स्थानीय स्वास्थ्य परम्पराएं पुनर्जीविकरण (एफआरएलएचटी) 1993 में स्थापित की गई पंजीकृत सार्वजनिक न्यास एवं चैरिटेबिल परिषद है। यह परिषद निम्नलिखित कार्योन्मुख प्रमुख क्षेत्रों पर आधारित विविध क्षेत्रीय क्रियाकलाप, अनुसंधान एवं विस्तार कार्यक्रमों द्वारा भारतीय चिकित्सा धरोहर को पुनर्जीवित करना चाहती है –

- भारतीय चिकित्सा धरोहर में उपयोग किए जाने वाले प्राकृतिक संसाधनों का संरक्षण
- भारतीय चिकित्सा प्रणालियों के सिद्धान्तों और व्यवहार की समसामयिक सुसंगति का प्रदर्शन
- स्वास्थ्य रक्षा के पारम्परिक ज्ञान को अधिक विस्तृत उपयोग और अनुप्रयोग को अन्य क्षेत्रों में पहुंचाने के लिए सामाजिक प्रक्रियाओं (सांस्थानिक, मौखिक और व्यापारिक) का पुनर्जीविकरण

आईएसओ 9001:2000 प्रमाणित संगठन एफआरएलएचटी को वैज्ञानिक एवं औद्योगिक अनुसंधान संगठन के रुप में विज्ञान एवं प्रौद्योगिकी मंत्रालय द्वारा मान्यता मिली हुई है। सन 2000 से भारत सरकार के पर्यावरण एवं वन मंत्रालय ने भी एफआरएलएचटी को औषधीय पादपों एवं पारम्परिक ज्ञान का राष्ट्रीय उत्कृष्ट केन्द्र नामित कर दिया है।

एफआरएलएचटी को औषध पादपों के संरक्षण में किए गए अपने योगदान के लिए नौर्मन बोरलाग अवार्ड (1998), प्रायद्वीपी भारत में औषध पादपों के कार्यक्रम के लिए इक्वेटर इनिशियेटिव पुरस्कार (2002) तथा अनुपूरक एवं वैकल्पिक औषधियों के रोजेन्थल केन्द्र, कोलम्बिया विश्वविद्यालय, सं.रा. अमेरिका द्वारा इनऔगोरल इण्टरनेशनल कल्चरल स्टीवार्डशिप अवार्ड (2003) द्वारा अन्तर्राष्ट्रीय स्तर पर भी मान्यता मिली हुई है। इसके संस्थापक अध्यक्ष मि. दर्शन शंकर को वर्ष 2010 में भारत के सर्वोच्च नागरिक सम्मान "पद्मश्री" से सम्मानित किया गया है।

फाउण्डेशन फॉर रीवाइटेलाइजेशन ऑफ लोकल हैल्थ ट्रेडिशंस

74/2, जरकाबन्दे कवल, पोस्ट : आत्तूर, वाया येलहांका

बैंगलूरू – 560106, भारत

ईमेल : info@frlht.org Website : www.frlht.org

शिवा ऑफसेट प्रेस, देहरादून द्वारा
डिज़ाइन एवं मुद्रित। फोन: 0135-2715748

पर्यावरण एवं वन मंत्रालय, भारत सरकार

औषधीय पादपों और पारम्परिक ज्ञान का उत्कृष्ट केन्द्र

एफ.आर.एल.एच.टी-आई.ए.आई.एम., बैंगलूरू

वार्षिक रिपोर्ट

2010-11

जहाँ है हरियाली।
वहाँ है खुशहाली।।

FRLHT

Foundation for Revitalisation of local Health Traditions (FRlHT) is a registered Public Trust and Charitable Society set up in 1993. It seeks to revitalize the Indian Medical Heritage through various field activities and research and extension programmes based on the following action-oriented thrust areas:

- Conservation of natural resources used in Indian Medical Heritage
- Demonstrating contemporary relevance of theory and practice of ISM
- Revitalisation of social processes (Institutional, oral and commercial) for transmission of traditional knowledge of healthcare for its wider use and application.

FRLHT, an ISO 9001:2000 certified organisation, is recognized by the Ministry of Environment and Forest, Government of India as a National Centre of Excellence of Medicinal Plants and Traditional Knowledge since 2002. The Ministry of Science and Technology, Government of India has designated FRLHT as a Scientific and Industrial Research Organization.

The work of FRLHT has also been recognized at International level through Norman Borlaug Award (1998) for its contribution to the conservation of medicinal plants, Equator Initiative Prize (2002) for its medicinal plants program in Peninsular India and the inaugural International Cultural Stewardship Award (2003) by Rosenthal Centre for Complementary & Alternative Medicines, Columbia University, USA. Mr. Darshan Shankar the founder chairman of FRLHT was awarded one of the highest civilian awards, Padmashri in 2010.

Foundation for Revitalisation of Local Health Traditions
#74/2, Jarakbande Kaval, Post Attur, Via Yelahanka
Bangalore – 560 106, INDIA
Email: info@frlht.org Website: www.frlht.org

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CENTER OF EXCELLENCE FOR MEDICINAL PLANTS AND TRADITIONAL KNOWLEDGE AT FRLHT-IAIM, BANGALORE

ANNUAL REPORT
2010-11

जहाँ है हरियाली ।
वहाँ है खुशहाली ।।

FRLHT

Ministry of Environment and Forests, Government of India's

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COVER DESIGN : N
PHOTO CREDIT : G S Goraya

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Flower buds of *Agapetes spicigera* in North East India.

1. INTRODUCTION

The **Foundation for Revitalisation of Local Health Traditions** (FRLHT), based at Bangalore is the Center of Excellence (CoE) for 'Medicinal Plants and Traditional Knowledge', as recognised by the Ministry of Environment and Forests (MoEF), Government of India under the 10th Five year Plan during the year 2002-03.

Its six major goals are:

- Establishment and strengthening of a bio-cultural herbarium of the medicinal plants of India
- Establishing and strengthening of an ethno-medicinal garden
- Developing educational materials on Indian medicinal plants used in the Indian Systems of Medicine
- Undertaking pharmacognostic studies of controversial botanical raw drugs
- Generation of Distribution maps for prioritised medicinal plants
- Training and capacity building of Forestry staff, Faculty and Master trainers from Forest departments, Forest Training Institutes and NGOs

1.1. The Project Components

The project comprises of the following six components. The details of these components alongside their central purposes are presented below:

Project Component Code	Project Component Title	Central Purpose of the Component
CE-P1	Project Coordination	The Centre of Excellence involves activities spread across different groups within and outside the organisation. The project coordination cell provides the common string to all the planned activities. It also forms an interface between the MoEF and FRLHT, liaison with other organisations and coordinates the project formulation to strengthen the CoE.
CE-P2	Herbarium of Medicinal Plants used in ISM	According to the Planning Commission Task Force on medicinal plants (2002), India's herbal industry has a huge economic potential in the global market. A National Repository of the medicinal plants of India is an essential requirement to support this potential. The FRLHT Herbarium is the only medicinal plants herbarium in the country. It has been designed as a bio-cultural herbarium which offers the vernacular names and the currently accepted botanical names of particular species including the specific location (latitude, longitude, altitude) on Indian Territory. This project requires expertise both in taxonomy as well as in traditional knowledge of plants.

Project Component Code	Project Component Title	Central Purpose of the Component
CE-P3	Establishment of Ethno-medicinal Plants Demonstration Garden	Ethno-medicinal gardens are different from the conventional botanical gardens and arboreta in that they raise the plants which are prominently associated with the ethnic groups. Such gardens, therefore, represent the cultural dimensions of the botanical wealth of a region. India has one of the world's richest ethno-botanical traditions. Therefore, it is important to create regional ethno-botanical gardens in every district of the country as they can serve not only to conserve plants but also to conserve the cultural history related to natural products of the country.
CE-P4	Pharmacognosy Studies on Medicinal Plants	India needs a large number of Pharmacognosy labs because internationally acceptable standards have to be developed for almost 2000 species of medicinal plants that are used by different traditional systems of medicine. In the last 50 years the pharmacopoeial standards have been developed for only around 400 species. The FRLHT lab activities supported under CoE are of a unique nature because they are focused on creating what may be termed as *traditional knowledge guided* standards. This is an innovative inter-cultural strategy in the field of Pharmacognosy.
CE-P5	Distribution mapping of Medicinal Plants using GIS	The GIS technology is well known for its application in the field of conservation of Natural Resources. Under the CoE project it is for the first time that GIS applications are being made use of specifically focusing on *medicinal plants resources.*
CE-P6	Outreach (Training & Educational Material on Plants of ISM)	Under the CoE project it is envisaged to train the master trainers from forest training institutes and NGOs who in turn can facilitate the process of developing a cadre of village botanists as para-taxonomists to help monitor populations of prioritised medicinal plant species and aid conservation initiatives. It is also envisaged to build capacities among the front line forestry staff and forest managers in respect of Identification and management of medicinal plants resources. In order to make the rich traditional knowledge about medicinal plants of India, accessible to students, teachers, researchers and pharmaceutical industry, it is necessary to use IT tools. This task of interpretation, and translation of the traditional knowledge requires inter-disciplinary expertise of ISM scholars and experienced Plant Taxonomists.

1.2. Project Implementation Mechanism:

FRLHT prepares the annual action plans in respect of the above project components within the overall 5-year project objectives and submits the same to the MoEF, GoI for approval. Within the MoEF, a special Project Steering Committee under the Chairpersonship of the Addl. Secretary, MoEF, appraises the annual proposals, recommends release of funds and monitors the project performance on a six monthly basis.

At the implementation level at FRLHT, each project component is steered and monitored on a monthly basis by the respective Joint and Assistant Directors designated as Principal Investigator for the chosen component.

During the year 2010-11, the project has moved further in the direction of achieving the goals of this centre of excellence. Whereas the project has made credible contribution in strengthening FRLHT's resource and knowledge base to get evolved into the Center of Excellence in the field of Medicinal Plants and Traditional Knowledge, the outcomes from this project have been making significant contribution to the overall cause of the Indian Medicinal Plants sector.

This report provides glimpses of the highlights of the project activities pertaining to the year 2010-11 (section 2) and a matrix of detailed annual progress report (section 3).

2. PROJECT HIGHLIGHTS 2010–11

The approved annual plan for the year 2010-11 was implemented as scheduled during the year. Detailed physical progress in relation to the stipulated targets under different activities are given in a matrix format in section 3 while the project highlights are given below:

Ce-P2: Bio-Geo Cultural Repository of Natural Resources used by the Indian Systems of Medicine

A "Herbarium" may be referred to as a repository of certain kind of "plant specimens" or vegetative parts of plants collected from far and wide, which are processed, dried, mounted, labeled and housed as per a known botanical classification scheme.

The FRLH herbarium[1] established in 1993 is a specialized herbarium with its focus on medicinal plants used in the Indian Systems of Medicine (ISM). Its objective is to represent the diversity of medicinal plant species and those found in trade, along with their morphological variations by collecting their herbarium specimens through botanical surveys, take up in different habitats, ecosystems and bio-geographic zones of the country.

During the year 2010-11, the herbarium team carried out different botanical surveys in many parts of India in order to add more species to the existing collection. The state wise collection of the specimens is as below:

State	No. of collections	State	No. of collections
Arunachal Pradesh	*54*	*Meghalaya*	*86*
Assam	*7*	*Nagaland*	*52*
Chattisgarh	*53*	*Karnataka*	*99*
Goa	*11*	*Rajasthan*	*113*
Himachal Pradesh	*17*	*Tamil Nadu*	*96*

These surveys resulted in the addition of 1764 specimens pertaining to 588 species of medicinal plants of which 150 were not present in the herbarium earlier. With this, the total number of medicinal plant species represented in the herbarium raised to 3157.

The botanical surveys in the North eastern and Semi arid regions of the country, resulted in many important collections hitherto not represented in the Herbarium.

1 FRLH" is the internationally accepted Acronym accredited by the New york Botanical gardens, New York, USA and the Herbarium of medicinal plants maintained at FRLHT is recognized by this accredited name.

Important collections during the year:

The botanical surveys this year especially in the North eastern and Semi arid regions of the country, resulted in many important collections from the view point of the herbarium, which were hitherto not represented and consequently the collections in the herbarium have been enriched.

In respect of the collections from the North eastern regions, the noteworthy ones are: *Arundina graminifolia* (D.Don) Hochr., *Dendrobium fimbriatum* Hook., and *Dendrobium nobile* Lindl. (Orchidaceae), *Daphne papyracea* Willd. ex Steud., (Thymelaeaceae), *Elaeocarpus varuna* Ham. ex Mast. (Elaeocarpaceae), *Illicium griffithii* Hook.f. Thoms. (Magnoliaceae), *Primula dentate* Hook. (Primulaceae), *Tsuga dumosa* (D.Don) Eichler (Pinaceae), *Agapetes setigera* (Wall.) D.Don ex G.Don (Ericaceae), *Citrus dimorphocarpa* Lush. (Rutaceae), *Litsea citrata* Blume, *Litsea khasiana* Meisn. and *Cinnamomum camphora* (L.) Presl (Lauraceae), and *Eupatorium adenophorum* Spreng (Asteraceae).

In respect of the collections from the Semi-arid regions the noteworthy ones are: *Asphodelus tenuifolius* Cav. (Liliaceae), *Dactyloctenium sindicum* Boiss (Poaceae), *Calligonum polygonoides* L. (Polygonaceae), *Tribulus alatus* Del. (Zygophyllaceae), *Leptadenia pyrotechnica* (Forssk.) Decne. (Asclepiadaceae). *Neurada procumbens* L. (Rosaceae), *Zaleya redimita* (Melville) Bhandari (Aizoaceae), and *Cistanche tubulosa* (Sch.) Hook. f. (Orobanchaceae).

Split open fruit of *Dysoxylum gobarum*.

An endemic climber species collected from Pasighat, North East India.

Tribulus alatus collected from semi-arid regions.

Neurada procumbens collected from semi-arid regions.

Development of Virtual herbarium:

High resolution photographs depicting the life forms of different plants, their key identification features, habitats, along with salient features of their population were captured during different field visits and botanical surveys for this purpose. More than 2000 such images which were appropriately edited were added to the virtual herbarium during the year.

Scanned image of the Herbarium Sheet of *Coscinium fenestratum* a critically endangered medicinal climber.

Educational Materials:

Continuing to strengthen the broad theme, "Medicinal Plant Wealth of India", the Herbarium team produced 4 more posters titled *Plant exudates, Dasamoola, Daaruharidra, and Ashtavarga plants.*

The poster on "Plant Exudates" illustrates different plant exudates which are put to medicinal uses. The poster on "Dasamoola", an important ayurvedic formulation that uses the roots of 5 herbs & shrubs and 5 tree species brings together comprehensive information on all the 10 authentic species and other substitutes and adulterants. The poster on "Daruharidra", an important controversial medicinal plant, describes different plant species being traded in the name of Daruharidra along with the north Indian and south Indian equivalents. The poster also highlights the molecular studies that help ascertain the authentic identity of these different species. The poster on Ashtavarga, brings together interesting information on this classical Ayurvedic plant drug whose identity has remained so obscure and which is often alluded to certain mystic plant entities.

The poster on Ashtavarga, brings together interesting information on this classical Ayurvedic plant drug whose identity has remained so obscure and which is often alluded to certain mystic plant entities.

Poster on Ashtavarga Plants.

Status Survey of Red-listed medicinal plant species:

Extensive Literature searches were conducted on *Coscinium fenestratum* for developing the Status survey report. Additionally field surveys were conducted in Karnataka, Kerala and Tamil Nadu to enrich the understanding. A status report was prepared based on these findings.

A hands-on-orientaion on Herbarium techniques for the Students in Pasighat, North East India.

Outreach Activity:

The Herbarium team also engaged in different Outreach activities during the year. Different 2-day training programs on "Herbarium

Techniques and Plant Identification" were organized. Students from Athreya Ayurvedic College, Bangalore North and Mount Carmel College, Bangalore were benefitted from these trainings. Learning sessions during these training programs included appropriate Field orientation and demonstrations.

RAW DRUG REPOSITORY:

The Raw Drug Repository specializes in the collection of plant raw drugs used in the Indian Systems of Medicine. In order to meet its objectives, the team engages in procuring different raw drugs from the field and markets. During the year, 253 authentic samples from the field collections and 152 samples from the market collections were added to the repository. With these additions the raw drug repository now houses 2576 samples of raw drugs. Of the 960 plant species found to be in the trade, the raw drug repository houses > 496 species. Besides the plant raw drugs, the repository also has in its collection >45 minerals and 2 metals used as raw drugs in ISM.

Arrangement and Display of the collections in the Repository:

During the current year, the collections at the repository were further grouped and arranged in a user-friendly fashion, around the following themes. 1) Medicinal bark, 2) Medicinal fruits, 3) Medicinal flowers, 4) Medicinal seeds, 5) Imported medicinal plants, 6) Metals, 7) Minerals, 8) One plant different parts, 9) Animal parts and 10) Dashamula. These were supported by relevant posters kept along side, for easy comprehension of the collections.

Collections in the Raw drug Repository: amorphous lumps of *Acacia nilotica* gum.

Catalogue:

Draft of the Catalogue of the Raw Drug Repository was finalized during the year and it is ready for printing. The catalogue illustrates the significance of the Raw Drug Repository and highlights its collections.

Database:

The database is used to store and retrieve information related to the raw drug specimens. Information pertaining to 461 samples was systematically documented in the database during this year.

Collections in the Raw drug Repository: Roots of Picrorhiza kurrooa.

CE-P3: ETHNO MEDICINAL GARDEN

The Ethno Medicinal Garden (EMG) on the FRLHT campus houses different medicinal plants used in the traditional systems of medicine, which are planted in different assemblages each one representing a definite theme or usage group. The EMG proudly boasts 31 such theme based plant assemblages. Such theme based plant assemblages has enhanced the user-friendliness of the garden and eventually transformed it as an educational resource on medicinal plants.

During the year 2010-11, the following thematic plantings were taken up.

- Plants used for Mental healthcare
- Plants which are used as Rasayana Drugs
- Plants whose medicinal significance is exclusively associated with the healthcare of a specific human organ

As a result of sustained efforts to enrich the diversity of the EMG, 66 more medicinal plant species were added during the year, to take the total number of species in the EMG to 1074 species.

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Appropriate signages for the additional 3 thematic plantings and 100 individual species were erected to make the garden more user-friendly. Eight awareness - cum - educational programs were organized in the EMG for target groups with different backgrounds such as Botany, Environmental Science, Pharmacy and other Indian Systems of Medicine. Additionally, students from about 75 schools visited the EMG during the year, as a part of their learning.

A view from the Garden.

Garden visit by the folk healers from Jharkhand.

Outreach Nursery:

The outreach nursery is spread over 78 seedling beds. During the current year the nursery activities were further consolidated with the completion of many structural improvements. Facilities for hardening of seedlings

Application of the principles of Vrikshayurveda for producing quality planting stock and pest and disease management has yielded favorable results in the nursery.

and display were added. The nursery produced 75,000 seedlings of 240 species during the current year.

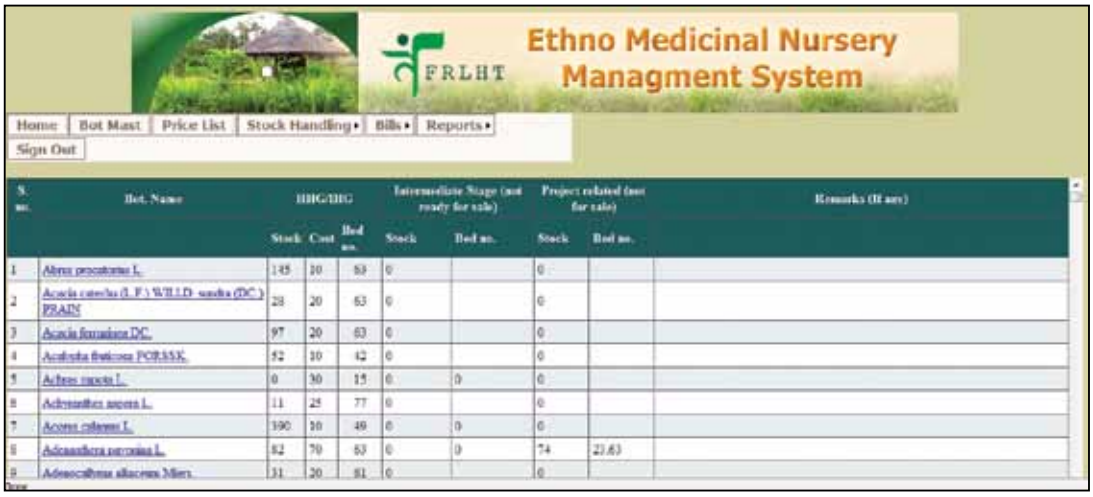
A view from the Nursery

En exciting experience for the students at the garden.

Another innovative element brought into the nursery was the application of Vrikshaayurveda principles in its management especially in respect of producing quality planting stock in an organic manner and pest and disease management of the plants. In this direction, the observations with *Embelia ribes* and *Stereospermum colais* are noteworthy. *Embelia ribes* which is known to be a difficult-to-germinate species, exhibited increased germination, while *Stereospermum colais* which otherwise exhibits a prolonged dormancy showed fairly quick germination when treated with Vrikshaayurveda principles.

Nursery Database:

The nursery database was further strengthened and put on the Institution's website, which may be accessed at http://frlhtweb/nursery%20login.aspx. It provides information on the availability of seedlings, their physical location in the nursery beds, and the type of garden packages they are included. It also helps to computerize information related to its different functions and helps to organize the physical stock.



A page view from the Nursery management database.

Garden management Software:

The Garden Management Software, *'Garden Accession Information System'* which was developed the previous year as a supportive tool for efficient management of the EMG was field tested this year and necessary refinements were made. The software offers to help the garden manager to manage different information sets of a species present in the garden.

As a part of this, a power point presentation on the EMG highlighting the genesis of the garden, its salient features, and noteworthy collections was developed and uploaded onto the Institution's website, which may be accessed at http://frlhtdata/Garden_ppt.pdf.

Seed Herbarium:

The Seed herbarium maintained by the EMG, was further strengthened during the year, by the addition of seeds of 24 species, which took the collection number to 154. All the collections were appropriately labeled.

EMG supports other Research projects and Garden initiatives:

EMG has been used by visitors, scholars and research students as a place for learning and aiding their conservation research. It has offered research material in the form of seeds, seedlings and plant produce for many studies related to propagation, pharmacology, pharmacognosy of Medicinal Plants.

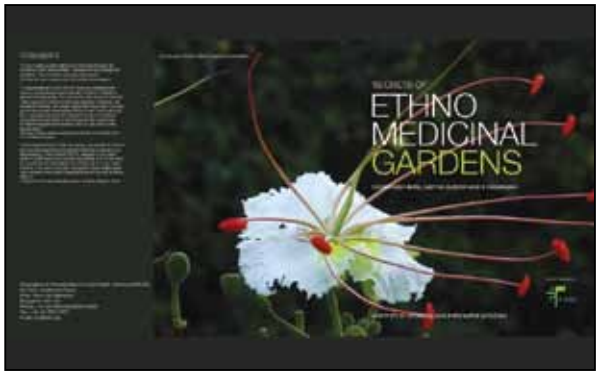
EMG extended technical support and provided the seedlings of >240 medicinal plant species to Andhra Pradesh Forest department to establish a biodiversity park at Nellore.

The EMG team extended appropriate technical support and offered planting resources to different agencies for establishing gardens. Noteworthy among the ones who received the support of the EMG was Andhra Pradesh Forest department to establish a biodiversity park at Nellore. EMG provided the seedlings of >240 medicinal plant species in this direction. Similarly it extended the technical support to Jindal Biodiversity Park, Bellary for planning and implementation of a region specific biodiversity park. Necessary technical support including the planting material was offered for landscaping and establishing herbal gardens at Nithyananda Ashram, Bangalore, Tata Hospitals, Jamshedpur, The Earth Trust, Kothagiri, Nilgris, Kala Bhaireswara Ayurveda Medical College, Bangalore and KKECS College of Pharmacy, Bangalore.

During the year, EMG signed an MoU with M/s Dabur for doing a contracted research on plantation and productivity of *Aegle marmelos*, *Clerodendrum phlomoides*, and *Premna serratifolia*. EMG also extended necessary technical support to Christ University, Bangalore to supplement their plant replication strategy, on their campus.

EMG manual:

The EMG manual titled **'Secrets of Ethno Medicinal Gardens'** was published during the year and its copies were made available to different user agencies. This manual, offers comprehensive, step-by-step guidelines to develop medicinal plants gardens on similar lines of the EMG. It highlights the different aspects of developing an Ethno Medicinal Garden, beginning from the surveys for collection of planting material; choice of planting themes and appropriate species; topography and landscape related issues, and intricacies of the garden management. The manual is quite illustrative and contains information on the nursery, and propagation methods for select medicinal plants and includes images of around 200 herbs, 130 shrubs, 100 climbers, over 200 trees, around 100 species of orchids and about 50 species of ferns that are appropriate for establishing a garden. Identity of a garden species under question can be ascertained using plant names given in 6 regional languages and English.



Front Cover of EMG manual.

Rudraksh tree in the garden bursts into profuse bloom.

Reproductive phase of many RET species:

Many plants in the EMG entered their reproductive phase during the year and witnessed their first flush of flowering. Noteworthy among them are Asoka and Jalpai.

Ashoka **(***Saraca asoca***),** which is a species of high conservation concern has been a prized collection in the EMG. Being a prioritized species for conservation action, obtaining authentic propagation material of Ashoka in sufficient quantities has been one of the concerns of late. The Ashoka plants in the EMG which exhibited profuse flowering during the year yielded quite a good number of seeds during May-June. The EMG team used these seeds to raise the seedlings and it hopes to contribute to the conservation initiatives by making available these authentic seedlings.

Another noteworthy flowering episode was seen with Jalpai**,** (*Elaeocarpus floribundus*)**,** a cousin of Rudraksh (*Elaeocarpus sphaericus*). This evergreen tree with a dense crown is also known for its edible fruits which are slightly sour in taste which are used for pickling and other culinary preparations in the north eastern regions of the country. This tree in the EMG, which was brought from the North eastern India witnessed a profuse flush of flowering this year and subsequently resulted in sufficient fruit setting.

Participation in Exhibitions:

As in previous years the EMG team took part in select exhibitions and public gatherings as a means to introduce and popularize medicinal plants among the urban residents. Participation during the International Ayurveda Congress at Bangalore, The National Biodiversity Congress at Trivandrum, World Sanskrit meet at Bangalore, witnessed an overwhelming response by the visitors.

Amruth Garden stall at the Flower show, Lalbagh, Bangalore.

CE-P4: PHARMACOGNOSY STUDIES

Authentic identity of medicinal plant raw drugs is an important determinant of the quality, safety and efficacy of herbal medicines. Increasing demand for the herbal drugs coupled with non-availability of genuine raw materials results in the substitution of genuine raw material with different alternative materials. The legitimacy of substitution if systematically analysed, can provide scientifically validated substitutes that are bio-equivalent to the original drug. Studies on drug substitution as suggested by the Ayurvedic texts can thus offer such solutions. Studies carried out this year in this direction, focused on the issues related to ascertaining the authentic identity of select medicinal plant raw drugs.

Vidanga:

The fruit of Vidanga is one of the botanical drugs traded in high volume (> 500 MT/year). The raw drug is the dried fruits of Vidanga plant, which is used in several formulations in Ayurveda, Siddha and Unani systems of Medicine. Vidanga is a well known drug for helminthiasis, indigestion, and tumours. The official pharmacopoeia has correlated the authentic botanical entity of Vidanga to *Embelia ribes* Burm.f (Myrsinaceae). Its sporadic distribution in the Western Ghats, Eastern Himalayas and North eastern India however indicates that the volumes traded cannot be contributed by this species alone. Three other species such as *E.tsjeriam-cottam* A.D.C., *Myrsine africana* L. and *Maesa indica* (Roxb.) A.D.C., all belonging to Myrsinaceae family, are also found to be used as Vidanga.

The official pharmacopoeia has correlated the authentic botanical entity of Vidanga to *Embelia ribes* Burm.f (Myrsinaceae). However three other species such as *E.tsjeriam-cottam* A.D.C., *Myrsine africana* L. and *Maesa indica* (Roxb.) A.D.C., all belonging to Myrsinaceae family, are also found to be used as Vidanga.

Embelin, the main constituent of the fruits *of Embelia ribes* is also found in *Embelia tsjeriam-cottam* and *Myrsine africana* while it is absent in *Maesa indica.* The earlier studies to examine the similarities and differences of these species involving the microscopic, molecular and phytochemical profiles brought to light quite many interesting findings. One of it being the presence a new chemical compound in *Maesa indica* which was later isolated, characterized and named as *Kiritiquinone*. This compound is a benzoquinone similar to *Embelin* (It may be recollected here that *Embelin* is an active chemical marker found in *Embelia ribes*, *Embelia tsjeriam-cottam* and *Myrsine africana* but not in *Maesa indica)*. It would be therefore interesting to examine whether or not all these three species also exhibit the anthelmintic activity. If so, it would imply that all the three can be used as a substitute of *Embelia ribes* for this purpose. And, since *Embelia ribes* is an endangered species, finding bioequivalent substitutes would be useful in order to offload the pressure on *Embelia ribes*.

In this direction, the Pharmacognosy team during the year was engaged in the studies on *Caenorhabditis elegans culture. C. elegans* is a commonly used research organism across the globe, particularly as a model to test the anthelmintic properties

of drugs. *Preliminary experiments* with *E. tsjeriam-cottam extracts* indicated that upon treatment with 500 ug/ml of ethyl acetate extract of E. *tsjeriam-cottam* for 2 hrs, viability of the worms was found to be reduced by ~ 80-90%, as analyzed by drop count method, thereby demonstrating the anthelmintic activity of the extract. Similar studies need to be carried out with other species (*Embelia ribes, Maesa indica* and *Myrisine africana)* as well as on the chemical markers *Embelin* and *Kiritiquinone*.

Intercultural studies on Daruharidra candidates:

The intercultural studies conducted on different accessions of *Berberis aristata* during 2009-10 revealed that the Berberine content in it was not consistent. Continuing from here during the year 2010-11, the intercultural studies focused on two more accessions of *Berberis aristata* and one accession of *Berberis lycium*. The phytochemical values of *Berberis aristata* found in these studies were identical with those of the previous year. However, the total alkaloid and Berberine content varied yet again from the earlier results. This could be due to the difference in the time of collection of the plant samples or their maturity level. Therefore, this needs to be verified by going in for more number of accessions. However, *Berberis aristata* being restricted to the Himalayan region owing to its identical morphological features with other species of *Berberis*, often poses difficulty in confirming its identity, and consequently its collection in sufficient quantity for the purpose of testing gets affected. However, in respect of *Berberis lycium* the physicochemical and phytochemical values were quite identical with the values obtained during the previous year.

Berberis aristata owing to its identical morphological features with other species of *Berberis*, often poses difficulty in confirming its identity, and consequently its collection in sufficient quantity for the purpose of testing becomes difficult.

***Abhava Pratinidhi* Dravya (Drug substitution):**

It is known that several species of medicinal plants are naturally found rare with limited distribution and population size, and consequently attract increased pressure for their medicinal raw material. Such insufficient availability of medicinal produce from such naturally rare species often leads to its arbitrary substitution and adulteration in the raw drug market.

It has been suggested in the Ayurvedic literature that in the absence of an intended unavailable drug (*Abhava Dravya*), an alternative drug (*Abhava Pratinidhi Dravya*) can be used. Around sixty pairs of such *Abhava-Pratinidhi Dravyas* can be found in *Yogaratnakara*, an Ayurvedic classical text. Scientific studies on *Abhava* and *Abhava Pratinidhi Dravyas* as per Ayurvedic recommendation can offer new insights into the choice of the substitutes. One such pair the pharmacognosy team considered for the study during the year was Ativisa- Musta.

Ativisa consists of the dried, tuberous roots of Aconitum *heterophyllum* Wall.ex.Royle, of the family Ranunculaceae. It is indicated in conditions of Jwara (fever), Kasa (cough), and Krmiroga (helminthiasis) and goes into a number of formulations such as Mahavisagarbha taila, Rodhrasava, and Siva gutika.

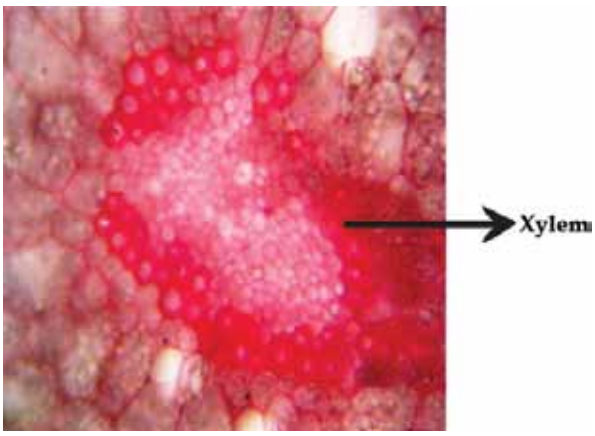
Musta consists of the dried rhizomes of *Cyperus rotundus* Linn, of the family Cyperaceae. Its therapeutic uses include Agnimandya (decreased digestion), Ajeerna (indigestion), Jwara (fever), and Atisara (diarrhoea). It is a component of formulations such as Mustakarista, Mustakadi Kwatha, and Asokarista. In the raw dug trade, *Cyperus scariosus* and *Cryptocoryne spiralis* are also sold as Musta.

Microscopy:

These four species were considered for the studies on Abhavadravya and microscopy was employed to study the anatomy of their medicinal parts. The microscopy studies revealed that in all the four species, a few outer most layers of the cortex get suberized to become corky. Only in the case of *Cyperus rotundus*, the cork region showed ridges and furrows while in case of others, it was more or less smooth. It was also found that many cork cells in the case of *Cyperus rotundus* were found to be filled with a dark brownish substance. In the case of *Cyperus scariosus* besides the parenchyma, some of the cortical cells were either sclerenchymatous or collenchymatous, while in the case of all other species the cortex was found to be entirely parenchymatous in nature. Starch was found in the cortical parenchyma cells of all the species. Some of the cortex cells in case of *Cyperus rotundus*, *Cyperus scariosus* and *Cryptocoryne spiralis* were found to contain silica along with a tanniferous substance.

The anatomical studies on the medicinal parts of the four Ativisa-Musta candidates such as Aconitum heterophyllum, Cyperus rotundus, Cyperus scariosus and *Cryptocoryne spiralis* revealed a number of dissimilarities among them.

Additionally many raphides (needle shaped calcium oxalate crystals) were found in the air spaces of the cortex in *Cryptocoryne spiralis*. All the species were found to contain a central stele which was separated from the cortex by a distinct layer of endodermal sheath. In respect of *Aconitum heterophyllum*, this stele was quite small and showed a typical radial arrangement of 5-6 protoxylem poles with phloem in between the arches. While in respect of other species, this stele region was fairly massive with a parenchymatous matrix. Many "vascular bundles" with phloem in the centre surrounded by xylem, were found embedded in this matrix. In addition, a sclerenchymatous sheath was found in *Cyperus scariosus*. The anatomical studies revealed a number of dissimilarities as above, among the four Ativisa-Musta candidates.



T.S of *Cypertus rotundus* L. shows arrangement if vascular bundle (phloem surrounded by xylem)

Phytochemical screening of Aconitum heterophyllum and *Cyperus rotundus*:

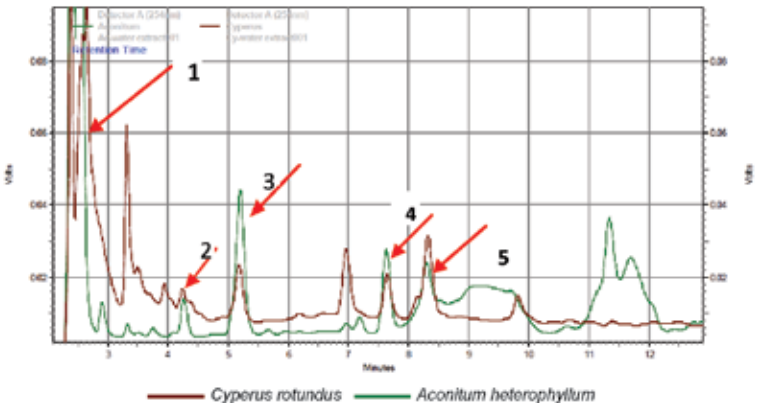
The earlier studies conducted during the previous years showed identical chemical profiles, particularly the presence of alkaloids in both the species. However, the studies during the year could not re confirm these results. This difference could be due to the low concentration of these alkaloids. In order to overcome this, the screening has to be repeated with more accessions to establish the similarities if any.

TLC profiles of the successive extracts of *Aconitum heterophyllum* and *Cyperus rotundus*:

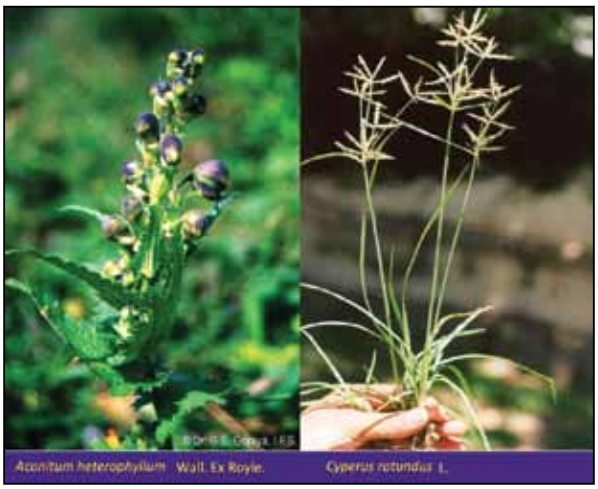
Successive extracts of the powdered samples of Aconitum heterophyllum and Cyperus rotundus were prepared and their TLC profiles compared. Several spots with similar Rfs in hexane, chloroform and ethyl acetate extracts of the two species were found. These similar Rfs suggest the possibility of the presence of similar compounds. In order to further strengthen these observations, more work needs to be done with HPTLC.

HPLC profiles of aqueous extracts *Aconitum heterophyllum* and *Cyperus rotundus*:

Earlier studies in this direction using the aqueous extracts of the two species had shown identical peak profiles. HPLC profiles of the successive extracts were repeated this year. It was observed that the chloroform and aqueous extracts provided the maximum number of identical peaks between the species.



It would be important to further identify the peaks and the similarity in the nature of the compounds through isolation, characterization and spectral studies including LCMS. Once the isolation and characterization is carried out, bioactivity of these common constituents needs to be tested to confirm the validity of their substitution.



Habit form of Ativisha-Musta duo.

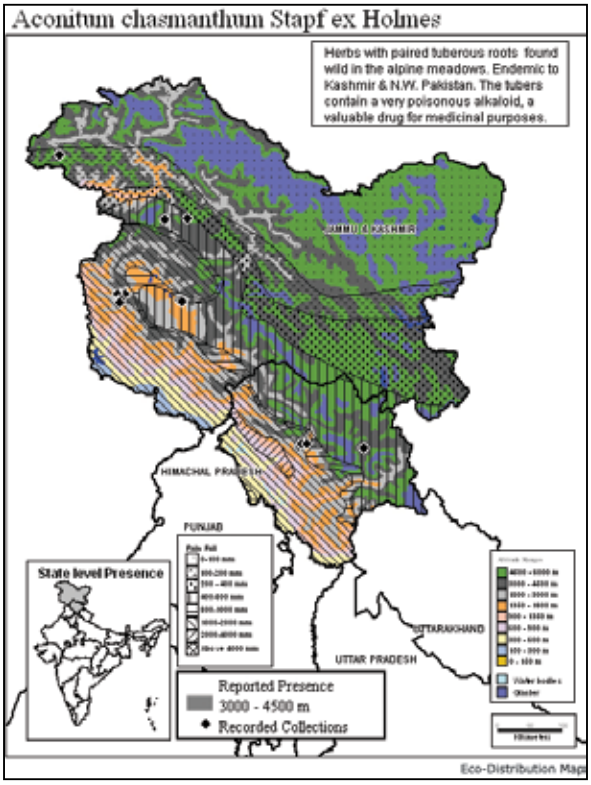
CE-P5: DISTRIBUTION MAPPING USING GIS & IDENTIFICATION ISSUES OF TRADED MEDICINAL PLANTS

Digital Geographical Distribution Atlas of Prioritised Indian Medicinal Plants:

Preparation of geographical distribution database, and maps for 250 wild medicinal plant species of India was undertaken during the year. Detailed eco-distribution maps were prepared for 25 species using GIS (Map info). This digital data has been incorporated into a searchable database and provided on CD-ROMs. Two sets of such CD-ROMs have been developed. The first one is a public version containing data and geo-distribution maps while the second version is a restricted version which incorporates the same geo-distribution data and also eco-distribution maps for prioritized species.

The digital atlas, now available on the CD-ROM, is aimed at providing the forest managers and researchers a reliable source of information on the natural distribution of medicinal plants within India.

The digital atlas, now available on the CD-ROM, is aimed at providing the forest managers and researchers a reliable source of information on the natural distribution of medicinal plants within India. This updated version of Geographical Distribution Atlas incorporates Geographical distribution maps for 1670 species (2243 botanical names) and Eco-distribution maps for 180 prioritized species.



Eco distribution map of *Aconitum chasmanthum*.

CE P6: OUTREACH

Training Course on Value Chain Development in Medicinal plants for Afghanistan Universities

The International Centre for Integrated Mountain Development, Kathmandu, Nepal (ICIMOD) under its project on 'Human Capacity Development of Afghan Universities' (HCD/AU) entrusted FRLHT a special task of designing and conducting an exclusive course on ***"Value chain development in Medicinal plants and traditional medicine use"*** to develop capacity and knowledge among the faculties of the universities in Afghanistan.

The Conservation Training team of CoE took up this responsibility and designed this course with the help of Resource persons drawn from in house and external agencies, and conducted the course during 2nd-10th June 2010 at Bangalore. In all, 27 participants (26 from Afghanistan) took part in the course actively.

The Course was structured around 8 exclusive themes: i) Medicinal plants Diversity of Afghanistan, ii) Health Traditions of Himalayas and Afghanistan, iii) Threats to medicinal plants diversity and methods of assessing them, iv) Strategies for conservation of Medicinal Plants, v) Value chain development possibilities in Medicinal Plants, vi)Strategies for Documentation of Traditional Medical knowledge, vii) Community friendly interventions for value chain development in Medicinal plants, viii) Cultural foundations of Health traditions.

The course witnessed an overwhelming participation with well illustrated PPT presentations, Discussions, Group activities, Field visits and interactions with community groups that turned the sessions unique and interesting. The entire course was very well appreciated for its novelty in respect of subject coverage, content delivery and presentation, and the training techniques adopted.

Course participants from Afghanistan Universities with Chief Guests and Resource persons after the Inauguration.

Course participants from Afghanistan examine a red listed climber in the field during their visit to Savanadurga MPCA.

Village Botanists ToT Program:

Towards furthering the cause of creating a cadre of Master trainers of Village Botanists (VB), the centre continued its novel initiatives of mentoring them through comprehensive TOT courses. The course this year focused on the faculty from the Forest training Institutes and Range Forest Officers from Karnataka.

Accordingly, a TOT course for select faculty from Forest training Institutes and Range Forest Officers from Karnataka was organized at the Forestry Training Institute, Gugaragatti, Dharwad during 16-19th and 23-26th February 2011. Twelve officers took part in the program and got an orientation to select subjects related to diversity and management of Medicinal plants resources.

Capacity Building of the Front-line Staff of State Forest Departments in respect of Identification and Management of Wild Medicinal Plants Resources:

Lack of adequate sensitization of the forestry staff towards the value and conservation imperatives of medicinal plants resources during the induction training programs has made them turn a blind eye towards medicinal plants and this apathy has eventually crippled their plant identification skills which remain limited to a few tree species.

Trying to fill this gap by way of building the necessary appreciation and capacities among the field forestry staff in respect of identification of medicinal plants diversity, species of conservation concern, threats, and necessary interventions for conservation and management of medicinal plants resources, the CoE's Training team conceived of an innovative training initiative in the form of state specific Capacity building training courses during 2008-09, with the financial support from the NMPB, New Delhi. The innovative initiative had focused on the following:

- to develop appropriate state-specific training modules (in local vernacular) on the subject.
- to sensitize and train the front-line staff in medicinal plant identification and management methodologies.
- to train the trainers by effectively involving them in the module delivery sessions.

Inaugural session from the Orientation Training to Frontline Forestry Staff of Karnataka, Gungaragatti.

Since then, the program has been successfully implemented in Uttarakhand, Himachal Pradesh, Rajasthan and Gujarat witnessing very overwhelming response and participation by the field forestry staff.

Lack of adequate sensitization of the forestry staff towards the value and conservation imperatives of medicinal plants resources during the induction training programs has made them turn a blind eye towards medicinal plants and this apathy has eventually crippled their plant identification skills which remain limited to a few tree species.

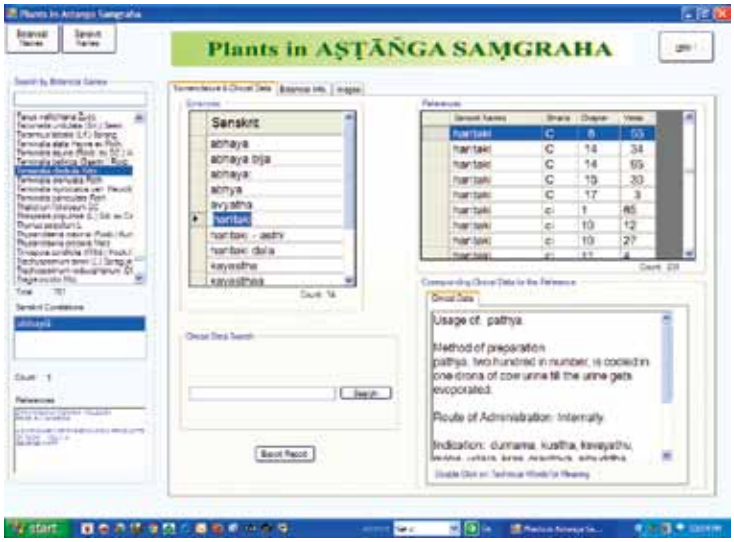
During the current year under this initiative, two capacity building training courses were organized for the field forestry staff of Karnataka during 16-19th February 2011 and 23-26th February 2011, at Forestry Training Institute, Gungaragatti, Dharawad, Karnataka.

A hands-on-orientation on Herbarium Techniques during the Training to Frontline Forestry Staff of Karnataka,

Altogether 110 participants including the frontline staff, middle level officers and the faculty of the Forestry Training Institutes took part in these two courses and obtained a re-exposure on various issues related to identification and management of medicinal plants. The Course pedagogy included multimedia presentations, hands on orientation, field exercises, games and group discussions.

Development of a CD-ROM on Plants in *Astanga Sangraha*:

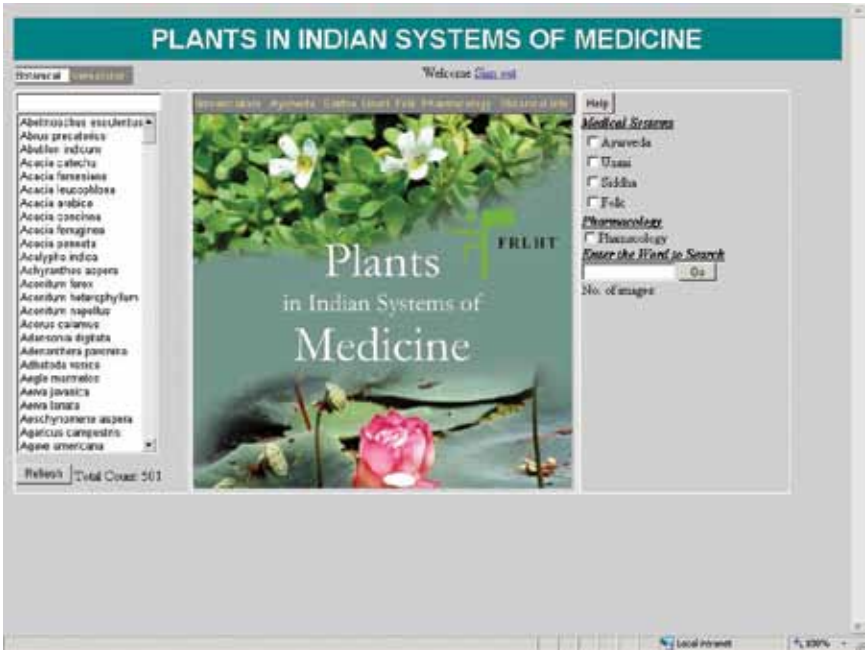
Astanga Sangraha a classical work of *Acharya Vagbhata* (one of the Brihat-trayees of Ayurveda during 600 AD) contains in-depth knowledge of different medicinal plants. The terms *Astanga* and *Sangraha* respectively correspond to eight main branches of Ayurveda and compilation of information pertaining to these eight branches. *Astanga Sangraha* is probably the first classical text to quote single drug of choice (*agrya oushadha*) in various diseases and when compared to other classical texts such as *Caraka samhita* and *Susruta samhita*, it offers additional references to several plants.



The database activity on the Plants of Astanga Sangraha was initiated during the previous year in which around 9000 records were compiled. During the current year >11,000 more records of citations were added taking the database to 20,000 records pertaining to 900 species of plants.

Astanga Sangraha is probably the first classical text to quote single drug of choice (*agrya oushadha*) in various diseases and when compared to other classical texts such as *Caraka samhita* and *Susruta samhita*, it offers additional references to several plants.

This database in the form of a CD-ROM brings together comprehensive information of around 900 plant drugs correlated to 1078 distinct botanical names including the synonyms. It also offers detailed clinical data and descriptive information for 528 plant species with 1300 plant images and comprehensive reporting and searching facility. The information is supported by 20,000 citations from the text, which correspond to 1614 distinct Sanskrit names, of which the identity of 150 is still obscure. All the Sanskrit names are grouped under specific basonyms which are further linked to their respective synonyms. The botanical correlation of these Sanskrit names is indicated in the order their accepted appropriateness along with the reference sources, while the status of the botanical correlation is shown under four types such as "Identified", "Controversial", "Doubtful" or "Probable" and "Unidentified".



A page view from the Website, Plants used in Indian Systems of Medicine.

Website on Plants used in Indian systems of medicine:

This facility aims to provide comparative profiles of about 500 plants used in Ayurveda, Unani, Siddha, and folk systems of Medicine. The huge wealth of Information on the properties and uses of these plants remarkably illustrates the range and depth of authentic knowledge of Indian medical heritage as found in the different classical texts of Indian Systems of medicine.

This facility is aimed to serve the diverse information needs of the different user groups, including the students of modern and Indian systems of medicine. The site is under testing and appropriate domain hosting needs to be adopted during the next year to make it available for public use.

Outreach activities:

Demonstration of the educational materials produced under the CoE project was carried out at the program venues of the following events:

1) Flower show during 9th-15 August 2010 at Lalbagh Botanical garden, Bangalore.
2) Arogya 2010, during 4th-14th October 2010, Patna.
3) World Ayurveda Congress during 9th-13th December 2010, Bangalore.
4) National Biodiversity Congress, during 27th – 31st December 2010, Trivandrum.
5) World Sanskrit book fair, during 7th-10 January 2011, Bangalore.
6) Flower show during 19th-26th January 2011 at Lalbagh Botanical garden, Bangalore.

3. COMPONENT WISE PROGRESS REPORT FOR THE YEAR 2010–11

CE-P1: PROJECT COORDINATION

Sl. No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
1.	Review of physical & financial project progress	2 six-monthly Steering Committee meetings	- Timely preparation & circulation of Agenda items to members. - Drafting, approval & circulation of minutes of these meetings. - Follow up on the action points. - Compilation of accounts, preparation of utilization certificates and annual audit of accounts.	♦ The 1st Steering Committee meeting held in March' 10 and approved the annual action plan and budget (2010-11) ♦ The 2nd Steering Committee meeting to review the progress was held on 1st Dec '10 at MoEF, New Delhi.
		6 bi-monthly project review meetings		6 bi-monthly project review meetings were held at FRLHT with the project staff.
		Timely audit of project accounts		Project accounts for the year 2009-10 have been audited and utilization certificate submitted to MoEF.
2.	Preparation of Progress Reports	Preparation of Annual Project Report (bi-lingual) for 2009-10	- Compiling reports on the basis of information received from PIs. - Finalization of reports.	Annual Report for the year 2009-10 (bi-lingual) prepared and printed.
		Preparation of 2 six-monthly progress reports		The progress report for the period April 2010 to October 2010 sent to Ministry of Environment & Forests, along with the Utilization Certificate.
3.	Writing of new proposals to strengthen CoE	Follow up of proposal to NMPB for funds towards strengthening the raw drug repository	- Liaison with NMPB for the purpose.	After sustained follow-up, NMPB has informed that our project proposal did not receive formal approval of dept of AYUSH.
4.	Liaison with other organizations to further the objectives of CoE	With BSI and its regional centres for sharing of herbarium sheets	- Drafting agreements, writing letters, personal meetings with target organizations.	Liaison and correspondence with BSI, AYUSH and SFDs was undertaken.
		With AYUSH for sharing of information on medicinal plants in ISM		
		With SFDs for sharing information on eco-distribution of red-listed medicinal plants		

CE-P2: HERBARIUM OF MEDICINAL PLANTS USED IN ISM

Sl.No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
1	Strengthening of Herbarium	Addition of voucher specimens pertaining to 150 species of medicinal plants (=500 voucher specimens) Addition of voucher specimens so as to cover the distribution range and morphological variations of medicinal plant species (=1000 voucher specimens).	- Preparation of action plan for the botanical survey including the geographical areas to be surveyed. - Plan the field visits, make logistic arrangements & obtain administrative permissions - Carry out the field visits in the identified sites for botanical collection. - Processing, mounting, identification and labeling of the specimens. - Data entry, accession and physical placement of the herbarium sheets in the cabinets.	♦ Additional 150 species were collected for the herbarium, of which identity of 120 has been properly established while the rest are in the process of authentication. ♦ Field surveys were taken up in the following different locations so as to cover the distribution range and morphological variations of Medicinal plant species: ♦ North East India (Nagaland, Meghalaya, Assam, Arunachal Pradesh), ♦ North West Himalayas (Himachal Pradesh), ♦ Western India (Rajasthan), ♦ Central India (Chhattisgarh) ♦ Southern India (Tamil Nadu and Karnataka). ♦ Altogether 1150 voucher specimens were added to the herbarium.
2	Development of virtual herbarium	Addition of 2000 images of medicinal plants, pertaining to their natural habitats and *officinale* parts	- Capture appropriate images of medicinal plant species in the field. - Scanning of selected herbarium sheets highlighting the flowers, fruits or both, and other morphological variations, and systematic storage of the same.	>2000 plant images were added to the image library along with >500 digitized herbarium sheets.
3	Designing of educational and extension material	Finalization of the draft (version 1) of the book titled, *'Red listed medicinal plant species of India'*	- Develop the manuscript, including the compilation and sourcing of appropriate images and visuals	Priority species for profiling in the book were identified; manuscript preparation initiated and compilation of appropriate images begun.
		Design and produce Posters (4) on select medicinal plants related themes.	- Prepare concept notes for 4 themes, compile relevant data, design and produce the poster sets.	4 Sets of posters covering the themes *Astavarga, Daruharidra, Dasamoola* and *Plant exudates* under the series *"Medicinal Plant Wealth of India"* were designed and printed. (So far, 10 thematic Posters have been brought out: *Red listed Medicinal Plants, Triphala, Medicinal fruits, Tulsi, Medicinal roots, Pashanabheda, Medicinal Flowers, Goksura, Herbal Toothbrush and Aromatic Plants*)

Sl.No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
4	Organising Training programs	Organize 2 training programs on herbarium techniques	- Design, Plan and organize the training programs	3 training programs on Herbarium techniques were conducted for the graduate students of Aryuveda, Pharmacy and Herbal Science courses.
5	Status survey of Red-listed medicinal plant species	Conduct a Status survey of wild populations of *Coscinium fenestratum* across its distribution range in India	- Plan and conduct the survey in selected pockets of Western Ghats of Karnataka, Kerala and Tamil Nadu.	Literature search completed; field surveys conducted in Karnataka, Kerala and Tamil Nadu; a status report has been prepared.
6	Strengthening of Raw Drug Repository	Addition of 250 raw drug samples, from field collections.	- Collection of authentic samples from properly identified plants	270 authentic samples from properly identified plants were added to the repository.
		Addition of 150 raw drug samples from the Raw drug markets.	- Procure raw drug samples from the raw drug markets.	152 raw drug samples obtained from different raw drug markets in the country were added to the repository.
		Showcasing of the samples appropriately	- Processing of the fresh samples - Display the raw drug samples in appropriate containers - Label the raw drug containers with appropriate identification labels	672 raw drug samples were processed, shade dried and stored in appropriate glass containers. (So far 1662 raw drug samples have been bottled and labeled).
		Computerisation of Raw drug sample data	- Computerise the field data into raw drug repository module.	Raw drug repository database has been enlarged by incorporating 456 records during the year. The total number of records in this module stands at 2143.
		Preparation of a catalogue of raw drug repository collections.	- Prepare the draft for printing - Printing of the catalogue.	The final draft of the catalogue has been prepared and is ready for copy editing and printing.
		Thematic arrangement of collections in the repository for educational purposes.	- Short-list 10 focal themes - Select representative herbarium sheets under each focal theme. - Prepare theme-wise write ups for educational material	Display of Raw drugs has been arranged under 2 themes: a) Plant parts, and b) Ayurvedic drugs. a) Plant parts: 1) Medicinal bark, 2) Medicinal fruits, 3) Medicinal flowers, 4) Medicinal seeds, 5) Medicinal leaves, 6) Medicinal roots, 7) Single plant-Multiple medicinal parts and 8) Imported Medicinal plants. b) Ayurvedic drugs::1) Triphala, 2) Trikatu, 3) Trimada, 4) Trijatka, 5) Agnimantha, 6) Daruharidra, 7) Gokshura, 8) Isabgol, 9) Pashanabeda, 10) Punarnava, 11) Vidanga, 12) Dashamula, and 13)Vidari.

CE-P3: ESTABLISHMENT OF ETHNO-MEDICINAL PLANTS DEMO GARDEN

Sl.No	Title of Activity	Targets for 2010-11	Achievements
1	Strengthening of Ethno-medicinal garden	Collection of propagules pertaining to 60 additional medicinal plant species	Propagules pertaining to 65 additional medicinal plant species were collected.
		Take up planting under 3 new themes in the EMG Rasayana plants Plants for Mental health Body organs V/s Plants	Planting under these 3 new garden themes was done.
		Strengthening & maintenance of thematic garden layouts established during the previous years.	Completed
2	Preparation, Design and affixing of educational signages	Prepare and install educational signages (3 themes + 100 individual species)	Signages for 100 individual species were prepared and installed appropriately.
3	Educational & Extension programs	Organize 4 EMG based Awareness-cum-Educational programs.	8 programs were conducted.
		Preparation of educational booklets on 10 designs garden thematic planting.	Prototype Booklets were prepared and circulated among the peer groups and subjects experts for review.

CE-P4: PHARMACOGNOSY STUDIES

Sl. No.	Title of Activity	Targets for 2009-10	Details of Activity	Achievements
1.	Studies on the controversial botanical raw drug groups	Continuation of laboratory work to complete the gaps in respect of *Daruharidra*	- Collect new accessions of *Berberis* spp.	3 new accessions of *Berberis* were collected
			- Carry out the anatomy work of the new accessions	Anatomical differences could not be established between the different species of *Berberis*. However, the *Berberis* candidates could be differentiated from *Coscinium* and *Morinda* candidates.
			- Carry out HPLC & HPTLC fingerprinting of the new accessions of *Berberis aristata* & *B.lycium*	HPLC & HPTLC fingerprinting of the new accessions of *Berberis* samples were carried out. However the results were found to be not matching with the earlier results.
			- Carry out Physicochemical analysis of the new accessions of *Berberis aristata* & *B.lycium* and compile the results.	Physicochemical analysis carried out. Results were found to be not matching with each other in respect of total alkaloid contents.
			- Carry out Phytochemical screening of the new accessions of *Berberis aristata* & *B.lycium.*	Phytochemical screening carried out.
			- Do the Verification of species-specific SCAR markers for the new accessions of *Berberis aristata.*	Verification of Species specific SCAR markers completed. A Paper on SCAR markers for *Berberis* species published: (see: Balasubramani SP, Goraya GS, Venkatasubramanian P., 2011. Development of ITS sequence-based markers to distinguish B*erberis aristata* DC. from B. *lycium* Royle and B. *asiatica* Roxb. *Biotech DOI*: 10.1007/s13205-010-0001-5 and Balasubramani SP, Goraya GS, Venkatasubramanian P., 2011. Molecular Identification and Development of Nuclear DNA ITS Sequence based marker to distinguish *Coscinium fenestratum* Gaertn. (Menispermaceae) from its Adulterants. *Current Trends in Biotechnology and Pharmacy*, 5 (2): 1163-1172.)

Sl. No.	Title of Activity	Targets for 2009-10	Details of Activity	Achievements
2	Vidanga focused studies	Preparation of a Monograph on Vidanga	-Publish the work on *Kirtiquinone* in a peer-reviewed journal.	Work on *Kiritiquinone* was published in Indian Journal of Chemistry. (see: Kuruvilla, G.R., M.Neeraja, A.Srikrishna, GSR SubbaRao, AVS Sudhakar, P. Venkatasubramanian, 2010. A new quinone from *Maesa indica* (Roxb.)A.DC, (Myrsinaceae). *Indian Journal of Chemistry* Vol.49B, pp.1637-1641.)
			Publish the findings about the anthelmintic & anti-cancer properties/activities of Vidanga.	Establishment of *Caenorhabditis elegans* facility as a bioassay for the comparative analysis of anthelmintic properties of different Vidanga species extracts and purified active components completed. Preliminary testing on *Embelia tsjeriam-cottam* extracts showed the anthelmintic activity against the nematode *Caenorhabditis elegans.*
3	Abhava Dravya studies	Comparative studies on the collected accessions of *Aconitum heterophyllum* & *Cyperus rotundus*	Collect at least 3 accessions each of *Aconitum heterophyllum* and *Cyperus rotundus.*	3 accessions each of *Aconitum heterophyllum* and *Cyperus rotundus* collected.
			Carry out preliminary phyto-chemical studies on collected accessions.	Phyto chemical studies were done, however, the results did not match with earlier results
			Carry out Comparative HPLC, HPTLC fingerprints of *Aconitum heterophyllum* and *Cyperus rotundus.*	HPLC of all the successive extracts was completed and the earlier results confirmed. Matching peaks were observed with chloroform, ethyl acetate and water extracts
			Carry out DNA extraction, Amplification of ITS region	DNA extraction was optimized for *Aconitum heterophyllum*, *Cyperus rotundus*, *Cryptocoryne spiralis* and *Cyperus scariosus*

CE-P5: DISTRIBUTION MAPPING OF MEDICINAL PLANTS USING GIS

Sl. No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
1	Generation of distribution maps for prioritized medicinal plants	Generate geo-distribution maps for 250 prioritized species	- Collate information from published sources & in-house survey results. - Generate geo-distribution maps for 250 species, and eco-distribution maps for 25 species. - Generate multi-layered maps based on this information. - Finalize the revised and upgraded version of digital atlas.	Data for preparing geo-distribution maps in respect of 250 medicinal plant species compiled and corresponding maps were generated.
		Generate eco-distribution maps for 25 prioritized species		Eco-distribution maps for 25 species completed.
		Finalize the upgraded version of Digital Atlas of Distribution Maps prepared during the previous year		Both the versions of revised and updated digital Atlas have been prepared.

CE-P6: OUTREACH (TRAINING & EDUCATIONAL MATERIAL ON PLANTS OF ISM)

Sl. No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
1.	Developing a cadre of village botanists	Organize 1 Master ToT course for the master trainers from select FD training Institutes from across the country	- Seek permission from the authorities - Invite nominations from the FD training Institutes - Develop the course contents and conduct the course	ToT orientation to select Master Trainers from FD institutes from Karnataka completed alongside the Capacity building programs for the frontline staff of Karnataka during February 2011.
2.	Capacity Building Courses for the front-line staff of SFDs in respect of Identification and Management of Wild Medicinal Plant Resources	Organise 6 training programs in 3 states for the frontline forest staff (2 back to back courses in each state)	- Seek adminiative permission from the respective authorities in the states - Liaise with the FD training Institutes for the logistics and organizing the course - Prepare state specific curriculum and modules - Conduct the courses	2 Capacity building training courses for the frontline staff of Karnataka state forest department completed during February 2011 at Gungargatti, Dharawad.
3.	Finalizing the Strategy and Guidelines for conservation of medicinal plants	Organise a National workshop to finalise the Strategy and Guidelines	- Invite participation of senior forest officers from across the states - Circulate the draft strategy and guidelines - Hold the workshop and review the draft	-The workshop was conducted during the month of May 2010. Thirty-five senior forest officers from across the country took part in the workshop and offered the is inputs/suggestions for finalization of "Strategy and guidelines for Conservation of Medicinal Plants in India"
		Consolidate and finalise the Strategy and Guidelines	- Plan a close reading discussion with select senior Forest officers - Review and finalise the draft	Close reading discussion held during December 2010; Revised version of the draft "Strategy and guidelines for Conservation of Medicinal Plants in India" prepared along with "Operational guidelines for conservation and management of medicinal plant resources in India".

Sl. No.	Title of Activity	Targets for 2010-11	Details of Activity	Achievements
4.	Develop and design educational CD-ROMs	Conduct a peer review of the prototype CD-ROM on "Plants in Astanga samgraha" and prepare the final version of the same after the peer review.	- Take up the Peer review of the prototype of the CD-ROM. - Update the prototype in view of the peer reviewers' comments.	An internal review brought out the need for addition of 11000 records, raising the total to 21000 records, and this was carried out. Peer review of the revised database is in progress.
		Web accessibility of the information in respect of medicinal plants used in the Indian Systems of Medicine (Ayurveda, Siddha, Unani and Homoeopathy)	- Interface development and testing of the same in the draft version. - Upload the trial version on the intranet for restricted users.	Interface development completed. Carried out Data integration and synchronization for the website. A module was uploaded onto the intranet for testing.
		Preparation of the book "Plants in Ayurveda".	- Develop the draft by drawing inputs related to Plant names, botanical correlation with references, bibliography citations from classical texts, status of identity etc.	Review of the botanical identity of the Sanskrit names of the plants in Brihatrayee i.e. (Charaka, Susrutha and Vaghbata) completed. First draft has been prepared and is under review.

4. BUDGET & EXPENDITURE

A grant of Rs. 110 lakhs was released towards the action plan of the Centre of Excellence for the year 2010-11. Component-wise expenditure, Utilisation Certificate and other expenditure details are presented below:

Component-wise Annual Expenditure (in Rs.)							
Budget Heads	**CE-P1**	**CE-P2**	**CE-P3**	**CE-P4**	**CE-P5**	**CE-P6**	**Total**
Salaries & Wages	3.60	15.20	13.72	11.40	9.60	8.00	**61.52**
Permanent Equipment	0.00	3.44	0.00	0.00	0.00	0.00	**3.44**
Expandable Items	2.19	2.99	3.38	3.80	1.70	1.50	**15.56**
Travel	2.16	4.39	1.37	1.30	1.33	0.58	**11.13**
Contingencies	0.51	0.00	0.00	0.00	0.00	0.00	**0.51**
Other Costs	0.57	0.89	2.30	0.00	0.00	8.45	**12.21**
Total	9.03	26.91	20.77	16.50	12.63	18.53	**104.37**

UTILISATION CERTIFICATE
APRIL 2010 TO MARCH 2011

1. Title of the Project	**Centre of Excellence**
2. Name of the Organisation	Foundation for Revitalisation of Local Health Traditions
3. Principal Investigator	Advisor FRLHT
4. Ministry of Environment & Forests Letter No. and date of sanctioning the project	No. 13-06/2007-CS-I dated 23rd June 2010
5. Amount Brought forward from the Previous financial year quoting Ministry of Enviornment & forests Letter No and date on which the authority to carry forwards the said amount was given	Rs. 9,27,065/- (Nine Lakhs Twenty Seven Thousand & Sixty Five Only)
6. Amount received from Ministry of Environment and Forests No. date and date of sanction	(1) Rs. 45,72,935/- Sanctioned vide No. 13-06/2007-CS-I Dated 23.06.2010 (2) Rs. 54,17,955/- Sanctioned vide No. 13-06/2007-CS-I dated 21.02.2011
7. Total amount that was available for expenditure incurred during the financial year 2010-11 inclusive of Interest	**Rs. 1,10,36,558/-**
8. Actual expenditure incurred during April 10 to March 2011(financial year 2010-11)	Rs.1,04,37,315 /-(Rupees One Crore Four Lakh Thirty Seven Thousand Three hundred and Fifteen Only)
9. Unspent balance refunded if any (please give details of cheque no. date)	NIL
10. Balance amount available at the end of March 2011	**Rs. 5,99,243/-**(Rupees Five Lakhs Ninety Nine Thousand Two Hundred and Forty Three Only)
11. Amount allowed to be carry forwards to the next financial year vide.	**Rs. 5,99,243/-**(Rupees Five Lakhs Ninety Nine Thousand Two Hundred and Forty Three Only)

Certified that the expenditure of Rs. 1,04,37,315 /-(Rupees One Crore Four Lakh Thirty Seven Thousand Three hundred and Fifteen Only) mentioned against column 8 was actually incurred for the project/scheme for the purpose:

Signature of Principal Investigator

Signature of Sr. Accounts Officer

Signature of Head of the Organisation

Director
Foundation for Revitalisation of Local Health Tradition
74/2, Jarakabande Kaval, Post Attur
Via Yelahanka, Bangalore-560 106
Ph: 080-28568007, Fax: 080-28568026

For G Anantha & Co.
Chartered Accounts
FRN:005160 S

Date: 22/05/2011

Our Ref. NO. 13-18/99-CSC
This certificate is issued at the request of FRLHT
For G Anantha & Co
Chartered Accounts

Rekha K R
Partner
M.NO:29695

G. ANANTHA & CO. BANGALORE CHARTERED ACCOUNTANTS

Accepted and Countersigned

COMPETENT AUTHORITY
MINISTRY OF ENVIRONMENT & FORESTS

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS

Project: Centre of Excellence

Annexure to Utilisation Certification for the period 01-04-2010 to 31-03-2011

Activity wise expenditure as on 31-03-2011

Sl No.	Activity in Project mode	Budget 2010-11	Expenditure upto 31st March 2011	Balance Budget
1	Project Co ordination	9,00,000	9,02,954	-2,954
2	Herbarium of Medicinal Plants used in ISM	30,00,000	26,91,712	3,08,288
3	Establishment of Ethno-Medicinal Plants Demo Garden	21,00,000	20,76,951	23,049
4	Pharmacognosy Studies	17,00,000	16,49,979	50,021
5	Distribution Mapping of Medicinal Plants using in GIS	13,00,000	12,62,710	37,290
6	Outreach (Training & Educational Material of Plants of ISM	20,00,000	18,53,009	1,46,991
	Total	**1,10,00,000**	**1,04,37,315**	**5,62,685**

Signature of
Sr. Accounts Officer

Signature of Head
of the Organization

Director
Foundation for Revitalisation of
Local Health Tradition
74/2, Jarakabande Kaval, Post Attur
Via Yelahanka, Bangalore-560 106
Ph: 080-28568007, Fax: 080-28567926

For G Anantha & Co.
Chartered Accounts
FRN:005160 S

G ANANTHA & CO. BANGALORE CHARTERED ACCOUNTANTS

Rekha K R
Partner
29695

Place: Bangalore
Date: 22/05/2011

5. INDIVIDUALS AND AGENCIES INVOLVED

The achievements under the project would not have been possible without the active support of many agencies and individuals. We would like to gratefully acknowledge the support provided by the following:

Ministry: Ministry of Environment & Forests, GoI, New Delhi.

Govt agencies:

- State Forest Departments of Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir Karnataka, Kerala, Maharashtra, Megahlaya, Nagaland, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal, for participating and facilitating the National Workshop on Strategy and Guidelines for conservation and Management of Medicinal Plants resources and for granting necessary permission and providing logistic support during field floristic surveys.
- National Medicinal Plants Board, New Delhi.
- State Medicinal Plants Boards of Arunachal Pradesh and Meghalaya.
- Forest Development Corporations of Maharashtra, Uttar Pradesh and Karnataka.
- Forest Training Institute, Gungaragatti, Dharawad, Karnataka.
- Western Ghats Task Force, Govt. of Karnataka, Bangalore.

Non-Government Organisations & Individuals:

- ICIMOD, Kathmandu, Nepal.
- Rural Communes, Mumbai, Maharashtra.
- Dr. RV Singh, Director General (Rtd), ICFRE, Dehradun, Uttarakhand.

6. PROJECT TEAM

Implementation of this multifaceted project was steered by the Advisor FRLHT with separate Program Incharges for each of the project components. The team members involved with the project is as under:

1. D K Ved, Advisor and Principal Investigator – CoE
2. Naresh, Office Secretary
3. Dr. K Ravikumar, Assistant Director
4. S. Noorunnisa Begum, Program Officer
5. R. Murugan, Research Officer
6. R. Sumathi, Research Officer
7. Dr. K Haridasan, Jt. Director
8. Ganesh Babu, Research Officer
9. B S Somashekhar, Assistant Director
10. Dr. Venugopal, Assistant Director
11. Dr. Shilpa, Research Fellow
12. Sugandhi Rani, Data Entry Operator
13. Vijay Barve, Sr. Program Officer
14. Sangeetha, Research Officer
15. Dr. Padma Venkat, Jt. Director
16. S. Lalitha
17. K.V. Padmashree Research Associate
18. Gina R. Kuruvilla
19. Balasubramani S.P. Research Associate
20. Dr. Subrahmanya Kumar
21. Santhosh K.
22. Balasubramani S.P., Research Associate
23. P V Somashekhar, Assistant Director

7. PROMINENT PERSONALITIES AT THE CENTRE

Mr. Ratan Tata, Chairman, Tata group of Companies, Mumbai, Dr. R. A Mashelkar, Former Director General, CSIR, New Delhi, Mr. Sam Pitroda, Chairman, Knowledge Commission, New Delhi, Prof. Kamaljit Bawa, and Ambassador of Denmark to India, New Delhi at the CoE with Mr. Darshan Shankar, Vice chairman, FRLHT.

8. PUBLICATIONS

A. Project Coordination Cell

Reports

1. Somashekhar B.S. & D.K. Ved. 2010. *Annual report of CoE for the year 2009-10.* FRLHT, Bangalore. Pp.52.

B. Ethno Medicinal Garden Group

1. Ganesh Babu, N.M., Geetha Suresh and K Haridasan, 2010. *Secrets of Ethno Medicinal Gardens.* IAIM, Bangalore

C. Laboratory Group

1. Balasubramani S.P., Goraya G.S., and Venkatasubramanian P. 2011. Development of ITS sequence-based markers to distinguish B*erberis aristata* DC. from B. *lycium* Royle and B. *asiatica* Roxb. 3 Biotech DOI: 10.1007/s13205-010-0001-5.
2. Balasubramani S.P., Venkatasubramanian P. 2011. Molecular Identification and Development of Nuclear DNA ITS Sequence based marker to distinguish *Coscinium fenestratum* Gaertn. (Menispermaceae) from its Adulterants. *Current Trends in Biotechnology and Pharmacy* 5 (2):1163-1172.
3. Kuruvilla G.R., Neeraja M., Srikrishna A., Subba Rao G.S.R., Sudhakar A.V.S. & Venkatasubramanian P., 2010. A new quinone from *Maesa indica* (Roxb.) A.DC, (Myrsinaceae). *Indian Journal of Chemistry* Vol.49B, pp.1637-1641.

D. Training Group

Reading material Compendia

1. Somashekhar B.S. & D K Ved. 2010. Compendium of Reading Material on Medicinal plants, Traditional Medicine Use, & Value Chain Development. 02-10 June 2010, Bangalore, India

2. Somashekar B.S., 2011. *Kaadu emba Kanaja* (Treasure Troves of Medicinal plants named as Forests). Supplementary reading material compendium in Kannada developed for the use of the participants in the Capacity Building Training for the Front-line Staff of Karnataka on Identification and Management of Wild Medicinal Plants Resources, 16-19th and 26-29th February 2011, Gungagati, Dharawad, Karnataka. FRLHT, Bangalore. Pp35.

Chapters and Books:

1. Somashekar B S, 2011. *Ondu Kaadina Nooru Uthpannagalu* (Hundred different produce from forests). In: Hegde, N. and Somashekhar B S (Eds.), *Ankanchaape.* Karnataka Forest Department and Western Ghats Task Force, Bangalore. Pp 130.

Invited Presentations:

1. Somashekhar B.S. *Overview of the Medicinal Plants Diversity of* Chikmagalur *District, RET species and their conservation.* Orientation Workshop for the front line forestry staff and local

communities on Medicinal Plants Conservation, 28th June 2010, Chikmagalur. Karnataka Forest Department, Chikmagalur & Western Ghats Task Force, Bangalore.

2. Somashekhar B. S. *Status of the village sacred groves in the Maidan area of Karnataka.* Workshop on Sacred groves, their status, and regeneration, 1st July 2010, Siddapura, Uttara Kannada. Karnataka Forest Department, Sirsi & Western Ghats Task Force, Bangalore.
3. Somashekhar B. S. *Overview of the Medicinal Plants Diversity of Belgaum District, RET species and their conservation.* Orientation Workshop for the front line forestry staff and local communities on Medicinal Plants Conservation, 19th July 2010, Belgaum. Karnataka Forest Department, Belgaum & Western Ghats Task Force, Bangalore.
4. Somashekhar B. S. *Overview of the Medicinal Plants Diversity of Uttara Kannada District, RET species and their conservation.* Orientation Workshop for the front line forestry staff and local communities on Medicinal Plants Conservation, 6th October 2010, Sirsi. Karnataka Forest Department, Sirsi & Western Ghats Task Force, Bangalore.
5. Somashekhar B. S. *Medicinal Plants Conservation Areas of Karnataka: Conservation Significance, Current status and need for Rejuvenation.* State level Workshop on MPCAs - their Conservation and Rejuvenation. 12-13th November 2010, Kargal, Sagar. Karnataka Forest Department, Sagar & Western Ghats Task Force, Bangalore.