh State Minor Forest Produce Federation Ltd.	8771-2513100
6	Mr. Paradeep Dubey	Gram Mooligai Corporation Ltd. 211/B, Ravindra Nagar, Adhartal, Opp. Dhani Ki Kuttia, Jabalpur-482004, Madhya Pradesh, India	8023632008
7	Mr. Beni Madhav Dutta	Annapurna Bhandar 1/3, Ganguli Lane, Kolkata -700 007	033-22302876
8	Mr. Apurba Dutta	Dutta & Dutta spiece and crude drugs Chemicals, 162, Cottong street, Kolkata-07	9051914280
9	Mr. Sudhir Ch. Bid	Chandan Traders, Crude Drugs , Herbs Marchant & Commission Agent, 1/1, Ratan Sarkar Garden Street, Kolkata-07	9434160908
10	Mr Jugraj Daga	Arihat Trading Co. 547, G. T. Road SouthHowrah -711 101.	033-2660 7130
11	Mr Avijit Dutta	8aidyanath Dutta & Sons 1688, Cotton Street, Kolkata -700 007	2238 5352
12	Mr Rishi Lal Bhatia	Beharilal Hemraj 176, Jamunalal Bajaj Street, Kolkata- 700007	2238 2130
13	Mr. Dinabondhu Dutta	60/4, P. Majumdar Road, Kolkata-78	9831064957
14	Mr. Debashish Kundu	Shiba Pada Kundu & Sons, Exporters & Importers- Spice, Crude Drugs, Chemicals, 168B, Cottong street, Kolkata-07	9830085329
15	Mr. Babulal Kothari	Excel Drug House, 18B, Sukheas Lane, Kolkata-700001	224285271
16	Mr Babulal Kothari	Harakhchand Kaluram 26/4A, Armenian Street, Kolkata -700 001.	22385267
17	Mr Sushil Daga	Herbo India, 6th Floor, 8, Amartolla Street, Kolkata -700001.	2231 3242

18	Mr Pradip Khanna	Khanna Trading Co. 20/B, Deshapriya Park Road, Kolkata -700014	22580269
19	Mr R. Kundu	Lakshman Chandra Das P48/B, C.I. T. Road, Kolkata- 700014	22386337
20	Mr Mitesh Gathar	M. Dhirubhai & Co. 18B, Sukeas Lane, Kolkata -700 001	98310 06942
21	Mr M. P. Mishra	Mata Prasad Mishra 3, Karbala Mohammed Street, Kolkata -700 001	2235 2276
22	Mr Sanjay Jain	Natural Drugs 26/4A, Armenian Street, Kolkata -700 001.	2231 3242
23	Mr . O. P. Agarwal	Om prakash Agarwal, 1A, Halwasiya Road, Kolkata -700 007	98301 36274
25	Mr Samar Chandra	Samar Chandra Ichapur Road, Kalitola Howrah -711 104	98310 77273
26	Mr Himmatsingh Daga	Sanjay Trading Co. Mr Himmatsingh Daga 26/4, Armenian Street, Kolkata -700001	2231 3242
27	Mr L. Maharaja Pillai	Sriniwas Trading Co. 25/2, Nepal Saha Lane, Howrah -711 101	2660 2132
28	Mr Raghu Nath Kundu	Sh;bapada Kundu & Sons 1688, Cotton Street, Kolkata -700007	2238 6337
29	Mr Om Prakas	Shree Vinayak Traders 164, Cotton Street, Kolkata -700007	98311 93015
30	MrSadhu Dubey	Sree Sai Baba Stores 21, Bartala Street, Kolkata -700007.	9830093316
31	Mr Chetan Doshi	8alajee Enterprises, 2nd Floor, 1688, Cotton Street, Kolkata -700 007.	2258 0479

Annexure VIII

Major players that facilitates the documentation, conservation, cultivation, sustainable collection, value addition, marketing and training as well as capacity building programs related to the medicinal plants sector.

Sl. No.	Name of the Organizations	Address	Remarks
1	National Medicinal Plants Board (NMPB)	New Delhi	Funding agency of Govt. of India for overall development of the medicinal plants sector
2	State Medicinal Plants Board (SMPB)	West Bengal	Facilitates in cultivation of medicinal plants in the state
3	West Bengal Forest Department	West Bengal	Overall conservation and augmentation of medicinal plants in the state
4	Ministry of Environment, Forest and Climate Change (MoEF CC)	New Delhi	Funding on conservation of medicinal plants
5	United Nation Development Program (UNDP)	New Delhi office	Socio-economic development related to this sector
6	International Tagore Society for Cultural, Educational and Environmental Development (ITSCEED)	West Bengal	Resource assessment, Ecological studies, Medicinal plants conservation, training and capacity building of local communities
7	TDU-FRLHT, Bangalore	Karnataka	Medicinal plants conservation, training and capacity building of local communities
8	Indian Institute of Bio-Social Research and Development (IBRAD)	West Bengal	Digital ethnography of tribal communities and their dependence on forest resources
9	Tagore Society for Rural Development (TSRD)	West Bengal	Cultivation of medicinal plants and livelihoods
10	Chattishgarh State Minor Forest Produce Federation Ltd.	Chhattisgarh	Facilitates in sustainable collection, processing and marketing of medicinal plants

References:

- Chakravarty, R.K., Srivastava, R.C., Mitra, S., Bandyopadhyay, Subhojit and Bandyopadhyay, Subir.1999 West Bengal. In: Floristic Diversity and Conservation Strategies in India. (Eds. Mugal, V. and Hajra, P. K. Botanical Survey of India, Calcutta. Pp. 1575-1630
- Goraya, G.S. and D.K. Ved. 2017. Medicinal Plants in India: An Assessment of their Demand and Supply. National Medicinal Plants Board, Ministry of AYUSH, Govt. of India, New Delhi, Indian Council of Forestry Research and Education, Dehradun. P 393.
- Ajayi, A.O .1995. Identification of training needs of women farmers in Oye state. Unpublished M.Sc. Thesis, Agric. Extension and Rural Sociology, O.A.U. Ile-Ife.
- Babu, A.R. and Singh R.P .1986. Training your farm manpower of extension education. Indian J. Ext. Edu., 22(3&4): 33-39.
- Caffarella R.S. 2002. Planning programs for adult learners. Apractical guide for educators, trainers and staff developers. 2nd Edition. San Francisco: John Wiley and Sons.
- Pholonngoe, M.B. and Richard, L. 1995. Training manual for non formal and adult education trainers. Extension Educator, Maseru: Lesotho Association of NFP.
- Sajeev M.V. and Singha A.K. 2010. Capacity building through KVKs: Training needs analysis of farmers of Arunachal Pradesh. Indian Res. J. Ext. Edu., 10(1): 83-90
- Atheequlla, G.A., Smitha, G.R., Bindu, K. H. and Venkattakumar, R. 2021. Empowerment of medicinal and aromatic plants stakeholders through institutional capacity building. Medicinal Plants. Vol. 13 (2), June 2021, 283-288. DOI: 10.5958/0975-6892.2021.00031.9
- Berneth, J. 2000. Production and marketing of medicinal plants. International journal of horticultural science. 6(2): 63-65
- Kuniyal, C. P., Kuniyal, P. C., Butola, J. S., Sundriyal R.C. 2013. Trends in the marketing of some important medicinal plants in Uttarakhand, India. International Journal of Biodiversity Science, Ecosystem Services & Management. Taylor & Francis.
- Karki, M. 2001. Certification and marketing strategies for sustainable commercialization of medicinal and aromatic plants in Chhatisgarh; Paper presented at the National Research Seminar on Herbal Conservation, Cultivation, Marketing and Utilization with special emphasis on Chhatisgarh, The Herbal State; December 13-14, 2001; Raipur, India.
- Bhadula S.K, Singh A, Lata H., Kuniyal C.P, Purohit, A.N. 2000.Distribution pattern, population diversity and propagation of some high altitude medicinal herbs from Garhwal Himalaya: problems and prospects for conservation. In: Pangtey YPS, editor. High altitudes of Himalaya-II: Biodiversity, ecology and environment. Nainital: Gyanodaya Publication; p. 389–413

Schippmann U, Leaman DJ, Cunningham AB, Walter S. 2005. Impact of cultivation and collection on the conservation of medicinal plants: In: Jatisatienr A, Paratasilpin T, Elliott S, Anusarnsunthorn V, Wedge D, Craker LE and Gardner ZE, editors. Proceedings of WOCMAP III, The Third World Congress on Medicinal and Aromatic Plants. Leuven: International Society for Horticultural Science (Acta Horticulturae 676); p. 31–44.

Ved DK, Goraya GS. 2008. Demand and supply of medicinal plants in India. New Delhi: National Medicinal Plants Board; p. 216.

Olsen C.S. 1998. The trade in medicinal and aromatic plants from central Nepal to northern India. *Econ Bot.* 52:279–292.

Rao M.R, Palada M.C, Becker B.N. 2004. Medicinal and aromatic plants in agroforestry systems. *Agrofor Syst.* 61:107–122.

Domestic Market Study for Selected Medicinal and Aromatic Plants. 2009. Delhi: Regional economic development program, German Technical Cooperation (GTZ) and Rawal Medherbs Consultants Pvt. Ltd.; p. 246.

Karki, M. 2001) Institutional and Socio-economic factors and Enabling Policies for Non-timber Forest Products-based Development in Northeast India — In: Consultation on NTFP-led Development in NE India; Confidential report No. 1145-In, 106 March, 2000, International Fund for Agriculture Development (IFAD), Rome; 1-16 p.

Maikhuri R.K., Rao K.S., Chauhan K., Kandari L.S, Prasad P, Rajasekaran C. 2007. Development of marketing of medicinal plants and other forest products – can it be a pathway for effective management and conservation. In: Negi S.S., Srivastava RK, Bisht N.S., editors. Medicinal and aromatic plants (taxonomy, conservation, cultivation and marketing). Dehradun: Indian Forester; p. 411–418.

Gusain M.S., Sultan Z., Singh C.J., Bisht N.S.. 2009. Potential of marketing medicinal plants in Uttarakhand. *J Non Tim For Prod.*16:239–244.

BIT .2003. Developing a sustainable chain in Uttaranchal, India, Bulletin 350, cultivating a Healthy Enterprise, Royal Tropical Institute. Amsterdam, Netherlands.

CRPA. 2002. Demand Study for Selected Medicinal Plants: Volume I and II. Centre for Research, Planning and Action (CRPA) for Ministry of Health and Family Welfare, GOI, Department of ISM & H and WHO, New Delhi, India.

Karki, M., B.K Tiwari; A.K Badony, and N. Bhattarai (2003). Creating livelihoods Enhancing Medicinal and Aromatic Plants Based Biodiversity-Rich Production Systems: Preliminary Lessons from South Asia; Paper presented at the 3rd World Congress on Medicinal and Aromatic Plants for Human Welfare (WOCMAP III); February 3-7-2003; Chiang Mai, Thailand.

EU Strategic Marketing Guide, 2000 : CBI, Netherlands; Natural Ingredients for Pharmaceuticals.

Discussion Document on Medicinal Plants 2001. International Trade Centre — Third UN Conference on The Least Developed Countries — Business Sector Round Table

Mitra, S., and Mukherjee, S. K. 2013. Some Lesser known plants from Maldah District of West Bengal used for the treatment of Arthritis, Rheumatism and Gout. Indian J. Pharmaceutical Research and Bio Sci.2 (4): 337-45.

Important government orders for sustainable development of medicinal and aromatic plants (in Hindi). 2005. Gopeshwar: Herbal Research and Development Institute (HRDI); p. 54.

Basak, R. K. 1979. Some noteworthy Plant from Birbhum District, West Bengal. Indian Forester.105 (6): 477-81.

Chopra, R. N., Nayar, S. L. and Chopra, I. C. 1956. Glossary of Indian Medicinal Plants. CSIR, New Delhi. 330p

Bennet, S.S.R. 1979. Flora of Howrah District. Best Book Publication. New Delhi, India.

Chakraborty, NiharRanjan&Duary, Budhadeb.2014. Utilization of some Weeds as Medicine by the local people in Birbhum District of West Bengal, India. Int. J. Bio –Reso. Stress Mang. 5(1): 148-52.

Chopra I.C., Khajuria, B.N. and Chopra, C.L. 1957. Antibacterial principles of *Alpiniagalanga* and *Acoruscalamus*. Antibiotics Chemother, 7: 378.

Chopra, R. N., Nayar, S. L. and Chopra, I. C. 1980. Glossary of Indian Medicinal Plants. CSIR, New Delhi.

Jain, S.K.and Rao, R.R.(1976). .A Handbook of Field and Herbarium Methods. Today and Tomorrow Publishers, New Delhi.

Chopra, R. N., Nayar, S. L. and Chopra, I. C. 1956. Glossary of Indian Medicinal Plants. CSIR, New Delhi. 330p.

Singh, K. P., Upadhyay, R., and Kumar, A. 2010. Screening of *adhatoda vasica* needs as a putative HIV-protease inhibitor. J. Phytol. 2 (4), 78–82.

Singh, P., Chakraborty, P., He, D. H., and Mergia, A. 2019. Extract prepared from the leaves of *Ocimum basilicum* inhibits the entry of Zika virus. Acta Virol. 63 (03), 316–321. doi:10.4149/av_2019_307

Agarwal, R., Diwanay, S., Patki, P., and Patwardhan, B. 1999. Studies on immunomodulatory activity of *Withania somnifera* (Ashwagandha) extracts in experimental immune inflammation. J. Ethnopharmacol. 67 (1), 27–35

<https://cites.org/eng/app/index.php>

https://www.wwfindia.org/about_wwf/enablers/traffic/about_traffic/

<http://www.pharmabiz.com/NewsDetails.aspx?aid=144964&sid=1>

**PLATES OF THE IMAGES CAPTURED DURING TRAINING
PROGRAM ON SUSTAINABLE COLLECTION, VALUE ADDITION
AND TRADE STUDY OF MEDICINAL PLANTS**

Plate 1: Inauguration of the training programs by the inaugural address of Mr. Devesh Pandey, IFS, ACF, Bankura (North) Division, Dr. Debabrata Saha, Assistant Professor, TDU University, Bangalore and Dr. Biswarupa Ghosh, BKC College, Kolkata



Plate 2: After the registration, participants are attending and interacting with the resource persons in the training program on conservation, sustainable collection, value addition and marketing of medicinal plants



Plate 3: Resource person Dr. Debabrata Saha, Asst. Prof. TDU University and Dr. Biswarupa Ghosh, Asst. Prof. BKC College explaining various aspects related to conservation, sustainable collection, value addition and marketing of medicinal plant with special reference to ISSC- MAP guidelines.



Plate 4: Resource person Dr. Debabrata Saha, Asst. Prof. TDU University and Dr. Biswarupa Ghosh, Asst. Prof. BKC College, Kolkata explaining various aspects related to conservation, sustainable collection, value addition and marketing of medicinal plant with special reference to ISSC- MAP guidelines.



Plate 5: Resource person Dr. Biswarupa Ghosh, BKC College, Kolkata explaining various aspects related to conservation, sustainable collection, value addition and marketing of medicinal plant with special reference to ISSC- MAP guidelines.



Plate 6: On field hands-on training on sustainable collection of **gums/resins** given by the resource persons Dr. Debabrata Saha



Plate 7: Medicinal plants collected, sorted, dried, graded and packed in gunny bags and stored in the warehouse.



Gulancha Lata



Haritaki



Bael



sun dried bark



Bahera



Tulshi



Plate 8. Pattern of Sorting, Processing, Drying and marketing of *Aegle marmelos* (Bael fruits) by the local community



Slide 9: Medicinal plants collected, graded, dried and sold both retail as well as whole sale.



Slide 10: Medicinal plants collected, graded, dried and sold both retail as well as whole sale.



Plate 11. Visit to different JFMCs– villages for interactions with the community regarding the pattern of collection, processing and marketing of medicinal plants, and livelihood



Plate 12: Trade study and interviews of the traders to gather data for better marketing and upliftment of the local community

