Chapter 6

DISCUSSION

"Earth provides enough to satisfy every man's need, but not every man's greed".

—Mahatma Gandhi

The wide gap between demand and availability of medicinal raw drugs for the manufacture of medicines is increasing day by day. On the one side, the natural areas like forests and waste lands are shrinking in extent due to various developmental activities and over use of land for meeting the demands of village population, and on the other side the requirement of medicine is also getting increased over time in order to meet the demand of increasing population. To meet the increasing needs of medicinal plants, they are extracted unscientifically resulting in the deterioration of the resource base. Apart from these, fire and grazing in the natural locations affect the regeneration of medicinal plants.

On the one side there is over exploitation, over use and unscientific extraction of the medicinal drugs and on the other side, there is gradual reduction of natural habitats. This situation resulted in many species getting rare, endangered and even
at the point of extinction. This situation needs careful examination and scientific planning.

To meet the above situation, it would be essential to consider the following

i Scientific extraction keeping in view the availability

ii Conservation

iii Cultivation

1. Scientific extraction:

Since the Forest Department considers the medicinal plants as a part of the Minor Forest Produce, not much importance is given for their exploitation. Presently, medicinal plants are collected by the tribal communities and sold to the tribal societies, which in turn sell the same to the Scheduled Caste Scheduled Tribe Development Co-operative Federation Limited. This Organization sells the produce to the medicine manufacturing units.

The collection being highly destructive and unscientific, the resource base gets depleted. Added to this, there is clandestine collection by the medicinal plant collectors who enter into the forests for taking medicinal drugs from areas as they please. This collection is also highly destructive and unscientific.

Annual fires sweep the forest areas especially the deciduous forest, which contain the maximum percentage of medicinal plants (Basha 1990) regularly every year and destroy the medicinal plant wealth. The uncontrolled grazing by cattle, goats, buffaloes etc. in the forest areas adjoining villages cause untold havoc not only by eating but also by trampling most of the species.

Large numbers of species are also found in the wastelands, cultivated fields etc.
Over exploitation, these lands. Utilization of wastelands also led to the depletion of this resource.
Many species have started disappearing due to uncontrolled grazing by cattle, goats etc.

**ii. Conservation:**

The above factors causing depletion of medicinal plant wealth lead to many species getting rare, endangered and threatened. This calls for attention to conserve at least the natural habitats from the interference of man and cattle so that the resource is conserved for posterity in its natural habitat.

Another attempt is to conserve the medicinal plants outside their natural habitats.

**iii. Cultivation:**

Conservation effort *in situ* will automatically lead to the reduction of collection of raw drugs from the forest areas. Introducing more restrictions will automatically lead to the reduction in the availability of the required medicinal raw drugs. To make up the shortage, some large medicine manufacturing units have already embarked on cultivation of the required species of medicinal plants.

Since the shortage is not possible to be made up, many units have gone for the purchase of raw drugs from other States.

The different activities carried out in the fields of conservation and cultivation of medicinal plants is examined below.
6.1 IN SITU CONSERVATION

In situ conservation of medicinal plants is achieved by two methods.

1. In situ conservation areas generally or commonly constituted to conserve the biota in which medicinal plants from a part. E.g., Protected Forest Areas, Sacred Groves etc.

2. In situ conservation areas specially constituted for the conservation of medicinal plants E.g., MPCAs.

All these above categories fall under the Protected areas, each having their own characteristic from the wild life management viewpoint. But basically the purpose is conservation of the biota contained in the area in totality so that the whole system with its ecological and biological aspects is fully protected.

The total extent of such natural protected areas in the forests of Kerala is 24.6% of the effective total forest area. Almost all the forest types except dry deciduous forests and sub-tropical temperate forests fall in the protected area network. These types of protected forests contain almost all the medicinal plants that grow in their natural habitats and are in viable populations except the very rare, and endangered species which also get automatic protection.

For ensuring whether the individual species are in viable population and to understand the location and geographic distribution, it is necessary to conduct a detailed species-wise survey of the protected areas in order to develop specific strategies for conservation of rare, endangered and threatened species of medicinal plants. The specific strategies include reintroduction of the species in its natural habitat to build up a viable population.
It is understood from the Kerala Forest Department that there are certain specific plants including medicinal plants in certain special locations or niches outside the protected area network and the Department has proposals to carve out such locations of the natural forests and preserve the same from any sort of interferences.

As far as the *in situ* conservation of medicinal plants growing in the forest is concerned there is no reason for much apprehension.

There are also species having medicinal properties growing in the mangrove areas. Presently there are no *in situ* conservation locations of larger extent within the mangrove vegetation except the ‘Mangalavanan’ in the Forest Department compound, under the control of the Forest Department. The mangrove locations of Kerala are presently under severe threat of devastation as major part of the mangroves are under private management.

The Government of Kerala has constituted a committee in 1998 for identifying the mangrove locations suitable for conservation (GOK 1998). When the areas are identified, the Government may take action for conservation of the same. When such a conservation attempt materializes, the mangrove medicinal plants also will get protection *in situ*.

Another storehouse of medicinal plants is the Sacred Groves of Kerala. Except a few like ‘poonkavanam’ (Sabarimala and surrounding forests), ‘Pakshipathalam’ and one very small grove, all the others are under private management. Of these Sacred Groves, only very few are fully protected. The important ones, which are under total preservation, are Mannarssala in Alappuzha district, Pambumekkattu Mana in Trichur District and Iringole Kavu of Ernakulam District. There is no anthropic interference in the vegetation, though people go to worship the deities in
the temples or worship places located inside the Groves. These are standing examples of cent per cent *in situ* conservation areas supporting the biota, which include the medicinal plants also with the full co-operation of people living around them. There are also Sacred Groves, which though under slight disturbance, can also be regarded as *in situ* conservation areas. Due to the very important genetic resource contained in the Sacred Groves, actions are under way in the national and international level for conserving the Sacred Groves containing genetic resources.

### 6.1.1. IN-SITU CONSERVATION OF MEDICINAL PLANTS — GENERAL.

The essence of *in situ* conservation of medicinal plants is to protect them in their natural habitats. Forests provide natural habitats for the majority of medicinal plant species in viable breeding population. Hence, Department of Forest becomes the most important and singular agency that can plan and implement *in situ* conservation strategies for the majority of medicinal plants either alone or in collaboration with Non-Governmental organizations. The Forest Department of Kerala has already taken stock of the seriousness of the problem and started the establishment of *in situ* conservation areas in the following forms.

1. Wildlife sanctuaries
2. National Parks
3. Biosphere Reserves
4. Bird Sanctuary areas
5. Project Tiger areas
6. Project elephant areas
6.1.2. **IN-SITU CONSERVATION OF MEDICINAL PLANTS — SPECIFIC.**

The Department of Forests, Government of Kerala in collaboration with FRLHT Bangalore, has set up 7 MPCA units across the State in the year 1993. A total of 1385 hectares of forest carved out from the different forest types and have been set apart especially for the conservation of medicinal plants. These are specially protected and are monitored regularly. As MPCAs, this much extent is too little and more areas having large species population of medicinal plants are to be identified in the forests and conserved for preserving the medicinal plants especially the rare, endangered and threatened one. These MPCA centres can act as gene conservation units and no commercial collection should be allowed.

All the 7 units of MPCAs serve as areas for conserving the common, rare, endangered and threatened species of medicinal plants specific to those areas. A total of 566 medicinal plants species have been recorded in all the 7 MPCAs put together Peechi MPCA which has been demarcated and maintained in the Peechi-Vazhani wildlife sanctuary has been selected for detailed study. Peechi MPCA contains 140 species of medicinal plants of which 7 fall under RET category. This finding widens the scope of *in situ* model, if we extrapolate this number in the given situation for a larger forest area.

No attempt of reintroduction of species is recorded in any of the MPC areas. They are intended for maintaining as *in situ* areas only for the conservation of whatever species exists in them.

*In situ* conservation of medicinal plants should be given top priority as this method alone can preserve different species on long term basis by providing natural ecological conditions for regeneration, thereby avoiding the risk of extinction.
Presently the Forest Department is following a conservation-oriented policy in the management of forests. As per this all the felling and extraction activities have been put a stop to in the natural forests. Thus the forests are set apart for the conservation of the biota contained in them. This is a policy decision taken by the Kerala Government in order to conserve the bio diversity of the forest area. Under this the plants having medicinal value are automatically protected.

How far the prevention of medicinal plant collection is legally possible, is a matter to be carefully considered. What happens now, is that lot of medicinal plant collectors enter into the forests and collect the medicinal plants illegally and sell the same to the medicine manufacturing units. It is to be considered in the policy making level whether sustainable collection of medicinal raw drugs is allowed from the natural forests outside the Protected Areas in order to meet the local requirements. Such a decision will lead to the following advantages.

i. Destructive collection can be prevented

ii. Collection can be controlled and restricted to plants of larger availability, thereby protecting rare, endangered and threatened species.

iii. Legislation of collection will lead to yielding some revenue to the Forest Department.

iv. The Forest Department can get an idea of the type of produce and the quantum collected from the forests. Presently such statistics is not available due to clandestine collection by smugglers.

Such a strategy will lead to sustainable utilization of the resource, side by side ensuring in situ conservation of the genetic base.

As already pointed out, 24.6% of the effective forest area is under Protected Area
network where *in situ* conservation of biota including the medicinal plants is the basic aim. What will be the percentage of medicinal plants in such protected areas is not yet been understood. Only through survey, one will be able to know the details. A conservation and sustainable utilization policy can be evolved only after knowing the details of the existing medicinal plant resource base.

**6.1.3. NATURAL REGENERATION:**

Natural regeneration of the medicinal plant species is very important for the continued survival of the species. Various factors influence natural regeneration in their natural habitat. The main factors are:

1. Flowering, fruiting, seed years (in the case of tree species).
2. Seed fall
3. Seed viability
4. Germination, establishment and survival
5. Light and shade conditions.

The processes occur naturally in the habitat but show difference among the different species. For example in the case of some trees there is regularity in the production of seeds prolifically in certain yearly intervals. But in most of the species seed production is an annual feature.

Survival and growth of the species again will be affected even when the factors mentioned above are favourable. Such over-riding factors are:

1. Climatic factors
2. Biotic factors

The climatic factors are the natural phenomena occurring in the habitats over
which none have control and the plant growth including the medicinal plants survive these odds and grow. As regards the biotic factors, these are animal induced or human induced. In the natural habitats, the wild animal induced influences are natural processes and the same though affect the natural regeneration, normally does not affect the continuance of the species. But there are animal influences due to cattle, goats, buffaloes, sheep etc., which adversely affect the natural process of regeneration of medicinal plants. The damages are primarily due to eating of seeds, seedlings, saplings and even plants, and also due to trampling and destroying the species. Another form of damage is due to fire in the habitat induced by the humans for various purposes.

As far as the medicinal plants especially herbs and shrubs are concerned the damage is very high from the human beings while extracting plants for the manufacture of medicines. The damages done to the plants are potentially great, can be listed as follows.

1. Pulling out the whole plant for use in the medicine.
2. Pulling out the plants in order to take out their roots, as roots are the raw drugs.
3. Collection of all the fruits from the plants where fruits and seeds are useful.
4. Collection of the whole plants in order to take way of the leaves for medicinal purposes.
5. Removal of the bark all round the plants especially trees for use so that the tree dies.
6. Collection of resin by putting fire at the base of the trees thereby maiming or killing the species.
7. Setting fires to live brush wood and leaves collected at the base of plants in order to collect the fruits from the armed climbers.
More than any other natural processes and animal interference, the activities enumerated above carried out by the humans do affect the natural regeneration to a very great extent. This affects even the very survival of the medicinal plant species belonging to all categories. Majority of the species thus affected by anthropic disturbance or destructive collection are the herbs and shrubs. Compared to herbs and shrubs the damage to trees is less.

In the natural forests which are under protection like National Parks etc., the natural regeneration of the species especially medicinal tree species are satisfactory. The study conducted by Basha (1987) in the Silent Valley National Park also corroborates the above statement clandestine collection of medicinal raw drugs from the protected areas affects the natural regeneration process considerably, thereby depleting the resource in the natural habitat which have been earmarked as in situ conservation areas.

As far as the other forests are concerned, the areas have not been notified as protected areas but come under the reserved forest category. Since the areas are not closed for collection, uncontrolled collection activity coupled with unscientific and destructive extraction leads to the high depletion of the resource which in course of time, may lead to the wiping out of certain much wanted medicinal plants.

6.1.4. OTHER ASPECTS.

An essential component complimentary to in situ conservation is the regulation/or plugging of the wild collection of identified species of medicinal plants whose harvest inevitably involves destructive collection. In cases of destructive harvesting, enrichment planting should be insisted as a part of afforestation programme. This will ensure continued growth of the species in its natural environment leading to
continued availability.

The SC ST Development Co-operative Federation (the apex body of tribal Co-operative societies) now offers a floor price, approximately equal to the market price to the tribal gatherers of medicinal plants or produces. Studies (Muraleedharan et al 1997) have showed that, tribal people were following in the past a way of sustainable extraction, when they used to receive a very low price to their commodities from the middle man, before the establishment of the Federation. Once the Federation started paying more (equal to market price), they also started destructive extraction of selected medicinal plant species. To curb this activity the unstable socio-economic factor prevailing among the tribal groups has to be tackled by appropriate policy changes. The floor prices have to be fixed by the Federation in such a manner that; the tribal get reasonable wages for their labour, which they spent for collecting the produce in a scientific way. Suitable training should be designed and given to the tribal in the field of non-destructive collection by designed awareness programs.

Medicinal plants are the most neglected NWFP by the foresters and policy makers in the traditional forest management system. The lack of integration of wood and non-wood products in the forest management, again adversely affect the medicinal plant resource. There are recommendations for adopting Participatory Forest Management (PFM) or Joint Forest Management (JFM) programmes. This is a forest management system re-oriented to respond to the local community's needs vis a vis forest management so that the interests of both the community and the forest is protected. It is high time that the department prepares a participatory management action plan to ensure the sustainable use of medicinal plants. Such an action plan may be possible in the tribal areas. In the non-tribal localities it may be difficult to
adopt this system for sustainable extraction of medicinal plants, as the priorities of the village people are different.

Lack of processing technology and storage and facilitates for many of the medicinal plant produce results in loss due to perishable nature of the produce. The total quantity extracted from the wild is not fully available for the user groups due to the produce becoming unsuitable for use owing to delay in delivering the produce to the manufacturing centres. This in turn increases pressure on the existing resource. To improve the in situ conservation status of medicinal plants and to ensure their sustainable extraction, the tribal people should be given training in the field of processing and facilities for storage of medicinal raw drugs.

Special training and orientation programs will have to be designed to the forest officials and the various groups of people and communities in the in situ conservation field. Identification of medicinal plants, scientific extraction, proper harvest assessment and harvest adjustments, pre-processing and semi-processing activities, propagation and planting of various medicinal plants are the expected contents of training. Field level staff in the forest department should be specially oriented about the restrictions in the collection and trade of medicinal plants notified by the Central Government and also about the list of prohibited species for exporting, issued by the Ministry of Commerce.

In situ conservation programmes on medicinal plants in the forests should mark the beginning of a paradigm shift of commercial forestry to environmental forestry. Bio-diversity conservation strategies can be integrated with in situ conservation programmes of medicinal plants so that new areas are opened up in the forest sector for a conscience, consistent environmental conservation and sustainable forest utilization.
Conservation programs, be it in situ or ex situ, can become more effective by creating awareness of the threat status of plants and their need for conservation among the end users of medicinal plants. This would help to bring down the pressure on the wild by defining the absolute demand by various groups rather than rely on speculative demand. Moreover, the manufacturing units can also consider reducing the use of such drugs or think of using alternatives.

The scientific community should develop and propagate appropriate technologies for large scale as well as homestead cultivation of suitable and commercially viable species, which have less availability from natural resource and greater demand. This would in turn reduce pressure on the meager wild population and improve the status of these species in the forest.

The in situ conservation areas need to be surveyed periodically. Such documentation would reveal, over a period of time, whether there is trend in the increase of population of the species in its natural habitat and if there is such a trend, the same will be a positive one.

Sacred Groves found in various parts of the State serve the purpose of conserving many valuable plants including medicinal plants as those are protected areas free from exploitation. The community staying nearby should be encouraged to maintain such Sacred Groves keeping their sacredness intact, as the belief in the presiding deity alone will help to save them from destruction and devastation. There are some instances in North Malabar where people started losing their belief in the deity with the result that the grove is exposed to destruction.

Lot of research support from the accredited research institutions is necessary to make the in situ conservation efforts meaningful and effective. For this purpose
appropriate research schemes should be evolved and implemented to collect the base line data regarding the population dynamics, rare, endangered and threatened species, ecological requirements, negative impacts affecting conservation etc. So far such programs have not been evolved. It is high time for the authorities to think in this line. For this purpose, support from the large scale Ayurvedic Medicine manufacturing units and Ayurvedic Research Institutions will also be necessary.

6.2 EX SITU CONSERVATION

Unlike the in situ models, the ex situ units are largely unorganized and poorly co-ordinated. Apart from the institutional units, the involvement of other agencies is nominal in this context. The investigation could identify a few agencies collecting and growing medicinal plants for a long period prior to the starting of the regular conservation efforts, in order to cater the needs of education, aesthetics and curiosity.

Ex situ models mainly fall into three major categories namely in vivo (Herb gardens, FGBs, Green houses, Plantations etc.), in vitro (plants in flasks, test tubes and other vessels under normal or restricted growth conditions) and cryogenic (seeds, excised embryos, pollen etc. under sub-normal temperature). Herbarium collections are used mainly as auxiliary support to all the above categories.

Of the three models mentioned above the most popular and widely adopted one is the in vivo method which may be in the form of mainly:

1. Herbal gardens
2. Field Gene Banks
3. Green Houses
4. Plantations
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Of the above four, the common one is the herb gardens which are maintained by many organizations either on a smaller extent or large extent. More number of species as per the choice of the agency is grown in this. The green house method is mostly adopted by the Research Institutions, Universities etc. Only very rare and important species, which usually do not respond to the local climate, are grown in this type. A few selected species, which are required for their own consumption are raised on a small scale, which may be small covering a few cents or slightly larger covering a few hectares.

Majority of the samples studied belonged to entrepreneurs and NGOs, as the number of these agencies is fairly large. This points to the fact that there is increased public awareness on the part of the individuals and NGOs in the conservation of medicinal plants. The past two decades (1980—1998) have witnessed the sprouting up of large number of conservation units in the State. The popularity of ex situ conservation can be attributed to the increasing awareness in the field of bio-diversity conservation and the easiness with which these can be set up even in very small extent of land.

It is understood from the present investigation that herbal gardens are the most common and popular among different models of ex situ conservation. Among the agencies involved, Government agencies possess the maximum extent of land under the herbal gardens.

One of the best examples of a well-maintained authentic herbal garden is the one maintained by a private agency namely the AVS, Kottakkal. Total extent of the garden is 8 hectares and contains the largest number of species.

Field Gene Banks are other exceptional models of ex situ methods designed to
grow and breed a viable population in the field. The FGB established at the TBGRI is the only outstanding model in this category and contain large number of species. Such FGBs are not maintained by any other institutions due to lack of sufficient land and technical support.

Botanical Gardens contain a collection of plants which are grown not within the intention of ex situ conservation but with a view to impart educational knowledge to people. When the bio-diversity conservation programme became popular these gardens also became ex situ conservation centres for plants which include medicinal plants also. Botanic gardens have now started giving more importance for the conservation of endemic, rare, endangered and threatened plants. A few individuals only represent each species and there will not be sufficient number to enable the plants to breed and multiply, as there is not much space set apart for this purpose.

The MPCP model is the superior model of herbal garden established with the involvement of the community and contains Red-listed species with attached nursery facility. The MPCP at Kanjikode and Peermedu are the best examples for this successful model. These serve as important ex situ centres.

Ethno-Medicinal Forest is yet another exceptional ex situ attempt covering the total plant diversity used for medicinal purposes in a locality which can grow in the given habitat. This simulates in all respects the forest habitat. Multi-cultural planting system is the essential component of the model. In the long run this will develop into a mini forest exclusively of the medicinal plants. This can be termed as a 'simulated' in situ model. This has been raised by the TBGRI. The future of this can be evaluated over a period time.

Seed Bank and Cryo Bank are expensive and sophisticated laboratory methods
adopted for *ex situ* conservation of medicinal plants. This has been established only by the TBGRI, Palode as the facilities for this are available here. Since the method assures medium to long term conservation of different species, this can be best utilized for the RET category of medicinal plants to ensure their survival and future multiplication.

Tissue culture and micro propagation techniques have little relevance in the direct conservation of medicinal plants, as these are intended for large-scale multiplication. These techniques are well suited in the context of cultivation of medicinal plants and also can be useful in mass multiplication of RET species for distribution to other conservation centres as well as for re-introduction to their natural habitats.

Number of species preserved in the *ex situ* centres varies from a few numbers to a large number. It was noticed that, of all the *ex situ* centres AVS, Kottakkal grows the largest number of species. This is attributed to the vast infrastructure and skilled manpower available with the agency. Some of the smaller institutions and individuals grow a very few number in order to keep their place in the list of *ex situ* conservation units.

There are conscious efforts on the side of Ayurvedic Pharmaceuticals, Research Institutes and also some NGOs for maintaining large number of species in their gardens. Many units are of the view that the *ex situ* units are not financially rewarding. At the same time considerable quantity of land, finance and manpower are required for development and maintenance of such units. The agencies having financial stability or provisions for exclusive funding for *ex situ* conservation and research are doing well in the conservation scenario.

A nursery is an essential component of any type of *ex situ* model. It serves the
dual purpose of availability of planting material for own use and for sale. It also acts as a source of income to the ex situ centre. Unlike agricultural and horticultural nurseries, exclusive herbal nurseries may not be financially viable, but herbal nurseries attached to ex situ centres could be more successful as there is demand for the seedlings from various centres. Sale of quality planting material can help to promote growing of the medicinal plants in homesteads and also helpful to encourage or cultivation. Nurseries also act as the best extension centres of the conservation units.

Going by the track record and demonstrated ability of the ex situ models, there can be considerable contributions in the coming years. What is gained in the past is substantial in terms of performance and gains.

In the wake of increasing damage to the ecological entities such as land, water, forests, atmosphere etc. and the present trend of unscientific and destructive collection of the majority of herbs and shrubs from natural habitat leaving very little for natural regeneration of species, there is considerable apprehension about the survival of the medicinal species in their natural habitat. Ex situ conservation having very many limitations is the only method which can be safely adopted for conserving the species on a very limited scale.

There is active involvement of entrepreneurs and NGOs in the field of ex situ conservation. The government institutions and Private Ayurvedic Pharmaceuticals do take sufficient interest in this field. The awareness generated among various agencies has to be boosted technically and financially, so that the concept of conservation of the medicinal plants can spread over a wider population. The NGOs have played and are playing a creditable role in extension activities in this field.
Community oriented programs have the advantage of larger participation of people, as evidenced in the formation of MPCPs. Such MPCPs can be started at least one in each District so that *ex situ* conservation becomes more effective by covering larger number of species in different eco-climatic locations.

Demonstration gardens of medicinal plants have their own importance in propagating the message of conservation. In this regard, medicinal plants in the herbal and botanic gardens, though not fulfil the purpose of conservation in its real perspective; can be very effective in spreading the message of conservation. Potted medicinal plants (mobile) in *ex situ* centres are much useful for putting up in exhibitions.

The detailed investigation revealed that many centres lack the required number of skilled and semi skilled personnel for looking after the garden. This shortcoming has affected the maintenance of proper records by many of the *ex situ* units. Persons having knowledge and genuine interest on medicinal plants are essential for the effective management of *ex situ* centres. The data collected will be of much use, as it will throw light on the behaviour and performance of the various species in their new habitat situations.

Presently the *ex situ* centres under the different kinds of agencies are working independently as water tight compartments. This situation of working in isolation will have to change to more co-ordinated and integrated working so that there can be benefit to all. Since the *ex situ* centres, whether small or large, are distributed and spread all over the State, if integrated by appropriate networking, can act as single field research unit where much repetition can be avoided and attention given to conserve more number of species. It will also help in studying the performance and efficacy of the same species growing in different ecological situations.
periodical data collection by a central agency from these centres will yield valuable
about the medicinal content of the species growing in different conditions. Such
data can be screened and utilized for the future benefit of the medicine manufacturing
units.

There has been a considerable discussion on the subject as to whether medicinal
plants need to be conserved *in situ* or *ex situ* to combat the increased threat to the
resource. So far the thinking has not crystallized in the form of a management plan.
It would be necessary to integrate both the methods and a network functioning of
all the centres involved and promoted under an adequate institutional system. This
will prove more effective, practical and meaningful.

As the scope and content of *in situ* and *ex situ* techniques are changing fast, the
observations of the present investigation serve as useful indicators of the past trends.
Since the benefits, costs and risks involved in the above are mostly unpredictable,
long term and short term strategies are to be evolved in order to build up the capacity
growth of these units to serve as 'true-to-concept' conservation centres.

Efforts to boost up public awareness in the field of conservation of medicinal
plants should start, right from the children at school levels. It can be easily built up
in the curriculum as part of health education. If five medicinal plants are included
in the syllabus from Vth standard, a student who comes out of the school after X
standard will be familiar with at least 30 medicinal plants and their importance.
This will slowly instill interest among the children in growing medicinal plants. At
the same time they will also start feeling the need for their conservation.

Mass media are to be utilized to the fullest extent. Extension wings of various
institutions will have to come forward with innovative programmes on the importance
of medicinal plants and the need for their conservation. New vistas of information technology like the CD ROMs can be developed on the importance of medicinal plants and their conservation in an interesting and interactive format.

Skilled manpower in the field of conservation can be made available by introducing degree course on medicinal plant management in Agricultural Universities, or introducing Post Graduate Diploma courses in medicinal plant management for Agricultural Science graduates.

6.3. CULTIVATION OF MEDICINAL PLANTS

The road to sustainable management and security of medicinal plants leads to alternative methods of producing raw drugs for medicine manufacturing units thereby reducing dependency on the natural resource which is getting depleted day by day. Cultivation of the required medicinal plants is the only method to obtain the increasing requirements. As in the filed of agriculture, scientific agro-techniques can be developed in order to get maximum yield of the raw drugs without affecting the quality of the vital compounds contained in them.

The present detailed study on the 61 samples helped to bring out the technological, financial, institutional and management constraints in the cultivation of medicinal plants.

6.3.1. TECHNOLOGICAL CONSTRAINT

Though large number of species mainly herbs and under-shrubs are cultivated by various agencies, the agro-technique is not available except for a few species. Unless proper technology for cultivation is perfected to suit the local conditions, the yield
and quality of the content in the produce will be affected. This will also increase the cost of cultivation. Many of the agencies complain about the low yield of the produce so as to affect the net income and effect poor cost-benefit ratio.

Three types of techniques are widely adopted in Kerala, for the cultivation of medicinal plants.

a. Mono-cropping or pure cropping.

b. Inter-cropping

c. Multi-cropping

a. Mono-cropping

Pure cropping is the widely used technology in various parts of Kerala. The main species cultivated using the technique are.

1. *Eclipta alba*

2. *Acorus calamus*

3. *Kaempferia galanga*

4. *Kaempferia rotunda*

5. *Indigofera tinctoria*

6. *Plumbago rosea* etc.

These species are mostly herbs and under-shrubs. All these are native species but not growing as a mono-crop in the wild. The ecological requirements of each species have not been fully studied to develop a problem free cultivation. However, the cultivation methodology adopted seems to be satisfactory but with poor yield. Proper technology with satisfactory yield will have to be perfected to obtain cost effectiveness. The low yield coupled with higher cost of production and sometimes low demand deters many of the small scale cultivators like entrepreneurs for
abandoning the cultivation.

b. Inter-cropping

Inter cropping method is one of the most suitable and cost effective methods which can be adopted widely in Kerala conditions where already lands are packed with one crop or the other. Presently this practice is not widely followed in the State. During the survey, only one entrepreneur could be found adopting this technique which according to him is profitable. The profitability is due to taking up this crop as a subsidiary one within the already cultivated land. According to him, the profit is marginal and there is satisfaction that he is producing raw drugs for the industry and his effort has helped to reduce pressure on the natural resource.

The species so planted in the coconut garden of Dr.P. Mohammed, Panoor, Cannanore District are

1. Eclipta alba
2. Adathoda beddomei
3. Alpinia galanga
4. Asparagus recemosus
5. Baliospermum montanum

The entrepreneur has developed his own inter-cropping technology.

Since there is lot of scope for inter-cropping in the State, proper agro-technology can be developed with the help of Research Institutions like CPCRI, Kasargode and Kayamkulam; and Kerala Agricultural University who have many plantations under them as experimental sites.

By evolving a programme, research plots/demonstration plots can be developed
in private plantations like Coconut plantations, Rubber plantations, etc. Similar plantations can also be developed in the Government owned oil palm plantations and forest plantations etc. The cultivation techniques suitable to each locality can be perfected and cultivation taken up as and when required by private agencies or Government agencies.

c. Multi-cropping

Multi-cropping technology is not widely practiced in the State in the case of growing medicinal plants. A few homesteads practicing on a smaller scale are noticed. In this method, only very limited number of species, which have dual use, like food and medicine are cultivated. The species grown under this technique are:

1. *Zingiber officinale*
2. *Zingiber zerumbet*
3. *Piper longum*
4. *Curcuma longa*
5. *Asparagus recemosus*
6. *Garcinia cambogea* etc.

Other species, which are of medicinal use only, are seldom cultivated under this technique. As far the technology of cultivation of the type of species already mentioned are concerned, there is no problem as the techniques are perfected and tested.

Part of the produce so cultivated goes to medicine manufacture.

6.3.2. **FINANCIAL CONSTRAINT**

Finance being a primary requirement for embarking on cultivation, it is necessary
to ensure timely return from the venture. In most cases people have to depend on loan from banks or moneylenders who charge a higher rate of interest. Unless the person is ensured of the returns equivalent to investment, interest and some profit for his effort and land, he will not go in for large-scale cultivation. Some entrepreneurs who have attempted small-scale cultivation to begin with had to abandon the same due to loss suffered by them. Since uncertainty is there in getting returns from cultivation, very few venture in this field and those who go for cultivation are mostly the ones requiring the raw drugs for their own use.

6.3.3. INSTITUTIONAL CONSTRAINT

Institutional constraints are mainly due to lack of technical manpower to manage the *ex situ* units and cultivation. The agencies mostly, individual owners or NGOs cultivate the medicinal plants in very small extents varying from say a few cents to ½ hectare. It is not at all economical for such units to employ technical manpower, as the income from the cultivation is very low.

The institutions like AVS Kottakkal do cultivation under the supervision of technical hands as they can afford such a step due to the vastness of the unit utilizing the produce directly for the manufacture of medicine.

Unless trained technical hands are there to supervise the cultivation practices, the success of the venture will not be satisfactory and paying. Development of technical human resource is pivotal in the context of cultivation of large-scale medicinal plants. As there is increased scope for requirement to the industry, cultivation on a large scale is to be promoted. For this, skilled personnel in the management of medicinal plants are essential to bring about ‘exploitative farming’ to meet the needs.
6.3.4. MANAGEMENT CONSTRAINT

Management of the cultivation mainly depends upon the purpose for which the cultivation is carried out. As far as the smaller units managed by individuals and NGOs are concerned, the purpose is mainly for sale of the produce. Most of the managements are not sure about the species of medicinal raw drugs which are in short supply, the market fluctuations, quantity that will be absorbed by the market/medicine manufacturing units etc. With the result most of them end up in loss.

As far as larger units cultivating the medicinal plants for their own consumption is concerned there is no management problem as the species chosen, the extent cultivated etc. depend upon their annual laid out programme.

In general, there are no tested and proved management practices for a safe and sound cultivation of most of the species. Trained personnel in cultivation technology also not available as such training is not presently imparted by any institution. The survey revealed that the cultivation is on the decline year after year. This is mainly because of the uncertain market demand and price fluctuation for the produce. Lack of agro-technologies or package of practices for most of the species of medicinal plants is the second problem that causes cultivation of medicinal plants less popular. Lack of credits/incentives/insurance of medicinal crops pose serious constraints to farmers who wish to opt for medicinal plants.

There is ambiguity in defining the actual demand of various medicinal plant produces since there exists no long term or short term plan/policy with any of the user groups. Due to this, approximate requirements of the different medicinal drugs are not known beforehand and the prospective cultivators are at a loss to decide on the species to be cultivated and the extent to be taken for each species. Appropriate
planning beforehand by the companies and the attempt for buy back arrangements can only solve this problem.

An apex body/nodal agency needs to be formed to collect the produces from the medicinal plant farms so that most of the marketing problems can be effectively solved.

Most of the important medicinal raw drugs have no other use except the use in the medicine manufacturing industry. In such a situation if the units get the drugs from outside State agencies or use the alternatives, there will be problem for the cultivator to dispose off their produce. Since such situations are likely to crop up in the case of many medicinal plants, it would be advisable to have buy back arrangements between the medicine manufacturer and the cultivator by fixing a floor price so that the cultivator is not left high and dry at the time of harvest. In the case of perishable produce, immediate consumption by the units will be necessary and unless there is strong agreement between the units and the cultivator, none will venture to enter into the field of cultivation.

6.3.5. SPECIES CULTIVATED

The group of medicinal plants includes herbs, undershrubs and trees. Some are very large climbers.

The group herbs include mainly annuals like _Eclipta alba, Kaempferia galanga, Aerva lanata_ etc. About 1/3rd of the medicinal plant species belongs to this group.

Because these plants give yield and returns within one year, the cultivators choose this group for cultivation. Moreover, agro-technology has been mostly perfected for many species belonging this group. Most of the cultivators interviewed had stated
that they prefer to cultivate the herbs as they are ensured of the returns in a year.

Under-shrubs and shrubs are mostly perennials and hence the yield can be expected only after two or more years. People cultivate such species not in a regular cultivation, but in the form of strip crop along the boundary of their land. The species like *Adathoda beddomei, Baliospermum montanum* etc, are planted in this manner and the yield of roots is taken after one or two years by digging the base of the plants and removing portions of the roots so that the plant is kept alive to produce more roots.

Except one cultivator, none is seen interested in the regular cultivation of shrub species.

Though medicinally very important and availability poor from natural source, none of the cultivators venture to cultivate large climbers like *Coscinium fenestratum, Caesalpinia bonduc, Calycopteris floribunda, Calamus rotang* etc.

Yet another group of species having medicinal importance belong to the tree category. Cultivation technology has not been perfected to any of the tree species which are medicinally more important. None of the small cultivators have attempted on this. The only one institution, which has ventured to grow a few species of trees having medicinal importance, is ‘Oushadhi’, a medicine manufacturing industry owned by the Government of Kerala. ‘Oushadhi’ has cultivated species like *Pongamia glabra, Pterocarpus santalinus, Phyllanthus emblica, Cassia fistula* etc. Though no return is available in the initial period of four to five years, once the trees mature, sustained yield year after year can be guaranteed.

Land availability for cultivation of medicinal plants is a major problem. Agricultural lands, committed to cultivate food crops can not be diverted to medicinal
plant cultivation. Utilization of wastelands and degraded/denuded forests, plantations etc. can be considered for the cultivation of medicinal plants.

To create demand for the cultivated medicinal plant crops, wild collection of species from their natural habitats is to be curtailed. This alone will ensure demand and reasonable price for the cultivated crops.

Bigger pharmaceutical industries can very well go for the cultivation of the most essential raw drugs. But majority of them do not attempt obviously due to the difficulty of managing the crop and possibly higher cost of production as they get the produce cheap from the plant collectors of other States.

Of the larger industries who have attempted cultivation, the name of Arya Vaidya Sala (AVS) Kottakkal, Ayurveda Pharmacy (KAPL), Oushadhi etc. are worth mentioning. AVS and KAPL do cultivation only in a very limited extent restricting the number of species to a few. Oushadhi, a Government owned company has recently started cultivation of medicinal plants as they got a project sanctioned with necessary funds. Once the project is over and the flow of funds cease, the practice of cultivation will be stopped. This means that so long as the project fund is available cultivation will be there. Since ‘Oushadhi’ owns land and the requirement of the various raw drugs is known to them and outside availability of some species is very limited, the unit can embark on cultivation of the important raw drugs for captive consumption.

Small-scale cultivators/NGOs/Tribal should be trained in pre-processing or semi-processing of different crops. A storage facility to preserve the crops after processing and before marketing is an important component of farm management of medicinal plants. Thus, it would be advisable that the sector should achieve a rapid improvement in post harvest technology which includes pre/semi processing.
processing, packing, storage, quality control and marketing of the raw drugs. This will largely help the cultivation to become viable.

Quality planting materials is a pre-requisite for good plantation. Planting stock can either be raised by the planting units in their own nurseries or get the same from accredited sources like the herbal nurseries attached to the *ex situ* conservation centres which can supply genuine planting stock for cultivation.

**6.3.6. INVOLVEMENT OF TRIBAL IN MEDICINAL PLANT CULTIVATION**

Tribal settlements are the most suited localities for the cultivation of medicinal plants. These areas provide suitable ecological conditions for the native species, which are in great demand by the industries.

An attempt at popularizing the tribal medicinal plant gardens has been made under the Kerala Social Forestry Project in the year 1989. (Basha, 1989). Gardens were raised in Begur, Oonchavayal and Neduthena of Wyanad District and all the species have grown well. Since none of the medicine manufacturing units volunteered for purchase of the raw drugs and help the tribal in their venture, the produce had to be sold at a very low price to the middlemen. Since it was found that income from cultivation was not sufficient enough even to meet the daily wages of the workers, gradually the attempt was given up. The vestiges of the cultivation still exist near the Begur tribal colony in Wyanad District. There are many possible attributes in the tribal involvement in the medicinal plant cultivation field.

1. The cultivation technology is known to the tribal.
2. Genuinely work in the field and produce better yield.
3. The nursery stock or planting stock used will be genuine as they collect seeds or planting materials themselves from forests. The tribal possess the required knowledge.
in this field.

4. The land being surrounded by the natural forests, the plants get the required ecological benefits for their growth, which will result in higher yield.

5. The cost of the cultivation will remain low due to less infrastructural and overhead costs.

6. Tribal do not use artificial manure like fertilizers for the cultivation of medicinal plants.

Because of the above advantages the pharmaceutical manufacturing units can come forward and utilize the tribal knowledge and power for producing the much-needed raw drugs in the tribal areas which are once the storehouse of these plants. A proper buy back arrangement for the produce before starting cultivation will give sufficient confidence to the tribal group to embark on this venture.

As forests offer natural habitats for many of the medicinal plants especially trees, site specific farming can be ‘Medicinal Plant Development Areas’ (MPDAs). These models are in vogue in the forests of Karnataka and Tamil Nadu as community based programmes, supervised jointly by FRLHT and State Forest Departments

**6.3.7. Homestead Cultivation**

As far as Kerala is concerned, more than 84% of the homesteads are small holdings with an extent ranging from 1 cent to 120 cents. Almost all of them contain a house, which occupies land area depending upon the financial stability of the homestead. Leaving the house, the land available will be invariably put under multiple cropping with food yielding plants. In such a situation finding vacant land for medicinal plant cultivation is almost impossible.

Still, if high priced raw drugs are required, people will be interested in small-
scale cultivation in the gunny bags or pots, which can be kept either on the terrace or in some suitable places inside the compound. Such plants can also be cultivated/grown along the boundary of the house compound to serve the dual purpose of yield as well as boundary protection.

Since many of the small households are interested in such activity, it is necessary to have a proper set up to popularize the species, supply planting materials and purchase the produce at the time of harvest at a reasonable price. Such cultivation, if popularized, will help to produce many species of raw drug plants.

A proper scheme for the homestead cultivation of medicinal plants can be worked out and popularized in the village with buy back arrangements. Such an effort can be profitable to the industries only if the produce is in very much short supply and is a very essential ingredient of a medicine.

This system may not work for plants, which are common and available cheap for collection from wastelands and other natural habitats.

6.3.8. OTHER ASPECTS

There are certain other aspects, which do not encourage the pharmaceutical industry for going in for cultivation of medicinal plants. The most important one is the free availability of most of the native medicinal raw drugs only by paying the collection charges.

Presently the industries float tenders for the supply of the medicinal raw drugs. The plant collectors collect the plants from the natural habitats and supply the produce to the industries at a rate equal to the collection charges and a margin of profit. There is no stake on the part of the plant collector for ensuring sustained yield from
the collection sites as his tender is only a one-year contract and he is not sure of getting the work in the next year. In such a situation, the collection is done very exhaustively and unscientifically with the sole motive of getting more quantity of each plant species. This, of course, affects the very survival of the species and sustained supply, in the future.

When the produce is available to the industries at a cheaper rate and bulk quantities, they are least worried about the survival of the species for the future. In such a situation none would like to go in for cultivation which is expensive.

This situation has led to the deterioration of the natural resource. Added to this lot of natural habitats have been put into alternative developmental uses with the result the habitat reduction has taken place. The net result is the non availability of the produce from the natural habitats. This will also lead to many of the highly wanted species getting rare and endangered in their natural habitat.

Now a stage has come that the collection from the natural habitats especially from the forest areas are either to be restricted to the minimum or fully prohibited. This situation will force the pharmaceuticals to go in for cultivation for themselves or to purchase the produce from the cultivators by paying a price for the produce. When such a situation arises, the conservation efforts in the natural forests will become complete and start paying dividends. Floating of tenders by the pharmaceuticals for the native species should be stopped so that the plant collectors do not venture to go into the forest areas for clandestine collection.

It is high time that such a stringent action is taken in order to conserve whatever little is left in the natural habitats.
Action by Forest Department

The forest department has to seriously think of stopping collection of the minor forest produce especially the medicinal plants and their produce from the forest areas. A detailed inventory will have to be prepared to understand the availability of various species, the localities where available, the quantum available etc. so that the status of each species, especially the important species including the rare, endangered and threatened ones is documented and appropriate strategy can be worked out for their survival. This will help to promote breeding of the species in their natural environment ultimately leading to the increase of their population. Once sufficient population has been built up, controlled collection can be allowed from the forest areas, purely by adopting scientific harvesting methods so that the resource is not depleted and the same can provide a sustained yield for future also.

Suitable species-specific harvesting technology is to be developed for harvesting the produce from the natural habitats. The technology can be developed with the help of institutions like Kerala Forest Research Institute, Tropical Botanical garden and Research Institute etc.

Loans and subsidies for cultivation

The small level cultivators do find it difficult to raise funds for starting cultivation of medicinal plants. Once the assurance for buyback arrangements is finalized, the cultivators can avail of bank loans for cultivation, as they are hopeful of paying back the loans after harvest. This way, cultivation of medicinal plants can be promoted. This arrangement can be had for both monoculture as well as intercropping.

Giving subsidy by the Government for raising medicinal plants is another incentive
for cultivation of medicinal plants.

**Formation of consortium**

A consortium consisting of pharmaceuticals using medicinal plants as raw drugs, experts in the field, the Research institutions, NGOs, a few entrepreneurs and the cultivators can be formed. By collecting contributions from the pharmaceutical industries and other participant organizations the consortium fund can be raised. This fund can be utilized for conservation of the natural resource, research, conducting inventory and other studies and for giving interest-free loans to the small scale cultivators. The studies mainly consist of development of agro-technology for the most important and less available medicinal plants, to development of scientific harvesting technologies for the selected species and in-depth research.